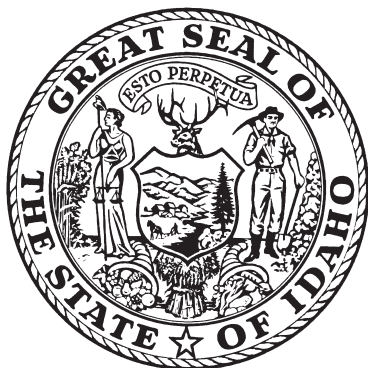


IDAHO TRANSPORTATION DEPARTMENT



STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION



EDITION OF 2012

**STATE OF IDAHO
TRANSPORTATION DEPARTMENT
BOISE, IDAHO**

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U.S. Customary Measurement Symbols

Symbol	Unit Name
mil	mil (0.001 inch)
in	inch
ft	foot
yd	yard
mi	mile
in ²	square inch
ft ²	square foot
yd ²	square yard
mi ²	square mile
Acre	acre
pt	pint
qt	quart
gal	gallon
in ³	cubic inch
ft ³	cubic foot
yd ³	cubic yard
oz	ounce
lb	pound
ton	ton, short (2,000 lb)
°F	degree Fahrenheit
ms	millisecond
s	second
min	minute
h	hour
mph	miles per hour
psi	pound-force per square inch
W	watt
kW	kilowatt
mA	milliamperere
A	ampere
V	volt
VA	voltampere
W	ohm
Hz	hertz
J	joule
lm	lumen
fc	footcandle
hp	horsepower
lbf	pound-force
kip	1,000 pound-force
lbf·ft	pound-force foot
cP	centipoises
P	poise
cSt	centistokes
gpm	gallons per minute
db	decibe

SECTION 100 - GENERAL PROVISIONS

SECTION 101 - DEFINITION OF TERMS GENERAL, ABBREVIATIONS, AND DEFINITIONS

101.01 Active Voice, Imperative Mood

The Department has rewritten the Standard Specifications for Highway Construction with an emphasis on the active voice. In a sentence written in the active voice, someone acts on something. For example: “The Contractor shall place the concrete.” A similar sentence in the passive voice— “The concrete shall be placed”—would be unclear about who was responsible for placing the concrete.

The rewritten Standard Specifications for Highway Construction also makes use of the imperative mood. The imperative mood is used when the party issuing an instruction and the party receiving it are already understood. In this rewritten Section 100, the Department is stating its requirements or directions for the work to the Contractor; such statements have the same force as if they contained the words “Contractor shall.” In an imperative sentence such as, “Place the concrete,” the Department is indicating that it requires the Contractor to place the concrete. Before an award of a contract, imperative statements are directed to the bidder(s). After a contract has been awarded, imperatives are directed to the Contractor.

The Department will identify parties other than the bidder or Contractor to whom it gives a responsibility in these Standard Specifications. In phrasings where the responsible party has already been clearly identified or in factual statements when it is not important to do so, the Department may use the passive voice.

101.02 Organization of Specifications

A. General. With the exception of Section 100, “General Provisions,” and Section 700, “Materials,” the sections of Standard Specifications are written in a five part format. Each section contains the following primary subsections:

XXX.01	Description
XXX.02	Materials
XXX.03	Construction Requirements
XXX.04	Method of Measurement
XXX.05	Basis of Payment

The subsections contain varying numbers of titled subordinate subsections composed of higher and lower levels, as in an outline.

B. Hierarchy of Organization. The requirements of a subsection apply to

101.03

subordinate subsections. In addition, many subsections begin with a lower-level subsection called "General." The requirements of "General" subsections apply to the associated same-level subsections that follow; they do not apply to the higher level.

C. Title (or Headings)

The titles or headings of sections and subsections are for the convenience of referencing and do not necessarily bear on the meaning or interpretation of the text.

D. References

The specifications rely on many cross references, both to internal sources in the specifications and external sources in other contract documents, Department manuals, and other industry resources. To minimize the text necessary for internal cross references, the specifications will not precede internal cross references with the terms "Section" and "Subsection". External cross references will contain just enough information to find the intended source.

101.03 Abbreviations and Acronyms

Where the following abbreviations and acronyms are used in the contract documents, they indicate the following expressions:

AASHTO Officials	American Association of State Highway and Transportation
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AISC	American Institute of Steel Construction
AIISI	American Iron and Steel Institute
ANSI	American National Standard Institute
AREA	American Railway Engineering Association
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society
IES	Illuminating Engineering Society
NPCA	National Precast Concrete Association
NRMCA	National Ready Mix Concrete Association
PCAA	Precast Concrete Association of America
PCI	Prestressed Concrete Institute
QPL	Qualified Products List
SAE	Society of Automotive Engineers
SSPC	Steel Structures Painting Council
WAQTC	Western Alliance for Quality Transportation Construction

101.04 Definitions

Where the following terms are used in the contract documents, they imply the following meanings:

Acceptance testing. Samples and tests that are conducted to determine whether the **Department** will accept a product or service for payment.

Addenda. Contract revisions issued after **notice of letting** and before **bid opening**.

Anticipated Profit. Profit for work not performed.

Award. Department acceptance of proposal.

Bid opening. The public opening and reading of **proposals**

Bidder. An individual, partnership, firm, corporation, or any acceptable combination thereof, submitting a **proposal**.

Bid Schedule. A list of **contract pay items** and their estimated quantities included with the **proposal forms** on which bidders are to or have provided unit prices.

Board. Idaho Transportation Board.

Bridge. A **structure**, including supports, constructed over a depression or obstruction, such as water, highway or railway, and having a track or passageway to carry traffic or other moving loads and a length of at least 20 ft measured along the center of the **traveled way** or railroad between abutment undercopings or extreme ends of openings for multiple boxes.

Business day. Any day except Saturdays, Sundays, and holidays.

Calendar day. Any day shown on the calendar, beginning and ending at midnight.

Central Materials Laboratory. The **Department's** Headquarters Materials Testing Laboratory located at the following address:

3293 Jordan

Boise, ID 83703

Change order. A written order to the **Contractor**, detailing changes to the specified **work** quantities or modifications within the scope of the **contract**, and establishing the basis of payment and time adjustments for the **work** affected by the changes.

Chief Engineer. An administrator within the **Department** designated by the **Director**.

Contingency item. A **contract pay item** for which the **Department** provides a set price on the **bid schedule**. The Department will pay for authorized work performed under a contingency item as required by the **contract**.

Contract. The written agreement between the **Department** and the **Contractor** covering the performance of the **work**, basis of payment and other obligations of the parties. The contract includes the **notice of letting, proposal forms, plans, specifications, contract bonds, change orders** and any other document designated by the **Department** as part of the **contract**.

Contract bonds. Statutory bonds, executed by the **Contractor** and the **surety**, including the **performance bond** and **payment bond**, guaranteeing performance of the **contract** and payment of all lawful indebtedness pertaining thereto.

Contract pay item. A specific unit of the **work** for which a price is provided in the contract. Each individual **work** item is considered a major item of work. Contract pay items are numbered to correspond to the appropriate sections of the **Standard Specifications**. **Special provision** contract pay items are numbered beginning with an "S" followed by either a section number to which work is similar, or to a 900 generic series number.

Contract time. The amount of time allowed by the **contract** for substantial completion of the work.

Contractor (prime contractor). The individual, partnership, firm, corporation, or any acceptable combination thereof, contracting with the **Department**, for performance of the **work**.

Critical habitat. Any public wildlife refuge and the specific areas within the geographical area occupied by a species of plant or animal, at the time it is listed as a threatened or endangered species, on which are found those physical or biological features essential to the conservation of the species. Those areas as above which may require special management considerations or protection and specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Director of the U.S. Fish and Wildlife Service that such areas are essential for the conservation of the species.

Cultural resource. Sites, structures, objects, or districts significant in history, architecture, archeology or culture that are on or eligible for the National Register of Historic Places.

Culverts. Any **structure** under the **traveled way** with a clear opening of 20 ft or less, measured along the center of the roadway.

Delay. An unanticipated deferment of the start, progress, or finish of a scheduled activity.

Department. Idaho Transportation Department acting on behalf of the **Board**.

Director. The chief administrative officer of the Department, as established by law, and the Director's authorized agents.

District Engineer. An authorized representative of the **Department** having general supervision over construction and maintenance work in one of the several districts of the Department. The boundaries of the districts are on file in the office of the Department.

Engineer. The Chief Engineer of the **Department** acting directly or through the **Resident Engineer**.

Equipment. All machinery, tools, apparatus and supplies necessary for upkeep and maintenance, and for the proper construction and acceptable completion of the **work**.

Erodible material or surface. Exposed earthen material, except solid rock, that may be carried or displaced by wind, rainfall, snowmelt, or mechanically applied water.

Extra work. Work not provided for in the **contract** as awarded, but found essential for satisfactory completion of the contract within its intended scope, as determined by the **Engineer**.

Force account. A method of payment for **work** performed by the **Contractor**, calculated as specified in 109.03.

Highway. A general term denoting a public way for vehicular travel, including the entire area within the **right-of-way**.

Holidays. In the state of Idaho, holidays occur on: New Year's Day, Martin Luther King Jr./Idaho Human Rights Day, President's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas, or on any day proclaimed as a holiday by legal authority.

Independent assurance (IA). An unbiased and independent evaluation of sampling and testing procedures.

101.04

Inspector. The Engineer's authorized representative assigned to inspect work and materials.

Laboratory. A qualified laboratory is a laboratory used for sampling and testing of **materials** that has been qualified through appropriate programs as determined by the **Department**. An independent laboratory is a laboratory that is not owned or controlled by the **Contractor** or the Department, which is qualified. The materials laboratory of the Department and any other testing laboratory designated.

Lot. A specified quantity of material from a single source; a measured amount of construction assumed to be produced by the same process.

Materials. Any substance or product specified for incorporation in the **work**.

Neat line. The line established on the **plans** that describe the location, shape and border to which work is to be built or formed.

Notice of letting. A public notification of the **Department's** intent to receive **proposals** and award a **contract** for construction. The Notice of Letting contains information regarding the receipt and opening of proposals.

Notification of award. Written notice to the **Contractor** to begin the **work**, including the date of beginning of **contract time**.

Overburden. Surface soil or granular material which may or may not be suitable for construction purposes and which overlies other material suitable for road or bridge construction.

Pavement structure. The **structure** that is constructed on the **roadbed** and typically includes pavement surfacing, base courses, and granular subbase.

Pay item. (see **Contract pay item**)

Payment bond. (see **Contract bonds**)

Performance bond. (see **Contract bonds**)

Plans. Approved drawings or reproductions of approved drawings included in the contract showing location, type, dimensions and details of the specified **work**.

Professional engineer. An engineer licensed in accordance with Idaho Code to practice the profession of engineering in the State of Idaho.

Project. The section of **highway** or that area as shown on the **plans**, within which the work is to be performed.

Proposal. A bidder's written offer to perform the **work**.

Proposal forms. The forms and information provided by the **Department** to all prospective **bidders** to use in composing a proposal.

Proposal guaranty. The required security submitted with the **proposal** to ensure execution of the **contract** and the execution of the bond for the performance of the work if the **proposal** is accepted.

Quality analysis (QA). Evaluation performed to determine percent of **material** within limits and to assign a pay factor to that material.

Quality assurance program (QAP). All those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality. Quality assurance program includes **quality control, independent assurance, verification testing, and acceptance testing**.

Quality control (QC). The sum total of activities performed by the producer, manufacturer, and/or Contractor to make sure that a product meets contract specification requirements. This may include: materials handling and construction procedures, calibration and maintenance of equipment, production process control, sampling, testing, and inspection that is done for these purposes.

Random sample. A sample selected in such a way that every element of the population has an equally likely opportunity to be included in the sample.

Recreational resource. Any publicly owned site that is used solely for recreational purposes.

Regulatory floodway. The area regulated by federal, state, or local requirements; the channel of a river or other watercourse and the adjacent land areas that must be reserved in an open manner, i.e., unconfined or unobstructed, either horizontally or vertically, to provide for the discharge of the base flood so the cumulative increase in water surface elevation is no more than a designated amount.

Resident Engineer. The authorized representative of the **Engineer**.

Responsible bidder. A **bidder** that possesses the ability to perform the work and complete the contract requirements.

Right-of-way. A general term denoting land, property, or an interest therein, acquired for or devoted to **highway** purposes.

101.04

Roadbed. The top of **subgrade**, upon which the **pavement structure**, curbs, sidewalks, median and other incidental facilities are constructed.

Roadside. The areas between the outside edges of the **shoulders** and the right-of-way boundaries and areas between the roadways of a divided **highway**.

Roadway. That portion of the highway within the limits of construction.

Shoulder. The portion of the **roadway** adjacent to the **traveled way** for accommodation of stopped vehicles, for emergency use and for lateral support of base and surface courses.

Special provisions. Additions and revisions to the **Standard Specifications** and **supplemental specifications** covering conditions specific to the contract.

Specifications. All provisions and requirements contained in the **Standard Specifications**, supplemental specifications, and special provisions including addenda.

Specialty item. A **contract pay item** identified on the **bid schedule** as a "Specialty Item" and which is not chargeable to subcontract percentages.

Standard Specifications. All provisions and requirements contained in the Idaho Transportation Department *Standard Specifications for Highway Construction*.

State. The state of Idaho, acting through an authorized representative.

Statistical analysis. A method of analyzing inspection test results to determine conformity with the **contract**.

Structures. Bridges, culverts, headwalls, retaining walls, cribbing, riprap, underdrains, pipelines, buildings, catch basins, manholes and similar features that may be encountered in the work.

Subcontractor. The individual, partnership, firm, corporation, or any acceptable combination thereof, with the department's written approval, sublets part of the contract.

Subgrade. Materials directly below the **pavement structure**. The subgrade is either natural in-place material (as in excavated areas), or compacted fill material (as in embankments).

Sublot. The quantity represented by one complete test.

Substantial Completion. The project is complete to the point that the traveling

public can safely use the improvements without further delays, disruption, or impediments. For conventional bridge and highway work, substantial completion is when all bridge deck, parapet, pavement structure, shoulder, permanent signing and markings, traffic barrier, and safety appurtenance work is complete.

Substructure. That part of the **structure** below the bridge seats, below the skewbacks of arches, below the top of footings of rigid frames, below the top of caps of trestle bents, or below the top of columns on box girders. The **Department** considers wingwalls and backwalls of abutments to be part of the substructure.

Superintendent. The **Contractor's** authorized representative responsible for and in charge of the work.

Superstructure. That part of the **structure** not defined as **substructure**.

Supplemental specifications. Modifications and additions to the Standard Specifications approved by the Department.

Surety. The corporation, firm, partnership, or individual supplying the **contract bonds** provided by the **Contractor**. The surety may also provide the **proposal guaranty**.

Topsoil. Surface soil that is suitable for the germination of seeds and the support of vegetative growth.

Traffic control device. Signs, signals, markings, and devices placed on, over, or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn or guide traffic.

Traffic lane. The portion of the **traveled way** for the movement of a single line of vehicles.

Traveled way. The portion of the **right-of-way** for the movement of vehicles, excluding shoulders.

Verification testing. The sampling and testing which is carried out independent of acceptance sampling and testing to verify the **Contractor's** results.

Wetland. Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and, under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Work. The furnishing of all labor, **materials, equipment,** and other incidentals

102.02

necessary for the completion of the **project** as required by the contract, and the carrying out of all the duties and obligations imposed by the contract.

Working Day. All days except the following:

1. Saturdays, Sundays, holidays, July 3 and July 5
2. For work on the critical path, days of Engineer ordered suspensions for reasons other than Contractor negligence or non-compliance.
3. Contract-identified, non-working days during the construction season
4. Days during December, January, and February
5. Days where one or more of the following prevent the Contractor from working on the critical path with normal production rates for at least five hours:
 - 5.1 Earthquakes and other cataclysmic phenomena of nature the Contractor cannot foresee or avoid
 - 5.2 Weather conditions
 - 5.3 Job conditions caused by weather
 - 5.4 During excusable delays as specified in 108.07.B and 108.07.D.

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

102.01 Contents of Proposal Forms. Upon request, the Department will provide proposal forms to a bidder. The proposal forms will include the following:

1. The location and description of the proposed project
2. A schedule of items with an estimated quantity for each
3. The contract time for the proposed project
4. Amount of the proposal guaranty
5. Date, time, and location of the bid opening
6. Special provisions
7. Supplemental specifications
8. Contract requirements not contained in the Standard Specifications.

Documents bound with or attached to the proposal forms are a part of the proposal forms. The plans, specifications, and other documents referenced in the proposal forms are a part of the proposal form, whether attached or not, and need not be submitted with the proposal. Do not detach or alter bound or attached documents from the proposal forms when submitting the proposal.

Pay the amount stated in the notice of letting for the proposal forms and set of plans.

102.02 Interpretation of Quantities in Bid Schedule. The quantities provided by the Department in the bid schedule are approximate and are used by the Department to compare proposals. The Department reserves the right to change these

quantities or eliminate contract pay items at any time in accordance with 104.02. The Department will only pay for the accepted quantities of work in accordance with 109.

102.03 Examination of Plans, Specifications, and Site of Work. Carefully examine the proposed work site, plans and the proposal forms, before preparing and submitting a proposal. If a bidder chooses to not perform site investigations and the Department awards the contract to that bidder, the bidder will be responsible for all site conditions that would have been discovered had the bidder performed a reasonable site investigation. A reasonable site investigation includes investigating the project site, borrow sites, hauling routes, and all other locations related to the performance of the work.

Immediately notify the Department of errors or omissions in the plans and proposal forms, or inconsistencies between these documents and the proposed work site. If the Department performed borings and subsurface investigations at the work site or other areas, such as possible material sources, the Department obtained and used these records for study, estimating, and design purposes only; they may not necessarily reflect the actual subsurface conditions existing at the work site. A reasonable site investigation also includes inspection of these documents. Such information is for the bidder's general knowledge only and is not a substitute for the bidder's own reasonable investigation, interpretation or judgment.

The Department considers a submitted proposal to be prima facie evidence that the bidder understands and is satisfied with the conditions of the work site, plans, and proposal forms.

The Department does not consider written or oral explanations, instructions, and interpretations provided before award of contract as binding unless confirmed by addenda. It is the Department's intent to provide all bidders an equal opportunity to access and acquire information to formulate a responsive proposal. If the Department discovers any information, specifications, plans, data, or interpretations important for the bidding process to be deficient, the Department will provide this data to all bidders as addenda. Bidders must acknowledge receipt of addenda.

102.04 Preparation of a Proposal. Complete proposal forms described in 102.01 that were purchased from the Department. Submit an electronic or hard-copy proposal on the Department-provided forms. Submit hard-copy proposals that are typed or handwritten in ink. Provide a numeric unit price for each contract pay item on the bid schedule. Multiply each unit price by the relevant contract pay item quantity and provide the numeric product in the "Amount Bid" column. Add the products of all the contract pay items and provide a numeric total bid amount at the bottom of the same column. If discrepancies exist between the unit prices and the products

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or total bid amount, the Department will use the unit prices and calculate a correct total bid amount.

If the bid schedule contains alternate contract pay items or alternate sets of contract pay items, provide a unit price for only one of the alternates.

Based on the type of company, the Department requires the following on the submitted proposal:

1. Ink signatures or electronic digital I.D. of the following individuals, based on the bidder's organization:
 - 1.1. The owner of a sole proprietorship.
 - 1.2. At least one member of a partnership.
 - 1.3. At least one member or officer from each firm representing a joint venture.
 - 1.4. At least one officer of a corporation.
 - 1.5. An agent of the bidder, legally qualified and accepted by the Department.
2. Name and business address of the following, based on the bidder's organization:
 - 2.1. The owner of a sole proprietorship.
 - 2.2. Each member of a partnership.
 - 2.3. Each member or officer of the firms representing a joint venture.
 - 2.4. The corporation and its corporate officials.

If the contract includes mechanical or electrical work (plumbing, heating, air conditioning, or electrical), include the names, addresses, Public Works Contractors license number and contract or subcontract amount.

102.05 Conditional Proposals. If a bidder wants to bid on more than one project at a single bid opening, and wants protection from the Department awarding the bidder more projects than it can successfully perform, that bidder may submit bid proposals for any number of projects by signing and attaching the following statement to the bid proposal for one or more of the projects:

This proposal is conditioned upon my (or our) receiving the award for only one (or a greater number) of the contracts for which I (or we) have submitted proposals at this bid opening. If proposals for a greater number of contracts than herein before stated are accepted, then this proposal shall be considered withdrawn.

A bidder may also condition, as above, to bids submitted in subsequent bid open-

ings, if the Department has not made a determination of intent to award the prior project(s). The written condition must include:

This proposal is conditioned upon my (or our) receiving the award for only one (or a greater number of contracts) for which I (or we) have submitted proposals at this bid opening or for proposals submitted at previous bid openings for which the Department has not made a determination of intent to award. If proposals for a greater number of contracts than herein before stated are accepted, then this proposal shall be considered withdrawn.

If a bidder that submitted conditional bid proposals becomes the apparent low bidder on more than one conditional bid proposal, the Board may choose which contracts to award to that bidder.

102.06 Proposal Guaranty. Provide a proposal guaranty of the type, and at least in the amount, stated in the proposal forms.

If using a surety bond, submit the bond on an acceptable form signed by the surety. Include Power of Attorney for the person who executes the bond on behalf of the surety as Attorney-in-Fact.

If using a government obligation, ensure it is in accordance with 103.04.

102.07 Delivery of a Proposal. Submit a complete proposal on the Department's proposal forms described in 102.01 and prepared as described in 102.04. Submit the proposal either electronically or in the special envelope provided by the Department, or in another envelope of the same size and shape. For submitting proposals by mail, correctly fill in the blank spaces on the special envelope to clearly indicate its contents (make similar markings on an alternative envelope), seal, and address to the Department, in the care of the office of the official who will receive the submittal. Submit before the date and time, and to the place stated in the Notice of Letting. If the Department receives a submittal after the bid opening date and time, the Department will return the unopened submittal to the bidder.

102.08 Withdrawal or Revision of a Proposal. To withdraw or revise a proposal after it has been submitted to and received by the Department, submit a written request to the Department (by hand delivery, mail, or fax) before the date and time set for the bid opening.

102.09 Public Opening of Proposals. The Department will publicly open and read proposals on the date and at the time and place stated in the Notice of Letting.

102.10 Irregular Proposals. The Department will consider a proposal to be irregular and will reject it for any of the following reasons:

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1. Submitting the proposal in pencil.
2. Not signing the proposal.
3. Submitting the proposal on proposal forms not purchased from the Department. Electronic submittals must represent the purchased proposal forms.
4. Altering or detaching any part of the proposal forms as provided by the Department.
5. Submitting the proposal with unauthorized additions, conditional or alternate bids, omissions of addenda, or irregularities that might make the proposal incomplete, indefinite, or ambiguous
6. Adding provisions to the proposal reserving the right to accept or reject an award, or to enter into a contract pursuant to an award, except when made in accordance with 102.05.
7. Submitting the proposal without a proposal guaranty.
8. Submitting the proposal without a unit price for each contract pay item on the bid schedule, except for alternate contract pay items in accordance with 102.04.

102.11 Disqualification of Bidders. The Department may disqualify a bidder and reject all of the bidder's proposals for the following reasons:

1. A bidder submits multiple proposals for the same project, under the same or a different name.
2. The Department finds evidence of collusion among bidders.

The Department will not allow a bidder that participated in collusion to bid future work until the Department reinstates the bidder.

102.12 Protesting a Proposal. To protest a proposal or the waiver of an irregularity in a proposal, submit a written protest to the Chief Engineer within 5 calendar days after the bid opening.

102.13 Licensing of Bidders. For projects that do not involve federal funding, bidders shall possess the appropriate license in accordance with 107.03 before submitting a proposal. For projects that involve federal-aid funding, bidders and subcontractors that are required to be listed in the proposal shall possess the appropriate license in accordance with 107.03 before the Department awards the contract. If the proposal forms for projects that do not involve federal-aid funding require bidders to list subcontractors, the subcontractor shall possess the appropriate license in accordance with 107.03 and as stated above before the bidder submits a bid proposal.

SECTION 103 - AWARD AND EXECUTION OF CONTRACT

103.01 Consideration of Proposals. After the bid opening, the Department will compare submitted proposals using the total proposal amount. The Department will immediately make the results of the comparison available to the public.

The Department reserves the right to take any of the following actions if the Department determines it is in the best interest of the State:

1. Award the contract.
2. Reject proposals.
3. Waive technicalities in proposals.
4. Advertise for new proposals.
5. Proceed to do the work by other means.

103.02 Award of Contract. If a proposal acceptable to the Department is received, the Department will award the contract to the lowest responsible bidder within 45 calendar days after the bid opening.

The Department and the lowest responsible bidder may mutually agree, in writing, to defer the award beyond 45 calendar days.

The period set forth above may be extended a reasonable time for the lowest responsible bidder to secure a license, provided application for license is filed with the Public Works Contractors License Board within 1 business day following receipt of the Notice of Intent to Award letter.

If either of the following conditions precludes award, the Department will release the proposal guaranty of the lowest responsible bidder:

1. Public Works Contractors License Board denies the bidder's application.
2. The Department determines it is not in the public interest to defer construction pending licensing.

If the lowest responsible bidder fails to submit the license application on or before the first business day following receipt of the Notice of Intent to Award letter, or if the lowest responsible bidder withdraws the application, the bidder forfeits the proposal guaranty the same as if the bidder fails to execute a contract.

103.03 Return of Proposal Guaranty. After the Department opens and compares the proposals, the Department will immediately return proposal guaranties to bidders, except those of the two lowest responsible bidders. The Department will

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return the proposal guaranty of the unsuccessful of the two lowest responsible bidders within 10 business days after award of the contract. The Department will return the proposal guaranty of the successful bidder after the successful bidder submits the required contract bonds and signed contract. The Department will not return surety proposal guaranties.

103.04 Contract Bonds. As the lowest responsible bidder, provide both a performance bond and a payment bond, each equal to the original contract amount, in accordance with the applicable Idaho law. Execute the contract bonds on the Department-provided forms.

The lowest responsible bidder may deposit a government obligation as performance and payment bonds. If depositing a government obligation, pay the initial and return transfer charges for transmittal of the obligations to the State Treasurer's office. Ensure the obligations are acceptable to the State Treasurer, payable to, or fully negotiable by the Department, and in an amount equal at fair market value to the penal sum of the required contract bonds.

Deposit government obligations with the State Treasurer with instructions to issue a safekeeping receipt to the Department.

The Department will return those obligations deposited as a performance bond within 45 calendar days after final acceptance of the project. The Department will subtract monies owed as a result of this contract from the obligations. For settlement of claims, the Department will hold obligations deposited as the payment bond for one year from the date of acceptance of the project in accordance with Idaho Code, Section 541927.

103.05 Execution and Approval of Contract. Sign and return the contract with the contract bonds within 15 calendar days after receipt of the contract. If required by the contract, include with the signed contract a Summaries of Disadvantaged Business Enterprise Good Faith Efforts on Department-provided forms and other documentation that supports the summaries. If the Department fails to execute the contract within 15 calendar days after the Department's receipt of the signed contract and bonds, the bidder may withdraw the proposal without penalty. The contract will not be effective until fully executed by all of the parties.

103.06 Failure to Execute Contract. If the bidder fails to perform any of the following within 15 calendars days after receipt of the contract, the Department may cancel the award of the contract and retain the proposal guaranty as liquidation of damage:

1. Execute the contract.

2. File the contract bonds.
3. Provide acceptable evidence of good faith efforts to obtain disadvantaged business enterprise participation in accordance with 103.05, if required by the contract.

The Department may award the contract to the next lowest responsible bidder, advertise for new proposals, or proceed to do the work otherwise.

SECTION 104 - SCOPE OF WORK

104.01 Intent of Contract. The intent of the contract is to define the scope of work, and identify the rights and obligations of the Contractor and the Department for the construction, execution and completion of the work. Perform the work as required by the contract.

104.02 Contract Revisions

- A. General.** The Contractor and Engineer shall provide the appropriate notices for contract revision in accordance with 104.03.

Upon receiving the Engineer's written authorization or change order, proceed immediately with the revised work. The Contractor and Department are both responsible for mitigating the cost and time impacts of contract revisions.

The Engineer will calculate the time and cost impacts of contract revisions in accordance with 108.07 and 109.03, respectively.

If the Engineer issues a change order revising the contract, return the change order signed or unsigned to the Engineer within 5 business days after receipt of the change order. If returning an unsigned change order to the Engineer, include a written explanation for not signing the change order. The Department may withhold payment for the change order work until the Contractor submits a signed change order or unsigned change order with written explanation.

1. Engineer Initiated

The Engineer reserves the right to make, at any time during the work, such changes in quantities and such alterations in the work as are necessary to satisfactorily complete the project. Such changes in quantities and alterations shall not invalidate the contract nor release the surety, and the Contractor agrees to perform the work as altered. An alteration in the work includes extra work which is not otherwise required by the terms of the contract.

2. Contractor Requested

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If the Contractor requests a contract revision, the Contractor shall notify the Engineer using the "Request for Change" form supplied by the Department. Provide a detailed description of the change, the reason for the change, the benefit to the Department, the benefit to the Contractor and a detailed cost analysis.

The Engineer will review the request and respond in accordance with the following:

- a. If the Engineer approves the request, the Engineer will issue a change order revising the contract.
 - b. If the Engineer does not approve the request, the Engineer will provide a written response in accordance with 104.03.
- B. Extra Work.** When necessary or desirable to complete the project, the Engineer may direct the Contractor to perform extra work. The Department will pay for extra work in accordance with 109.03. The Engineer will determine time extensions, if warranted, in accordance with 108.07

The Engineer will provide direction to the Contractor in accordance with 104.03.

- C. Differing Site Conditions.** During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, are encountered at the site, the party discovering such conditions shall promptly notify the other party in writing of the specific differing conditions before the site is disturbed and before the affected work is performed.

Upon written notification, the Engineer will investigate the conditions, and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding anticipated profits, will be made and the contract modified in writing accordingly. The Engineer will notify the contractor of the determination whether or not an adjustment of the contract is warranted.

No contract adjustment which results in a benefit to the contractor will be allowed unless the contractor has provided the required written notice.

- D. Suspensions of Work Ordered by the Engineer.** If the performance of all or any portion of the work is suspended or delayed by the Engineer in writing for an unreasonable period of time (not originally anticipated, customary, or

inherent to the construction industry) and the contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, the Contractor shall submit to the Engineer in writing a request for adjustment within 7 calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

Upon receipt, the Engineer will evaluate the Contractor's request. If the Engineer agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the contractor, its suppliers, or subcontractors at any approved tier, and not caused by weather, the Engineer will make an adjustment (excluding profit) and modify the contract in writing accordingly. The Contractor will be notified of the Engineer's determination whether or not an adjustment of the contract is warranted.

No contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time prescribed.

No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided or excluded under any other term or condition of this contract.

- E. Significant Changes in the Character of the Work.** If the alterations or changes in quantities significantly change the character of the work under the contract, whether such alterations or changes are in themselves significant changes to the character of the work or by affecting other work cause such other work to become significantly different in character, an adjustment, excluding anticipated profit, will be made to the contract. The basis for the adjustment shall be agreed upon prior to the performance of the work. If a basis cannot be agreed upon, then an adjustment will be made either for or against the contractor in such amount as the engineer may determine to be fair and equitable.

If the alterations or changes in quantities do not significantly change the character of the work to be performed under the contract, the altered work will be paid for as provided elsewhere in the contract.

The term "significant change" shall be construed to apply only to the following circumstances:

1. When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction; or
2. When a major item of work, as defined elsewhere in the contract, is

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increased in excess of 125 percent or decreased below 75 percent of the original contract quantity. Any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed.

If the Engineer determines that alterations or changes in quantities significantly change the character of the work as follows, the Engineer will issue a change order revising the contract in accordance with 104.02.A.

If the Engineer determines that the alteration, or change in quantity, is not a significant change to the character of work, and the Contractor disagrees, follow the notification procedures as specified in 104.03.

If the alteration, or change in quantity, does not significantly change the character of the work, the Department will pay for the altered work at the contract unit price.

- F. Eliminated Contract Pay Items.** The Engineer reserves the right to eliminate a contract pay item that the Engineer determines to be unnecessary to complete the work. Such action will in no way invalidate the contract. The Contractor, when notified of the elimination will be reimbursed for direct costs incurred before notification of elimination.

104.03 Notification of Contract Revision

- A. General.** The step-by-step notification and documentation process to expedite the resolution of contract revisions is defined in this subsection. The responsibilities of both the Contractor and the Department are outlined.

The Contractor's non-compliance with the requirements of this subsection may constitute a waiver of entitlement to a pay adjustment under 109.03 or a time extension under 108.07. Entitlement is waived if the Engineer is not afforded the opportunity by the Contractor to examine the site of work or is not afforded the opportunity to review the Contractor's project records.

1. Engineer Notification

- a. **Engineer's Notification and Request for Proposal**
The Engineer will notify the Contractor of a contract revision, identify the scope of the revised work, and request a detailed cost and time proposal for the revised work. The request will specify a time requirement for the Contractor's response.
- b. **Contractor's Proposal**

Provide the Engineer with a complete and itemized proposal within the time specified in the request, at no additional cost to the Department. Include the following information in the proposal:

- i. The estimated increase or decrease in the contract amount.
 - ii. The estimated increase or decrease in the contract time.
 - iii. Any other perceived adjustments necessary to complete the work.
- c. Engineer's Direction
- The Engineer may issue a change order to the Contractor in accordance with 104.02.A. If the Contractor disagrees with the Engineer's decision, the Contractor may pursue a claim in accordance with 105.16.

2. Contractor Notification

a. Contractor's Initial Written Notification

If required by 104.02 or 108.07, or if the Contractor believes that the Department's action, the Department's inaction, or some other situation has caused a contract revision, the Contractor must immediately provide initial written notification to the Engineer. Upon notification, the Engineer will investigate the issue.

The Contractor is encouraged to provide any additional information requested by the Engineer as early as possible to assist the Engineer in the timely resolution of the issue. The Engineer will not require, in subsequent submissions, duplication of information already provided.

b. Engineer's Response to Contractor Notification

Within 10 business days after receiving the Contractor's notification, the Engineer will provide a written response to the Contractor with one or more of the following responses:

- i. If the Engineer determines that a contract revision exists, the Engineer will issue a change order in accordance with 104.02.A.
- ii. If the Engineer determines that a contract revision does not exist, the Engineer will provide the Contractor with a statement as to why the issue does not necessitate a contract revision.
- iii. If the Engineer needs more information to make a determination,

the Engineer will request the information and specify a due date.

If the Engineer fails to provide a response or when the Contractor believes that the Engineer has no further basis to request additional information as described in item a above, or disagrees with the Engineer's decision, the Contractor may pursue the dispute as specified in 105.16.

104.04 Value Engineering Change Proposals (VECP). To reduce construction cost without impairing the project functions or characteristics, the Contractor may submit proposals to modify the plans, specifications, or contract requirements to the Engineer. The Engineer will not consider a VECP that changes the following:

1. Basic design or components of elevated structures.
2. Type, size, elevation or structural requirements of foundations.
3. The types, thickness, or joint designs of a concrete, bituminous, or stabilized surface or base course.
4. Environmental mitigation commitments for the project.

The Contractor and the Department will equally share cost savings to the contract as a result of Department-approved VECP.

The Department will pay for a VECP through the change order process in accordance with 104.02. Payment for VECP shall be considered as full consideration for performance of the work of the change order.

Do not base prices in a bid proposal on the anticipated approval of a VECP.

The Engineer will determine the acceptability of a VECP and the estimated net savings in construction cost. If the Engineer believes the contract unit prices do not represent the work, the Engineer may use other calculated costs for determining the estimated net savings, such as fair market value. The Department will assume no liability in considering a VECP, including delays and VECP refusals.

- A. Submittal and Review of VECP Concept or Idea.** To illustrate the VECP, submit to the Engineer the preliminary plans, specifications, and costs. Indicate whether sufficient time is available in the project schedule for a formal submittal and review before VECP implementation.

The savings generated by the VECP must be sufficient to warrant a review and processing of the VECP.

The Engineer will review the VECP concept or idea and, within 10 calendar days of the initial submittal, will reject or approve the VECP concept or idea. If the Engineer approves the VECP concept or idea, the Engineer will provide the Contractor with written authorization to submit a formal VECP.

The Engineer may evaluate the need for an extension to the contract time based on the additional time needed for the Engineer's review and the expected impact on the Contractor's schedule.

B. Formal Submittal of the VECP. The Engineer will only consider a formal VECP after approval of the initial submittal in accordance with 104.04.A. Submit a formal VECP within 30 calendar days after written authorization. Include the following in the formal VECP:

1. A statement that the final proposal is submitted as a VECP.
2. A description of the difference between the existing contract and the proposed change.
3. The advantages and disadvantages of each difference, including effects on service life, economy of operations, ease of maintenance, benefits to the traveling public, desired appearance, and safety.
4. A complete set of plans and specifications that show the proposed revisions relative to the original contract features and requirements, including design calculations supporting the revision.
5. A complete cost analysis indicating the original estimated costs and quantities proposed to be replaced compared to the new costs and quantities in the VECP.
6. A schedule or date for the Engineer to issue a change order to maximize cost reduction during the remainder of the contract and the reason for this schedule.
7. A statement detailing the impact of the VECP on final project completion.
8. A revised CPM schedule showing changes to the construction schedule resulting from the VECP.
9. A description of the conditions and results of previous use of the VECP.

10. If the proposal was previously submitted, provide the date, ITD contract number, and the action taken by the Department.

- C. Conditions.** A Contractor-submitted VECP only applies to the ongoing contract referenced in the proposal. When submitted, the VECP will become the property of the Department. The Department may duplicate and disclose any data unless the Contractor specifically restricts the use of certain portions of the proposal. This provision is intended to protect trade secrets, bidding and pricing methods, and rights provided by law with respect to patented designs, materials, or processes.

The Department will not consider requests for additional costs or delays resulting from the rejection of a VECP.

The Department will not consider a submittal as a VECP if savings are the sole result of the elimination or reduction of a single contract pay item. The Department will consider the VECP if savings result from the elimination or reduction in quantity of a contract pay item specified as part of a VECP.

If specified as individual contract pay items, the Department may consider contingency items when reduced as part of a VECP to change scope, method, or procedure.

If the VECP requires the services of a professional engineer as required by Idaho Code, the professional engineer, licensed by the state of Idaho, shall stamp the VECP.

- D. Acceptance, Rejection, and Payment.** After the Contractor formally submits the complete VECP, the Engineer will accept or reject the VECP within 30 calendar days.

The Engineer will issue a change order that pays the Contractor 50 percent of the net savings amount. The Engineer will calculate the net savings amount by using the difference between the cost of the proposed changes to the work and the cost of the work as required by the contract, using contract unit prices or other calculated costs.

The Department will not reimburse the Contractor for development, design, and implementation of the VECP. The Department's estimated cost to evaluate, review, and implement the VECP will not be included in the calculation of net savings.

The Engineer will calculate the incentive payment in accordance with the following equation:

$$S = \frac{A - B}{2}$$

where

S = Share in quantifiable cost savings from the VECP.

A = Cost of the work as required by the contract.

B = Cost of the work as revised by the VECP.

SECTION 105 - CONTROL OF WORK

105.01 Authority of the Engineer and Suspension of Work. The Engineer decides all questions regarding the quantity, quality, acceptability of materials furnished and work performed, work progress, contract interpretation, and acceptable contract fulfillment.

The Engineer may order the Contractor in writing to suspend, delay or interrupt all or any part of the work for any condition or reason considered to be in the Department's interest.

The Engineer may also suspend the work, wholly or in part for the Contractor's failure to:

1. Correct conditions unsafe for project personnel or the public.
2. Complete contract provisions.
3. Comply with the Engineer's direction.

During periods of suspensions, perform the following tasks:

1. Maintain traffic.
2. Prevent damage to the project.
3. Provide normal drainage.
4. Protect erodible surfaces using approved erosion and sediment control measures.
5. Prevent water pollution.
6. Prevent damage by sedimentary deposits.
7. Erect temporary facilities as directed by the Engineer.
8. Maintain and protect the condition of newly planted living material.

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If a suspension increases the cost, time, or both required to perform the work, the Engineer will determine the responsibility for and impacts of the suspension in accordance with 104.02.D.

105.02 Plans and Working Drawings. The Engineer will provide the Contractor with 10 sets of the plans and proposals.

The plans show details of structures, lines, grades, and typical cross sections of the roadway. The plans also show the design and location of structures and a schedule of items. Supplement the plans with working drawings to adequately control the work. Working drawings include shop and erection drawings, associated trade literature, calculations, schedules, manuals, and similar documents to detail required work. Keep one set of the plans, including approved working drawings, available on the project at all times.

Submit working drawings to the Engineer on 22 in × 34 in sheets unless otherwise approved. Obtain the Engineer's approval of working drawings before starting any work represented on the working drawings. The Engineer's approval of working drawings does not waive any contract requirements or relieve the Contractor's responsibility for the accuracy of the working drawings, including details and dimensions.

For structures, submit six sets of working drawings that include the following:

1. Stress sheets.
2. Shop drawings.
3. Erection plans.
4. Cofferdam plans.
5. Bending diagrams for reinforcing steel.
6. Any other supplementary plans or similar data required by the contract.

For structures, unless otherwise required by the contract, the Engineer will require up to 30 calendar days from receipt of each submittal or resubmittal for review and response to the Contractor. For all other submittals and resubmittals, the Engineer will require up to 10 business days, unless otherwise required by the contract.

The Department considers the cost of furnishing working drawings to be included in the contract unit prices of the contract pay items covering the work reflected in the working drawings.

Before the completion of the project, provide the Engineer with one set of reproducible

3 mil mylar copies of the Department-approved working drawings for any permanent part of any completed structure.

105.03 Conformity with Plans and Specifications. Perform work and furnish materials to meet contract requirements.

If the Engineer determines that the Contractor did not perform the work or provide materials in accordance with the contract, the Engineer will decide on the acceptability of the work.

If the Engineer accepts the work, the Engineer will document the basis of acceptance and adjust the contract price accordingly. The Engineer will use the schedule of price adjustments in the ITD Laboratory Operations Manual for certain non-specification materials the Department allows to stay in place.

If the Engineer does not accept the work, the Engineer will direct removal and replacement or repair of the work or materials in accordance with 105.12.

105.04 Coordination of Contract Documents. The specifications, the supplemental specifications, the plans, special provisions, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. The Department considers them to be complementary and to describe and provide a complete contract.

In case of discrepancy between contract documents:

1. Calculated dimensions govern over scaled dimensions.
2. Plan sheets govern over Standard Specifications, supplemental specifications, and standard drawings.
3. Plan details govern over general notes.
4. Supplemental specifications govern over Standard Specifications.
5. Special provisions govern over Standard Specifications, supplemental specifications, and the plans.
6. Details on the bid schedule govern over other contract documents.

Do not take advantage of errors or omissions in the contract documents. Immediately notify the Engineer of an apparent error or omission encountered in the contract documents. The Engineer will determine if an error or omission exists, interpret and correct the error or omission to fulfill the intent of the contract documents, and determine if a contract revision is required as a result of the error or omission in accordance with 104.02.

105.05 Administrative Cooperation. Give the project the constant attention necessary to promote progress of the work, and cooperate with Department inspectors and other contractors.

Provide a superintendent as a representative on the project at all times. The superintendent shall be capable of reading and understanding the contract documents and have experience in the type of work being performed. As the Contractor's representative, the superintendent shall cooperate and communicate with and receive directions and instructions from the Engineer or other Department authorized representatives.

Delegate authority to the superintendent to immediately execute the Engineer's directions and instructions, and to supply all materials, equipment, tools, labor, and incidentals necessary to perform the work.

105.06 Cooperation Between Contractors. Other work may be ongoing on or near the work covered by the contract. Cooperate with other contractors that are working within the same project limits or adjacent to the project limits.

Do not interfere with or hinder work being performed by other contractors. Perform the work and place materials to avoid interference with the operations of other contractors. Properly perform, join, and sequence the work with other contractors.

Each contractor involved shall assume all liability in connection with their contract and shall protect and save harmless the State from any and all damages or claims that arise because of inconvenience, delay, or loss from the presence and operations of other contractors working within the limits of the project.

105.07 Utility Facilities. The plans or special provisions will identify the location of known utility facilities requiring removal, relocation, or adjustment. Before beginning construction, verify the location of the identified utilities on the project at no additional cost to the Department.

Immediately notify the Engineer upon discovery of an unidentified utility facility that may require removal, relocation, or adjustment to continue the work. The Engineer will coordinate the necessary utility facility removal, relocation, or adjustment with the utility owner. If the Engineer directs the Contractor to remove, relocate, or adjust the utility facility, the Department will consider this as extra work in accordance with 104.02. If performed by others, the Contractor shall not be responsible for the cost of the removal, relocation, or adjustment of the utility facility.

For utility facilities identified in the contract, perform the following:

1. Coordinate the work with the operations of utility owners and provide sufficient time in the project schedule for the utility operations.
2. Provide sufficient prior notification to utility owners of when the utility owners need to schedule and perform their operations.
3. Provide required notification to utility owners in accordance with Title 55, Chapter 22, Idaho Code.

Do not interfere with or delay utility work being performed by utility owners or their authorized agents. The Contractor is liable to the utility owners for damage or service interference resulting from the Contractor's operations in accordance with 107.12.

The Contractor is responsible for the cost and time impacts caused by utility removals, relocations, or adjustments not required by the contract and made only for the Contractor's benefit or convenience.

If the Contractor believes that a utility owner caused a delay, immediately notify the Engineer, in writing, of the location and circumstances in accordance with 104.03. If the Engineer determines that a utility owner delay occurred under the following conditions, the Engineer will issue a change order revising the contract in accordance with 104.02:

1. The utility owner failed to remove, relocate, or adjust the facility within the time agreed to by the Contractor and utility owner.
2. The Contractor attempted to minimize the impact of the delay in accordance with the contract.
3. The Contractor showed that the utility owner delayed the work.

The Department will consider delays caused by the Contractor's failure to communicate, coordinate, and schedule with the utility owners or railroads as non-excusable delays in accordance with 108.07.

105.08 Construction Stakes, Lines, and Grades. The Department will provide initial surveying on the project unless the contract requires the Contractor to provide surveying services.

The Engineer will set or provide the following:

1. Construction stakes to establish lines, slopes, and continuous grade for road work.
2. Roadway centerline and bench marks for bridge work.
3. Structure centerline and bench marks for culverts and other structures.

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4. Additional information on lines, slopes, and grades to allow the Contractor to establish other necessary controls required to perform the work.

The Engineer will not provide additional stakes or marks.

The Engineer may spot check the lines and elevations established by the Contractor. Such spot checks do not relieve the Contractor of the following responsibilities:

1. Performing normal checking and testing as required by the contract.
2. Producing work that meets the contract requirements.

The Contractor is responsible for correcting any Contractor-caused surveying errors and any work resulting from the error at no additional cost to the Department. Preserve construction stakes and benchmarks; and replace stakes or benchmarks destroyed or disturbed by the Contractor at no additional cost to the Department.

The Department will be responsible for the accuracy of survey work performed by the Department and information provided by the Engineer. The Contractor shall be responsible for controls provided and work performed by the Contractor.

The Department assumes no responsibility for staking delays unless the Engineer is notified 10 calendar days before the Contractor begins work on an item and 72 hours if stakes are subsequently needed.

105.09 Authority of the Resident Engineer. As the authorized representative of the Engineer and under the direction of the District Engineer, the Resident Engineer has immediate charge of the engineering details of the project and has direct supervision of the administration of the contract.

105.10 Duties of the Inspector. Inspectors authorized by the Department will inspect the Contractor's completed work and the preparation, fabrication, or manufacture of the materials. Inspectors may not alter or waive the contract requirements, issue instructions contrary to the contract, or direct the Contractor's work. Inspectors may reject work or material and will refer disputes to the Engineer.

105.11 Inspection of Work. The Engineer may inspect the Contractor's work and materials. Allow the Engineer access to the work and provide information and assistance for inspection. The Engineer's inspections will not relieve the Contractor from the responsibility for providing quality control to ensure the work meets the contract requirements.

The Engineer may reject defects when discovered. The lack of discovery of a rejected defect before this decision shall not preclude this decision nor obligate the Department to accept.

The Engineer may direct the Contractor to remove work to access other portions of the work for inspection. After inspection, restore the removed work in accordance with the contract requirements. If the Engineer determines that the inspected work is acceptable, the Department will pay for the restored work as extra work in accordance with 104.02. If the Engineer determines that the inspected work is unacceptable, proceed in accordance with 105.12 and restore the removed work to the standard required by the contract at no additional cost to the Department.

When a government agency, utility, or railroad company is to accept or pay a portion of the contract cost, that organization's representatives may inspect the work. Inspections by such organizations do not make them a party to the contract and do not interfere with the rights of parties to the contract.

105.12 Unacceptable and Unauthorized Work. Except as otherwise specified in 105.03, the Contractor is responsible for removing and replacing or repairing unacceptable work at no additional cost to the Department.

The Department will not pay for unauthorized work and the Engineer may direct the Contractor to remove and replace the unauthorized work at no additional cost to the Department. The Department defines unauthorized work as any of the following:

1. Work performed contrary to the Engineer's instructions.
2. Work performed beyond the lines shown on the plans.
3. Extra work performed without the Engineer's authorization.

If the Contractor fails to comply with the Engineer's instructions, the Engineer may direct others to remove and replace or repair unacceptable or unauthorized work and deduct the cost of this work from any monies due or to become due to the Contractor.

105.13 Load Regulations. Observe legal load regulations if hauling materials on public roads. The Engineer will not allow the Contractor to operate equipment that will damage structures, roadway, or the completed work. Do not exceed legal load limits on structures, subbase, base, and pavement, unless otherwise approved, in writing, by the Engineer.

105.14 Maintenance During Construction

- A. General.** The Department does not consider snow removal part of the maintenance work covered in this subsection, and will provide snow removal on the project. Provide a safe smooth surface usable by snow removal equipment. Do not interfere with snow removal operations.
- B. Maintenance of Work.** Until the Department accepts a portion of or all of the

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work in accordance with 105.15, continuously maintain the work in accordance with the contract requirements.

Maintain previously constructed work when the contract involves placing material on, or the use of, a previously constructed subgrade, base course, pavement, or structure

If the Contractor fails to correct unsatisfactory maintenance as directed by the Engineer, the Engineer may direct others to maintain the work and will deduct the cost of the maintenance work by others from any monies due or to become due to the Contractor.

The Department considers the cost of maintaining work in place to be included in the contract unit price of the contract pay items covering the work being maintained.

- C. Maintenance of Public Haul Roads.** Maintain and restore public highways and streets to a condition equally as good as they were in when hauling was started at no additional cost to the Department.

Use water to abate accumulated dust on public highways and streets resulting from hauling related with the work, as directed by the Engineer. The Department will pay for dust abatement in accordance with 205.05 or, if the contract does not specify a dust abatement contract pay item, as extra work in accordance with 104.02.

- D. Maintenance of Traffic.** Unless otherwise directed by the Engineer, maintain the road for use by traffic and minimize traffic delays during roadway construction. Ensure that individual traffic delays do not exceed 15 minutes and that all traffic delays do not exceed a total of 30 minutes through the length of the project, unless otherwise approved, in writing, by the Engineer. Implement remedial action to eliminate the excess delays to traffic.

Before starting the work, submit a traffic control plan to the Engineer for approval and include the following information:

1. Construction phasing.
2. Areas of work.
3. Proposed detours.
4. Traffic control devices.
5. Pavement markings.

Also submit to the Engineer for approval proposed measures to address traffic delays resulting from emergencies, highway incidents, emergency vehicles, and scheduled school bus routes within the project limits. Notify the Engineer at least 2 calendar days before making changes to the traffic control plan and submit the revised traffic control plan to the Engineer for approval.

Provide a Worksite Traffic Control Supervisor, certified in accordance with the American Traffic Safety Services Association, or an approved equal, to direct the installation, modification, and maintenance of traffic control devices required by the contract. Ensure vehicles used to perform traffic control activities such as installation, removal, maintenance or monitoring of traffic control devices are equipped with a working high-intensity rotating, flashing, oscillating, or strobe light that meets the requirements of the MUTCD.

Perform the following functions at no additional cost to the Department unless otherwise specified by the contract:

1. Maintain traffic so that the roadway and structures are kept passable to traffic at all times.
2. Provide and maintain temporary approaches, crossings, and intersections with trails, roads, streets, businesses, parking lots, residences, garages, and farms in a safe condition.

The Department considers the cost of monitoring traffic control work during working hours to be included in the contract unit prices for the respective traffic control devices.

Monitor and maintain traffic control devices during nonworking hours and nonworking days. During nonworking hours, make an employee available to maintain traffic control devices. During nonworking days, perform required maintenance and review the project traffic control at least once per day as approved by the Engineer. Provide a written statement describing the time and work performed during nonworking days. The Department will pay for Engineer-approved time and work performed during nonworking hours and nonworking days as the Traffic Control Maintenance contract pay item in accordance with 626.

- E. Maintenance of Temporary Detours.** If approved in writing by the Engineer, the Contractor may reroute traffic over detours constructed and maintained at no additional cost to the Department instead of maintaining traffic through the project improvements. The Department will not pay for quantities that exceed the estimated quantities provided by the Department on the bid schedule

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for traffic control devices, flagging, and pilot cars used to maintain traffic on approved temporary detours.

Use water or dust oil to abate accumulated dust on detour routes, as directed by the Engineer. The Department will pay for dust abatement in accordance with 205.05 or, if the contract does not specify a dust abatement contract pay item, as extra work in accordance with 104.02.

105.15 Acceptance. Before the Engineer declares a portion of the work complete or the entire project complete, clear the project areas and all applicable authorized areas outside of the project limits (except established commercial sites) of waste, excess material, temporary structures, and equipment. Leave the work in an acceptable condition.

A. Partial Acceptance. After completing a portion of the work (such as a structure, an interchange, or a section of road), the Contractor may submit a written request to the Engineer for final inspection of that portion. For a portion of the work to receive partial acceptance, it must be able to be open to the traveling public with no restrictions. After inspection, if the Engineer determines that the Contractor completed the portion of work in accordance with the contract requirements, the Engineer will consider this a final inspection for that portion. The Engineer will deem that portion of the work completed by written notification to the Contractor, and relieve the Contractor of construction site responsibilities for that portion.

If the inspection discloses work not completed in accordance with the contract requirements, the Engineer will give written notice to the Contractor of the non-compliant work found in the inspection. The Resident Engineer will not declare that portion of the project complete until the Contractor addresses the noncompliant work to the satisfaction of the Engineer.

If, after partial completion, the Contractor or a Subcontractor damages the work, the Contractor shall repair or replace the damaged work in accordance with the contract requirements and to the satisfaction of the Engineer at no additional cost to the Department.

Partial acceptance occurs after the Contractor executes and submits all documents, certificates, and proofs of compliance for that portion. When the Contractor submits, and the Engineer accepts all contract required project documentation, the Engineer will make the partial acceptance for that portion and notify the Contractor in writing of this acceptance.

A partial completion and acceptance decision by the Engineer does not void or alter the terms of the contract.

- B. Final Acceptance.** After completing the work for the entire project, provide a written notice of completion to the Engineer and the Engineer will inspect the work. If the Engineer determines that the Contractor completed the work in accordance with the contract requirements, the Engineer will deem the project complete by written notification to the Contractor, and relieve the Contractor of all construction site responsibilities.

If the inspection discloses work not completed in accordance with the contract requirements, the Engineer will give written notice to the Contractor of the noncompliant work found in the inspection. The Engineer will not declare the project complete until the Contractor addresses the noncompliant work to the satisfaction of the Engineer.

Final acceptance occurs after the Contractor executes and submits all documents, certificates, and proofs of compliance. When the Contractor submits, and the Engineer accepts all contract required project documentation, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance.

105.16 Administrative Resolution Process for Disputes. The Department and Contractor shall follow the administrative resolution process defined in this subsection to resolve all disputes that arise out of the contract or the performance of the work, unless the contract specifically allows the use of an alternate resolution process in accordance with 105.19 to assist the administrative resolution process.

If the Contractor fails to follow the claim procedures as specified in this subsection, the Contractor shall waive its right to pursue the issue, dispute, or claim under the contract.

The Contractor bears the burden of proving entitlement, damages and causation related to disputes.

The Contractor shall continue to perform the work during any dispute.

The Department will allow the Contractor to make oral presentations in support of a dispute, at any level of review in accordance with this subsection. The Department and the Contractor may mutually agree to extend any time requirement related to the administrative resolution process.

At any time during the administrative resolution process, the Department and the

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Contractor may mutually agree to obtain technical analysis support from a technical expert in accordance with 105.17.

The Department and Contractor must exhaust all steps in the administrative resolution process before referring a dispute to binding arbitration or litigation.

A. Resident Engineer Level. If a dispute arises out of the contract or the performance of the work, immediately provide a signed written notice of intent to file a construction dispute to the Resident Engineer. To preserve the right to pursue a dispute in accordance with the contract requirements, perform the following:

1. Provide timely notice of intent to the Resident Engineer.
2. Allow the Resident Engineer to examine the site of work.
3. Contemporaneously provide the Resident Engineer with daily records of actual costs incurred performing the disputed work.
4. Allow the Resident Engineer to review the Contractor's project records.

Submit unrelated disputes separately.

Supplement the written notice within 15 calendar days with a written statement that contains the following:

1. Date of the dispute.
2. Nature and circumstances causing the dispute.
3. Contract provisions that support the dispute.
4. Estimated cost of the dispute and supporting calculations.
5. An analysis of the schedule showing schedule changes, disruptions, and delays.

If the circumstances causing the dispute continue, provide the Resident Engineer with timely updates that supplement the above information.

Submit to the Resident Engineer full and final documentation to support the dispute no later than 60 calendar days following the date the dispute has fully matured. A dispute fully matures when all the direct damages (money and/or time) resulting from the dispute can be reasonably quantified. Impact damages may be submitted later as separate disputes if and when they occur. The possibility of impact damages should not delay the submittal of full and final documentation of disputes with direct damages.

Include the following information in the full and final documentation to support the dispute:

1. A factual narration of events that detail the nature and circumstances causing the dispute, including dates, locations, and the items of work affected by the dispute.
2. Specific provisions of the contract or laws supporting the dispute and a statement explaining how these provisions support the dispute.
3. Identification and copies of all documents and oral communication that support the dispute.
4. Reference to standard industry manuals.
5. Any other information, arguments, and data relevant to the dispute.

For time extension requests, provide the following:

1. Specific days or events that justify the request.
2. Reasons supporting the request.
3. Contract provisions supporting the request.
4. Detailed analysis of the Contractor's schedule supporting the request in accordance with 108.07.

For additional compensation requests, identify the amount and provide justification in the following categories:

1. Labor, including a list of individuals, classifications, and hours worked.
2. Material, including invoices and purchase orders.
3. Equipment, including a detailed description and the hours and dates operated. Use equipment rates in accordance with 109.03.
4. Field office overhead.
5. Home office overhead (general and administrative) if applicable.
6. Other categories as necessary or as requested by the Department.

Provide a signed and notarized statement that contains the following certification:

Under penalty of law for perjury or falsification, the undersigned, hereby certifies that the dispute is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the

amount requested accurately reflects the contract adjustment for which the Contractor believes the Idaho Transportation Department is liable; and that I am duly authorized to certify the dispute on behalf of the Contractor.

During performance of disputed work, keep complete records of extra costs and time incurred. Provide copies of these records to the Resident Engineer during performance of disputed work (daily if necessary) so that they can be verified contemporaneously.

If the Contractor provides a complete dispute submittal, the Resident Engineer will review the dispute submittal and issue a written decision to the Contractor within:

1. 60 calendar days from the date the Resident Engineer receives the dispute submittal if the dispute amount is less than or equal to \$100,000.
2. 90 calendar days from the date the Resident Engineer receives the dispute submittal if the dispute is greater than \$100,000.

If the Resident Engineer does not provide a written decision within the specified time, the Contractor shall consider no response as a dispute denial decision.

If the Resident Engineer decides a contract revision is justified a change order will be issued in accordance with 104.02. If the Contractor disagrees with the decision, the Contractor may appeal the dispute in accordance with 105.16.B.

The Resident Engineer's decision will be final unless the Contractor submits a written appeal and a copy of the complete dispute submittal to the Chief Engineer within 30 calendar days of the Resident Engineer's decision.

B. Chief Engineer Level. The Chief Engineer will acknowledge receipt of the Contractor's appeal.

The Chief Engineer will review the dispute submittal and issue a written decision to the Contractor within 90 calendar day after the date the Chief Engineer receives the appeal and complete dispute submittal.

If the Contractor agrees with the Chief Engineer's decision, the Resident Engineer will issue a change order in accordance with 104.02. If the Contractor disagrees with the decision, the Contractor may request binding arbitration in accordance with 105.18 within 120 calendar days from receipt of the Chief Engineer's decision.

The Chief Engineer's decision will be final and conclusive unless subsequently changed by a court of competent jurisdiction or by binding arbitration.

- C. Audits.** Department auditors, or independent auditors under contract with the Department, may perform inspections and audits. The Contractor and subcontractors shall allow authorized auditors to perform an audit, an inspection, or both on wage, payroll, and cost records related to the dispute. The Contractor and subcontractors shall retain these records at the respective company offices. During normal business hours, the Contractor and subcontractors shall provide facilities acceptable to the authorized auditors for the inspection, the audit, or both. The Contractor and subcontractors shall cooperate with the authorized auditors. The Department will notify the Contractor before the first, scheduled day of the audit. The Contractor shall retain cost records supporting the dispute value until the dispute is resolved. The Department will maintain information obtained in an audit as confidential to the extent provided by law.

The Contractor and subcontractors shall perform the following for all parts of a dispute or waive the right to that dispute part:

1. Maintain and retain sufficient records.
2. Allow authorized auditors to verify the dispute.
3. Allow authorized auditors to access the records of the Contractor or subcontractors.

The Contractors and subcontractors shall allow the authorized auditors to access the following documents relating to the dispute:

1. Daily time sheets and supervisors' daily reports.
2. Union agreements.
3. Insurance, welfare, and benefits records.
4. Payroll registers.
5. Earnings statements and records.
6. Payroll tax statements and records.
7. Material records, invoices, and requisitions.
8. Material cost distribution sheets.
9. Equipment records.
10. Vendors, rental agencies, subcontractor's and lower-tier subcontractor's invoices.
11. Subcontractor's and lower-tier subcontractor's payment certificates.

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12. Canceled checks for payroll and vendors.
13. Job cost reports.
14. Job payroll ledgers.
15. General ledgers.
16. Cash disbursement journals.
17. Financial statements for all years reflecting operations on the contract. The Department may require additional financial statements for three years before the work began and for three years after final acceptance of the project.
18. Documents that relate to each dispute for this project; including documents that support the dispute amount.
19. Documents used to prepare the elements of the construction dispute including labor, benefits and insurance, material, equipment, subcontractors, time periods, individuals involved, the hours and rates for the individuals.
20. Documents and computation sheets used during the course of bidding to the extent the dispute is based upon the original bid proposal.
21. Scheduling documentation.

105.17 Technical Analysis Support (TAS). If the Department and the Contractor agree to use TAS in accordance with the administrative resolution process specified in 105.16, the Department and the Contractor shall interview potential technical experts (TEs) jointly. The selected TE shall be a neutral, impartial, and objective technical expert on the dispute issues, and represent the interests of the project.

The Department and the Contractor shall sign a written agreement of the following:

1. Scope of the TE services.
2. Budget for the scope of TE services.
3. To not retain the services of the TE or to allow the TE to represent either party in subsequent steps in the administrative resolution process, and if necessary, any alternate resolution process, related to this project.

The Department, Contractor, and TE shall sign a written agreement of the following:

1. Notice to proceed with the analysis of the dispute issues.
2. Deadline for the TE to report the findings and recommendations.

The TE will provide the findings and recommendations to the Department and the Contractor jointly. If requested by either the Department or Contractor, the TE will discuss clarifications of the findings and recommendations with both parties.

The Department and the Contractor will separately accept or reject the TE's findings and recommendations and will notify the other party, in writing, of their decision within 10 calendar days of receipt of the findings and recommendations. If the Department and the Contractor agree with the TE's findings and recommendations, the Resident Engineer will issue a change order in accordance with 104.02.

The TE's findings and recommendations are nonbinding on the Department and Contractor. However, the following information may be admissible as evidence in any subsequent dispute resolution proceeding or forum to the extent permitted by law:

1. Qualifications of the TE.
2. The fact that an independent TE considered the dispute.
3. TE's findings and recommendations.

The Department and Contractor will equally share the cost and expenses of the TAS. The TE will invoice the Contractor. After the Department and Contractor each approve the invoice, the Contractor will pay the TE invoice. The Contractor will submit to the Department an invoice for one-half of the total cost of the TE invoice. The Department will reimburse the Contractor for the invoiced amount representing one-half the total cost of the TE invoice.

105.18 Binding Arbitration. The Department and Contractor shall agree on an arbitration process. If the Department and Contractor do not agree on an arbitration process, the American Arbitration Association (AAA) will administer arbitration in accordance with the following:

1. For disputes with an amount equal to or less than \$250,000, AAA will use the current version of the Expedited Procedures of the Construction Industry Arbitration Rules.
2. For disputes with an amount greater than \$250,000, AAA will use the current version of the Standard Procedures of the Construction Industry Arbitration Rules.

Unresolved disputes will be combined for a single arbitration hearing unless the Department and Contractor agree otherwise.

The Department and Contractor shall agree to the following:

1. Arbitration panels shall be composed of three members.

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2. Arbitration hearings shall be conducted in Boise, Idaho.
3. The arbitrator's judgment and decision for the binding arbitration is final.

The arbitrator shall submit the decision and the specific basis for the decision in writing. The arbitrator shall use the contract as a basis for the decision.

The Contractor shall include 105.16 and 105.18 in subcontracts and contracts with suppliers. The Contractor shall manage subcontractor and supplier disputes.

105.19 Alternate Resolution Processes. The contract may specifically allow either of the following alternate resolution processes to assist in the administrative resolution process specified in 105.16:

1. Dispute Review Board (DRB) – a project specific board of three neutral individuals selected by the Contractor and the Department to assist in the administrative resolution process at the Resident Engineer level.
2. Claims Review Board (CRB) – a statewide standing board of three neutral individuals selected by the Department and representatives of the Idaho AGC to assist in the administrative resolution process at the Chief Engineer level.

The DRB or CRB review may not be used as a substitute for the Department's and Contractor's responsibilities to make a good-faith effort to resolve the dispute using the administrative resolution process.

This subsection describes the purpose, procedures, function, and features of the DRB and CRB processes. In either case, the Department, Contractor, and the members of the DRB or CRB must sign a Three-Party Agreement to do the following:

1. Formalize the creation of the DRB or CRB.
2. Establish the scope of services for the DRB or CRB.
3. Establish the rights and responsibilities of the Department and the Contractor.

In the event of a conflict between this subsection and the Three-Party Agreement, the latter will govern.

Use of an alternate resolution process (DRB or CRB) does not relieve the Department or Contractor from complying with the contract and with the requirements specified in 105.16. In general, the DRB and CRB will operate in accordance with 105.19.A and 105.19.B, respectively, however, it is desirable to allow flexibility in the DRB and CRB processes in order to adapt to changing situations and facilitate resolution of a dispute. The Department and Contractor may mutually agree in writing on new procedures or modifications to the existing procedures for a specific dispute

in accordance with 105.16. The DRB or CRB may also establish new or modified procedures with the mutual written agreement of the Department and Contractor. If the Department and Contractor cannot agree, the Department will determine the new or modified procedures.

Because the requirements of the DRB and CRB processes are very similar, the DRB requirements in 105.19.A are specified in full detail whereas the CRB requirements in 105.19.B only specify where the CRB process differs from the DRB process.

A. Dispute Review Board. The DRB will only be available to review disputes at the Resident Engineer level of the administrative resolution process.

The DRB will consist of three members selected jointly by the Department and Contractor in accordance with 105.19.A.1.

1. Member Criteria and Selection

a. Experience and Qualifications

Prospective DRB members should have experience with the construction process, including design, construction, contract administration, contract law, industry practices, and resolution of construction disputes. Typical DRB members are retired or semi-retired engineers, contractors, claim consultants, or construction attorneys.

It is not necessary that prospective DRB members be intimately familiar with the specific type of construction involved in the dispute. If necessary, the DRB may consult technical and legal experts in accordance with 105.19.A.4.g.

Prospective DRB members must have attended the Dispute Review Board Advanced Update workshop offered by the Dispute Resolution Board Foundation or its substantial equivalent in other training, or shall be a pre-qualified DRB member in another state that has training as a prerequisite to qualification for services on a DRB.

b. DRB Pre-Qualification Roster

The Department, in consultation with representatives of the Idaho AGC, will establish and maintain a DRB Pre-Qualification Roster of at least 12 qualified individuals available to serve on DRBs. The Department and Idaho AGC will select members to the DRB Pre-Qualification Roster from the prospective members as defined in 105.19.A.1.a.

c. Neutrality

DRB members must be neutral, act impartially and in the best interest of the project, and be free of any conflict of interest.

For the purpose of this subsection, the term “member” also includes the member’s current primary or full-time employer, and “involved” means having a contractual relationship with the Department, Contractor, or any entity involved in the dispute, including subcontractors, suppliers, architects, engineers, construction managers, consultants, etc.

Prohibitions or disqualifying relationships for prospective members include any of the following:

1. An ownership interest in any entity involved in the contract, or a financial interest in the contract, except for payment for services on this DRB.
2. Previous employment by, or financial ties to, any party involved in the contract within a period of one year before award of the contract, except for fee-based consulting services on unrelated projects.
3. A close professional or personal relationship with any key member of any entity involved in the contract that, in the judgment of the Department or the Contractor, could suggest partiality.
4. Previous involvement in the contract of a nature that could compromise the member’s ability to participate impartially in the DRB’s activities.

Prohibitions or disqualifying relationships for members include any of the following:

1. Current employment, including fee-based consulting services, by any entity involved in the contract.
2. Discussion concerning, or the making of, an agreement with any entity involved in the contract regarding employment after the contract is complete.

d. Disclosure Statement

All prospective members for a DRB shall submit complete disclosure statements to the Department. Each statement shall include the following:

1. Resume of experience.

2. Declaration that describes all past, present, and anticipated or planned future relationships (including indirect relationships through the member's primary or full-time employer) to the Department, Contractor, or any entity involved in the contract, including subcontractors, suppliers, architects, engineers, construction managers, consultants, etc.
3. Disclosure of any close professional or personal relationships with key members of the Department, Contractor, or other entity involved in the contract.

e. Selection Process

To form a DRB, the Department will provide the Contractor with access to all members on the current DRB Pre-Qualification Roster. Within 20 calendar days after contract award the Department and Contractor shall each nominate five individuals from the Roster and notify the other party of their nominees. The Department and Contractor shall each confirm the availability and neutrality of their nominees.

Within 30 calendar days after contract award the Department and Contractor shall jointly select the DRB using the following procedure:

1. Combine all nominees into one list.
2. Flip a coin to see which party goes first.
3. Take turns striking names off the list until there are only three names left.
4. The three remaining nominees will constitute the three-member DRB.

If the Department and Contractor mutually agree on a one-member DRB, take turns striking names off the list until there is only one name left. This remaining nominee will be the one-member DRB.

The Department will notify all members of their selection to the DRB. The members of the three-member DRB will choose one member to act as chairperson.

If necessary, the Department and Contractor will use the same selection process for selecting replacement members.

f. Three-Party Agreement

Within 14 calendar days of the Department notifying the members of their selection to the DRB, the DRB members and the authorized representatives of the Department and the Contractor shall execute a DRB Three-Party Agreement.

g. Tenure of the DRB.

The DRB becomes effective upon execution of the DRB Three-Party Agreement; and dissolves when the Department and Contractor mutually agree to dissolve the DRB.

2. Ongoing Project Involvement

a. Contract Documents, Reports, and Information

The Department will provide each DRB member with a set of the plans and specifications.

To keep the DRB members informed of construction activity and other developments, the Department and Contractor will provide, in a timely manner, relevant information and documentation requested by the DRB. The DRB may request information and documentation that the Department and Contractor produce in the normal course of construction, including, but not limited to, periodic reports and minutes of progress meetings. The DRB may not request information or documentation that the Department or Contractor would not have normally produced.

b. Periodic Meetings and Site Visits

The DRB members may visit the project and meet with representatives of the Department and Contractor at regular intervals and during significant construction events as agreed to by the Department and Contractor.

To minimize the time and expense of meetings, the Department and Contractor may decide to use conference calls, videoconferences, or any other means. Each meeting shall consist of an informal roundtable discussion followed by a field observation of the work. Representatives from the Department and Contractor shall attend the roundtable discussion. The meeting agenda shall generally include the following:

1. Meeting convened by the chairperson of the DRB
2. Contractor discussion topics, such as the following:
 - 2.1. Work performed since the last meeting.

- 2.2. Status of the work schedule and schedule for future work.
- 2.3. Anticipated or potential problems and proposed solutions.
- 2.4. Status of current and potential issues, disputes, and other controversies.
3. Department discussion topics, such as the following:
 - 3.1. The schedule and schedule updates.
 - 3.2. Perspective on potential issues, disputes, and other controversies.
 - 3.3. Status of past issues, disputes, and other controversies.
4. Any other topics the Department or Contractor want to discuss with the DRB.
5. Set tentative date for next meeting.

The Department, Contractor, and DRB members shall agree on the frequency and scheduling of visits depending on the progress of the work. Observations by the DRB members during project visits shall cover all active segments of the work. A representative from both the Department and Contractor shall accompany the DRB members on project visits.

3. Informal Review Process

The Department and Contractor may involve the DRB in the review of an emerging dispute at the Resident Engineer level of review. Use of an informal review by the DRB does not relieve the Department or the Contractor from complying with all contract requirements. However, if informal review by the DRB is used, the dispute submittal time frames and review time frames of 105.16 may be revised by mutual written agreement of the Department and the Contractor, or if they are unable to agree, shall be established by the Department.

At the request of either the Department or Contractor, the DRB is available to provide informal non binding preliminary review regarding an emerging dispute. After a dispute is brought before the DRB for informal review, both the Department and Contractor shall have sufficient notice and time to prepare for informal review by the DRB. Upon the request of either the Department or Contractor to the chairperson of the DRB for an informal review by the DRB, the chairperson shall be responsible to contact the

other DRB members, if any, and to make necessary arrangements for the review.

Informal review meetings will consist of informal oral discussions with input and comments encouraged from the Department and Contractor. After private deliberation, the DRB will provide initial impressions and oral guidance. Minority guidance (should it exist) will also be offered. The DRB will not make written findings and recommendations or any record of the informal review.

The DRB is not bound by its oral recommendations to the Department and Contractor in the event that a Dispute that was considered in informal review by the DRB is later submitted to the DRB for formal review.

It is the intent of the Department and Contractor to establish informal review by the DRB as a method of dispute mitigation. To the extent permitted by law, the Department and Contractor agree that all written or verbal communications and documentation submitted and/or discussed during informal review by the DRB shall be privileged and confidential pursuant to Idaho Rules of Evidence 507 and 408. Rule of Evidence 408 shall also apply to all written or verbal communications prepared for or exchanged during the informal review process.

4. Formal Review Process

a. General

The Department and the Contractor shall cooperate to ensure that the DRB considers disputes promptly by taking into account the specific circumstances of the dispute, and the time required to prepare documentation.

b. Prerequisites to Request for Review

Either the Department or Contractor may request a review once negotiations will be, or have become, unsuccessful.

c. Requesting Review

The requesting party shall prepare and submit a written request for review to the DRB chairperson and the other party. The request for review shall state clearly and in full detail the specific issues of the dispute to be considered by the DRB.

The DRB chairperson shall confer with the Department and Contractor to

establish a submittal schedule to allow adequate time before presentations for both parties to review the requesting party's request for review and for both parties to prepare and submit position statements in accordance with 105.19.A.4.e.

The Contractor shall provide each DRB member with a complete copy of the dispute submittal if available at the time of the request for DRB.

d. Scheduling the Hearing

After receiving a request for review, the DRB chairperson will schedule a hearing date.

e. Pre-Hearing Requirements

The Department and Contractor shall prepare and submit concise, written position statements with page number references to any supporting documentation. First, the Contractor will submit its position statement to the DRB and the Department; then the Department will submit its position statement to the DRB and the Contractor.

f. Hearing

Unless otherwise agreed by the Department, Contractor, and DRB members, the hearing will occur at the nearest Department District Office. The three parties may agree to any other location that would be more convenient and still provide the required facilities and access to necessary documentation.

The Department and Contractor shall each have representatives in attendance at all hearings. The Contractor shall make its presentation first. The Department and Contractor shall take successive turns for rebuttals until all aspects are fully covered. The DRB members and the Department and Contractor representatives may ask questions, request clarification, or ask for additional data during the presentations.

For difficult or complex disputes, the DRB may schedule additional hearings to facilitate full consideration and understanding of the information presented by the Department and Contractor. The DRB will allow both the Department and Contractor adequate opportunity to present evidence, documentation, and testimony supporting their position regarding all issues of the dispute. The Department and Contractor cannot present, and the DRB can not consider in its review, any documents, reports, analysis,

or other information, unless the same was previously provided to the other party as supporting documentation for the position statement.

Unless otherwise agreed by the Department and Contractor, the DRB will limit the position statements, presentations, and reviews to issues of entitlement only. If the Department and Contractor agree to the DRB reviewing or giving guidance on issues of entitlement and quantum, both the Department and Contractor shall complete their presentations on entitlement before presenting issues of quantum.

Normally, a formal transcript of the hearing is not necessary. The Department or Contractor may request that the DRB allow recordation and transcription by a court reporter. The Department and Contractor shall agree on the allocation of the associated cost. This transcription, if prepared, will not constitute the official record of the DRB review. The DRB-prepared record will be the official record of the DRB review. The DRB may provide for audio or video recordings of the hearing for DRB use only.

Attorneys representing the Department and Contractor may attend the hearing to counsel and advise only. The Department and Contractor may mutually agree to allow the attorneys to play a more involved role in the hearing, such as making brief opening and closing remarks to the DRB.

If either the Department or Contractor representatives fail to appear before the DRB on the date scheduled for the hearing without justifiable cause, the party that is in attendance shall prevail in their position on the dispute.

g. Deliberations

After the conclusion of the hearing, the DRB members will hold private deliberations to prepare the DRB's findings and recommendations. The DRB may hold its private deliberations at any location. The individual views of the DRB will be kept strictly confidential from disclosure to anyone other than the DRB members.

If necessary, the DRB may submit a written request to the Department and Contractor that briefly describes the scope and budget for special services such as legal, technical, or other expert assistance or testimony, or other consultation, accounting, data research, and the like. If the Department and Contractor agree to the request, both parties shall execute a written agreement with a provider of the necessary special services chosen by mutual agreement. The DRB's findings and recommendations will not

be bound by any information provided by special service providers. The Department and Contractor will share and pay for the cost of the service provider in accordance with 105.19.A.5.

Typically the special service provider will respond to the DRB's questions in private consultation and the Department and Contractor may not request a permanent record of the questions or responses.

h. Findings and Recommendations

The findings and recommendations of the DRB concerning any dispute are non-binding but admissible in accordance with 105.19.A.4.k. The DRB is not responsible for resolving disputes; that responsibility remains with the Department and Contractor.

The DRB will base its findings and recommendations on the contract, applicable contract law, industry practices, and the facts of the dispute. The DRB must also evaluate whether the burden of proof has been met.

Within 14 calendar days from completion of the hearing, the DRB will provide the Department and Contractor with a written copy of the findings and recommendations by certified mail return receipt requested. For difficult or complex disputes, and in consideration of the DRB's availability, the Department, Contractor, and DRB may mutually agree to revise the time requirement.

The DRB will set forth, as clearly as possible, the logic and reasoning behind its findings and recommendations. The findings and recommendations will address entitlement only, unless the Department and Contractor mutually request that the DRB review entitlement and quantum in accordance with 105.19.A.4.f. If the DRB cannot expeditiously determine the exact value of the quantum, the DRB may address quantum in its findings and recommendations by providing guidelines for determining the quantum. The Department and Contractor shall then make the final determination of quantum. If the Department and Contractor continue to disagree on the determination of quantum, the Department and Contractor may submit the disagreement back to the DRB for further review and amended findings and recommendations.

If the DRB is unable to reach unanimity in its deliberations, the DRB will advise the Department and Contractor of that fact in the findings and recommendations. A dissenting DRB member may prepare a minority report to be included in the DRB findings and recommendations.

i. Acceptance or Rejection

Within 7 calendar days of receipt of the DRB's findings and recommendations, both the Department and Contractor shall provide a written notice of acceptance or rejection of the DRB findings and recommendations to the DRB and each other.

If, with the aid of the DRB's findings and recommendations, the Department and Contractor are able to resolve the dispute, the Department will promptly process any necessary contract revisions in accordance with 104.02. If either the Department or Contractor rejects the DRB's findings and recommendations, the dispute will continue under the administrative resolution process in accordance with 105.16.

j. Clarification and Reconsideration

If the dispute remains unresolved because either the Department or Contractor has a bona fide lack of understanding of the DRB's findings and recommendations, either party may request that the DRB clarify specific parts of the findings and recommendations. The Department or Contractor shall provide a written request to the DRB and the other party within 7 calendar days of receipt of the DRB's findings and recommendations.

If evidence becomes available that was not available at the time of presentations, either the Department or Contractor may request that the DRB reconsider its findings and recommendations with the new evidence. The DRB will decide if reconsideration is necessary.

k. Admissibility

If the DRB's findings and recommendations do not aid in resolving the dispute, the following will be admissible as evidence in any subsequent dispute resolution proceeding or forum to the extent permitted by law:

1. The contract.
2. The written findings and recommendations, including any minority report.
3. The disclosure statements of the DRB members.

l. Legal Relations

Each DRB member, in the performance of his or her duties on the DRB, is acting as an independent agent and not as an employee of either the Department or Contractor.

Each DRB member is acting in a capacity intended to facilitate resolution of the dispute. Accordingly, the Department and Contractor agree, to the fullest extent permitted by law, that each DRB member shall be accorded quasi-judicial immunity for any actions or decisions associated with the review and findings and recommendations. The Department and Contractor may not call any DRB member as a witness in subsequent proceedings on a dispute. Other than the findings and recommendations of the DRB, all records, proceedings, and deliberations of the DRB are to be kept confidential to the fullest extent permitted by law. The DRB shall, upon completion of the project, turn all records of the DRB over to the Department for storage and preservation.

Each DRB member shall, by agreement, be held harmless for any personal or professional liability arising from or related to DRB activities. To the fullest extent permitted by law, the Department and Contractor will indemnify all DRB members for disputes, losses, demands, and damages (including reasonable attorney's fees) for bodily injury, property damage, or economic loss arising out of or related to the DRB members carrying out DRB functions. This indemnity is a joint and several obligation of the Department and Contractor.

5. Payment

The Department and Contractor shall equally bear the following costs and expenses related to DRB activities preauthorized by both the Department and Contractor, including the following:

1. Time spent on-site, at hearings, at meetings, or reviewing the dispute away from the project site.
2. Travel time to and from the location of the DRB activities listed in item 1.
3. Travel expenses.
4. Approved special service providers.

The Department and Contractor will pay each DRB member for actual time spent at the rate of \$125 per hour with a maximum of \$1,000 per day. This rate includes all normal incidental expenses such as telephone, fax, postage, courier, printing, and computer services. The Department and Contractor will compensate each DRB member at the same daily and hourly rate.

The Department and Contractor will pay each DRB member for actual travel time to and from DRB meetings at the rate of \$50 per hour with a maximum of \$200 each way. The Department and Contractor will reimburse DRB members at the State standard rates for transportation, lodging, and meals for each day, or portion thereof, for DRB member travel to or from, or attending, a DRB activity.

The Department will not pay for mark-ups applied to the cost and expenses of the DRB, either by the Contractor or DRB members.

The Department will provide administrative services such as conference facilities and secretarial services for the DRB, at no cost to the Contractor.

Each DRB member may submit invoices for payment for work completed and qualified expenses no more often than once per month during the progress of their work. The invoices shall be in a format approved by the Department, and accompanied by a general description of activities performed during that period. The value of work accomplished for payment shall be established from the billing rate and hours expended by the DRB member together with qualified expenses incurred.

The Contractor shall pay the invoices of all DRB members within 30 calendar days after approval by both the Department and Contractor. The Contractor shall then invoice the Department for one-half of the value of the DRB invoices.

The cost records and accounts related to DRB activities shall be kept available for inspection by representatives of the Department and Contractor for 5 years after final payment to the DRB members.

- B. Claim Review Board.** The CRB will only be available to review disputes at the Chief Engineer level of the administrative resolution process. The CRB will not be available to review disputes on projects where there was an established DRB available for review at the Resident Engineer level of review unless agreed to by the Contractor and the Chief Engineer.

The Department will establish at least one CRB available to hear disputes for construction contracts statewide.

The CRB will consist of three members selected jointly by the Department and the Idaho AGC in accordance with 105.19.B.1.

If agreed by the Department and Contractor, and the total dispute amount is

less than \$100,000, a one-member CRB may be convened to review a dispute. The Department and Contractor shall agree on the selection of the one-member CRB from the existing threemember CRB.

The CRB's involvement in the alternate resolution process is limited to the formal review process in accordance with 105.19.B.2.

1. Member Criteria and Selection

a. Experience and Qualifications

The experience and qualifications requirements for the CRB are the same as those for DRB in accordance with 105.19.A.1.a.

b. DRB Pre-Qualification Roster

The DRB Pre-Qualification Roster requirements for the CRB are the same as those for DRB in accordance with 105.19.A.1.b.

c. Neutrality

CRB members must be neutral, act impartially and in the best interest of the project, and be free of any conflict of interest.

For the purpose of this subsection, the term "member" also includes the member's current primary or full-time employer, and "involved" means having a contractual relationship with the Department, Contractor, or any entity involved in the dispute, including subcontractors, suppliers, architects, engineers, construction managers, consultants, etc.

Prohibitions or disqualifying relationships for CRB members in general include any of the following that suggest partiality:

1. Any substantial financial interest involved in current ITD construction projects.
2. Any close professional or personal relationship with key employees of the Department or the State, or key representatives of the Idaho AGC.
3. Any past history with the Department, State, or representatives of the Idaho AGC.

Prohibitions or disqualifying relationships for CRB members regarding the dispute or the contract at issue include any of the following:

1. An ownership interest in any entity involved in the contract,

or a financial interest in the contract, except for payment for services on this CRB

2. Previous employment by, or financial ties to, any party involved in the contract within a period of one year before award of the contract, except for fee-based consulting services on unrelated projects.
3. A close professional or personal relationship with any key member of any entity involved in the contract that, in the judgment of the Contractor or the Department, could suggest partiality.
4. Previous involvement in the contract of a nature that could compromise the member's ability to participate impartially in the CRB's activities.

d. Disclosure Statement

CRB members must provide current disclosure statements for involvement on specific projects in accordance with 105.19.A.1.d.

e. CRB Replacement Process

If a temporary replacement for the CRB is necessary for a specific dispute, the Department and Contractor will choose the replacement from among the alternate members using the following procedure:

1. Flip a coin to see which party goes first.
2. Take turns striking names off the list of five alternates until there is one name left.
3. This alternate member will be the replacement for the specific dispute.

The Department or Contractor may disqualify any member of the CRB for a dispute by providing the reasons for disqualification in notices to the following:

1. The disqualified CRB member.
2. The remaining CRB members.
3. The other party.

f. Three-Party Agreement

Upon agreement of the Department and Contractor to submit

a dispute to the CRB, the CRB members and the authorized representatives of the Department and the Contractor shall execute a CRB Three-Party Agreement.

g. Tenure of CRB

The CRB involvement on a dispute will commence after the Department, Contractor, and CRB members execute the CRB Three-Party Agreement; and will end as of the date the CRB submits its written findings and recommendations, unless the Department and Contractor mutually agree on subsequent CRB services, such as clarification.

2. Formal Review Process

a. General

The Department and the Contractor shall cooperate to ensure that the CRB considers claims promptly by considering the specific circumstances and time required to prepare documentation. Although the CRB will not typically visit the project or meet with the Department and Contractor during the construction of the project, if deemed advantageous or necessary and mutually agreed by the Department and Contractor, a visit or meeting may be scheduled. To minimize the time and expense of meetings, the Department and Contractor may decide to use conference calls, videoconferences, or any other means. Representatives from both the Department and the Contractor shall accompany the DRB members on project visits.

b. Prerequisites to Review

Either the Department or Contractor may request a review under the following conditions:

1. The Contractor has properly appealed to the Chief Engineer's level in accordance with 105.16.B.
2. A DRB was not available to hear the dispute at the RE level of review.

The Department and Contractor may agree to waive the condition listed in item 2.

c. Requesting Review

The requesting party shall prepare and submit a written request for

review to the other party and include an estimate as to when the requesting party would be ready to submit its final position statement and dispute documentation to the CRB and the other party.

The Department and Contractor must mutually agree to refer a dispute to the CRB. If the Department and Contractor agree to refer the dispute to the CRB, the Department will promptly submit the request for review to the CRB chairperson.

The CRB chairperson shall confer with the Department and Contractor to establish a submittal schedule to allow adequate time before presentations for both parties to prepare and submit position statements in accordance with 105.19.B.2.f.

d. Creation of Claim Record for Review

The Contractor shall provide each CRB member with a complete copy of the dispute submittal submitted by the Contractor when appealing to the Chief Engineer in accordance with 105.16.B.

The Department will provide each CRB member with the following:

1. A copy of the contract, including a set of the plans and specifications.
2. A copy of the Resident Engineer's dispute analysis and decision.
3. A copy of the Chief's Engineers preliminary analysis of the dispute, if the Chief Engineer has prepared one.

e. Scheduling the Review

The scheduling requirements for the CRB review are the same as those for DRB in accordance with 105.19.A.4.d.

f. Pre-hearing Requirements

The Department and Contractor shall prepare and submit concise, written position statements with page number references to the claim record. First, the Contractor will submit its position statement to each CRB member and the Department; then the Department will submit its position statement to each CRB member and the Contractor.

The Department and Contractor cannot reference in their position statements, and the DRB cannot consider in its review, any

documents, reports, analysis or other information not contained in the claim record.

g. Hearing

The hearing requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.f, except for the following:

Unless otherwise agreed by the Department, Contractor, and CRB members, the hearing will occur at the Department Headquarters in Boise.

The Department and Contractor cannot present, and the DRB can not consider in its review, any documents, reports, analysis, or other information, unless the same was contained in the claim record.

h. Deliberations

The deliberation requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.g.

i. Findings and Recommendations

The findings and recommendations requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.h.

j. Acceptance or Rejection

The acceptance or rejection requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.i.

k. Clarification

The clarification requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.j, except the CRB will not reconsider disputes.

l. Admissibility

The admissibility requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.k.

m. Legal Relations

The legal relations requirements for the CRB are the same as those for DRB in accordance with 105.19.A.4.l.

3. Payment

The payment requirements for the CRB are the same as those for DRB in accordance with 105.19.A.5

SECTION 106 - CONTROL OF MATERIAL

106.01 Source of Supply and Quality Requirements. Provide materials meeting the contract requirements and produced using acceptable quality control practices. The Contractor is responsible for quality control. The Department considers the cost of the quality control process to be included in the contract unit prices for the relevant contract pay items. Use new materials unless otherwise specified. Notify the Engineer of proposed material sources to allow for the Engineer's inspection before manufacture, fabrication, and delivery of material. The Engineer may inspect and approve material at the source before delivery to the project. If the Engineer determines that the source no longer produces material meeting the contract requirements, use another source to provide material that meets the contract requirements.

Use material from the Department's Qualified Products List (QPL) as specified in the contract and in accordance with 106.15.

Install or apply material in accordance with the manufacturer's recommendations, unless otherwise required by the contract. If a conflict exists between the contract and the manufacturer's recommendations, immediately notify the Engineer in writing.

106.02 Ordering, Producing, and Delivering Materials. Quantity estimates are only approximate. Do not place orders for or produce full quantities of materials required to complete the work until work has advanced to a stage that allows the quantities to be determined with reasonable accuracy.

The Department is not responsible for:

Materials the Contractor may order, produce or deliver in excess of contract requirements except as specified in 109.07.

Extra expense the Contractor may incur because materials were not ordered, produced or delivered earlier.

The Contractor's expenses related to materials ordered, produced or delivered by the Contractor that are not subsequently approved for use.

Before ordering piling, pipe, pipe culvert, guardrail, pipe siphon or sign posts, obtain the Engineer's approval of the quantities of these materials, unless otherwise permitted by the Engineer.

106.03 Samples, Tests, and Cited Specifications. The Engineer will accept material, based on inspection and test results, before the Contractor incorporates material into the work. The Contractor may, with the Engineer's approval, incorporate material the Engineer cannot routinely sample before delivery, at the Contractor's risk. The Department will pay the Contractor for material incorporated into the work if the material meets the contract requirements for sampling, testing, and certification.

Ensure the sampling and testing required by the contract including references to WAQTC, ASTM, AASHTO, and Idaho Standard Methods are in accordance with the edition in effect January 1 of each year.

For contracts requiring Contractor responsibility for testing, provide sampling and testing as specified in the contract. The Department considers the costs for sampling and testing to be included in the contract unit prices of the respective contract pay items. Provide test results to the Engineer as required by the contract and allow the Engineer access to the testing facilities at all times.

For testing performed on the Contractor's behalf for plant mix designs, alkali-silica reactivity expansion and dispute resolution, a professional engineer, licensed in the state where the testing will be performed, will supervise the testing and stamp the reports.

Ensure a safe means of sampling and testing.

Ensure the technicians sampling and testing material and the testing facilities are qualified for tests performed.

Provide crushing, screening, and hot plants with Engineer approved sampling equipment capable of operating from the ground or a platform. Ensure the sampling equipment is capable of the following:

1. Moving at a constant rate across the width of the material falling from the discharge belt or chute.
2. Taking a representative sample of the material.
3. Conveying the sample to ground level, using a slide, chute, or other means, where the sample can be safely and conveniently collected.

Unless otherwise required by the contract, the Contractor is responsible for quality (process) control testing and the Department will be responsible for acceptance testing, verification testing and independent quality assurance testing. The Contractor may employ an independent laboratory or use the company's approved

quality control program for process control testing. Make all test results for specified contract quality requirements available at the Engineer's request.

- A. Material Subject to Statistical-Based Acceptance.** The Department and Contractor are responsible for completing and providing test results for acceptance by the next calendar day.

The Contractor is responsible for performing the testing for evaluating the quality characteristics as specified in Table 106.03-1 Material Subject to Statistical based Acceptance of the Quality Assurance Special Provision, unless otherwise specified. The Department and Contractor shall obtain all samples randomly. For acceptance testing, the Engineer will determine sampling schedules and times using a random sampling system. The Contractor is responsible for obtaining the random sampling numbers for acceptance from the Engineer. Failure to obtain the random number from the Engineer and obtain samples at the random number locations, will result in the subplot being subject to rejection.

Upon submittal and approval of Contractor acceptance test results as required by the contract, the Engineer will calculate the quality level and pay factor (PF) for each quality characteristic using statistical analysis as required by the contract and in accordance with the pay factor decision criteria specified in 106.03.B.

- B. Pay Factor Decision Criteria.** For aggregate, the Engineer will use the lowest pay factor computed for any one sieve as the pay factor for that lot.

The Engineer will accept a lot containing non-specification material if the pay factor is at least 0.75. The Engineer will reject a lot containing non-specification material, which fails to obtain at least a 0.75 pay factor, except as specified in 403.05 and 404.05. Remove all non-specification material rejected by the Engineer from the work, including those portions of the work in which that material was incorporated, at no additional cost to the Department. Unless otherwise required by the contract, the Contractor may reuse the removed material if adjustments are made so that the material meets the specifications.

If the pay factor of a lot falls below 0.85, terminate production or delivery. Production or delivery may resume after the Contractor takes effective and acceptable actions to improve the quality of the production. If the resumption of production involves a significant change to the production process, as determined by the Engineer, terminate the current lot and begin a new one.

For plantmix accepted by asphalt content, gradation and density, if any one of these pay factors falls below 0.85, the Engineer will determine the pay factor

for all quality characteristics represented by the same quantity using the lowest pay factor.

For plantmix accepted by air void, VMA, and density, if any one of these pay factors falls below 0.85, the Engineer will determine the pay factor for all quality characteristics represented by the same quantity using the lowest pay factor.

The Engineer will determine an average pay factor (PFAV) for each individual lot not rejected and replaced, except as otherwise specified, for use in the basis of payment calculations. The Engineer will calculate a PFAV on a weighted basis considering the amount of material represented by each lot.

The Contractor may elect to remove any defective material and replace it with new material, at no additional cost to the Department, to avoid a pay factor of less than 1.00. The Department and Contractor, as required by the contract, must re-sample, re-test, and re-evaluate the new material for acceptance.

The Engineer may isolate and reject obviously defective material without regard to testing procedures. The Department will not allow continued production or delivery of material that does not meet the material quality requirements of the contract.

- C. Retesting of Material Subject to Statistical-Based Acceptance.** The Contractor may request the Engineer to retest a lot that falls below a pay factor of 0.75. If the Engineer approves the Contractor's request for retesting, the entire lot must be retested. If adequate and appropriate material samples are not available for the retesting, the Engineer will deny the Contractor's request.

Third party resolution will be in accordance with 106.07.C except that the Contractor shall bear the costs and time associated with the retesting. The third party shall use split material samples for retesting except for density testing. The third party shall use cores obtained at the proximate location of the original density test.

- 106.04 Certification of Materials.** If allowed by the contract, the Engineer may base the acceptance of specified material on certifications provided by the manufacturer. Standard forms as specified in the Department's Quality Assurance Manual must be completed in their entirety and be signed by the manufacturer's representative who has quality control responsibility for the manufacturer or fabrication of the material. The manufacturer's certification shall not preclude the Engineer from sampling, and testing the material, and considering acceptance, or rejection on the basis of the test results. Ensure the manufacturer's certificate refers to the project and contract pay items and numbers.

106.06

For the Engineer to accept material based on manufacturer certification, provide the certificate and backup documents (e.g. mill reports) with each shipment and identify the type and quantity of certified material in the shipment.

106.05 Plant Inspection. The Engineer may inspect materials at the source. The Engineer may inspect manufacturing plants periodically for compliance with contract-required manufacturing methods. The Engineer will also obtain material samples for testing to verify the material meets contract quality requirements. The Engineer may approve material by manufactured lot based on these test results. The Engineer will inspect plants under the following conditions:

1. The Contractor and the material manufacturer shall cooperate with and assist the Engineer.
2. The Contractor and the material manufacturer shall allow the Engineer entry, during normal business hours, to the plant location that produces the material.
3. The Contractor and material manufacturer shall provide adequate safety measures and maintain the safety of the plant.

After delivery to the project the Engineer may inspect or retest materials that the Engineer has already inspected, tested, and approved at the source. The Engineer will reject inspected or retested material that does not meet contract requirements. The Engineer will base final acceptance of material on the in-place condition of material on the project.

106.06 Storage and Handling of Material. Provide storage for material to maintain its quality. The Engineer may reinspect stored material before use. Provide the Engineer with access to stored material for inspection. Store material at least 30 ft off the traveled way, unless the Engineer approves otherwise. If the posted speed limit for the traveled way is 40 mph or less, the Engineer may approve storage of material at least 10 ft off the traveled way.

If the contract allows or the Engineer approves, the Contractor may use specified portions of the right-of-way or other approved locations for storage of material and for placement of plant and temporary facilities. The Contractor may use private property for material storage if the property owner or lessee provides written permission. Provide copies of the written permission to the Engineer.

Before storing material at storage locations, obtain clearances for the locations in accordance with 107.18.

Handle material, incorporated in the work, to preserve the quality of the material.

Prevent separate stockpiled material from mixing. Provide separation or use bulk-heads between stockpiles.

106.07 Test Result Dispute Resolution. The Department and Contractor may use dispute resolution when differences between the Contractor's quality control test results and the Department's acceptance test results exceed the values specified in the Department's Quality Assurance Special Provision (QASP) for the quality characteristics specified in Table 106.03-1 of the QASP.

Testing must meet the requirements of the contract. For disputed acceptance test strip mix design parameters, the Contractor's testing must include all mix design properties. The Contractor cannot dispute its own test results.

A. Dispute Resolution Initiation. To request dispute resolution, immediately provide written notice after receipt of the test results.

As soon as possible after submittal of the written notice, but no later than 3 working days, submit complete supporting documentation, including the complete testing results and worksheets demonstrating that the testing meets the minimum requirements of the contract.

The Contractor will waive its right to dispute differences in test results if either of the following conditions occurs:

1. The Engineer does not receive a written notice or complete supporting documentation in accordance with the time requirements of this subsection.
2. The Contractor does not obtain the proper size samples to be split and retained for dispute resolution testing.

B. Dispute Resolution Process. The Department will review the written notice and complete backup documentation. As necessary, the Department and Contractor shall identify differences in procedures and equipment. If the Department and Contractor cannot resolve the discrepancies, the two parties shall agree to a work plan for initiating resolution by a third party in accordance with 106.07.C. For disputed acceptance test strip mix design parameters, the work plan shall include testing for all mix design properties.

C. Third-Party Resolution. The third party shall be either the Department's Central Materials Laboratory or a Department qualified, AASHTO-accredited Laboratory not currently working on the project. The Department and Contractor shall agree to the third party in writing. The third party test results are final and the Engineer will use the third party test results for quality analysis.

If the third party determines that the Contractor's test results are the source of the differences, the Department will not extend the contract time for any delays

in production and the Contractor shall bear the costs associated with the third party resolution. If the third party determines that the Department's test results are the source of the differences, the Department will extend the contract time for any delays and bear the costs associated with third party resolution.

106.08 Test Facilities. Provide all necessary test facilities and equipment, including test trailers, for all quality control and acceptance testing required by the contract. Furnish the test facilities with all standard equipment and supplies necessary to perform the tests required by the contract. Provide test facilities that are qualified through the Department's Laboratory Qualification Program.

If the contract specifies that the Department is responsible for testing, the Department will provide a field laboratory. If the contract specifies that the Contractor is responsible for testing, the Contractor shall provide the field laboratory. Ensure field laboratories provided by the contractor meet the contract requirements for qualification.

If the Department provides a field laboratory, the Contractor shall provide the features and services specified in this subsection.

Provide a commercially comparable, 200 amp, 125/250 V, single phase, four-wire, 60 cycle AC service to the outlet of the field laboratory or field office, unless otherwise approved by the Engineer. Do not modify the service outlet or power supply cord assembly. Install the service outlet or power supply cord at no additional cost to the Department.

Provide a service for electrical hook-up that is equipped with a feeder assembly and compatible with the requirements of the current National Electrical Code (NEC). Ensure this assembly is rated for 200 amp service, unless otherwise approved by the Engineer.

A licensed electrical contractor shall connect the service. The electrical contractor shall file for an electrical inspection permit with the Idaho Department of Labor and Industrial Services at no additional cost to the Department. The electrical contractor shall not connect the field laboratory to the service pole until the Electrical Inspector approves the hook-up.

Ensure the electrical service is grounded using a copper-clad grounding rod at least 8 ft long and ½ in in diameter.

Provide a parking area for the field laboratory or field offices unless otherwise approved by the Engineer. Ensure the parking area is 15 ft wide and 35 ft long, level, clear of vegetation and debris, and sloped to drain.

106.09 Material Sources. The Department divides material sources into two groups: designated sources and contractor-provided sources. Construct and maintain haul roads, including dust abatement, from material sources to the project or to the nearest public road. Do not discharge turbid water into streams or other bodies of water that do not comply with the contract requirements.

A. Designated Sources. The Department may acquire, and make available to the Contractor, material sources specified on the plans and special provisions. The contract lists the designated sources by number and location.

Variations in the limit, location, quality and volume of material meeting contract requirements may occur. The Engineer may direct the Contractor to extract material, meeting contract requirements, from locations within a designated source, but will not require removal of material from below water, unless otherwise specified by the contract.

Determine the amount of equipment and work necessary to produce material that meets the contract requirements.

The Department may acquire, and make available to the Contractor the right to take materials from a designated source and the right to use the property of the designated source for plant sites, stockpiles, and hauling roads.

The Department will deduct royalty payments from partial payments and will pay the property owner of the designated source for material removed by the Contractor.

If the state or federal government does not own or control the designated source, provide the Engineer with three copies of a letter of release, from the owner of the designated source. The release shall certify the following:

1. The Contractor left the designated source in a presentable condition with all debris resulting from the Contractor's operations removed and disposed of.
2. The Contractor met the requirements of the approved reclamation plan.

The Department will not require a letter of release from commercial sources.

B. Contractor-Provided Sources. The Department considers Contractor-provided sources to be all sources not specified by the contract as designated sources. The Engineer will provide the Contractor with a list of Department-controlled sources upon request. If approved by the Engineer, the Contractor may use Department-controlled sources as Contractor-provided sources. If

approved, the Engineer will include requirements specifying the final condition and appearance of a Department-controlled source. Determine if material from a Department-controlled source meets the contract requirements.

For Department-controlled sources, if the Engineer approves the Contractor's written request for use, the Engineer will establish the terms and conditions and prepare an agreement for the Contractor's signature within 14 calendar days. The Department will not allow access to Department-controlled sources until the Contractor returns a signed agreement to the Engineer.

For Contractor-provided sources that are not Department-controlled, the Department will require the Contractor to obtain written approval from the source owner before using material. Submit a written request to the Engineer for using a Contractor-provided source, and allow the Department 14 calendar days for review.

Before beginning work at a Contractor-provided source, comply with the requirements of 107.18.

Obtain the rights, including access and conditional use permits for exploring, developing, and testing a Contractor-provided source for approval and use, at no additional cost to the Department. Do not use material from a Contractor-provided source until sampling and testing results indicate the material meets the contract quality requirements. Take samples from areas within the Contractor-provided source where material will be extracted. Use a qualified independent laboratory to perform the sampling and testing. Ensure the independent laboratory provides copies of test reports to the Department for review and approval. Maintain and verify the quality of the material during the project. Ensure the material meets the contract quality and design requirements.

The Contractor may use Contractor-provided sources instead of designated sources at no additional cost to the Department. The Contractor shall be responsible for providing the quantity of material necessary to complete the work.

106.10. Rights In and Use of Materials Found on the Work. The Contractor, with the Engineer's approval, may use stone, gravel, sand, or other material found on the project. The Department will pay the Contractor for these materials as follows:

1. At the corresponding contract unit price for excavating these materials.
2. At the contract unit price for which the excavated material is used.

The Contractor shall replace the excavated material, used at the Contractor's discretion, with material meeting contract requirements, at no additional cost to the

Department. The Department will not charge the Contractor for the value of the material found on the project. Do not excavate or remove material that is not within the grading limits unless approved in writing by the Engineer.

106.11 Production of Material in Department-Controlled Sources. Reject material that contains an excessive amount of sand or unacceptable material, before starting secondary crushing. Use all acceptable materials, regardless of size, in the production of aggregate.

Produce a material of uniform gradation. Do not remove intermediate size aggregate for other contract pay items, unless the procedure produces material that meets the specified contract requirements, and is approved by the Engineer.

Do not end-dump or conveyor stack material over the sides of a stockpile. Do not stack conveyor-placed stockpiles over 5 ft. deep before leveling, to minimize coarse and fine aggregate segregation.

Material produced, but not used in the work, shall remain the property of the Department. Stockpile rejected materials at Department-controlled sources as directed by the Engineer at the source. If the Engineer directs the Contractor to load and haul rejected material to a stockpile site outside the source, no greater than 0.5 mi beyond the source boundaries, the Department will pay the Contractor for loading, hauling, and stockpiling in accordance with 109.03.C.5. If the Engineer directs the Contractor to haul material to stockpile sites over 0.5 mi beyond the source boundary, the Department will pay for hauling in excess of the 0.5 mi distance as extra work in accordance with 104.02.B.

If the bid schedule includes a contract pay item for providing sanding material in stockpile in accordance with 403.03.C, the pay provisions for reject material will apply after the Contractor reaches the plan quantity of the sanding material.

The Department will pay royalties to the source owner for material the Contractor removes from the material source, including reject material.

Create material stockpiles in neat shapes using minimal surface area. Clear and grub the stockpile foundation and place a base of material to protect the stockpile from contamination. Unless otherwise directed by the Engineer, build the stockpile in successive layers no greater than 3 ft thick.

106.12 Depletion of Designated Sources. If the Contractor depletes designated sources, the Department will designate a new source of material. The Department will pay the Contractor, in accordance with 109.03, for the additional cost

106.15

of developing and reclaiming a new material source, including the cost of moving production plants.

The Department will not allow an extension of time for moving a plant between designated sources, unless the Contractor depletes all designated sources or the source is otherwise found unsatisfactory.

106.13 Department-Provided Material. Provide all material required to complete the work, unless the contract requires the Department to provide certain material.

The Department will make Department-provided material available to the Contractor at locations specified in the special provisions.

Include the cost of handling and placing Department-provided material in the contract unit price for the contract pay item incorporating the material.

The Contractor is responsible for protecting Department-provided material after its delivery to the Contractor. The Department will deduct the cost of replacing material from shortages, deficiencies and damage, and the cost of demurrage charges from payments to the Contractor.

106.14 Trade Names and Alternatives. The contract may require certain materials under a trade name or manufacturer and catalog information. The Department will allow the Contractor to use alternative materials of equal quality and specified characteristics. Submit to the Engineer, the required information supporting the equal quality and specified characteristics of alternative materials.

106.15 QPL and Non-QPL Products. The Department will classify products as either Qualified Product List (QPL) Products or Non-QPL Products. The Department considers QPL Products as manufactured products, available on the market, classified under at least one category included in the Department's QPL Program. The Department website lists categories of products, covered by the QPL program. Department considers NonQPL Products as manufactured products available on the market and not classified under a category covered by the ITD QPL Program.

A. QPL Products. The Contractor may use approved products on the QPL within the specified conditions. The Department also lists, for information only, products that it is currently reviewing and has not yet approved.

Use of material from the QPL does not relieve the Contractor of its responsibility to incorporate the material into the work as required by the contract. If materials from the QPL do not meet the contract requirements, the Engineer will reject the

material. Replace material rejected by the Engineer at no additional cost to the Department.

The Contractor may use products, covered by but not listed in the categories of the Department's QPL web site, in accordance with the following requirements:

1. Submit a written request to the Engineer to substitute an alternate product for a product in the QPL.
2. Submit a QPL Application form that includes data showing that the proposed product is equal or better than the QPL product.
3. The Engineer will review and respond to the request within 7 calendar days after receipt of the request.
4. The Contractor must receive written approval from the Engineer before using an alternative product.

If requesting the use of an alternative product, consider the following:

1. Intended purpose.
2. Compatibility with environmental conditions.
3. Aesthetics.

If testing required by the contract to determine the acceptability of a product will take longer than seven days, the Engineer will notify the Contractor of the additional time necessary to make a decision.

- B. Non-QPL Products.** The Contractor may use products in categories not covered by the QPL web site in accordance with the contract requirements. Unless otherwise specified by the contract, the Engineer will review the Contractor's request to use a non-QPL product and respond within 7 calendar days after receipt of the request. The Contractor must receive written approval from the Engineer before using a proposed product.

106.16 Disposal Materials. Unless otherwise required by the contract, all disposal material shall become the property of the Contractor.

Remove these materials from the project or dispose of them in accordance with the contract requirements, or as approved by the Engineer. Certify to the Engineer, in writing, the final disposal of hazardous materials.

SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107.01 Laws to be Observed. Comply with all applicable local, state, and federal laws, ordinances, regulations, orders, and decrees. Protect and indemnify the State, its agents, officials, employees, and the Public Owner (known as Local Public Agency and Local Sponsor) against claims or liability that arise from, or are based on the violation of laws, ordinances, regulations, orders, or decrees, by the Contractor, the Contractor's employees, or subcontractors.

On non-federal-aid projects, ensure at least 95 percent of employees working on the project are Idaho residents, except for projects with fewer than 50 employees. For projects with fewer than 50 employees, up to 10 percent may be nonresidents, provided the Contractor and subcontractors give employment preference to Idaho residents.

On federal-aid projects, each Contractor, subcontractor, or both shall provide a certified copy of each weekly payroll to the Engineer. Include a statement, verifying payment of the fringe benefits, either to the employee, or to an authorized agent.

107.02 Permits and Licenses. Unless otherwise required by the contract, the Contractor is responsible for any of the following that are necessary to perform the work:

1. Obtaining and complying with permits and licenses.
2. Paying charges, fees, and taxes.
3. Providing the necessary notices.

The Department will not issue extensions to the contract time for delays resulting from the Contractor's failure to obtain permits in a timely manner.

The Contractor agrees to the following:

1. Promptly pay taxes, (except on real property), excises, and license fees due to the state, its subdivisions, and municipal and quasi-municipal corporations, accrued during the contract, even if they are payable at the end of the contract term.
2. Secure to the satisfaction of the Engineer the taxes, excises, and license fees with officers of the taxing unit if they accrue and create a liability constituting a lien on the Contractor's property. during the contract term, but are not payable at the end of the contract term.

3. Allow the Department, officer, board, or taxing unit, to withhold, from contract payments due, the estimated amounts of accrued taxes, excises and license fees if the Contractor defaults on the payment or security of taxes, excises, and license fees.

107.03 Licensing of Contractors. The Contractor, and any subcontractors, must possess the appropriate public works contractor license in accordance with Title 54, Chapter 19, Idaho Code, as amended.

The Contractor, and any subcontractors required to be listed in the bid proposal, must possess the license in accordance with the following:

1. On projects that involve federal-aid funding, at the time the Department executes the contract.
2. On projects that do not involve federal-aid funding, by the date and time of bid opening.

Public works contractor licensing does not apply to Professional Service providers. The Department requires Professional Service providers to have an appropriate professional license or certification in the State for the work performed on the project.

107.04 Patented Devices, Materials, and Processes. If the Contractor uses a design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide, to the Engineer, proof of the legal agreement with the patentee or owner. The Contractor and the surety shall protect and indemnify the State, its agents, officials, employees, and the Public Owner from the following:

1. Infringement claims for the Contractor's use of a patented design, device, material, process, trademark, or copyright.
2. Costs, expenses, and damages, resulting from infringement claims, during or after the completion of work.

107.05 Restoring Surfaces Opened by Permit. Allow individuals, firms, or corporations with authorized permits by the Department to enter the project and perform the permitted work.

If directed by the Engineer in writing, repair work damaged by permit holder actions to the original standard. The Department will pay for the repair work in accordance with 104.02.

107.06 Traffic Control Devices. Provide, erect, and maintain traffic control devices in accordance with the contract requirements, and protect the work and the safety of the public.

107.08

Ensure traffic control devices are in accordance with the Manual on Uniform Traffic Control Devices as adopted by the State and published by the U.S. Department of Transportation, Federal Highway Administration. Obtain the Engineer's approval before the erection and removal of traffic control devices.

107.07 Use of Explosives. If the use of explosives is necessary for the performance of the work, exercise the utmost care not to endanger life or property. Do not use any explosives on the project, including Department-controlled sources, without prior written approval of the Engineer.

Transport, use, and store explosives in compliance with applicable federal, State, and local laws, regulations, and ordinances. Notify each public utility company having structures in proximity to the site of the work of the intention to use explosives. Provide such notice sufficiently in advance to enable the companies to protect their property from damage.

Provide blasting plan submittals as required by the contract in accordance with 205. Perform blasting operations in accordance with 205, and in a safe and professional manner.

107.08 Preservation, Protection, and Restoration of Property and Landscape. Preserve and protect public and private property. Protect land monuments and property marks until the Engineer has witnessed or otherwise referenced their locations. Do not move land monuments and property marks until directed by the Engineer.

The Contractor is responsible for damage or injury to property due to acts, omissions, neglect, or misconduct during the performance of the work, or due to defective work or materials at any time. The Department will release the Contractor from this continuing responsibility for damage or injury to property when the work is deemed completed in accordance with 105.15.

If the Contractor damages public or private property due to acts, omissions, or neglect in performing the work, the Contractor shall restore the property to its original condition by repairing, rebuilding, or restoring as directed by the Engineer, at no additional cost to the Department. The Contractor shall repair, rebuild, or restore damaged property in a timely manner to minimize any loss and inconvenience to the property owner.

Protect and indemnify the State, its agents, officials, employees, and the Public Owner from any claims from property owners for property damage or injury caused by the Contractor's operations.

107.09 Forest Protection. If performing work within or adjacent to State or national forests, comply with the regulations of the authority governing the protection and performance of work within forests.

Prevent and suppress forest fires and assist forest officials in preventing and suppressing forest fires; and immediately notify forest officials of the location and extent of a fire.

Comply with all directives from forest officials or the Engineer in the prevention or suppression of forest fires.

107.10 Responsibility for Injury Damage. Protect and indemnify the State, its agents, officials, employees and the Public Owner from the expenses of all claims by third parties for money damages, including costs and attorney fees caused in whole or part by any of the following:

1. Operations of the Contractor or subcontractors.
2. Neglect in safeguarding the work.
3. Use of unacceptable materials in constructing the work.
4. Acts, omissions, or neglect by the Contractor or subcontractors.
5. Infringements of patent, trademark, or copyright.
6. Violations of the Workers' Compensation Act or any other law, ordinance, order, or decree.

The Contractor's duty includes all claims caused in whole or part by the Contractor, subcontractors, anyone directly or indirectly employed by the Contractor or subcontractors, or any entity or person whose actions the Contractor or subcontractors may be liable for, regardless of whether the claim is caused in part by a party indemnified pursuant to this subsection.

The Contractor shall carry public liability and property damage insurance that will protect the Contractor, the State, its agents, officials, employees and the Public Owner from claims for bodily injury, including accidental death, and claims for property damages from operations under the contract whether by the Contractor, subcontractors, anyone directly or indirectly employed by the Contractor or subcontractors, or any entity or person whose actions the Contractor or subcontractors may be liable for.

Do not start work before obtaining the insurance, providing to the Engineer a certificate or other proof of the insurance, and the Department approves the certificate or proof of the insurance. Provide signed copies of insurance policies and certificates.

107.10

Maintain the required insurance coverage until the Engineer deems the project completed in accordance with 105.15.

The Contractor shall be responsible for third party injury or damage on the project until the Engineer deems the project completed in accordance with 105.15. Submit damage claims to the Contractor's insurer and provide proof of damage claim submissions, if requested by the Engineer, within 15 calendar days of the request.

Ensure the certificates state that cancellations or changes of the required policies and coverage are not effective without 30 days prior written notice to the State and affected railroad.

A. Comprehensive or Commercial General Liability Insurance

For Comprehensive or Commercial General Liability Insurance, provide at least a combined single limit of \$2,000,000.00 for each occurrence. Ensure the policy includes coverage for the following:

1. Bodily injury.
2. Broad form property damage including completed operations.
3. Personal injury including employee acts.
4. Blanket contractual.
5. Contractor's protective.
6. Products.
7. Completed operations.

Ensure the policy also includes coverage for the hazards commonly referred to as XCU (explosion, collapse, and underground). If a subcontractor is performing XCU operations, the subcontractor may provide this protection, naming the Contractor and the State as additional insureds. For Comprehensive or Commercial General Liability insurance policy containing an aggregate limit, ensure a limit of at least \$4,000,000.00.

The above limits may be met by policies having limits such as \$1,000,000 per occurrence, \$2,000,000 aggregate plus an umbrella policy of \$2,000,000.

Ensure the Comprehensive or Commercial General Liability Insurance is endorsed to include the State, its agents, officials, employees, and the Public Owner as additional insureds. Ensure the General Liability Insurance also stipulates that the Contractor's insurance coverage is primary insurance and insurance carried by the State or Public Owner will not be applicable to any

claim and will not be contributory insurance to that purchased by the Contractor for the benefit of the named insureds. The insurance shall provide coverage for the named insureds for the Contractor's defense and indemnification duties under 107.10. Ensure the insurance contains a separation of insureds provision. The insurance provided shall be first dollar coverage to the named insureds regardless of any per occurrence or aggregate deductible under the policy.

- B. Comprehensive Automobile Liability Insurance.** For Comprehensive Automobile Liability Insurance, covering the owned, hired, or non-owned vehicles used in the performance of the work, provide a combined single limit policy for bodily injury and property damage of at least \$2,000,000.00 each occurrence.
- C. Workers Compensation Insurance.** Carry Workers' Compensation Insurance as required by Idaho Code to cover the Contractor and subcontractor work forces.

107.11 Contractor's Responsibility for Work

- A. General.** Provide and be responsible for the work and material, including change order work, until the Engineer deems the project completed in accordance with 105.15, unless otherwise specified in this subsection.

Rebuild, repair, and restore damage to permanent or temporary work occurring before the Engineer deems the project completed in accordance with 105.15 at no additional cost to the Department, except for damages due to the following causes:

1. Acts of God; a cataclysmic natural phenomena such as tornadoes, earthquakes, floods, and officially declared natural disasters.
2. Acts of the public enemy or governmental authority.

These exceptions do not apply to damages resulting from the Contractor's failure to take reasonable precautions or to exercise sound engineering and construction practices in performing the work.

If damage by others delays the work, the Engineer will evaluate an extension of contract time in accordance with 108.07.

- B. Relief of Responsibility for Completed Work.** The Department may relieve the Contractor of the duty of maintaining and protecting portions of the work that the Engineer has deemed completed in accordance with 105.15. This relief applies to damages caused by public traffic, the elements, or other causes, but not from damage caused by the Contractor's operations or negligence.

107.12

C. Relief of Responsibility for Damage by Public Traffic When it is necessary for public traffic to use a highway facility during construction, the Department will relieve the Contractor of its responsibility for damages to the permanent work caused by public traffic under the following conditions:

1. The work is in accordance with the plans or approved stage or phase construction plans.
2. The contract requires the Contractor to open the section of roadway to public traffic.
3. The Contractor implements traffic controls in accordance with the approved traffic control plans.

The Contractor shall resume responsibility for the work when one of the following occurs:

1. The section of roadway is relocated to another section of roadway.
2. The Contractor submits a written request for the work that is complete to a point where the Engineer can grant relief in accordance with 107.11.B.

D. Repair of Damage. Immediately repair damage to temporary or permanent work as directed by the Engineer. For damage to permanent work qualifying for relief under this subsection, the Department may direct the Contractor to perform the repair work in accordance with 104.02, or direct others or State forces to perform the repair work.

The Department will pay the Contractor for repair of damaged permanent work only. The Department will not pay for delay or disruption caused by damage to, or repairs of, the temporary or permanent work including extended home office overhead, idle equipment, or inefficiency.

107.12 Contractor's Responsibility for Utility Facilities and Property.

Prevent damage to utility facilities, and property supporting utility facilities. Do not begin work adjacent to utility facilities if damage, loss, or inconvenience may result to the utility facility until all arrangements necessary for damage prevention have been made.

Contact a representative from each utility company with facilities on the project to locate underground facilities that the work may affect.

Allow and accommodate utility companies and their representatives to enter the project to make emergency connections or repairs to utility facilities.

Promptly notify the utility company representatives of service interruptions resulting from Contractor operations that cause any of the following:

1. Accidental breakage.
2. Facility exposure.
3. Unsupported facilities.
4. Other damages or disruption.

Cooperate with the utility company to restore interrupted utility service. If construction operations interrupt utility service, the Contractor and the utility company shall perform continuous repair work to restore the utility service. Do not perform work around fire hydrants until the local fire authority approves of temporary means to maintain continued service.

If constructing or reconstructing structures during the irrigation season, provide temporary ditches, siphons, or other structures for conveying water without waste, loss, or delay. The Department considers the cost of temporary water conveyance to be included in the contract unit prices for the respective contract pay items.

107.13 Personal Liability of Public Officials. The Board members, administrator, and authorized representatives of the State or Public Owner, personally, or in their official capacity, will have no personal liability in executing the provisions of this contract or exercising the power or authority granted them. The Board members, administrator, and authorized representatives of the State or Public Owner act solely as agents and representatives of the State or Public Owner.

107.14 No Waiver of Legal Rights. The State is not precluded or estopped by measurements, estimates, final pay quantities, or certificates, made before or after the completion and acceptance of the work and payment, from establishing the following:

1. The true amount and character of work performed and materials provided by the Contractor.
2. That the measurements, estimates, final pay quantities, or certificates are untrue or incorrect.
3. The work or materials do not conform to the contract.

The State is not precluded or estopped, despite measurements, estimates, final pay quantities, or certificates and payments, from recovering from the Contractor and its surety damages State may sustain due to the Contractor's failure to comply with the terms of the contract or an incorrect measurement of a contract pay item. Damages shall include any overpayment that the State made due to an incorrect measurement or calculation of a contract pay item.

107.17

No waiver of the rights of the State under this subsection shall occur if there is:

1. Acceptance by the State or authorized representative.
2. Payment for or acceptance of the whole or any part of the work.
3. Extensions of time.
4. Possession taken by the State.

No waiver of any breach of contract shall occur.

107.15 Access to Records. The Contractor and subcontractors shall keep all books, documents, papers, accounting records and other evidence pertaining to incurred costs.

The Contractor and subcontractors shall make these records available to authorized agents of the State or federal governments for inspection and copying at the Contractor's or subcontractor's offices during normal business hours for the following time periods:

1. The contract time.
2. Five years after the date on which the Department makes final payment to the Contractor.

Failure of the Contractor or any subcontractor to maintain the required records and provide access to these records may result in a waiver of any claim the Contractor may have for additional compensation or for breach of contract by the State.

107.16 Sanitary, Health, and Safety Provisions. Federal, state, and local laws, rules, and regulations related to construction safety and health standards are essential terms of the contract. The Department prohibits the Contractor from allowing or requiring workers to work in conditions that are unsanitary, hazardous, or dangerous to their health or safety.

Provide reasonable restroom facilities for project personnel and provide project personnel adequate work time to use those facilities including provision of portable facilities for moving operations.

107.17 Environmental Protection. Comply with federal, state, and local laws, regulations, and ordinances addressing protection of the environment. Abide by permit conditions and mitigation measures included in permits and environmental clearances.

If any of the following are discovered and not identified by the contract, notify the

Engineer immediately and do not attempt to excavate, open, or remove without written approval:

1. Underground storage tank.
2. Buried drum.
3. Other container.
4. Contaminated soil.
5. Lead paint.
6. Asbestos.
7. Debris.

Do not use public recreation areas, regulatory floodways, wetlands, or critical habitat without the Engineer's written approval.

A. Permit and Plan Requirements. The contract identifies whether a National Pollutant Discharge Elimination System (NPDES) Permit is required. If the Contractor increases the area of disturbance beyond the area shown on the plans, and the resulting area of disturbance exceeds 1 acre, the Department will require a NPDES Permit and the Contractor to prepare a Stormwater Pollution Prevention Plan (SWPPP).

If the plans show an area of disturbance less than 1 acre, and the contract does not require an NPDES Permit, perform the work in accordance with Federal and State water quality regulations and policies and the Department will require an Erosion and Sediment Control Plan (ESCP).

The Department will require the Contractor to obtain the necessary environmental approvals for work areas outside the project limits. Provide written evidence acceptable to the Engineer that all environmental clearances have been obtained before starting work. Work areas outside the project limits include the following:

1. Material sources
2. Disposal areas
3. Waste areas
4. Staging areas
5. Haul roads

Submit written evidence to the Engineer that construction activities shall not

encroach or affect regulated wetlands as defined by the U.S. Army Corps of Engineers. The Engineer will review and approve the written evidence before allowing the Contractor to begin construction in noncommercial areas outside the project limits. The Engineer may require a wetland specialist to prepare the written evidence.

Take immediate corrective action, in accordance with state and federal regulations, if contaminants, hazardous, or toxic materials are released into the environment.

Schedule and conduct operations in accordance with the conditions of state or federal permits to avoid impacts to any of the following:

1. Streams
2. Lakes
3. Wetlands
4. Reservoirs
5. Aquifers
6. Associated fish and wildlife habitat

All stream alteration, stream encroachment and the 404 Permits for the project are attached to this contract. Provisions of the permit(s) take precedence over all other sections of the contract to the extent there is a conflict or ambiguity. The Contractor shall have complete responsibility for compliance with the provisions of the permit(s) for all activities on the project. Violation of a condition or provision of a permit incorporated into this contract shall be a breach and the Department may terminate the contract for default in accordance with 108.09.

For changes to the approved permits, the Department will submit separate applications to the Idaho Department of Water Resources and the U.S. Army Corps of Engineers. Do not begin the work described on a permit before these agencies approve the permit. The Contractor is responsible for the following:

1. The cost for changes or additional permits requested by the Contractor for the convenience of the Contractor.
2. Fines, penalties, and costs to mitigate damages for work not authorized by a Corps of Engineers and Water Resources Permit.
3. Penalties against the state and the cost for resolving regulatory action.
4. Time delays and related costs.

B. National Pollutant Discharge Elimination System Permit. If required, the contract will specify if the contract requires a National Pollutant Discharge Elimination System (NPDES) Permit. The Department will include a preliminary draft of the NPDES SWPPP in the contract. The NPDES permit will also cover the following work areas outside the project limits that do not operate beyond the completion of the project, or serve multiple projects:

1. Concrete or asphalt batch plants
2. Equipment staging yards
3. Material storage areas
4. Excavated material disposal areas
5. Material Sources
6. Borrow areas

The Department will include information about the following in the draft SWPPP:

1. Project site characteristics.
2. Drainage patterns.
3. Areas where pollution prevention and erosion control measures are needed.

If the Contractor increases the area of disturbance, the Contractor shall prepare the entire SWPPP.

Present the SWPPP information no later than the preconstruction conference. Provide detailed information about the intended sequence of work, pollution control methods, staging area locations, stockpiles, and other ground disturbing activities. Identify the controls and measures in the SWPPP for covering discharge from the work areas outside the project limits. Include details about initial site preparation, including the following:

1. Sediment basins
2. Sediment traps
3. Perimeter dikes
4. Silt fencing

After Department review of the Contractor provided SWPPP information, incorporate the information provided by the Department into the initial SWPPP. The Department, the Contractor and the subcontractors performing ground disturb-

ing work, will sign the SWPPP once approved by the Engineer. Document revisions of the SWPPP.

The Department and the Contractor must each complete a Notice of Intent (NOI) form and file it electronically. Do not begin construction work until both NOIs are posted on the EPA website and the 7-day waiting period is over.

The Department considers the cost of SWPPP revisions and costs associated with the permitting process to be incidental to the contract.

An NPDES permit does not authorize the Contractor to take threatened or endangered species or to destroy critical habitat.

- C. Erosion and Sediment Control Plan.** The Department will require an Erosion and Sediment Control Plan (ESCP) on contracts that do not require an NPDES Permit. Prepare an ESCP that meets the requirements of 212. Include a Spill Prevention and Control Plan that addresses hazardous waste, solid waste, fueling and washouts. Submit the ESCP and Spill Prevention and Control Plan to the Engineer for review and approval prior to or at the preconstruction conference. Include a certification that reads as follows: *

“As an operator, I certify that this Erosion and Sediment Control Plan (ESCP) narrative and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

As an operator, I certify that I understand requirements of the Clean Water Act as it relates to my activities and will, to the maximum extent practicable, implement BMP’s to minimize release of pollutants into the environment.”

The Department, the Contractor, and subcontractors performing applicable work, will sign the ESCP.

- D. Air Quality.** Obtain construction approval from the Idaho Department of Environmental Quality if the project, or off-site area of disturbance, are in an area of air quality non-attainment for any pollutant.

107.18 Cultural Resource Protection. Comply with federal and state laws and regulations governing the protection of cultural resources. These resources include items such as bottles, projectile points, stone flakes, mortars, or pottery.

Cultural resources require identification, protection, and preservation. Before using

a work area outside the project limits, obtain a cultural resource clearance. Unless otherwise specified by the contract the project has received archeological clearance.

Discontinue work in an area of the project or an area outside the project limits that is being used in the performance of the work if operations encounter previously unidentified cultural resources. Notify the Engineer of the nature and exact location of the find. The Engineer will immediately arrange for a cultural resource investigation with the State Historic Preservation Office (SHPO) to determine the extent of the find or will direct the Contractor to retain a consultant if the find is outside the project limits. Protect the find and provide written confirmation of the discovery to the Engineer within two working days. The Engineer will provide the Contractor the following to update the status of the restriction implemented by the investigation:

1. The time necessary for the State to handle the site, structure, object, or district.
2. The area of the project that the Contractor may work.
3. Written confirmation when the restriction is terminated.

The Engineer will determine cost and time impacts due to cultural resources not previously identified in the contract in accordance with 104.02 for archeological finds within the project. The Department will not pay the Contractor or extend the contract time for archeological finds outside of the project limits.

The State requires cultural resource clearance for additional areas proposed for use by the Contractor, to complete the project. Obtain clearance for Contractor-proposed areas, including sources, stockpiles, disposal sites, and staging areas before work within the proposed area begins. Notify the Engineer when these areas are known to facilitate the clearance process with the SHPO. If the Contractor disturbs an area believed to have cultural resources before obtaining cultural resource clearance, the Engineer may preclude the area from project use.

Obtain the Engineer's approval for the use of all areas outside the project limits, to ensure the Contractor meets the requirements of this subsection. The Engineer may assist the Contractor in arranging cultural resource investigations. The Contractor shall contract with a qualified professional archeologist to conduct a cultural resource investigation. The Engineer will coordinate consultant investigations and reports through the Department Highway Archeologist. The SHPO will review and concur with these reports or require further archeological testing. Consultant qualifications and performance shall meet SHPO standards.

Delays caused by the clearances and SHPO concurrence for Contractor-proposed areas shall not entitle the Contractor to additional compensation or time.

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Obtain additional testing or mitigation for cultural resource clearance when requested to do so by the SHPO, at no additional cost to the Department.

Allow at least 42 calendar days from the date the contractor submits the consultant investigation to the Engineer to obtain a clearance, if SHPO finds no cultural sites and does not require further testing. The Department may delay, disallow, or grant clearance with certain conditions if the SHPO finds a cultural site.

107.19 Fencing. If the contract requires fence removal, replace the fence to the original or better condition. Ensure the confinement of livestock during the project. The contract may require temporary fencing.

Provide advance written notice to adjacent landowners before removing portions of any fence. Contact and coordinate with adjacent landowners 48 hours before removing the fence, and submit written evidence of coordination with adjacent landowners to the Engineer before removing the fence.

SECTION 108 - PROSECUTION, PROGRESS AND TERMINATION

108.01 Subletting of Contract. Do not sublet, sell, transfer, assign, or otherwise dispose of the contract or any portion of the contract, or of the right, title, or interest in the contract without the Engineer's written consent. If the Engineer consents to subletting a portion of the work, the Contractor shall use its own organization to perform work amounting to at least 50 percent of the original contract amount for projects that involve federal-aid funding and 20 percent for projects that do not involve federal-aid funding. The phrase "its own organization" includes only workers employed and paid directly, inclusive of employees who are employed by a lease agreement acceptable to the Department, and equipment owned or rented with or without operators; and does not include employees or equipment of a subcontractor, assignee, or agent of the Contractor.

Calculate this percentage using the following equation:

$$X = \frac{C}{O - S} \times 100$$

where

X = Percentage of work performed by the Contractor's own organization (%)

C = Contract amount of work performed by the Contractor's own organization (\$)

O = Original contract amount (\$)

S = Contract amount of specialty items (\$), if included in the contract.

If the contract requires contract pay items to be performed at stipulated prices or invoice prices and these items are not shown in the bid schedule, add the prices of

these items to the original contract amount for the purpose of determining the minimum percentage specified above. Provide written quotations as support for invoice prices.

The Department will not allow a subcontractor to work on the project until the Engineer approves the subcontractor's executed agreement with the Contractor (the subcontract), with all required attachments and addenda. Neither of the following relieves or releases the Contractor or the surety of their responsibilities or liability under the contract or the contract bonds:

1. The Engineer's consent to subcontract work.
2. Any language in the subcontract.

Subcontracting creates no contract between the Department and the subcontractor. The subcontractor gains no rights, and the Department accepts no responsibilities by reason of the subcontractor's contract with the Contractor. The Contractor is responsible for all work performed on the project.

108.02 Contract Time

A. General. The proposal forms will specify the contract time as one of the following:

1. Working day contracts, the number of working days.
2. Calendar day contracts, the number of calendar days.
3. Completion date contracts, a contract completion date.

The contract time allowed to complete the work will be stated in the proposal forms and in the contract. Contract time commences 20 calendar days after award of the contract, or as stated in the proposal forms.

Do not begin work on the project until the contract is fully executed in accordance with 103.05.

Achieve substantial completion within the contract time. The Engineer will not charge contract time after substantial completion as evidenced in writing by the Engineer, as long as the Contractor diligently performs the remaining work.

B. Working Day Contracts. Beginning with the start of work specified in 108.02.A, the Engineer will assess working days for all days except as specified in 101.04.

The Engineer will assess working days if the Contractor is not performing work on the critical path, and that non-performance is due to causes the Contractor could have foreseen, controlled, or prevented.

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The Engineer will prepare and provide to the Contractor a monthly statement showing the number of working days charged for the preceding month and the number of working days remaining in the contract time. If the Contractor disagrees with the working days assessed, the Contractor may give notice on the monthly statement in accordance with 104.03.

- C. **Calendar Day Contracts.** Beginning with the start of work specified in 108.02.A, the Engineer will assess calendar days for all days on the calendar.
- D. **Completion Date Contracts.** For completion date contracts, the contract time concludes on the specified contract completion date.

108.03 Project Schedule

- A. **General.** Develop and maintain a project schedule that represents the scope of work required by the contract and the proposed sequence of operations. Include activities with reasonable durations for work that is the responsibility of the Department. Reasonable is defined as “customary or normal” for the type of work involved or as required by the contract.

The “critical path” is the longest path of activities through the project schedule that establishes the scheduled substantial completion date. Therefore, at any point in time, the critical path will typically be the path with the least amount of total float. The critical path may follow different paths of activities at different times during the performance of the work due to the progress of the work or revisions made to the schedule.

Float in the project schedule is the total number of days that a scheduled activity can be delayed and still achieve substantial completion within the contract time. Float prior to substantial completion is not for the exclusive use or benefit of either party, but is a resource available to either party on a first-come first-served basis as needed. Float after substantial completion is owned by the Contractor.

Notify the Engineer at least two days in advance of stopping work, resuming work, or changing the work schedule.

The cost of preparing, updating, and revising the schedules is incidental to other contract pay items. The Engineer may withhold partial payments if the Contractor fails to provide the schedules and updates as required.

The Department’s acceptance of any schedule does not relieve the Contractor of its responsibilities to adjust labor and equipment forces or work schedules and provide sufficient materials to substantially complete the work within the

contract time. Acceptance does not modify the contract or constitute endorsement or validation by the Engineer of the Contractor's logic, activity durations, or assumptions in creating the schedule.

Provide a Critical Path Method (CPM) schedule in accordance with the following minimum requirements:

1. Created in a software format that is compatible with the most current version of Primavera Suretrack or Microsoft Project .
2. Includes all activities required to complete the work, including, but not limited to, engineering, surveying, permitting, submittals, resubmittals, approvals, procurement, fabrication, deliveries, crushing, utility work, and third-party work.
3. Includes milestones, interim completion dates, substantial completion date and contract completion date.
4. Describes activities such that the work is readily identifiable.
5. Identifies the scheduled early and late start and finish dates for each activity.
6. Limits activity durations to 20 working days, unless otherwise approved by the Engineer.
7. Limits activity relationships to finish-to-start, start-to-start, and finish-to-finish relationships. Do not use dummies, leads or lags unless otherwise approved by the Engineer.
8. Uses only contractual date constraints, unless otherwise approved by the Engineer.
9. Defines the work calendar for each activity.

Also submit to the Engineer with the CPM schedule:

1. A narrative that describes the major equipment and assumed production rates for the major work activities.
2. A description on how the number of anticipated weather days in accordance with table 108.1 have been incorporated into the schedule (calendar and completion date contracts only).

Ensure each CPM schedule submittal includes one electronic copy of the CPM schedule on a compact disc or other medium approved by the Engineer, and two paper copies of the following:

1. Time-Scaled Logic Diagram

Submit the Time-Scaled Logic Diagram in accordance with the following:

- a. Plot the logic diagram on sheets with a horizontal time scale that is the project calendar. Ensure each activity's duration and dates are plotted on the horizontal time scale.
- b. Submit the logic diagram using a sheet size approved by the Engineer.
- c. Ensure the activity information includes activity numbers, activity descriptions, durations, total float, and scheduled or actual start and finish dates.

The logic diagram must clearly show the sequence and interdependence of all activities required for performance of the work required by the contract, and indicate the project's critical path.

2. Predecessor and Successor Report

The Predecessor and Successor Report should define all of the schedule logic. It will clearly indicate all logical relationships and constraints.

3. Bar Chart Printout

Ensure the Bar Chart Printout includes the following information for each activity:

1. Activity number or ID
2. Activity description
3. Activity calendar
4. Original duration
5. Remaining duration
6. Percent complete
7. Early or actual start and finish dates
8. Late start and finish dates
9. Total float

B. Initial Schedule. Submit the initial schedule to the Engineer for review at or before the preconstruction conference.

The initial schedule must meet the contract requirements and show that substantial completion is achieved within the contract time.

When approved by the Engineer, the Contractor may submit a preliminary schedule defining the Contractor's planned operation for the first 60 calendar days after the award date and indicating the Contractor's general approach for the rest of the project.

Meet with the Engineer to jointly review, correct, and adjust the initial schedule within 10 calendar days after submitting the initial schedule. Resubmit the initial schedule to the Engineer for acceptance within 10 calendar days after the meeting. If the Engineer does not accept the resubmitted schedule, repeat this process.

- C. Monthly Update Schedules.** Attend monthly jobsite progress meetings to update the schedule. The Engineer and Contractor will review progress to verify actual start and finish dates, remaining duration, percent complete of uncompleted activities, and any proposed revisions to the schedule. It is the Contractor's responsibility to provide the Engineer with the status of activities at this progress meeting and prepare schedule updates based on this information once it has been verified and agreed upon.

Each month, submit to the Engineer the updated schedule reflecting progress. Submit a written narrative describing the project schedule status, the critical path, and any revisions to the schedule with the schedule update. Resubmit the schedule update if it does not contain the agreed-upon as-built information.

At the written request of the Engineer, and within 7 calendar days after receipt of the written request, submit a revised schedule in accordance with 108.03.A if the actual prosecution of the work is, as determined by the Engineer, significantly different than that represented on the current schedule.

The Department will provide the Contractor with one of the following responses within 10 calendar days after the Department's receipt of the revised schedule:

1. Accept the revised schedule.
2. Reject the schedule and identify the reasons for rejection.
3. Request more information.

Address the reasons for rejection or submit the information requested within 10 calendar days after the Department's request. The Department may withhold partial payment until the Contractor submits and the Department accepts the revised schedule.

- D. Final Schedule.** Submit a final schedule with the written notice of completion

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once the Engineer deems the project completed, in accordance with 105.15, that reflects actual start and finish dates for each activity.

The Department will not grant final acceptance in accordance with 105.15 until the Engineer receives and accepts the final schedule.

108.04 Preconstruction and Preoperational Conferences. Meet with the Engineer for a preconstruction conference at a mutually agreed time. At or before the preconstruction conference, submit the following to the Engineer:

1. Initial schedule in accordance with 108.03.B.
2. List of material suppliers and subcontractors.
3. Other requested information.

Meet with the Engineer for preoperational conferences before beginning any new phase of work.

108.05 Limitation of Operations. Do not start an operation involving traffic until traffic control devices are completely installed and approved by the Engineer. Perform the work in a manner and sequence that will ensure the least interference with traffic. The Contractor is responsible for the location of all detours and provisions for handling traffic. Access the project only at existing interchange ramps, public road connections, or approaches, unless otherwise shown on the plans. The Engineer may require the Contractor to finish one section of the project before starting on any additional sections of the work if the opening of the first section is essential to convenience of the traveling public.

Unless otherwise approved by the Engineer, do not work on any roadway open to the traveling public, except for normal maintenance operations, during a three-day holiday weekend or on July 3, 4, and 5.

108.06 Methods, Equipment, and Character of Workers. At all times, provide sufficient labor and equipment for prosecuting the work in a satisfactory manner and within the contract time.

Employ workers with sufficient skill and experience to properly perform the work assigned to them.

If, in the opinion of the Engineer, any person employed by the Contractor or by any subcontractor, does not perform the work in a proper and skillful manner, or is intemperate or disorderly, the Engineer will issue a written direction for removal of the worker. Do not again employ the removed worker in any portion of the work without the Engineer's approval.

If the Contractor fails to do either of the following, the Engineer may suspend the work by written notice until the Contractor complies with the contract requirements:

1. Remove such person or persons as required above.
2. Provide suitable and sufficient labor and equipment for the proper prosecution of the work.

Ensure the equipment used on any portion of the project does not damage the roadway, adjacent property, or other highways. Park unattended equipment at least 30 ft off the traveled way, unless the Engineer approves otherwise. If the posted speed limit for the traveled way is 40 mph or less, the Engineer may approve parked equipment at least 10 ft off the traveled way.

Use the methods and equipment required by the contract. If the Contractor desires to use a method or type of equipment other than those specified in the contract, submit a written request that includes a full description of the proposed method and equipment and the reasons for making the change. If the Engineer approves the change, the Contractor is fully responsible for performing the work as required by the contract. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet the contract requirements, discontinue the use of the substituted method or equipment and complete the remaining work with the method and equipment required by the contract. Remove the deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer directs. The Engineer's approval of changed methods or equipment does not modify the contract amount or the contract time.

If the methods and equipment required to complete a specific portion of the work are not specified in the contract, then the Contractor may use any methods or equipment that will satisfactorily complete the work as required by the contract.

108.07 Extension of Contract Time

A. General. The Engineer will extend the contract time by issuing a change order if an excusable delay, as specified in 108.07.B, 108.07.D, or 108.07.F extends the scheduled substantial completion date. The Engineer will only consider a request to revise contract time if the following conditions are met:

1. Notice as specified in 104.03.
2. Documentation from the project schedule, including updates, justifies the time extension.

The Engineer will evaluate the information submitted and determine the time

extension, if any. The Contractor's plea that insufficient contract time was specified is not a valid reason for a time extension.

Time is of the essence in the Contractor's performance of the contract. Delays inconvenience the traveling public, obstruct traffic, interfere with and delay commerce and increase risk to highway users. Delays also increase costs to the Department, adding time needed for administration, engineering, inspection and supervision. It is essential and in the public interest that the Contractor prosecute the work vigorously to contract completion.

The Engineer will not grant time extensions for delays incurred during the months of December, January, and February unless the Contractor's accepted project schedule shows the delayed work was scheduled to be performed during this time period and was critical at the time of the delay.

If the Engineer extends the contract time, the Department will relieve the Contractor from associated liquidated damages, as specified in 108.08.

- B. Excusable, NonCompensable Delays.** Excusable, noncompensable delays are delays that are not the Contractor's or the Department's fault or responsibility, and could not have been reasonably foreseen or anticipated by the Contractor prior to bid. The Engineer will grant a time extension if justified per 108.07.A, but will not compensate the Contractor for costs incurred due to the delays.

The following are examples of excusable, noncompensable delays:

1. Delays due to floods, tornadoes, lightning strikes, earthquakes, or other cataclysmic phenomena of nature.
2. Delays due to weather as specified in 108.07.C.
3. Unavoidable delays in material deliveries resulting from freight embargoes, government acts, or area-wide material shortages. This applies to the Contractor and subcontractors or suppliers at any tier. Delays due to the Contractor's, subcontractors', or suppliers' insolvency or mismanagement are not excusable.
4. Delays due to civil disturbances.
5. Delays from fires or epidemics.
6. Delays from labor strikes that are beyond the Contractor's, subcontractors', or suppliers' power to settle and are not caused by improper acts or omissions of the Contractor, subcontractor, or supplier.

7. Added quantities that delay work on the critical path.
 8. Delays due to acts of the government or a political subdivision other than the Department.
 9. Delays from damage to temporary or permanent work.
- C. Extension to the Contract Time for Weather.** For calendar day and completion date contracts, the Engineer will extend the contract time one day for each lost day of work on the critical path caused by weather that exceeds the reasonably anticipated weather days per month as listed in Table 108.07-1.

**Table 108.07-1 - Anticipated Weather Days per Month
Number of Working Days Lost
Due to Weather by District**

Month	1	2	3	4	5	6
January	10	7	8	8	8	8
February	7	6	6	6	6	6
March	7	6	6	6	6	6
April	5	6	4	4	4	4
May	5	6	4	5	5	5
June	4	4	2	3	3	3
July	1	1	1	1	1	1
August	1	1	1	1	1	1
September	2	1	1	1	1	1
October	4	3	2	1	1	1
November	9	6	6	5	5	5
December	11	7	7	7	7	7

A "lost day of work" means that normal production on critical activities cannot proceed for at least 5 hours per day as determined by the Engineer. The Engineer will not consider weather experienced on weekends or holidays as lost working days unless the Contractor normally works on those days or unless the Engineer directs the Contractor to work on those days.

- D. Excusable, Compensable Delays.** Excusable, compensable delays are de-

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lays that are caused solely by the Department. The Engineer will extend the contract time for the following excusable, compensable delays, if the conditions specified in 108.07.A are met:

1. Delays due to contract revisions as defined in 104.02.B, 104.02.C, 104.02.E, or 104.02.F.
2. Delays due to utility interference within the project limits as defined in 105.07.
3. Delays due to an Engineer-ordered suspension as defined in 104.02.D
4. Delays due to the actions or neglect of the Department or its failure to act in a timely manner.

The Engineer will determine compensation for excusable, compensable delays in accordance with 109.03.D.

- E. NonExcusable Delays.** Non-excusable delays are delays that are the Contractor's fault or responsibility. All nonexcusable delays are noncompensable. The Engineer will not grant time extensions for non-excusable delays.
- F. Concurrent Delays.** Concurrent delays are independent delays to critical activities occurring at the same time. When a non-excusable delay is concurrent with an excusable (compensable or non-compensable) delay, the Contractor is not entitled to a time extension or additional compensation for the period the non-excusable delay is concurrent with the excusable delay. When an excusable (non-compensable) delay is concurrent with an excusable (compensable) delay, the Contractor is entitled to a time extension but no additional compensation for the period the non-compensable delay is concurrent with the compensable delay.

108.08 Failure to Complete on Time. If the contract time expires, the Department will assess liquidated damages for each working day the work remains substantially incomplete after the contract time or its most recent extension has expired. Liquidated damages are not a penalty. The Engineer will determine working days for the assessment of liquidated damages in accordance with 108.02.B, except, for calendar day and completion date contracts, the Engineer will not exclude days during December, January, and February. The Department will deduct liquidated damages from money due the Contractor or will bill the Contractor, as appropriate, at the rates required by the contract.

The Engineer will not assess liquidated damages after substantial completion of the

work as evidenced in writing by the Engineer, as long as the Contractor diligently performs the remaining work.

Allowing the Contractor to continue and finish the work after the contract time expires in no way operates as a waiver on the part of the Department of any of its rights under the contract.

108.09 Default and Termination of Contract. If the Contractor is responsible for any of the following, the Engineer may provide written notice to the Contractor and surety of such delay, neglect, or default:

1. Failing to begin the work by the date specified in the notification of award.
2. Failing to perform the work with sufficient labor and equipment or with sufficient materials to ensure completion of the work within the contract time.
3. Performing the work unsuitably and neglecting or refusing to remove materials or to replace unacceptable or unsuitable work.
4. Discontinuing the prosecution of the work.
5. Failing to resume work that has been discontinued within a reasonable time after notice to do so.
6. Becoming insolvent or being declared bankrupt, or committing any act of bankruptcy or insolvency.
7. Making an assignment for the benefit of creditors.
8. For any other cause, failing to carry on the work in an acceptable manner.

If, within 10 calendar days after receipt of the Engineer's written notice, the Contractor or surety does not respond as specified by the notice, the Department will have full power and authority without violating the contract, to remove the prosecution of the work from the hands of the Contractor. The Department may appropriate or use any or all suitable and acceptable materials and equipment within the project limits, may enter into an agreement for the completion of the contract according to the terms and provisions of the contract, or use other methods that, in the opinion of the Engineer, are required for the completion of the work as required by the contract.

The Department will deduct the costs and charges incurred for the completion of the work under the contract from any amounts due, or which may become due, the Contractor. If the amount exceeds the sum that would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Department the excess amount. If, after termination of the contract, it is determined that the Contractor was not in default the rights and obligations of the parties will

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be the same as if the termination had been issued for the convenience of the Department in accordance with 108.10.

108.10 Termination for Convenience of the Department

A. General. The Department may terminate the contract in whole or in part for:

1. Executive Orders of the President or State Governor, or
2. Court restraining orders based on acts or omissions of persons or agencies other than the Contractor.
3. Conditions are determined to be in the best interest of the Department.

The Department will detail the specifics on the termination and the effective date in a Notice of Termination.

B. Submittals and Procedures. Upon receipt of a Notice of Termination, immediately:

1. Stop work as specified.
2. Place no further subcontracts or order materials, services, or facilities, except as approved to complete any remaining portion of the contract.
3. Terminate all subcontracts to the extent they relate to terminated work.
4. Settle all outstanding liabilities and termination settlement proposals.
5. Transfer title and deliver to the Department:
 - a. Unfabricated or partially fabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated; and
 - b. Completed or partially completed plans, drawings, information, and other property required to be furnished to the Agency if the contract had been completed.
6. Complete work not terminated.
7. Coordinate a time and date with the Engineer to inventory materials obtained but not yet used for the project.
8. Take all necessary or directed action to protect contract-related property that is in the possession of the Contractor and in which the Department has or may have an interest.

C. Settlement Provisions. Accept final payment for:

1. Completed work items at the contract bid price.
2. Eliminated work as specified in 104.02.F.
3. Partially completed work at agreed prices or as follows: Submit a claim for additional damages or costs not covered above or elsewhere in the contract within 60 calendar days of the termination date. Furnish cost documentation. Exclude anticipated profits on work not completed. Ensure the claim is less than the total contract price, reduced by the amount of previous payments, and the contract price of nonterminated work.

Following Department agreement with claimed costs, the Department will amend the contract and make payment.

D. Disputed Settlement. If the Department does not agree with the costs claimed by the Contractor, the Department will make payment as follows, but without duplicating any amounts agreed upon under 108.10.C:

1. For contract work performed before the termination date, the total of
 - a. The cost of work completed
 - b. The cost of settling and paying termination settlement proposals under terminated subcontracts properly chargeable to the termination portion of the contract if not included in 108.10.D.1.a
 - c. Profit on 108.10.D.1.a., determined by the Department to be reasonable. The Department will exclude profit under this subdivision if the Contractor's costs for work performed exceed the bid item payments made.
2. Reasonable settlement costs of terminated work, including
 - a. Accounting, legal, clerical, and other expenses reasonably necessary to prepare termination settlement proposals and support data
 - b. Subcontract termination and settlement (excluding the amounts of settlement)
 - c. Storage, transportation, and other costs incurred that are reasonably necessary to preserve, protect, or dispose of the termination inventory.
3. Except for normal spoilage and to the extent that the Department accepts the risk of loss, the Department will exclude the fair value of destroyed, stolen, or damaged material.

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4. The following will be deducted to arrive at the amount owed the Contractor:
 - a. all unliquidated advance or other payments under the terminated portion of the contract.
 - b. any Department claim against the Contractor under the contract.
 - c. the agreed upon price or the proceeds from the sale of materials, supplies, or other items acquired and sold by the Contractor but not covered by or credited to the Department.
- E. **Partial Termination.** File a proposal with the Department for an adjustment of the price(s) of the continued portion of the contract within 90 calendar days of the effective termination date. Provide supporting information. The Department will make any agreed upon adjustment. The Department may establish terms and conditions for making partial payments against costs incurred by the Contractor for the terminated portion of the contract. Provide access to all project cost records for Department audit. Request approval to maintain photographs, microphotographs, or other accurate reproductions rather than original records and documents.

Termination does not relieve the Contractor of responsibility for work completed.

SECTION 109 - MEASUREMENT AND PAYMENT

109.01 Measurement of Quantities. The Department will measure the quantities of contract pay items using the units of measure specified in the contract and the methods of measurement and calculation in accordance with this subsection. Units of the U.S. customary system of weights and measures are defined in 15 U.S. Code.

The Department defines the following measurement quantities:

1. "Station" as 100 ft.
2. "Ton" as the short ton of 2,000 lb.
3. "Size number," in reference to the measurement of wire, is the size number specified in AASHTO M 32.

For standard manufactured materials identified by gage, thickness, unit weight, or section dimensions, the Department will consider these as nominal weights and dimensions and accept industry-established manufacturing tolerances, unless otherwise required by the contract.

The Engineer will measure quantities of contract pay item by the actual quantity or by the plan quantity, as required by the contract.

- A. Actual Quantities.** Where the contract requires “actual quantity” as the basis of payment for a contract pay item, the Engineer will measure and calculate the actual quantity of work performed, using quantities from measurements taken from the work complete and in-place or from measurements taken from delivery vehicles, excluding work outside the project limits, in accordance with the “Method of Measurement” subsection for the relevant contract pay item.

The Engineer will measure the actual contract pay item quantities using the following methods:

1. Area

The Engineer will calculate area measurements from linear distances measured horizontally or vertically. The measurement will be the neat lines shown on the plans or ordered in writing. The Engineer will not deduct for individual fixtures occupying areas less than or equal to 9 SF.

2. Structures

The Engineer will measure structures using the neat lines shown on the plans or ordered in writing.

3. Linear

The Engineer will measure linear measurements in accordance with the following:

- a) By the foot – measured parallel to the surface on which the work is installed.
- b) By the mile – measured using project stationing.

For materials manufactured in standard lengths, the Engineer will calculate the measurement of length by multiplying the number of pieces by the nominal length.

4. Lump Sum or Each.

Consider “lump sum” or “each” payment as full compensation for all labor, equipment, material, and incidentals including fittings and accessories necessary to complete the work on a contract pay item or other element of work.

5. Volumes of Excavation, Embankment, and Similar Contract Pay Items.

The Engineer will measure volume quantities using specific volumetric

measurements in accordance with the “Method of Measurement” section for the relevant contract pay item.

6. Volumes and Weights in Hauling Vehicles.

The Engineer will measure material delivered in trucks by the cubic yard or by weight. Haul material in trucks approved by the Engineer. Display a unique identification mark on each truck.

a. Cubic Yard

If the contract does not require otherwise, the Engineer will measure contract pay items with cubic yard pay units using trucks with calculated struck volumes as the Method of Measurement.

The Engineer will measure volume at the point of delivery. Hauling units may be of any size or type acceptable to the Engineer, provided the unit's body is shaped to enable an expeditious and accurate determination of the content's volume. The Engineer will calculate the struck volume of each truck to the nearest 0.1 CY. The Department defines struck volume as the three inside dimensions of a truck box with the length and width confined by the physical limits of the truck box and the height measured from the floor of the truck box to the top of the shortest side elevation. This volume shall not change without approval of the Engineer.

The Engineer will not make allowances for the settlement of material in transit. For material delivered to the project in trucks, the Engineer will not pay for material above the struck volume of the truck box, and will reduce the calculated struck volume of the truck box by 0.5 CY increments when the truck is not filled to its struck volume.

b. Weight

Provide scales approved by the Engineer to weigh material paid by weight. Obtain the Engineer's approval of the installation of the scales.

For material measurement based on scale tickets, ensure that scales used to weigh materials include a controller capable of printing a weight ticket that indicates the project name, project number, contract pay item number, current date, current time, load number, truck number, load gross weight, load tare weight, and load net weight. Ensure the scale controller can automatically print the date,

time, and weights without modification of the weight ticket. Assign sequential load numbers for each load weighed for delivery to the project. Supply the labor to weigh loads and prepare weight tickets.

If paying for granular borrow or aggregate by weight, the Engineer will not pay for water over 4 percent of the dry weight of the material unless otherwise required by the contract. The Engineer will correct material weight for excess moisture content in accordance with AAS-HTO T 255.

Weigh trucks empty at least once a day if used to haul material paid by weight.

Ensure the accuracy of scales to within ± 1 percent.

Weigh materials proportioned or measured by weight on beam or springless dial scales in accordance with the following:

1. Ensure the springs in the scale do not carry any part of the load.
2. Provide a commercial certificate of compliance for weighing equipment before hauling operations begin. The Department considers the cost of this certificate to be incidental to the contract pay item for the weighed material.
3. Provide clearance between the scale parts and the structure to prevent displacement of the scale parts.
4. Protect the working parts of scales to prevent material from falling on or against the parts.
5. The Department will allow the weighing of separate units of combination vehicles if the scale platform and approaches are at the same elevation and can maintain all units of the combination vehicles at the same elevation during the weighing operation.
6. When weighing each vehicle, take the tractor unit out of gear and release the brakes.

Ensure plants used to proportion or batch materials by weight operate in accordance with the following:

1. The operator can fully view the graduated scale when operating the gate that delivers material to the weighing hopper.

2. Location of hoppers and bins allow access for calibration.
3. Inspect and calibrate platform scales as directed by the Engineer.

Instead of platform scales, the Department will allow the use of conveyor weighing equipment that meets the requirements of the Idaho Department of Agriculture, Division of Agricultural Markets, Bureau of Weights and Measures. The Contractor shall inspect conveyor weighing equipment for calibration at least every 7 calendar days, unless otherwise approved by the Engineer, in accordance with the manufacturer's requirements.

Obtain the Engineer's written approval to use automatic weighing equipment. Ensure that the accuracy of material weighing is within ± 1 percent of actual.

The Engineer will not pay for wasted or rejected material, material not delivered to the project, material placed outside of the specified or directed project locations, and material on hand after the completion of the work unless otherwise specified in the contract.

7. Converting Between Weights and Volumes

The Engineer may convert minor quantities specified for measurement by volume or weight from one measurement to the other if the Contractor and Engineer agree to the conversion(s). The Engineer will determine the factors to be used for such conversion(s), and the Contractor and the Engineer shall agree on these conversion(s) before proceeding with the relevant work.

8. Asphalt Material

The Engineer will measure asphalt and anti-stripping additive (at 60 °F or converted to 60 °F) by the gallon or ton. The Engineer will use net certified weights or weights based on certified volumes as the basis of measurement when measuring asphalt shipped by rail, truck, or transport, corrected for material lost, foamed, wasted, or not incorporated in the work. The Engineer will measure anti-stripping additives by the percentage of additive per ton of asphalt.

9. Commercial Additives

The Engineer will measure bulk additives by the ton and additives in sacks by the net weight on the manufacturer's label.

10. Timber

The Engineer will measure timber incorporated in the structure by the MFBM (one thousand feet board measure), based on nominal widths and thicknesses and the longest dimension of each piece.

11. Equipment Time

The Engineer will measure equipment time by the actual number of hours the equipment is operated to perform the work, including necessary travel time within the limits of the project.

12. Water

If specified as a separate contract pay item in the contract, the Engineer will measure water separately using calibrated tanks, distributors, or water meters.

13. Stockpiled Material

The Engineer will determine the volume of material in stockpiles using the cross-section, average-end-area method. For quantities less than 100 CY, the Engineer may use trucks with calculated struck volumes as the method of measurement.

- B. Plan Quantities.** If the contract requires "plan quantity" as the basis of payment for a contract pay item, the Engineer will base payment for the work on the quantity shown on the plans for that contract pay item. The Engineer will not make measurements for contract pay items paid by plan quantity, except if the Engineer changes the plan quantity in accordance with 104.02.

If the Engineer believes that the actual quantity of a contract pay item to be paid by plan quantity differs significantly from the plan quantity, the Engineer will measure and pay for the actual quantity of work performed at the contract unit price. If the Contractor believes that the actual quantity of a contract pay item differs significantly from the plan quantity, submit a written request for the Engineer to measure the actual quantity. If the value of the actual quantity measured does not exceed the value of the plan quantity by \$2,000.00, reimburse the Department for the cost of measurement.

109.02 Scope of Payment. The Department will pay the Contractor for accepted quantities of contract pay items at the contract unit prices, as required by the contract, except as otherwise specified in 104.02, 109.03, 109.06, and 109.08.

The Contractor shall accept this compensation as full payment for providing the necessary materials, labor, tools, equipment, and incidentals to perform and complete

109.03

the work as required by the contract. The Department defines incidentals as work necessary to complete the project that is not measured or paid separately. Assume liability for risk, loss, damage or expense resulting from the work, subject to 107.14.

109.03 Payment for Quantity Variations, Contract Revisions, and Delays

- A. General.** The Department will pay for quantity variations, contract revisions, and delays in accordance with the requirements of 104.02, 104.03, 105.07, 109.03.B, 109.03.C, and 109.03.D.

The mark-ups specified in 109.03.C.5 compensate the Contractor for all field office overhead, home office overhead, and profit. The Contractor is not entitled to additional payment in excess of these mark-ups, unless the Contractor incurs additional costs resulting from an excusable, compensable delay as specified in 108.07.D and 109.03.D.

The Department will not pay for any changes to bonding costs, property damage and bodily injury insurance costs, or TERO taxes for force account work until project completion. After project completion and Contractor submission of satisfactory evidence, the Department will calculate an adjustment to reconcile all bonding, insurance, and TERO tax issues and execute a contract change order.

- B. Payment for Quantity Variations.** If the measured quantity for a contract pay item varies from the quantity specified in the contract, the Engineer will only modify the contract unit price in accordance with 104.02 and 104.03.

If the total pay quantity of an item of work varies from the bid quantity by more than 25 percent, the Department will make an adjustment in the contract unit price upon written request of either the Engineer or the Contractor. The Engineer and the Contractor shall agree to the adjustment before the performance of the work. The Department's adjustment to the contract unit price will be the difference between the contract unit price and the actual contract unit cost to perform the work plus 6 percent profit.

If the Engineer and the Contractor cannot agree upon a price adjustment, the Engineer will establish a price considered to be fair and equitable or have the work done on a force account basis as specified in 109.03.C.5.

If the actual unit cost includes fixed costs, the Department considers these costs recovered by the Contractor through Department payments made for 125 percent of the bid schedule quantity. The Engineer will exclude these costs in computing the actual unit cost. The Engineer may include fixed costs when computing the actual unit cost for contract pay items that decrease by more

than 25 percent of the bid schedule quantity. When the total pay quantity of an item of work is less than 75 percent of the contract bid quantity, the Department payment for the work will not exceed the payment which would have been made for performance of 75 percent of the bid schedule quantity at contract unit price.

The Engineer will not make an allowance for anticipated profit when computing the adjusted price.

C. Payment for Contract Revisions

1. General

If the Engineer modifies the contract under 104.02 or 105.07, the Engineer will compensate the Contractor using the methods specified in this section. This compensation will include payment to the Contractor for performing the revised work, delay costs, and all other associated costs approved by the Engineer and not expressly precluded by the contract.

The Engineer will compensate the Contractor in order of preference beginning with the use of contract unit prices, negotiated prices, or, if a price cannot be agreed upon, by force account or by a fair and equitable price as determined by the Engineer.

2. Unrecoverable Costs

The Department will not pay the Contractor for costs not specifically allowed or provided in 109.03.C and 109.03.D including the following:

1. Home office overhead in excess of the allowable mark-ups specified in 109.03, including unabsorbed home office overhead, extended home office overhead, or home office overhead calculated using either the Eichleay formula or another method.
2. Profit in excess of the allowable mark-ups specified in 109.03
3. Loss of anticipated profit resulting from work not performed on the project due to contract revisions.
4. Consequential damages, including loss of bonding capacity, loss of bidding opportunities, insolvency, and the effects of force account work on other projects, or business interruption.
5. Other costs not specified in 109.03.C.5.

6. Attorneys fees, claim preparation expenses, and the costs of litigation.

3. Contract Unit Prices

The Engineer will use the contract unit prices if they are representative of the work associated with the change. Contract pay items with a price per unit in the original contract are not eligible for additional overhead and profit.

4. Negotiated Prices

The Engineer will request the Contractor to provide an estimate of the proposed unit prices or lump sum price for the contract revision, including the cost of performing the revised work, delay costs, all other associated costs, plus a reasonable allowance for profit and applicable overhead. The Engineer may request that the Contractor justify the estimate by providing one or more of the following:

1. Labor requirements by trade in hours for each task.
2. Equipment costs and time requirements.
3. Material costs.
4. Cost analysis for compensable delay costs in accordance with 109.03.D.

If the Engineer and the Contractor cannot agree on a negotiated price adjustment, the Engineer may direct the Contractor to perform all or part of the revised work by force account or will use a fair and equitable price as determined by the Engineer.

The Department considers that overhead and profit for the subcontractor are included in the agreed price, and no additional compensation, above that provided for the prime Contractor's overhead and profit, will be allowed.

When work is performed by an approved first or lower tier subcontractor, compensation to the prime Contractor for overhead and profit will be in accordance with the following:

		Prime Contractor's Compensation
To	\$10,000	10%

Over	\$10,000	\$1,000 + 5% of excess over \$10,000
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5. Force Account

a. General

Perform work on a force account basis, if required by the contract or directed by the Engineer.

Record force account work on forms provided by the Engineer and submit the forms to the Engineer for review at the end of each work day so that they can be field verified contemporaneously.

The Engineer will revise, as appropriate, the daily force account records and provide duplicate report sheets to the Contractor for signature. The Department considers duplicate report sheets, signed by the Engineer and the Contractor, as the true record of force account work.

b. Satisfactory Evidence/Documentation

The Engineer will not approve payment for force account work before the Contractor submits an itemized statement of the cost for that work. The Engineer will review the itemized statement and approve payment for the cost the Engineer deems reasonable based on experience and prevailing market rates. The Engineer may request that the Contractor provide additional evidence to support questioned statement cost.

Provide the Engineer the following information in duplicate itemized statements for all force account work:

1. For labor – Name, classification, dates worked, daily hours, total hours, labor rate, and extended amount for each laborer and foreman.
2. For equipment – Designation, dates used, daily hours, total hours of actual operation and stand-by, rental rate, and extended amount for each unit of equipment. Include the manufacturer's name or trademark, model number, and year of manufacture with the designation.
3. For material – Quantities, cost, and extensions.
4. Transportation cost for material, free on board (f.o.b.) at the job site.

5. Cost of property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; and social security tax.
6. Cost of bonding.
7. TERO taxes estimated (the Department will modify for final payment).
8. Documentation showing payment for all invoiced items, including work, material, and transportation.

If providing material from Contractor stock for force account work, submit to the Engineer an affidavit to certify the following:

1. Material was provided from Contractor stock.
2. Material quantity was used for the force account work.
3. Material and transportation costs represent the Contractor's actual cost, excluding overhead.

The Department will pay for force account work based on the Engineer's review and approval of the Contractor's itemized statement of cost. The Department considers this payment as full compensation for performing the force account work.

c. Labor

The Department will pay for all labor and foremen performing Engineer-approved force account work. The Department will pay the wage rate or scale approved by the Engineer in writing before beginning work. The Department will pay for the actual cost of fringe benefits paid to, or on behalf of, laborers and foremen performing the force account work. Fringe benefits include health benefits, retirement benefits, and vacation benefits, but exclude payroll burdens as described below.

The Department will pay an amount equal to 20 percent of the sum of the direct labor cost and fringe benefits. This payment is compensation for field office overhead (5 percent), home office overhead (10 percent), and profit (5 percent). The Department will pay for the actual cost paid to, or on behalf of laborers and foremen performing force account work for travel and subsistence cost incurred while performing force account work and as approved by the Engineer. If

performing other work, prorate travel and subsistence cost proportionally between force account work and non-force account work. Do not exceed currently authorized Federal per diem rates, unless approved by the Engineer.

The Department will pay for payroll burdens for workers' compensation insurance, unemployment insurance contributions, and social security taxes at the actual, documented cost, plus 6 percent of the total documented cost as compensation for field office overhead, home office overhead, and profit.

The Department will pay all wages, fringes, payroll burdens, and subsistence expenses at the normal, customary, and legal rates unless otherwise approved in writing by the Engineer before the work begins. The Department will not pay for any cost the Engineer deems unreasonable.

d. Bonds, Insurance, and TERO Taxes

The Department will not pay for any changes to bonding costs, property damage and bodily injury insurance costs, or TERO taxes for force account work until project completion. After project completion and Contractor submission of satisfactory evidence, the Department will calculate an adjustment to reconcile all bonding, insurance, and TERO tax issues and execute a contract change order.

e. Material

For materials accepted by the Engineer and used in the work, the Department will pay for the cost of material, including transportation cost, but excluding equipment rentals in accordance with 109.03.C.5.f.4. The Department will pay the Contractor an additional 15 percent of this sum as compensation for field office overhead, home office overhead and profit.

f. Equipment

The Department will pay the Contractor for machinery or special equipment (other than small tools) on force account work in accordance with this subsection, plus those transportation costs directly attributable to that work. Obtain the Engineer's written approval of the rental rates established in this subsection before starting the force account work.

1) General

The Department will establish rental rates for Contractor-owned or subcontractor-owned equipment used on force account work. The Department modifies The Rental Rate Blue Book published by Equipment Watch, Penton Media, Inc. (Blue Book), to establish the rental rates. The Department will use the Blue Book section revisions from the publisher and considers the effective date of each section of the Blue Book as the date that the revision is received by the Engineer. The Department will use the rates established by the Engineer before the start of force account work to compensate the Contractor for the force account work.

2) Operated Rate

The Department will pay for equipment on an hourly basis for each hour the equipment is operated for Contractor-owned equipment and for equipment owned by entities associated with the Contractor or its parent company. Operated means the equipment is running, has an operator, and is being used to effectively accomplish the force account work. The Department will pay for non-operated hours at the stand-by rate. The operated rate will be calculated, in accordance with the following formula:

$$HR = \frac{(MR = AT) \times RA \times RF}{MH} + OC$$

where

HR = Hourly Rate

MR = Blue Book Monthly Base Rate

AT = Blue Book Monthly Attachment Rate

RA = Blue Book Rate Adjustment Factor

RF = Blue Book Regional Adjustment Factor

OC = Blue Book Operating Costs

MH = 176 (hours per month)

The Department will pay the Contractor an additional 10 percent to the hourly operated rate calculated above as compensation for field office overhead, home office overhead, and profit.

The Department will include the attachment rate in the operated rate calculation only if applicable and essential to the force account work directed by the Engineer. If multiple attachments are approved for use by the Engineer and the attachments are used interchangeably for the work, the Engineer will only approve payment for the attachment with the highest rate.

3) Standby Rate

The Department will pay for standby time in accordance with the following formula:

$$HR = \frac{(MR = AT) \times RA \times RF}{MH} + 50\%$$

The Department will pay up to eight hours of standby time during a 24-hour period and up to 40 hours of standby time during a one-week period.

The Department will pay the Contractor an additional 10 percent to the hourly standby rate calculated above as compensation for field office overhead, home office overhead, and profit.

4) Rental Invoices

If Contractor-owned or affiliated equipment is not available and the Contractor rents equipment from other sources, the Department will pay the Contractor for the actual invoiced rental cost, plus 5 percent.

Provide evidence that the rental rates paid by the Contractor are the standard rates established, published, and used commercially by the rental company.

If the invoice indicates that the rental rate does not include fuel, lubricants, repair, and servicing cost, the Department will pay an additional 15 percent of the rental cost.

5) Leased Equipment with Operator or Owner-Operated Equipment

The Department will pay on the basis of actual invoice cost plus 5 percent. Do not separate the labor and equipment cost. Provide evidence that the rates paid by the Contractor are the standard rates established, published, and used commercially by the company or owner operator.

6) Transportation Costs

The equipment rates established in this subsection are based on the Contractor having the equipment available on the project to perform the directed force account work. If the required equipment is not available on the project and the Engineer directs the Contractor to transport the equipment to the project, the Department will pay the cost of transporting the equipment to and from the project.

The Department will pay for transporting by common carrier at invoice cost plus 5 percent as compensation for field and home office overhead and profit. The Department will pay for transporting self-propelled equipment, other than trucks, at a rate equal to 75 percent of the rental rates established in this section.

7) Equipment Condition and Job Conditions

The rental rates established in this section are for equipment of modern design in good working condition. For equipment that does not meet this requirement or does not provide the production rates expected by this requirement, the Engineer will direct removal of the equipment or negotiate its use at a reduced rental rate, as proposed by the Contractor and approved by the Engineer.

If the Contractor encounters conditions in performing force account work that would result in an increase in "normal wear and tear" on the equipment, the Contractor may request an adjustment to rates established for the work. The Engineer will review and approve, if appropriate, the request for adjustment of the rental rates.

8) Unlisted Equipment

If the equipment available for force account work is unlisted, the Engineer will negotiate or establish an equitable rental rate with the Contractor.

9) Shop Tools

The Department will not pay for equipment listed in the Blue Book, Section 18 - Shop Tools, if the daily rate is less than \$10.

g. Professional Services

If the force account work requires professional services, the Engineer will approve the scope of work and cost estimate (including travel and per diem) before the work begins. The Engineer will allow the Contractor a mark up for field and home office overhead and profit in accordance with 109.03.C.5.i, but will not allow other mark-ups in the calculation of this payment.

h. Miscellaneous

The Engineer will not provide compensation for the use of small tools or for other costs not specified in the contract.

i. Contractor's Overhead and Profit on Subcontractor Work

Engineer-approved first-tier or lower-tier subcontractors may perform work on a force account basis and are entitled to Department payment in accordance with 109.03.C.5.a through 109.03.C.5.h.

If an Engineer-approved first-tier or lower tier subcontractor performs work on a force account basis, the Department will additionally pay the Contractor for field office overhead, home office overhead, and profit in accordance with the following:

		Prime Contractor's Compensation
To	\$10,000	10%
Over	\$10,000	\$1,000 + 5% of excess over \$10,000

The Engineer will calculate the Contractor's overhead and profit based on the total amount of force account work performed, including allowable mark-ups.

Submit receipts and invoices to the Engineer. The Department will approve and pay the additional amount after receipt of the invoices.

D. Payment for Delays

1. General

The Department will not pay for profit on delay costs, unrecoverable cost in accordance with 109.03.C.2, or costs that duplicates payment made in accordance with 109.03.C. The Department will not allow mark-ups on delay costs except as specified in this subsection.

The Contractor is obligated to mitigate delay costs in accordance with 108.07.A, and shall coordinate mitigation efforts with the Engineer in accordance with 105.05.

Submit an itemized statement of delay costs to the Engineer. After receipt of the itemized statement, the Department will pay the justified delay cost. Provide applicable items in this statement in accordance with 109.03.C.5.b.

2. Allowable Delay Cost

a. Extended Field Overhead

The Department will pay the Contractor for the cost of extended field overhead, including the cost for general field supervision, field office facilities and supplies, and maintenance of field operations.

General field supervision costs include field supervisors, assistants, security guards, clerks, and other field support staff. Calculate labor cost as specified in 109.03.C.5.c, except for salaried personnel, calculate the daily wage rate actually paid by dividing the weekly salary by 7 days per week. Do not include the specified 109.03.C.5.c mark-ups for field overhead, home office overhead, and profit when calculating general field supervision costs.

Field office facility and supply cost include field office trailers, tool trailers, office equipment rental, temporary toilets, and other incidental facilities and supplies. Calculate this cost on a calendar-day basis using actual cost incurred during the delay.

Maintenance of field operations cost includes telephone, electric, water, and other similar expenses. Calculate this cost on a calendar-day basis using actual cost incurred during the delay.

In addition, the Department will add a mark-up of 5 percent to the extended field office costs (general field supervision, field office

facility and support, and maintenance of field operations costs) to compensate the Contractor for home office overhead.

b. Escalated Labor

The Department will pay for the cost of escalated labor, excluding mark-ups for field office overhead, home office overhead and profit, if the Contractor can demonstrate that the compensable delay caused the work to be performed with labor at higher wage rates than planned at the time of the bid opening. Provide documents supporting the cost, labor rates, and benefits as specified in 109.03.C.5.c. The Department will add a mark-up for home office overhead of 5 percent.

c. Equipment Stand-By or Equipment Demobilization

The Department will pay the stand-by rate for equipment, other than small tools, that must remain on the project during the delay. Calculate this rate as specified in 109.03.C.5.f.3. Do not include the specified 109.03.C.5.c mark-ups for field overhead, home office overhead, and profit. If approved by the Engineer, the Department will pay the Contractor's actual transportation cost to remove and return equipment not required on the project during the delay. To the standby cost or transportation costs, the Department will add a mark-up for home office overhead of 5 percent.

d. Stand-by Labor

The Department will pay for stand-by labor as specified in 109.03.C.5.c, excluding mark-ups for field office overhead, home office overhead and profit, for all non-salaried personnel remaining on the project as approved by the Engineer. To this cost, the Department will add a mark-up for home office overhead of 5 percent.

e. Material Escalation or Material Storage

The Department will pay for actual increased material cost or material storage cost due to the delay, as approved by the Engineer. To this cost, the Department will add a mark-up for home office overhead of 5 percent.

109.04 Increases or Decreases Due to Taxes. The Department considers the total contract amount to include all applicable federal, state, and local taxes and duties, unless otherwise required by the contract.

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The Department will not adjust the contract amount for increases or decreases due to taxes unless the amount of an increase or decrease is greater than \$100 from the contract amount.

The Department considers the term “contract date” to mean the date of the bid opening, except that for the purchase of supplies or services by contract modification, the term “contract date” means the date of the contract modification.

Notify the Engineer promptly of any statute, court decision, written ruling, or regulation that will result in either an increase or decrease in the contract amount.

A. Increases Due to Taxes. The Department will increase the contract amount if the following conditions exist:

1. A statute, court decision, written ruling, or regulation increases any federal, state or local excise tax or duty on the transactions or property covered by the contract and takes effect after the contract date.
2. The statute, court decision, written ruling or regulation was unanticipated by the Department and the Contractor before the contract date.
3. The Contractor pays or bears the burden of the federal or state excise tax or duty or rate increase.

The Department will increase the contract amount by the amount of the tax, duty, or rate increase paid by the Contractor. If requested by the Engineer, certify in writing that the new federal or state excise tax or duty or rate increase was not included in the contract amount.

B. Decreases Due to Taxes. The Department will decrease the contract amount if the following conditions exist:

1. A statute, court decision, written ruling, or regulation decreases any federal, state or local excise tax or duty on the transactions or property covered by the contract and takes effect after the contract date.
2. The statute, court decision, written ruling or regulation was unanticipated by the Department and the Contractor before the contract date.
3. The Contractor pays or bears a lesser burden for any federal or state excise tax or duty or rate decrease.

The Department will decrease the contract amount by the amount of the relief, refund, or drawback. Pay that amount to the Department, as directed by the Engineer.

The Department will also decrease the contract amount if the Contractor,

through fault or negligence or failure to follow instructions of the Engineer, is required to pay or bear the burden of a federal or state excise tax or duty, or does not obtain a refund or drawback.

109.05 Partial Payments. The Department will make partial payments at least once each month as the work progresses, if the Contractor performs work in accordance with the contract or as directed by the Engineer. The Department will make bimonthly payments upon the Contractor's written request to the Engineer. The Engineer will prepare estimates and the Department will make partial payments based on the value of the work performed in accordance with the contract requirements and for material delivered and on hand in accordance with 109.06.

The Engineer may withhold part of a partial payment if the Contractor fails to comply with the contract requirements including for the following reasons:

1. The Contractor's failure to timely submit schedules in accordance with 108.03.
2. The Contractor's failure to correct defective or deficient work, or complete incomplete work
3. The Contractor's failure to maintain completed work or correct deficiencies resulting from the Contractor's failure to provide proper maintenance.
4. Materials certifications.
5. Certified payrolls.
6. Storm water management practices.
7. The Contractor's failure to make prompt payment to subcontractors or suppliers.

Partial Payments are approximate only and are subject to correction in any payment following the discovery of an error.

If the Engineer or Contractor discovers defective work or material or overpayment based on quantity or unit price, or if the Engineer reasonably doubts the integrity of completed work before the final acceptance and payment, the Engineer will deduct an amount, equal to the value of the defective work or overpayment, from the next partial payment after the discovery of defective work or overpayment. The Engineer will not include this amount in subsequent estimates until the Contractor corrects the defect or addresses the Engineer's doubt. The Engineer will determine the value of the suspect or defective work and overpayment using quantities or unit prices established in the Contract.

Pay each subcontractor or supplier by the 20th calendar day after receiving payment from the Department, provided work performed by the subcontractor or supplier

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complies with contract requirements. Return retainage to each subcontractor or supplier by the 20th calendar day after the subcontractor or supplier completes work satisfactorily.

Certify to the Engineer that the Contractor provided payments to subcontractors or suppliers within the time specified in this section for each partial payment. Make the certification on forms provided by the Department, and return the forms by the 30th calendar day after receipt of the partial payment.

Submit to the Engineer at the end of each calendar year and with the final estimate the actual amounts paid to subcontractors and suppliers using forms provided by the Department. Return the forms to the Engineer within 30 calendar days, at the end of each calendar year, and when the final estimate is received.

Ensure that first or lower tier subcontractors or suppliers meet these requirements.

109.06 Payment for Material on Hand. The Engineer may make partial payments for material that will be incorporated into the work, if the material is delivered to the project or stockpiled in Engineer-approved storage sites. Ensure the quantity of stockpiled material eligible for partial payment does not exceed the total estimated quantity required to complete the project. The partial payment for the stockpiled material will not exceed the value of the portion of the contract pay item in which the material will be incorporated.

The Engineer will not make partial payments on living or perishable plant materials until planted.

109.07 Allowance for Material Left on Hand. If materials are not incorporated into the work because of elimination of contract pay items, contract revisions in accordance with 104.02 or termination of the contract for convenience of the State in accordance with 108.09, and it is not commercially feasible for the Contractor to return the material for credit or otherwise dispose of the material, the Department will purchase the materials provided the Contractor:

1. Requests the Department purchase the unused materials.
2. Shows acquisition of the applicable materials in accordance with 106.02.
3. Shows the materials meet specifications.
4. Provides receipts, bills and other records of the cost of materials delivered to the designated delivery points.

The Department will pay the Contractor the verified cost of the materials plus 5 percent unless the payment would exceed the contract unit price. If the payment

would exceed the contract unit price, the Department will then pay the contract unit price.

The Department may purchase surplus aggregates from the Contractor if the following conditions exist:

1. The material is stockpiled where the Engineer directs.
2. The material meets specification requirements when stockpiled.

The Department will pay the Contractor for accepted material on an agreed price normally based on the material production cost. The Department will pay the Contractor to haul the material to the stockpile site in accordance with 104.02.

109.08 Acceptance and Final Payment

After accepting the project in accordance with 105.15, the Engineer will prepare a final estimate that reflects the following:

1. All accepted contract pay item quantities and unit prices.
2. All previous partial payment amounts.
3. Release of all remaining retainage.
4. Any deductions made in accordance with the contract.

When the Contractor accepts the final estimate and provides consent of surety to the Engineer, the Engineer will process the final estimate and the Department will provide the Contractor with final payment.

If the Contractor has not accepted the final estimate and provided consent of surety to the Engineer within 30 calendar days, the Engineer may process the final estimate and the Department will provide the Contractor with final payment.

The Contractor's acceptance of the final payment will not prejudice pending claims filed in accordance with 105.15. Upon final adjudication of any outstanding claims, the Department will process additional payments to the Contractor as required.

The Department reserves the right to correct prior partial estimates and payments in the final estimate and payment.

SECTION 200 - EARTHWORK

SECTION 201 - CLEARING AND GRUBBING

201.01 Description. Cut and dispose of trees, brush, shrubs, logs and windfalls, and remove and dispose of stumps and related roots, debris, etc., from the designated areas.

The Department considers areas to be cleared and grubbed to be the area described by a line drawn 5 ft outside the grading area. Other areas to be cleared and grubbed will be as shown on the plans or as directed by the Engineer.

201.02 Materials. Not Specified.

201.03 Construction Requirements. Where shown on the plans or directed by the Engineer, preserve and protect trees within the construction area not requiring removal as approved by the Engineer. Paint retained trees or shrubs, which have been cut or scarred, with an asphaltum base paint prepared especially for tree surgery.

The Department considers merchantable timber in the clearing area that has not been removed from the right-of-way before the beginning of construction the property of the Contractor, unless otherwise specified.

Do not dispose of materials by open burning. The Department will allow materials and debris to be disposed of at locations off the project out of view from the project limits. Obtain owner's written permission on whose property the materials and debris are placed. Provide copies of agreements with property owners to the Engineer. Comply with the requirements of 107.18.

Protect and preserve from damage, trees, shrubbery, grass and other vegetative ground cover outside the construction area, including median areas not to be graded that are within the construction area. The Department will hold the Contractor responsible for any damage resulting from the work. Take reasonable care to avoid damage by construction operations to streams and lakes adjacent to the road.

201.04 Method of Measurement. The Engineer will measure acceptably completed work by the acre or by lump sum.

When the quantity is measured by the acre, the Engineer will measure the area cleared and grubbed in accordance with stakes set by the Contractor, unless otherwise specified

201.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Clearing and Grubbing	Acre or Lump Sum

If a contract pay item for clearing and grubbing does not exist, the Department considers the work incidental and the cost included in the contract unit prices for other earthwork contract pay items.

SECTION 202 - SELECTIVE REMOVAL OF TREES OR STUMPS

202.01 Description. Remove and dispose of separate trees (including stumps) and stumps designated for removal.

202.02 Materials. Not Specified.

202.03 Construction Requirements.

A. Selective Removal of Trees. Remove designated trees including their stumps, and dispose of the material in accordance with 201.

B. Selective Removal of Stumps. Excavate and remove stumps, and dispose of the material in accordance with 201.

202.04 Method of Measurement. The Engineer will measure acceptably completed work per each and as follows:

1. For trees, the Engineer will measure the tree diameter at a point 2 ft above the ground line.
2. For stumps, the Engineer will measure the stump diameter 2 ft above the ground line or at the top of the stump if it is less than 2 ft in height.

202.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Selective Removal of Trees (including stumps)	Each
Selective Removal of Stumps	Each

The Department considers the removal of trees or stumps with diameters of less than 6 in as incidental to other earthwork contract pay items.

If a contract pay item does not exist for selective removal of trees and stumps, the Department considers the work incidental and the cost included in the contract unit prices for other earthwork contract pay items.

SECTION 203 - REMOVAL OF OBSTRUCTIONS

203.01 Description. Remove, wholly or in part, and dispose of buildings, fences, structures, old pavements, abandoned pipelines, and other obstructions that are not designated to remain, except for the obstructions to be removed and disposed of under other contract pay items in the contract. Salvage designated materials and backfill the resulting trenches, holes, and pits.

203.02 Materials. Not Specified

203.03 Construction Requirements.

A. General. Raze, remove, and dispose of buildings and foundations, structures, fences, and other obstructions within the right-of-way and as shown on the plans, except utilities, and those for which other provisions have been made. Remove without unnecessary damage to designated salvageable material in sections or pieces that may be readily transported, and stored at specified places within the project limits. Unusable material may be disposed of out of view from the project limits with written permission of the property owner on whose property the material is placed. Dispose of unusable material so that no unsightly appearance will result. Provide copies of agreements with property owners to the Engineer. Fill basements or cavities left by structure removal to the level of the surrounding ground, and compact in accordance with 205.03.E if within the prism of the construction.

Where new work abuts existing materials, saw the edges of the existing materials to a vertical line, unless otherwise directed by the Engineer.

Comply with the requirements of 107.17 and 107.18.

B. Removal of Bridges, Culverts, and other Drainage Structures. Do not remove bridges, culverts, and other drainage structures in use by traffic until satisfactory arrangements have been made to accommodate traffic.

Remove the substructures of existing structures to the natural stream bottom. Remove those parts outside of the stream to 12 in below natural ground surface unless otherwise directed by the Engineer. If portions of existing structures lie wholly or in part within the limits for a new structure, remove only those portions as necessary to accommodate the construction of the proposed structure.

The Department considers salvageable materials the property of the Contractor unless otherwise specified. Remove structural steel that has been identified as having a lead based paint and deliver to a scrap metal recycler approved by

the Engineer. Certify in writing to the Engineer the final disposition of structural steel with lead based paint.

- C. Disposal of Concrete and Masonry.** Place removed concrete and masonry in embankments. Dispose of any concrete or masonry as specified in 203.03.A Where new concrete work abuts existing materials to be left in place, saw the existing materials to a vertical line.

203.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum or by the foot or by the square yard or per each.

203.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Removal of Obstructions.....	Lump Sum
Removal of	Each, ft, SY

If a contract pay item for removal of obstructions does not exist, the Department considers the work incidental and the cost included in the contract unit price for other earthwork contract pay items.

SECTION 204 - OBLITERATION OF OLD ROAD

204.01 Description. Shape and blend into the surrounding area abandoned roads designated on the plans or as directed by the Engineer after the pavement is removed as specified in 203.

204.02 Materials. Not Specified.

204.03 Construction Requirements. When the old road requiring obliteration is no longer needed for traffic:

1. Fill ditches.
2. Rough grade, scarify, harrow and blade the entire road to present a pleasing appearance with slopes rounded and flattened to blend naturally with the adjacent topography.

Break down, bury or remove structures designated on the plans for which a contract pay item is not included in the contract.

When shown on the plans, remove pavement as specified in 203.03.A including removal of either asphaltic or Portland cement concrete pavement down to unbound base or sub-base material.

204.04 Method of Measurement. The Engineer will measure acceptably

205.02

completed work by the foot along the centerline of the road obliterated outside the excavation or embankment limits of new work.

204.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Obliteration of Old Road.....	ft

If a contract pay item does not exist for pavement removal in 203, the Department considers the work incidental and the cost included in the contract unit price for other earthwork contract pay items.

SECTION 205 - EXCAVATION AND EMBANKMENT

205.01 Description. Excavate, haul, dispose of, place, and compact specified materials necessary to construct the project.

- A. Excavation.** This work includes excavation performed under this contract pay item regardless of the material encountered. The Department may divide excavation into schedules as shown on the plans.
- B. Blasting.** Use explosives to excavate rock. Perform the blasting operations in a safe and professional manner to provide rock meeting project requirements.
- C. Embankment.** Construct embankments with soil, aggregates, rock, or a mixture of these materials unless otherwise specified:
 - 1. Soil Embankment. Embankments with materials that can be tested for in-place dry density in accordance with WAQTC FOP for AASHTO T-310, Method B.
 - 2. Rock Embankment. Embankments with materials that are too granular to test as specified in 205.03.E.
 - 3. Embankment with other materials. Embankments constructed with other materials instead of soil or rock, if specified. These materials include wood fibers, light-weight concrete, recycled glass, and geofoam. Use recycled glass that meets the requirements of 720.05.

205.02 Materials.

- A. Borrow.** Obtain borrow from designated or Engineer approved sources.
- B. Granular Borrow.** Provide sand, sand and gravel, or sand and rock mixtures, obtained from designated or Engineer approved sources. Select material that has a sand equivalent greater than 30. The Department will not require the

sand equivalent if the material has less than 5 percent passing the No. 200 sieve, in accordance with AASHTO T27 / T11.

The Contractor may use Reclaimed Asphalt Pavement (RAP) in Granular Borrow when approved by the Engineer. RAP is salvaged bituminous pavement that may have minor coatings of dust or aggregate particles from the reclamation process with no discernable seams, pockets, or of untreated aggregate or soils. Only use material meeting this definition. Mix RAP in approximately equal proportions with material meeting the requirements for Granular Borrow.

- C. **Dust Abatement.** Use water for dust control unless otherwise specified.
- D. **Other Materials.** Use materials other than soils or rock in constructing embankments as specified.

205.03 Construction Requirements.

- A. **General.** Do not proceed beyond the dimensions and elevations established. Stake and cross-section any areas to be worked before removing material. Maintain roadway so that it is well drained. Maintain the subgrade during construction in accordance with 105.13, and 105.14.

Dispose of surplus or unsuitable excavated material at locations acceptable to the Engineer. Comply with 107.17 and 107.18. Obtain written permission to access any project specific site required by a Stormwater Pollution Prevention Plan until final acceptance of the project. The property owner must acknowledge, in writing, that they have been made aware that project requirements may remain active and that access to the site may be required after construction of the project is complete. Alternatively, the property owner, by written agreement, may take responsibility for complying with requirements such as the NPDES Permit by becoming a third party to the Notice of Intent (NOI).

Do not waste material unless Engineer approved. Schedule excavation and borrow operations so no unauthorized waste of excavation will result.

Protect erodible surfaces of cut and embankment slopes in accordance with 212.

Remove and dispose of material originating outside the staked lines of cut slopes that slides due to causes beyond the control of the Contractor. Remove and dispose of the material and refinish the cut slopes as directed by the Engineer.

- B. **Slope Finishing.** Finish slopes as specified.

Remove loosened or shattered rocks that will not remain in their natural position from the slopes. Remove and dispose of rocks shattered or loosened outside the staked lines of cut slopes caused by overbreak from the Contractor's operation that constitutes a safety hazard.

- C. Process Old Road.** Scarify the old road to full depth and spread to form a uniform foundation where the old road surfacing is within 5 ft of the roadbed of the new road.
- D. Excavation and Repair of Soft Spot.** Excavate soft spot material and repair soft spots so that the subgrade meets compaction and density for Class A compaction as specified in 205.03.F.

Remove and dispose of unsuitable soft spot material. If the material is suitable except for excessive moisture content, scarify and dry the material to the acceptable moisture content, or replace with Engineer approved materials, and recompact to the specified density. The Department will not pay for these approved replacement materials used at the Contractor's option.

The Engineer will determine the limits of areas included in soft spot repair.

- E. Embankment Construction.** Prepare the natural ground surface by:

1. Removing vegetation, topsoil and other unsuitable materials.
2. Scarifying to provide a bond with the new embankment.

Do not place embankment material until the foundation has been approved by the Engineer. Do not construct embankments with frozen materials or on snow covered or frozen foundations.

Key new embankments constructed on existing slopes steeper than 3H:1V with horizontal benches having a vertical face approximately 1 ft in height. Slope each bench to drain. Incorporate material excavated from the benches in the embankment or waste the material if directed by the Engineer.

Drain any seepage encountered from the embankment.

Construct the first lift of an embankment across swampy ground or saturated soils by enddumping with an adequate thickness that will provide a stable surface. Construct the remainder of the embankment in layers as specified.

Allow embankment material containing excessive moisture to dry to a moisture content that will permit the specified compaction.

Provide sufficient water to facilitate compaction and to meet the required density. The Department considers this water incidental.

1. Soil Embankments. Place soil embankments in horizontal layers 8 in thick or less, before compaction. Uniformly compact each layer at the Engineer approved uniform moisture content, and to the class of compaction specified.
2. Rock Embankments. Construct rock embankments in horizontal layers 18 in thick or less before compaction. The Engineer will allow the placement of isolated individual, competent rock fragments having dimensions greater than the specified layer thickness if:
 - a. The clearance between adjacent rocks provides adequate space for placement and compaction equipment to compact the materials in horizontal layers as specified.
 - b. The rocks are placed more than 36 in below the roadbed. When a majority of the embankment materials are rocks or rock fragments, distribute the material in a manner that avoids nesting and provides spacing between the rocks to allow for filling with smaller rocks and soils.
- i. Compaction 18" or less below Roadbed: For rock material placed 18 in or less below the roadbed and for rock backfill of over excavated areas in rock cuts, construct in layers 9 in thick or less, unless otherwise directed by the Engineer. Uniformly compact each layer with a minimum of 12 full coverages of a vibratory roller meeting the minimum requirements specified in this section. The Contractor may reduce vibratory rolling by one full coverage for each increase of 5,000 lb per impact above the specified minimum. Ensure at least six full coverages per 9 in lift, or fraction portion.
- ii. Compaction more than 18" Below Roadbed: For rock material placed more than 18 in below the roadbed, uniformly compact the material with at least three full coverages for each 6 in of lift thickness or fraction portion with rollers of the following minimum requirements:
 1. Vibratory rollers having a rated centrifugal force of 30,000 lb per impact and at least 1000 vibrations per minute. Limit the speed of vibratory rollers to no more than 130 ft/min.
 2. Grid rollers having a static weight of at least 20,000 lb and 4,000 lb/ft of drum width. Limit the speed of grid rollers to no more than 350 ft/min.

The Contractor may reduce rolling requirements one coverage per 6 in, or fraction thereof, for each increase of 5,000 lb per impact for vibratory rollers or 1,000 lb/ft of drum width for grid rollers. Ensure at least one complete coverage for each 6 in of lift thickness, or fraction thereof.

3. Density Determination. Determine the maximum dry density in accordance with the following applicable test methods:

Moisture-Density Relations of Soils AASHTO T 99 Method A or C

A block of concrete weighing a minimum of 75 lb and well seated on a compacted base may be substituted for the compaction base specified in AASHTO T 99.

Correction for Coarse Particles in the Soil Compaction Test..... AASHTO T 224

Family of Curves – One point Method..... AASHTO T 272

Compaction Standard for Coarse Granular Materials

by Use of the Vibratory SpringLoad Compactor..... Idaho T74

Instead of Idaho T74, and when approved by the Engineer, determine the maximum dry density of coarse granular material in accordance with the following test method:

MoistureDensity Relations of Soils..... AASHTO T 180
Method D

Determine in-place density and percent compaction by the following test methods:

In Place Density and Moisture Content of Soil and Soil-Aggregate

by Nuclear Methods (Shallow Depth)..... WAQTC FOP for AASHTO T 310
Method B

F. Classes of Compaction and Density Requirements. If the class of compaction is not specified in the contract, the Department will require Class A compaction.

Before placement, moisten or dry embankment material to a moisture content ranging from 4 percent under optimum moisture content to 2 percent over optimum moisture content as determined by AASHTO T 99 or AASHTO T 180.

Scarify materials at the bottom of excavations to a depth of 8 in, moisture condition as specified and compact to Class A compaction.

1. Class A Compaction. Compact to class A compaction embankment and backfill material placed within an approximately 2H:1V slope. Perform the work as specified in Table 205.03-1.

Table 205.03-1 - Class A Compaction

	Material Property	Required Compactive Effort	Classification
a.	more than 10% retained on the 3 in. sieve; or more than 30% retained on the ¾ in. sieve	as specified in 205.03.E.2 – Rock Embankments	Too granular to test.
b.	less than 10% retained on the 3 in. sieve; and more than or equal to 30 percent retained on the ¾" sieve;	minimum of 95 percent of maximum dry density by AASHTO T 99 Method C	Testable material

Note: If more than 10 percent of the material is retained on the ¾ in sieve, correct for coarse particles by AASHTO T 224 when using AASHTO T 99, Method C.

2. Class B Compaction. Compact embankment and backfill material for the top 12 in of subgrade to the density requirements for class A compaction. Compact other soil embankment more than 12 in below the top of subgrade by routing construction equipment uniformly over the entire surface of each layer. The Engineer may require additional compaction if routing of equipment does not provide satisfactory results.
3. Class C Compaction. Compact designated areas under embankments to the density requirements for Class A compaction to a depth of 8 in. The station limits of Class C compaction will be as shown on the plans or as directed by the Engineer. The Department considers the width of compaction to be between top of subgrade shoulders.
4. Class D Compaction. Compact the embankment and backfill material placed within median areas and on slopes that are outside the roadway prism on an approximate 2H:1V slope with at least one coverage using Engineer approved tracktype or rubber-tired earthmoving equipment. The roadway prism is shown on the plans. Place the uncompacted embankment material in lifts 12 in deep or less. Ensure the fill material is moist before compaction.
5. Construction of Embankment with Other Materials. Compact materials

in embankments constructed with materials other than soil or rock as specified in the contract.

G. Blasting. Plan and execute the blasting operations in a safe and professional manner.

1. Blasting Plan Submittals

a. Preliminary Blasting Plan. At least ten working days before starting test or production drilling and blasting operations, submit to the Engineer a Preliminary Blasting Plan for review. Provide details of the proposed drilling and blasting patterns and controls for both the controlled and the production blasting. Include the following in the Preliminary Blasting Plan:

- (1) Station Limits. Station limits of the proposed shots including limits of blasting left and right of centerline, number of holes to be drilled and holes per blast.
- (2) Scaled Plan and Section Views. Scaled plan and section views of the proposed drill pattern including free face, burden, spacing, blast hole diameter, blast hole angles, lift height and, sub-drill depth. Base the plan on project stationing or area to be worked in a materials source.
- (3) Loading Diagram. Loading diagram showing the type and amount of explosives, primers, initiators as well as location and depth of stemming including the material to be used as stemming. Show quantity of explosive to be used per delay and per blast.
- (4) Initiation Sequence. A diagram and explanation of the initiation sequences of blast holes including delay times for each blast hole. Identify the type of delay system with associated delay periods.
- (5) Information and Bulletins. Manufacturer's product information sheets or technical bulletins for explosives, primers, delays and initiators to be employed.
- (6) Proposed Quantities. Proposed quantities of controlled blasting and production blasting.
- (7) Safety Plan. Include the following information, at a minimum:

- (a) Proposed methods describing the prevention of fly rock or blast debris.
 - (b) The name and telephone number of the Blaster-in-Charge. The Department will require the Blaster-in-Charge to be responsible for:
 - (i) directing the day to day drilling and blasting operations,
 - (ii) clearing the blast site before blasting,
 - (iii) preparing required reports such as daily blast logs, and daily explosive material consumption and loss reports.
 - (c) Methods proposed to clear the blast area and to control access to the blasting site during loading and blasting.
 - (d) Methods proposed to notify local residents and construction workers of an impending blast.
 - (e) Methods proposed to document, assess and correct misfires or undetonated explosives. Develop a recovery and disposal plan in the event that misfires cannot be refired.
 - (f) Methods proposed and planned to control ground vibration and air blast as well as calculated scaled distances to each effected structure.
 - (g) A detailed vibration and blast monitoring plan.
 - (h) A fire prevention and protection plan.
 - (i) A plan to identify all potential blast site electrical hazards, including, a lightning detection and protection plan.
 - (j) An emergency plan in the event an injury occurs. At least one blast crew member should be trained in first aid procedures.
- b. Detailed Blasting Plan. Following the Engineer's review of the Preliminary Blasting Plan, submit to the Engineer a site specific Detailed Blasting Plan for each blast site for review. Include the information specified in the Preliminary Blasting Plan supplemented by site-specific information as necessary for successful and safe blasting.

Include the details of test blasting procedures, design, and expected results.

Demonstrate the adequacy of the plan by drilling, blasting, and excavating short test sections. Ensure the test blast sections are at least 50 ft but not more than 100 ft in length for controlled blasting and at least 50 blast holes for production test blast. For production blasting, contain test blast areas within production blast areas. The Department will not allow test blast areas within the final excavated slope area for control blasting, except as Engineer approved. Perform test sections for variations of the Detailed Blasting Plan and backslopes. Include final backslopes excavated with or without controlled blasting. Perform the test section to demonstrate that the blast will not damage the final slope, that acceptable rock fragmentation is provided, and that fly rock, ground vibration and air blast are properly controlled. Do not start full-scale drilling and blasting operations until the test blasting is completed and Engineer approved.

- c. Revised and Supplemental Detailed Blasting Plan. After satisfactorily completing the test blast sections, revise the Detailed Blasting Plan and submit as the Revised Detailed Blasting Plan. Incorporate test blast results in the Revised Detailed Blasting Plan.

Submit Supplemental Detailed Blasting Plans when the blasting operation differs from the parameters provided in the Preliminary Blasting Plan, Revised Detailed Blasting Plan, or as requested by the Engineer due to poor results of the blasting, damage to the backslope, or any unsafe condition.

Do not begin production drilling and blasting until the Revised Detailed Blasting Plan has been reviewed by the Engineer. If necessary, discontinue blasting until a Supplemental Detailed Blasting Plan has been submitted. Do not resume production drilling and blasting until the Engineer has reviewed the Supplemental Detailed Blasting Plan. The Engineer will review the blasting plan submittals solely for compliance with the contract plans and specifications. The Engineer's review of blasting plans does not relieve the Contractor of responsibility for the accuracy, adequacy, and safety when implemented in the field.

2. Blasting Operations

Perform blasting operations, including the transport, storage, handling, and loading of explosives and blasting agents, including primers and initiators, under the direct supervision of the Blaster-in-Charge, and in accordance with the contract and Federal, State, and local regulations.

Drill production blast holes on the patterns shown on the blasting plan and within two blast hole diameters of the marked hole location. The Department considers locating and depth controlling of the blast holes incidental to the work. If more than 5 percent of the holes are drilled outside of this tolerance, fill these holes with crushed stone or approved material and then redrill them at the proper locations at no additional cost to the Department.

Take necessary precautions in the production blasting to prevent blast damage to the rock final slope or backslope.

Check the blast holes before any explosives are loaded. If the blast holes are not drilled to the correct depth, are plugged, or are unable to be fully loaded, clean out or redrill those holes.

If more than 5 percent of the blast holes are shallower than those shown in the blast plans, redrill the shallow holes to the proper depth at no additional cost to the Department.

Prove the proposed stemming material performs as required by a test blast.

Fit blast holes with a temporary plug to keep overburden, drill cuttings or other foreign material from falling into the holes after drilling. Fill unused drill holes with crushed stone or approved materials.

The Engineer has the authority to prohibit or halt the Contractor's blasting operations if it is apparent that, through the methods being employed, the excavated slopes are not being obtained in a stable condition or the safety of the public is being jeopardized.

Where controlled blasting is required to form the final backslope, the Engineer will not allow drilling ahead of the test blast area until the test section results have been completely evaluated and the Contractor has adopted such revised methods as are necessary to achieve the required results. The Department considers unsatisfactory test blast results to include unstable slopes, fragmentation beyond the indicated lines and grade, fly-rock, excessive ground vibration or air blast, or violation of other requirements within these specifications. The Department will not pay for the

adoption of revised blasting methods necessary to produce an acceptable test blast.

Drill, blast, and excavate in short sections, not exceeding 100 ft in length, until satisfactory results are achieved. If during the progress of the work, the methods of drilling and blasting do not produce the desired result of a stable, safe, and uniform slope, within the tolerances specified. The Department will not provide additional payment for this work.

All other requirements for controlled and production blasting operations specified elsewhere in 205 also apply to the blasting carried out in conjunction with the test blast.

3. Safety Procedures

Perform blasting operations, including the transport, storage, handling, and loading of explosives and blasting agents, including primers and initiators, under the direct supervision of the Blaster-in Charge, and in accordance with the contract and Federal, State and local regulations.

Do not blast before sunrise or after sunset.

Include a fire prevention and protection plan, and lightning detection and protection plan in the blasting plan. Provide a plan to prevent entry into the blasting site by unauthorized personnel during the loading and blasting operations. Before each blast, remove and properly dispose of explosive packing materials from the site.

- a. Warnings and Signals. Establish a method of warning for personnel on the project of an impending blast, consisting of a five-minute warning signal, to notify anyone in the area that a blast will be fired within a five-minute period. Sound a second warning signal before the blast. After the blast is over, sound an all clear signal so that anyone in the area understands that blasting operations are finished.
- b. Check for Misfires. Observe the entire blast area for at least five minutes following a blast to guard against rock fall before starting work in the area.

After the five-minute delay, ensure the Blaster-in-Charge goes into the shot area and checks holes to make sure that they have detonated and, if holes have not fired, handle and correct these misfires in a safe manner. Ensure that misfires have been handled and corrected before others enter the work area. Close traffic from

the blast site and prohibit personnel from entering the blast site, except for authorized personnel, until potential explosion hazards have been eliminated. The Department will not pay for misfires or work associated with misfires.

- c. Flyrock Control. Provide an acceptable method to control flyrock before firing in areas where flying rock may result in personal injury or unacceptable damage to property or the work. If flyrock occurs during the blasting operations to the extent of endangering workers, equipment, or is propelled outside the project limits, cease blasting operations until the Contractor reviews the blast plan and determines the cause and solution to the flyrock problem to the satisfaction of the Engineer.
- d. Scaling and Stabilization. Remove or stabilize rock on the cut face that is loose, hanging, or otherwise creating a potentially dangerous situation as determined by the Engineer. Do not drill the next lift until this work has been completed.

Scale slopes at the direction of the Engineer and at such frequency as required to remove loose rocks, overhangs, or hazards. Hand scale slopes using a suitable standard steel mine scaling rod. If approved by the Engineer, other methods such as machine scaling, hydraulic splitters or light blasting may be used instead of or to supplement hand scaling. The extent of the scaling will be determined by the Engineer who will also determine the completion of the work. The Department will pay for scaling necessitated by the structural geology of the rock as extra work.

Use rock bolting, rock dowelling or other approved stabilization techniques when in-place stabilization is required, as determined by the Engineer. The Department will pay for the stabilization necessitated by the structural geology of the rock as extra work.

The Department will not pay for stabilization or scaling necessary because of the Contractor's blasting operations.

- e. Daily Blasting Logs. Provide the Engineer, on a weekly basis, a daily log of blasting operations. Update the log at the close of each day to indicate what blasting work was performed. Include the number of blasts, times, dates of blasts, blasting locations, patterns and the following information:

1. Station limits of the shots and the number of holes blasted including limits left and right of centerline and the number and depth of holes blasted.
2. Plan and section views of drill pattern including free face, burden, blast hole spacing, blast hole diameters, blast hole angles, lift height, and sub drill depth.
3. Loading diagram showing type and amount of explosive, primers, initiators and location and depth of stemming.
4. Initiation sequence of blast holes including delay times and delay system in each blast hole.
5. Trade names and sizes of explosives, primers, and initiators used.
6. Signature of the Blaster-in-Charge.
7. Ground vibration and air blast (noise) records.

The blasting logs are for quality control and record keeping purposes. The Engineer's review of the blast log does not relieve the Contractor of the responsibility for the accuracy and adequacy of the blasting log.

- f. Daily Explosive Material Consumption and Report of Loss Report. Include the signature of the Blaster-In-Charge on the reports. Comply with Federal, State and local law, regulations, and conditional use permits.
- g. Traffic Safety. Provide a traffic control plan for the Engineer's review and approval whenever blasting is planned within 1,000 ft of a roadway. Cover or remove signs when there are no explosives in the area or the area is otherwise secure. The Engineer will require that the Blaster-in-Charge determine whether road users in the blasting zone will be endangered by the blasting operation. If there is danger, do not permit road users to pass through the blasting zone during blasting operations.
- h. Pre-blast Survey. Before any blasting, conduct a Pre-blast Survey of both the interior and exterior of adjacent buildings, structures, and utilities and other structures that may be subject to damage from blast induced ground vibration or air blast over pressure. Contact the property owner or resident to setup a Pre-blast Survey inspection

appointment. Document the Pre-blast Survey, in sufficient detail that the existing condition of these items can be later determined by the Engineer if the Contractor's blasting operation has caused any damage. Submit a copy of the survey to the Engineer and the owners of the structures no less than seven days before blasting.

- i. Post-blast Survey. No later than two weeks after the conclusion of blasting operations or as required, reexamine the items inspected during the Pre-blast Survey. Reexamine each item using the Pre-blast Survey photos, audio recorder, video tape or disk, to confirm that no change has occurred to any of these items. Notify owners if any change has occurred. Contact the property owner or resident to setup a post-blast inspection appointment. Initial a check off sheet for structures included in the Pre-blast Survey.

Within 30 days after the conclusion of blasting operations, or as directed by the Engineer, submit to the Engineer and the property owners a final written Post-blast Survey Report addressing the items inspected in the Pre-blast Survey as performed by the Contractor. Specifically note in the report apparent damages observed or measured in the Post-blast Survey.

Repair damage to public or private property caused by the use of explosives, as a first order of work. The Department will not pay for repair damages.

4. Production Blasting.

Production blasting is rock fragmentation blasts resulting from more widely spaced production holes drilled throughout the main excavation area adjacent to the controlled blast line or from the production holes in a rock quarry.

For the row of production blast holes located immediately adjacent to the controlled blast line, drill on a plane approximately parallel to the controlled blast line. Drill production blast holes no closer than 6 ft from the controlled blast line. Do not drill the bottom of the production holes lower than the bottom of the controlled blast holes. Do not allow the production holes to exceed 3.5 in in diameter unless proven by test blast procedures and approved by the Engineer. Detonate production holes in a controlled delay sequence.

Take necessary precautions in the production blasting to minimize blast damage to the final cut slope.

5. Controlled Blasting.

Controlled blasting refers to the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to produce a smooth surface or shear plane in the rock along the specified final excavation backslope. Controlled blasting techniques allowed by the Department are presplitting and cushion blasting. Other controlled blasting techniques may be used if Engineer approved.

Use controlled blasting in the excavation of rock or hard cemented materials where cut slopes, shown on the plans, are equal to or steeper than $\frac{3}{4}$ H:1V even if the rock or hard materials can be ripped. Controlled blasting is not required for rock quarry operations.

Unless otherwise allowed by the Engineer, begin the controlled blasting tests with the controlled blast holes spaced 24 in apart, and then adjust the spacing only as approved in writing by the Engineer. The Engineer will not allow blast hole spacing to exceed 30 in.

Pioneering the top of cuts and preparing a working platform to begin the controlled blast drilling operations may require unusual working methods and use of equipment. The Contractor may use angle drilled holes or fan drilled holes during the initial pioneering operations if Engineer approved. The blast hole diameter requirements for controlled blasting are applicable for pioneering work.

Remove potentially dangerous boulders or other material located beyond the excavation limits as directed by the Engineer before drilling controlled blast holes. The Department considers removal of the material located beyond the excavation limits as extra work.

- a. Presplitting. Presplitting is the detonation of a single line of lightly loaded, closely spaced drill holes before the detonation of adjacent production holes. Perform presplitting in accordance with the following requirements:

Do not allow the presplit drill holes to exceed 3 in in diameter.

Control drilling operations by using proper equipment and techniques to ensure that no hole deviates from the plane of the planned slope by more than 9 in in either parallel to or normal direction to the

final excavation slope. The Engineer will allow offset benches, up to 2 ft wide, for multi-lift blasts. The Department will not pay for presplit holes exceeding these tolerances.

Drill presplit holes within 3 in of the staked blast hole collar location. If more than five percent of the presplit holes are outside of the 3 in tolerance, fill and compact those holes with crushed stone or approved material and re-drill.

Extend presplit holes at least 30 ft beyond the limits of the production holes or to the end of the cut as applicable.

Do not exceed 30 ft in length presplit holes for each individual lift unless Engineer approved. Do not exceed the specified lift height unless Engineer approved after a test blast is performed by the Contractor. The Department will not pay for test blasting that is within 30 ft of the final excavation face.

When the cut height requires more than one lift, a 2 ft offset between lifts will be allowed by the Engineer for drill equipment clearances. Begin the control blast hole drilling at a point that will allow for necessary offsets and adjust, at the start of lower lifts, to compensate for drift that may have occurred in the upper lifts. The Department will pay to these over drill limits.

Perform sub-drilling a minimum of 2 ft below final ditch grade to facilitate removal of the toe berm.

Determine that the hole is free of obstructions for its entire depth before placing charges. If drill hole conditions vary from dry to wet, use appropriate type(s) of explosives, blasting accessories or both, to accomplish the specified results.

Do not allow the diameter of explosives used in presplit holes to be greater than one-half the diameter of the presplit hole.

Do not use bulk ammonium nitrate and fuel oil (ANFO) as explosive for controlled blasting.

Use only standard explosives specifically manufactured for presplitting in presplit holes.

As long as satisfactory presplit slopes are obtained, the Contractor may either detonate the presplit blasting holes forming the slope face before drilling for production blasting or detonate the presplit blasting

holes forming the slope face and the production blast holes within the same blast event, provided that the presplitting drill holes are detonated ahead of the adjacent production blast holes. If required to reduce ground vibrations or noise, presplit holes may be delayed, provided the hole to hole delay is no more than 25 milliseconds.

Do not allow the final cut slope face to deviate more than 9 in from a plane passing through the presplit drill holes, except where the character of the rock is such that, irregularities are unavoidable. The Engineer will measure the 9 in tolerance perpendicular to the plane of the planned final cut slope.

- b. Cushion Blasting. Cushion blasting is similar to presplitting except that the detonation along the cut face is performed after the detonation of the production holes. Where the horizontal distance from the cut face to the existing rock face is less than 15 ft, the Contractor may cushion blast instead of presplitting. Do not allow differences in delay times between the cushion blasting line and the nearest production row to be greater than 75 milliseconds or less than 25 milliseconds. With the exception of these criteria, the requirements specified for presplitting also apply to cushion blasting.

205.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Excavation, borrow, excavation and repair of soft spots, and granular borrow will be by the cubic yard in its original position from field survey or photogrammetric cross sections, using the average end area method with no correction for curvature, or by the ton.
2. Where it is impractical for the Engineer to measure material by either the average end area method or in its original position, alternate practical methods with appropriate adjustments may be used. The total will not include the volume of any material used for purposes other than those directed by the Engineer. No measurement will be made for rock excavation made below the roadbed unless such excavation is required or directed by the Engineer. No measurement will be made for borrow replaced by unauthorized rock or soil excavation below roadbed.
3. Channel change excavation will be measured only for excavation necessary to construct the channel or ditch from established bank elevation to flow line grade. Earthwork necessary to construct the cut or fill to bank elevation will

be included in the roadway quantities. Overbreak will not be included in the measurement of excavation.

4. Class C compaction and the Processing of Old Road surfacing will be measured by the unit. A unit is 1000 Square Yards.
5. Water ordered for dust abatement will be measured by the MG (1 MG = 1000 gal) by means of calibrated tanks, distributors or accurate water meters.
6. Controlled blasting will be measured by the foot of drilled hole. The Department will measure only those holes drilled, loaded with explosives, and detonated for the purpose of creating a final excavation face as controlled blasting.
7. When granular borrow is measured on the weight basis, the water in excess of 4 percent of the dry weight of the material will not be measured unless otherwise specified in the contract. The Department will correct the measured quantity for moisture content in accordance with AASHTO T-255.
8. Quantities of granular borrow replaced by other approved materials, such as asphalt pavement (RAP), is considered as a portion of granular borrow.

205.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Excavation.....	CY
Excavation Schedule No.	CY
Controlled Blasting	ft
Channel Change Excavation.....	CY
Borrow	CY or Ton
Granular Borrow	CY or Ton
Class C Compaction	Unit
Process Old Road	Unit
Water for Dust Abatement	MG
Excavation and Repair of Soft Spots	CY

The Department will not pay for rock overbreak.

The Department considers embankment incidental and the work included in the contract unit prices for other contract pay items.

The Department will pay for removal and disposal of unsuitable material from below the roadbed under excavation and repair of soft spots. The Department considers excavation and repair of soft spots to include excavation, drying, and compaction of in-place material. If Engineer approved, the Department will pay for replacement

207.03

material under the applicable contract pay item or as extra work. The Department will not pay for replacement material if used at the Contractor's option.

The Department considers pay for production blasting incidental, and included for contract unit price for other roadway contract pay items.

The Department considers backfill incidental to the contract unit price for the item used.

The Department will pay for removal of slides, slumps, settlements, and associated work not caused directly by the Contractor's operations at the contract unit price for excavation where the slide occurred or as extra work.

The Department will pay for water that the Engineer orders for the purpose of controlling dust for safety and comfort of the traveling public; for the health and comfort of people working on or residing near the project; to protect crops from possible dust damage or that is applied in the public interest, at the contract unit price for Water for Dust Abatement.

The Department will pay for excavation that must be stockpiled or stored before final placement, including topsoil, at the contract unit price for each handling approved by the Engineer, unless paid for as another item of work for the second handling.

The Department will pay for Reclaimed Asphalt Pavement (RAP), if used as Granular Borrow, at the contract unit price for Granular Borrow without any additional compensation.

SECTION 207 - STRIPPING DESIGNATED SOURCE MATERIAL DEPOSITS

207.01 Description. Strip earth overburden and other unsuitable material from designated source material deposits. Keep topsoil in separate stockpiles from other stripped materials.

207.02 Materials. Not Specified

207.03 Construction Requirements. Clear and grub that portion of the source necessary for the removal of the material, if necessary, and remove all earth overburden, vegetation, or other deleterious materials. Dispose of wasted material and debris.

The Department will not pay for stripping of overburden from Contractor provided material sources. The Department will not pay for the developing of alternate material deposits.

207.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard in its original position or in approved stockpiles, using the average end-area method.

207.05 Basis of Payment. The Department will pay for accepted quantities at contract unit price as follows:

Pay Item	Pay Unit
Stripping Designated Source Material Deposits.....	CY

If the contract does not include a stripping designated source material deposits contract pay item, the Department considers this work incidental and the cost included in other contract pay items when a material source is designated in the contract.

The Department considers clearing and grubbing as incidental, and included in the contract unit price for stripping designated source material deposits.

SECTION 208 - INTERCEPTOR DITCHES

208.01 Description. Construct interceptor ditches as specified.

208.02 Materials. Not Specified.

208.03 Construction Requirements. Construct interceptor ditches as shown on the plans or as directed by the Engineer.

208.04 Method of Measurement. The Engineer will measure acceptably completed work by the station along the centerline and profile of the completed ditch.

208.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Interceptor Ditches.....	Sta

SECTION 209 - SMALL DITCHES

209.01 Description. Construct small ditches, which the Department defines as having an average volume of less than 0.2 CY per foot of ditch, as specified.

209.02 Materials. Not Specified.

209.03 Construction Requirements. Construct small ditches according to the typical section shown on the plans. If no typical section is shown, construct small ditches by side casting the excavated material.

210.03

Conduct the work so that the least possible interruption in the irrigation water flow occurs, and make suitable arrangements with users of irrigation water so that no claims for damage to crops or interruption to farming operations will result.

Construct dikes first when they are needed to construct ditches across low ground as shown on the plans or as directed by the Engineer. Use Engineer approved impervious material for the dikes. Place material in horizontal layers and compact each layer to 90 percent of maximum dry density as specified in 205.03.E.3 and then construct a small ditch in the top of the dike. Direct irrigation water, if available, into dike ditches for testing and approval before acceptance by the Engineer.

209.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along the centerline and profile of the completed ditch.

The Engineer will measure dikes and cuts constructed to carry small ditches as specified in 205.04.

209.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Small Ditches	ft

The Department will pay for dikes and cuts as specified in 205.05

SECTION 210 - STRUCTURE EXCAVATION AND COMPACTING BACKFILL

210.01 Description. Excavate and dispose of materials required for the construction of structures unless otherwise specified as Structural Excavation. Include necessary drainage, pumping, bailing, sheeting, shoring; the construction of cribs and cofferdams and their subsequent removal. Remove old structures or parts as required. Place and compact backfill material as Compacting Backfill. Include sloping and cleaning up the sites.

The contract pay item "Structure Excavation, Schedule No. 1," includes excavation for bridges, box and stiffleg culverts. The contract pay item "Structure Excavation, Schedule No. 2," includes excavation for other structures.

210.02 Materials. The Engineer will test material for backfill in accordance with AASHTO T 310, Method B, excluding materials too granular to test, unless otherwise specified.

210.03 Construction Requirements.

- A. General.** Remove and dispose of unsuitable foundation material below the designed elevation as directed by the Engineer. Use suitable surplus excavated material in the construction of embankments. Replace material removed below the elevation shown on the plans with Engineer approved material.

Sheet and brace trenches if necessary. Do not remove sheeting or bracing until backfill has progressed to such a stage that no damage to pipe lines or structures will result from its removal.

Remove sheeting and bracing used in supporting structure excavation unless otherwise shown on the plans or directed by the Engineer.

Where rock, hardpan, or other unyielding material is encountered, and a yielding material is required, remove the unyielding material below the grade shown on the plan and backfill as directed by the Engineer.

Do not begin structure work until the foundation has been approved by the Engineer.

Unless otherwise specified, the Department considers backfill as consisting of suitable material uniformly distributed in layers of 8 in or less and compacted to the density requirements for Class A compaction as specified in 205.03.F, before successive layers are placed.

For backfill material placed within 3 ft of any concrete structure or any type of retaining wall, uniformly distribute the backfill material in layers of not more than 8 in and compact with lightweight compacting equipment having impact force of 1000 lb to 3,000 lb. Compact the backfill to the density requirements for Class A compaction as specified in 205.03.F, before successive layers are placed. For backfill material determined as too granular to test by the Engineer, apply a minimum of five compacting equipment passes per 8 in or less lift.

Compact backfill in areas not within a roadway prism, or special backfill around pipe underdrains not requiring a higher degree of compaction for some other purpose, to approximately the same density as the adjacent undisturbed soil or gravel. The Contractor may obtain compaction by any effective means.

- B. Conduit and Structural Plate Arch.** Backfill pipe culverts and other conduits first with Engineer approved material. Carefully hand tamp under the lower one-fourth of the overall pipe diameter, and then compact for the balance of the pipe height and for the specified amount of cover to be placed over the pipe.
- C. Structures.** Fill solid rock excavation below the established footing elevation with Class 15 concrete for bridge and box culvert foundations.

210.04

Take special care not to destroy the bearing value of the material the footing is to rest on where the material is other than rock or boulders. Remove disturbed material from the excavation and backfill to the plan elevation with material approved by the Engineer.

Pump water from foundation enclosure interiors so that the possibility of a portion of the concrete materials being carried away is prevented. Do not pump during the placing of concrete or for at least 24 hours, unless it is done from a suitable sump or well point separated from the concrete work.

Place suitable backfill material in layers through water around abutments, wing walls and piers. No compaction is required for this placement.

Do not place backfill against newly constructed masonry or concrete structures before meeting the requirements in Table 502.03-5

210.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard. Excavated material will be measured in its original position, using the average end area method. The Engineer will measure the volume of material actually removed within prism limiting planes as follows:

1. Conduit and Structural Plate Pipe: As shown on the plans.
2. Other Structures:
 - a. The bottom of the foundation.
 - b. The vertical planes 2 ft outside of and parallel to the outside lines of the structure, in the case of bents with individual column footings, the entire bent are considered as one structure.
 - c. With upper limits as follows:
 - (1) In embankment sections, the existing ground surface as cross sectioned.
 - (2) In roadway cut sections or channel changes, the planes of the roadway cut or channel change as excavated.

The Engineer will measure compacting backfill by the cubic yard of backfill material placed and as follows:

1. Conduit: As shown on the plans.
2. Other Structures:
 - a. Below the original ground surface: A volume equal to the volume of structure excavation less the volume of the permanent structure including

opening, contained within the limits of measurement for structure excavation.

- b. Above the original ground surface: The volume contained between the outside walls of the structure and vertical planes 4 ft outside thereof; the original ground surface; and a horizontal plane 1 ft above the top of the structure or of the subgrade, whichever is less.
- c. Volumes of backfill placed through water around abutments, wing walls and piers, will not be included in the measurement of quantities for compacting backfill.

210.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Structure Excavation Schedule No. _____	CY
Compacting Backfill.....	CY

When the contract does not include a contract pay item for structure excavation or compacting backfill, the Department considers this work incidental and the cost included in other contract pay items.

The Department will pay for backfill material or bedding material required whose source is other than structure excavation at the contract unit price for the material being used, or as extra work if no unit price has been established.

If the Contractor is directed by the Engineer to remove material below the elevation shown on the plans, the Department will pay for the excavation work at the contract unit price or as extra work.

The Department will pay for Class 15 concrete used to backfill rock excavation below the bottom of the design footing grade based on the actual quantity used, but not to exceed a prism 1 ft outside the footing neat lines with an average depth of 1 ft below the bottom of footing.

No payment will be made by the Department to excavate, backfill, and compact material removed for safety purposes.

SECTION 211 - SOURCE RECLAMATION

211.01 Description. Reclaim land used for borrowing material or mining for aggregates in Department-controlled sources.

211.02 Materials. Not Specified.

212.02

211.03 Construction Requirements. Do the following where usable material has been removed from the source:

1. Salvage and replace the top 1 ft of topsoil or as shown on the plans.
2. Grade and contour the slopes and floor to a pleasing, natural appearing conformation.
3. Replace topsoil, seed, fertilize, and mulch.
4. Perform other work required by the reclamation plan and contract.
5. Seed the area as specified in 621.

211.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum for each source involved.

211.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Source Reclamation.....	Lump Sum

When the contract does not include an item for source reclamation, the Department will consider the work incidental and the cost included in the contract unit price for other contract pay items.

Should the Contractor receive Engineer approval to use an alternate source of material, the Department will not pay for source reclamation.

The Department will furnish seed to the Contractor at no cost for designated sources only.

SECTION 212 - EROSION AND SEDIMENT CONTROL

212.01 Description. Control erosion and sediment using berms, dikes, dams, sediment basins, erosion blankets, netting, fiber wattles, compost socks, inlet protection, gravel, mulches, grasses, slope drains, and other approved erosion control devices or methods.

212.02 Materials. Provide materials as specified in:

Seeding.....	621.02
Metal Apron.....	708.21
Pipe.....	706
Riprap.....	711.04
Fiber Wattle.....	711.20

Compost Sock.....	711.21
Inlet Protection	711.23
Gabion and Revet Mattress	715
Geotextile	640 & 718

Provide other Engineer approved materials that meet commercial grade standards.

212.03 Construction Requirements.

- A. General.** Submit for approval by the Engineer a plan and schedule for installing temporary and permanent erosion and sediment control measures at the preconstruction conference or before the start of the applicable construction. Incorporate ground disturbing activities including haul roads, material sources, staging areas, and excess material sites. Do not start work until the erosion and sediment control schedule and methods of operations for the applicable construction have been approved by the Engineer

Cease earthwork operations when erosion or sediment control features are determined by the Engineer to be inadequate. Resume only after demonstrating effectiveness of erosion and sediment control features. Provide temporary erosion control measures immediately when seasonal limits prohibit permanent measures.

Do not construct slopes more than 15 ft vertically, regardless of slope angle, before installing perimeter sediment control measures. Install erosion and sediment control measures for cut and embankment slopes with an erodible surface, regardless of size, within 5 calendar days. The Engineer may extend this time period 5 additional calendar days during the seasonal dry period of June 15 to October 15 when NOAA (National Weather Service) forecasts indicate there is little chance of precipitation.

Incorporate erosion and sediment control measure to prevent sediment transport from either cut or embankment slopes as part of the daily construction operation.

Provide an individual qualified in erosion and sediment control measures to oversee inspection and maintenance of control measures. Control measures may require the removal of sediments during maintenance operations. The Engineer may allow sediments removed to be used on the project. Preserve the function of control measures and prevent water pollution when disposing of sediments.

B. Temporary Erosion and Sediment Control Measures

1. **Seeding, Mulching, Hydraulically Applied Erosion Control Products, and Erosion Blankets.** Seed the designated slopes and other ground disturbed areas as early as practical and as specified in 621. It is not necessary for slopes to be completely constructed before seeding a finished portion of the slope.

Apply seed as specified in 621 except for seeding that is allowed outside the designated season(s). Reseed areas that do not produce established vegetation during the designated season(s). Unless otherwise specified, seed will be provided by the Department at no cost.

Install mulch, hydraulically applied erosion control products, or erosion blankets as specified in 621.03.E and 621.03.F

2. **Slope Drains.** Convey concentrated runoff water down a slope by use of a plastic liner or pipe material placed on the ground.

Provide plastic liner of sufficient width to convey the expected volume of runoff water without overlapping of liner material. Overlap the length of the plastic liner so that runoff water is prevented from flowing under the liner. Anchor the lengthwise edges of the plastic liner so that runoff water is prevented from flowing onto the unprotected slope or displacing the anchor material. Bury the inlet and outlet ends of the plastic liner so that runoff water is prevented from flowing under the liner.

Anchor pipe material with an inlet apron to prevent displacement.

Construct an earth berm at the inlet to direct runoff water into the slope drain.

Protect the discharge area at the outlet of the slope drain pipe by use of riprap or other Engineer approved methods.

3. **Silt Fence.** Install silt fence according to the manufacturer's recommendations.

Attach wire reinforced fence and silt fence fabric securely to the upstream runoff water side of posts with the fabric on the upslope side to create a taut fence. Bury the bottom edge of the fabric below ground level.

Place end posts inside one another with the fabric and wire reinforcing interlocked on each post, so the fence is overlapped where two silt fences join and as shown on the plans.

4. **Sediment Traps.** Construct pond that collects, stores, or removes

sediment particles, sand size or larger, from runoff water. Do not exceed 5 acres of disturbed ground for the sediment trap drainage area.

Install the sediment trap as shown on the plans or as directed by the Engineer.

5. **Diversion Channels, Ditches and Swales.** Install diversion channels, ditches and swales to collect or divert runoff water. The Contractor may use them in conjunction with a berm or dike. For diversion ditches and channels, install a plastic liner or erosion control geotextile so that water is prevented from flowing under the liner or geotextile.
6. **Dikes and Berms.** Construct and compact soil as shown on the plans and grade to drain to the designated outlet. Protect the ground along the drainage side when Engineer directed. Install a plastic liner when directed by the Engineer. Bury plastic liner overlaps into dike and uphill slope to prevent runoff water from flowing under the liner.
7. **Open-Top Culverts.** Drain runoff water from the surface of unpaved temporary roads. Install the top of the culvert level across the travel surface of the unpaved temporary road at downgrade locations. The Contractor may construct culvert of lumber, metal, or other Engineer approved materials. Ensure the culvert diameter and top openings are adequately sized to drain the runoff water. Construct to withstand the traffic traveling on the temporary road.
8. **Waterbars.** Construct this combination berm and ditch across an unpaved temporary road to drain runoff water. Angle the waterbar downgrade across the road. Adequately size the depth and width of the ditch and height of the berm to handle the runoff water from a 2-yr 24-hr storm event.
9. **Rolling Dips.** Construct a very wide shallow ditch across the surface of an unpaved temporary road to drain runoff water. Locate rolling dips along the downgrade of the unpaved temporary road.
10. **Siltation Berms.** Construct siltation berms to contain and direct runoff water. Construct siltation berms using graded aggregate covered with plastic liner. Overlap and anchor the plastic liner so that water is prevented from flowing underneath.
11. **Stabilized Construction Entrance.** Construct the stabilized construction entrance as shown on the plans to prevent vehicles and equipment from

tracking aggregate, mud, or sediment onto a paved public road. Do not allow aggregate to be tracked from the stabilized area.

Inlet Protection. Pass runoff water through a filtering material before draining into a drop inlet. Protect inlets by using graded aggregate, silt fence geotextile, or a pre-manufactured inlet protection device.

The Contractor may use graded aggregate to filter material by berming the aggregate around the inlet in a manner that runoff water will flow through, without over-topping the berm before draining into the inlet. The Contractor may enclose aggregate in permeable bags.

The Contractor may use silt fence geotextile as a filtering material. Securely install silt fence geotextile backed with wire reinforcing fence by use of a wooden frame to create a taut fence. Ensure the wire for reinforcing fence is at least 14 gage. Bury the bottom edge of the silt fence geotextile below ground level to a sufficient depth so that water is prevented from flowing underneath the geotextile.

The Contractor may use pre-manufactured inlet protection devices. Obtain the Engineer's approval of inlet protection device before use. Install according to the manufacturer's recommendations. Use inlet devices that fit inside the inlet if there is a possibility of the devices being hit by traffic.

- 13. Soil Binder.** Apply a mixture to erodible earthen material that upon drying forms a film or mat that allows water and air to penetrate but retains the earth material in place. Obtain the Engineer's approval of soil binder before use. Apply the soil binder in accordance with the manufacturer's recommendations.

Incorporate a method to differentiate between the binder and earth material, by color or tracer material, during application operations. Do not apply binding mixture when wind interferes with placement. Ensure that, when cured, the binder is not re-emulsifiable. Provide manufacturer's certification that states it is nontoxic to plant or animal life and nonstaining to concrete or painted surfaces.

- 14. Fiber Wattle.** Use fiber wattles for sediment capture or velocity dissipation for existing culvert inlets/outlets, ditches, channels, slope stabilization, and perimeter protection.

Use fiber wattles in areas with flow rates less than 1 cfs, and in drainage areas not to exceed five acres. In areas where the gradient is 2H:1V or steeper, additional erosion control measures must be in place.

Install fiber wattles in accordance with the manufacturer's recommendations.

Leave fiber wattles in place after final construction unless otherwise Engineer directed.

- 15. Compost Sock.** Use compost socks for sediment capture or velocity dissipation for existing culvert inlets/outlets, ditches, channels, slope stabilization, and perimeter protection.

Use compost socks in areas with flow rates less than 1 cfs, and in drainage areas not to exceed five acres. In areas where the gradient is 2H:1V or steeper, install additional erosion control measures. Install compost socks in accordance with the manufacturer's recommendations.

The Department considers removal of compost sock to be incidental to this item.

C. Permanent Control Measures

- 1. Seeding, Erosion Blankets, and Mulching.** Seed slopes and other ground disturbed areas. It is not necessary for slopes to be completely constructed before seeding a finished portion of the slope. The Engineer may require re-seeding of areas previously seeded due to non-establishment of vegetation.

Seed as specified in 621.

Install erosion blankets, mulch, or hydraulically applied erosion control products as specified in 621.03.E and 621.03.F.

- 2. Gabion and Revet Mattress.** Provide and construct as specified in 512.
- 3. Stone Filter Berms / Dams.** Use rock in constructing stone filter berm/dam that is graded with a minimum size of 1 in to a maximum of 8 in measured along the longest dimension.
- 4. Sediment Basins.** Construct sediment basins as shown on the plans or as Engineer directed. Stabilize the inlet, outlet, and emergency spillway of the basin as Engineer approved.
- 5. Inlet and Outlet Protection.** Protect the ground at the inlet and outlet of pipes and other water discharges as shown on the plans.

212.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

212.05

1. Slope drain and open-top culvert by the foot along the length of plastic liner or pipe.
2. Inlet protection, waterbar, stabilized construction entrance, sediment trap, and sediment basin by the each.
3. Silt fence, fiber wattle, and compost sock by the foot along the ground.
4. Diversion channel, diversion ditch, swale, dike, berm, and siltation berm by the foot along the centerline of constructed item. This measure includes the excavation and embankment required to construct the item, as well as the materials used to construct outlet and overflow structures.
5. Soil Binder by the acre of surface treated.
6. Gabion and revet mattress by the cubic yard based upon the nominal size of the units.
7. Stone filter berm and dam by the cubic yard using the average end area method.

212.05 Basis of Payment. The Department will pay for accepted quantity at contract unit prices as follows:

Pay Item	Pay Unit
Slope Drain	ft.
Sediment Trap	Each
Silt Fence	ft.
Diversion Channel	ft.
Diversion Ditch	ft.
Dike	ft.
Berm	ft.
Open-Top Culvert	ft.
Waterbar	Each
Siltation Berm	ft.
Stabilized Construction Entrance	Each
Soil Binder	Acre
Gabion	CY
Revet Mattress	CY
Stone Filter Berm Type	CY
Stone Filter Dam Type	CY
Sediment Basin	Each
Inlet Protection	Each
Fiber Wattle	ft.
Compost Sock	ft.

The Department will not pay for temporary erosion and sediment control measures required due to the Contractor's negligence, carelessness, or failure to install permanent measures as part of the scheduled work.

The Department considers erosion and sediment control measures required for areas outside the project limits such as borrow pits, materials sources, haul roads, plant sites, and storage and disposal areas, as incidental to the work.

The Department will pay for seeding, erosion blankets, mulching, hydraulically applied erosion control products, and other seeding items under the appropriate contract pay items of 621.

The Department considers the following work incidental and the cost included in contract unit prices for other contract pay items:

1. Berm, ditch, pipe apron, rock, and excavation used either to direct drainage to a slope drain or to construct a stabilized discharge area.
2. Geotextile, rock, sandbags, and plastic liner used in construction of sediment trap, diversion channel, or diversion ditch.
3. Wire reinforcing fence, geotextile, and posts for silt fence.
4. Diversion channels, diversion ditches, swales, berms, and dikes constructed as a standard part of the Contractor's normal operation within the slope limits.
5. Ditches built in conjunction with dikes and berms.
6. Swale and rolling dip.
7. Geotextile and graded aggregate for stabilized construction entrance.
8. Inspection of erosion and sediment control measures.
9. Maintenance of erosion and sediment control measures unless otherwise specified.

The Department will pay for structure excavation and compacting backfill for gabion and revet mattress under 210. The Department will pay for geotextile for gabion and revet mattress under 640.

SECTION 213 - TOPSOIL

213.01 Description. Excavate suitable topsoil from stockpiles, sources outside the roadway, or from its natural position on portions of the right-of-way that will be occupied by the roadway. Place the topsoil upon designated constructed cut and fill slopes after grading operations are complete.

213.04

213.02 Materials. Provide topsoil that consists of fertile, friable soil of loamy character and that contains an amount of organic matter normal to the region. Obtain topsoil from well-drained arable land and reasonably free from subsoil, refuse, roots, heavy or stiff clay, large stones, coarse sand, sticks, brush, litter, and other deleterious substances. Incorporate vegetative matter into topsoil, except brush, trees, and noxious weeds.

Provide microorganism inoculants that contain a diverse mix of regional specific mycorrhizal species for specific condition, provide macronutrients and micronutrients to plants that are tolerant of chemical imbalances in the soil, produce humic compounds and binding compounds, and improve soil structure.

213.03 Construction Requirements. Excavate to a depth of at least 6 in, unless otherwise Engineer directed. Place topsoil excavated from the roadway directly on cut and fill slopes without use of stockpiles whenever conditions and the progress of construction permit. Where this procedure is not possible, excavate topsoil, and stockpile along the project.

Stockpile topsoil so as not to interfere with natural drainage or cause off-site sediment damage. Surround topsoil stockpile with sediment controls. Treat topsoil stockpile with temporary soil stabilization measures immediately upon stockpile completion.

Ensure topsoil stockpiles do not exceed 4 ft in height unless otherwise Engineer approved. If the stockpile is undisturbed for longer than 3 months, mix the top 1 ft with the remainder of the stockpile to ensure that living organisms are distributed throughout at the time of final placement, or add microorganism inoculants, after final placement, in accordance with manufacturer recommendations. Apply microorganism inoculants as dry granular mixes, tablets, or injectable soluble.

Do not place topsoil in its final position until the areas to be covered have been properly prepared. Place topsoil and spread at locations shown on the plans and key into the underlying material by the use of harrows, rollers, or other equipment suitable for the purpose.

Ensure the thickness of topsoil placement is 6 in unless otherwise specified.

213.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Topsoil obtained from the roadway and placed directly upon designated slopes or placed in temporary stockpiles will be by the cubic yard in its original position or in approved stockpiles.
2. Topsoil measured by the square yard will be parallel to the slope.

213.05 Basis of Payment. The Department will pay for accepted quantities at contract unit prices as follows:

Pay Item	Pay Unit
Topsoil	CY or SY

The Department will pay for topsoil excavated from the roadway at the contract unit price for Excavation as specified in 205.

The Department will pay for topsoil in its final position at the contract unit price for Topsoil, which includes the cost to stockpile (if necessary), haul to the site where it is to be placed, and finished on the slope.

SECTION 214 - ROADSIDE CLEANUP

214.01 Description. Remove and dispose of stumps, foundations, debris, and boulders and perform minor leveling and drifting of material between the limits of clearing and right-of-way only as shown on the plans or as specified, or as Engineer directed, or both. The Department will not pay for necessary cleanup resulting from the Contractor's operations.

214.02 Materials. Not Specified.

214.03 Construction Requirements. Not Specified

214.04 Method of Measurement. The Engineer will measure acceptably completed work as specified in 109.03.

214.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Roadside Cleanup (Contingency Item)	Contingency Amount

SECTION 300 – BASES

SECTION 301 - GRANULAR SUBBASE

301.01 Description. Provide, place, and construct one or more courses of granular subbase on a prepared subgrade.

301.02 Materials. Provide materials as specified in 703. The Engineer will accept granular subbase for quality requirements at the point of delivery.

Use the following standard methods for tests:

Compaction Standard for Coarse Granular Materials

by Use of the Vibratory Spring-load Compactor..... Idaho T-74

In-Place Density and moisture content of Soil and Soil Aggregate

by Nuclear Methods (Shallow Depth)..... AASHTO T-310 Method B

Prepare and submit an Idaho T-74 density curve to the Engineer for the subbase material to be incorporated into the project, before placing granular subbase on the roadway. The Department considers this testing incidental; no separate payment will be made. Reclaimed Asphalt Pavement (RAP) may be used in granular subbase when Engineer approved. RAP is defined as salvaged bituminous pavement that may have minor coatings of dust or aggregate particles adherent from the reclamation process with no discernable seams, pockets, or amounts of untreated aggregate or soil. Only use material meeting this definition. Do not exceed a RAP size of 3 inches. The Engineer will visually verify the RAP daily, in place, to confirm the size requirement has been met.

301.03 Construction Requirements.

A. General. Do not exceed a maximum compacted thickness of 0.8 ft for each layer. Construct the subbase in two or more layers of approximate equal thickness if the required compacted thickness of the granular subbase layer exceeds 0.8 ft. The compacted thickness of a single layer of the subbase may be increased to 1 ft when vibrating or other Engineer approved types of special compacting equipment are used. The minimum compacted thickness of any course is 1.5 times the maximum particle size.

Unless otherwise specified by the contract, mix the subbase as specified in 303.03.A.

After each layer has been spread, compact the layer for its full width. Continue compaction until at least 95 percent of the maximum dry density is attained when tested in accordance with 301.02.

Determine the in place density of granular subbase in accordance with AAS-HTO T 310, Method B.

Maintain the surface of each layer during the compaction operations so that a uniform texture is produced and the subbase is firmly keyed. Apply enough water uniformly over the base materials during compaction to ensure proper compaction is achieved.

B. Granular Subbase Material in Stockpile. Provide granular subbase material in stockpiles at designated locations. Stockpile as specified in 303.03.B.

C. Granular Subbase Material, Load, Haul and Place. Load, haul, and place designated stockpiled granular subbase material on the roadbed.

Spread, process, distribute, shape and compact the granular material as specified in this section. The Department will specify location and cost of the stockpiled subbase material will be as specified in the special provisions.

D. Reclaimed Asphalt Pavement (RAP). Mix RAP in approximately equal proportions with material meeting the requirements for granular subbase. Ensure the final mix of materials is of uniform consistency.

1. Perform in place density testing for RAP/subbase mixtures at the frequency specified in this section using the following procedure:
2. Establish the roller pattern by using in-place density from an uncorrected nuclear gauge. The required compaction is achieved and final process rolling is defined as when the final roller pass adds no more than 0.5 lb/ft³ to the previous in-place density.
3. Make sufficient additional roller passes to determine that a "false break" or leveling-off point is not used for compaction density.
4. Reestablish the roller pattern when mixture properties in the processed material change and at least every 7200 yd² of finished surface for each lift.
5. Perform additional tests where soil conditions have changed or as determined by the Engineer to ensure that the required compaction is achieved.

301.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Granular Subbase by the ton or cubic yard except that moisture in the material in excess of 7 percent will not be paid for.

302.03

2. Granular Subbase in Stockpile by the ton or cubic yard.
3. Granular Subbase Load, Haul, and Place by the ton or cubic yard except that moisture in the material in excess of 7 percent will not be measured.

RAP, if used in granular subbase will not reduce the quantity of granular subbase but will be measured as a portion of granular subbase without any additional compensation by the Department.

301.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Granular Subbase	Ton or CY
Granular Subbase in Stockpile.....	Ton or CY
Granular Subbase Load, Haul, and Place.....	Ton or CY

SECTION 302 - EMULSION TREATED BASE

302.01 Description. Construct one or more courses of emulsion treated base.

302.02 Materials. Provide aggregate as specified in 703. The Engineer will accept aggregate for quality requirements at the point of delivery.

Provide emulsified asphalt of the type and grade specified and meeting the applicable requirements of 702. The Engineer will accept the material at the point of delivery.

Use the following standard methods for tests:

Compaction Standard for Coarse Granular Materials

by Use of the Vibratory Spring-load Compactor..... Idaho T-74

In-Place Density and moisture content of Soil and Soil Aggregate

by Nuclear Methods (Shallow Depth) AASHTO T 310, Method B

Instead of Idaho T-74 and when approved by the Engineer, the maximum dry density of aggregate base may be determined in accordance with the following:

Moisture Density Relations of Soils..... AASHTO T180, Method D

Prepare either an Idaho T-74 density curve or an AASHTO T 180, Method D, moisture-density curve for the aggregate base to be incorporated into the project, and submit to the Engineer before placement on the roadway. The Department considers this testing incidental; no separate payment will be made.

302.03 Construction Requirements. Mix the aggregate, emulsified asphalt and water in an Engineer approved stationary plant.

Mix the emulsified asphalt with water at a ratio of 1:1 and uniformly mix with the aggregate base until approximately 4 percent diluted emulsified asphalt, by weight of dry aggregate, has been added. Additional water may be required to complete the mixing of the aggregate base and to facilitate compaction.

Place the base material on the roadbed by means of an aggregate spreader approved by the Engineer. Do not exceed a maximum compacted thickness of 0.5 ft for each layer. Construct the base in two or more layers of approximate equal thickness if the required compacted depth of the base exceeds 0.5 ft. The compacted depth of a single layer of the base may be increased to 0.8 ft when vibrating or other Engineer approved types of special compacting equipment are used.

Shaping and spreading may be performed with motor graders or Engineer approved methods in areas where it is not practical to operate the spreader.

Compact for its full width after each layer has been spread, and continue compaction until at least 100 percent of the applicable maximum density is attained.

Produce a surface for each layer that has uniform texture and aggregate that is firmly keyed. Maintain the surface during the compaction operations.

302.04 Method of Measurement. The Engineer will measure acceptably completed work for emulsion treated base and emulsified asphalt by the ton. The Engineer will not use batch weights as a method of measurement.

The Engineer will use the weight of the emulsion treated base quantity in the accepted base and will include the weight of aggregate and emulsified asphalt.

The Engineer will deduct the weight of water and emulsified asphalt in excess of 7 percent of the weight of dry aggregate from the weight of the emulsion treated base.

302.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Emulsion Treated Base	Ton
Emulsified Asphalt for Emulsion Treated Base	Ton

SECTION 303 - AGGREGATE BASE

303.01 Description. Provide, place, and construct one or more courses of aggregate on a prepared surface.

303.02 Materials. Provide aggregate as specified in 703. The Department will

303.03

accept the aggregate from the windrow or roadway, except when purchased and stockpiled, then acceptance will be at the crushing plant.

The Contractor may use crushed glass in base. Uniformly blend the crushed glass with the aggregate. Ensure the glass-aggregate blend meets the aggregate gradation specified.

The Contractor may use glass crushed to 3/4 in minus up to approximately 15% by weight of aggregate base. Place the glass-aggregate base material at least 1 ft below unpaved surfaces.

The Contractor may use glass crushed to 5/16 in minus up to approximately 15% by weight in aggregate base, with no restriction on location.

Use the following standard methods for tests:

Compaction Standard for Coarse Granular Materials

by Use of the Vibratory Spring-load Compactor..... Idaho T-74

In-Place Density and moisture content of Soil and Soil Aggregate

by Nuclear Methods (Shallow Depth) AASHTO T 310, Method B

Instead of Idaho T-74 and when approved by the Engineer, the maximum dry density of aggregate base may be determined in accordance with the following:

Moisture Density Relations of Soils..... AASHTO T180, Method D

Prepare and submit an Idaho T-74 density curve or an AASHTO T 180, Method D, moisture-density curve to the Engineer for the aggregate base to be incorporated into the project, before placing aggregate base on the roadway. The Department considers this testing incidental; no separate payment will be made.

303.03 Construction Requirements.

A. General. Do not exceed a maximum compacted thickness of 0.5 ft. for each layer. Construct the base in two or more layers of approximate equal thickness if the required compacted thickness of the base exceeds 0.5 ft. The compacted thickness of a single layer of the base may be increased to 0.8 ft when vibrating or other types of special compacting equipment are used upon approval by the Engineer.

Mix the base by one or a combination of the following four methods, unless otherwise specified:

1. Stationary Plant Method. Mix the aggregate and water in an Engineer approved mixer. Add enough water during the mixing operation to facilitate compaction. After mixing, place the base material on the roadbed by means of an Engineer approved aggregate spreader.

2. Travel Plant Method. After the material for each layer of base has been placed through an aggregate spreader or windrow sizing device, uniformly mix the base by a traveling mixing plant. During the mixing, add enough water to facilitate compaction.
3. Road Mix Method. After material for each layer of base has been placed, mix the material by motor graders or other Engineer approved equipment until the mixture is uniform throughout. During the mixing, add enough water to facilitate compaction.
4. Premixed Method. Mix the aggregate and water as approved by the Engineer before placement. Add enough water during the mixing operation to facilitate compaction. After mixing, place the base material on the roadbed by means of an Engineer approved aggregate spreader.

After each layer has been spread, compact the layer for its full width. Continue compaction until at least 95 percent of the maximum dry density is attained using the methods specified in this section.

Determine the density of aggregate base in place in accordance with AASHTO T 310, Method B.

Maintain the surface of each layer during the compaction operations so that a uniform texture is produced and the aggregate firmly keyed. Apply enough water uniformly over the base materials during compaction to ensure proper compaction is achieved.

- B. Aggregate Base Material in Stockpile.** Provide aggregate base material in stockpiles at designated locations.

Before placing material in stockpile, prepare the site by clearing and smoothing for Engineer approval.

Provide stockpiles that are neat and regular in form and occupy as small an area as possible. Construct stockpiles by first distributing the material to be stockpiled over the entire base and building upward in successive layers not more than 3 ft. in depth. Do not end dump or conveyor stack materials over the sides of the stockpile.

- C. Aggregate Base Material, Load, Haul and Place.** Load, haul, and place stockpiled aggregate from designated sources on the roadbed.

Spread, process, distribute, shape, and compact as specified in this subsection. The Department will specify the location and cost of the stockpiled aggregate will be as specified.

303.04

2. Excavation of soft spots and soft spot repair by the cubic yard in its original position using the average end area method and will include excavation, drying, replacement, and compaction of the in-place soil; or with Engineer approval, Contractor's optional replacement material.
3. Water by the MG (1 MG = 1000 gal) by means of calibrated tanks or distributors or by means of accurate water meters. Only that water which is used in mixing materials or ordered to keep the surface moist will be measured for payment.

304.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Reconditioning	Sta. or mi
Water for Reconditioning.....	MG
Excavation of Soft Spots	CY
Soft Spot Repair	CY

The Department will pay for removal and disposal of unsuitable material under excavation of soft spots. The Department will pay for any backfill material used to replace unsuitable material under its respective item or as extra work. The Department will not pay for Contractor's optional replacement material.

SECTION 306 - ROLLING

306.01 Description. Provide and use rollers for the compaction of earthwork, base, granular borrow, rock embankments, surface courses, surface treatments and seal coats.

Whenever end results are specified, the Contractor may choose the compaction equipment and rolling methods that produces the required compaction without damaging the mixture.

Operate the rollers, unless otherwise Engineer approved, at a speed between 3 mph to 5 mph.

306.02 Materials. Not Specified.

306.03 Construction Requirements. Provide Engineer with the weight of each roller by: a) manufacturer's rating attached to the roller; b) manufacturer's specifications; or c) direct scale reading.

A. Steel Rollers. Provide steel rollers consisting of 3-wheel or tandem type self-propelled rollers equipped with cleaning devices to prevent adhesion of material to the wheels.

Provide steel-wheel rollers for use on base material and reconditioning that have a minimum weight of 10 ton and a minimum compression of 325 lb/in of width for the rear wheels or drum.

Provide tandem axle rollers for use on plant mix and road mix that weigh 8 to 12 ton. The Engineer may allow a 3-axle tandem weighing 10 to 14 ton for finish rolling.

- B. Pneumatic-Tire Rollers.** Wherever required and allowed by the contract, provide self-propelled rollers with adequate power to perform the required compaction.

Use pneumatic tire rollers used on seal coats, surface treatments, and roadmix pavement use tires that have inflation pressures of 55 psi and wheel loadings of 220 lb/in width of tire as shown on the tire sidewall.

Use pneumatic tire rollers for compacting bases and plant mix pavement use tires that have inflation pressures of 110 psi and minimum wheel loadings 400 lb/in width of tire as shown on the tire sidewall.

Provide rollers equipped with smooth compactor tires. Do not use wobble-wheel rollers whose tires revolve in a plane that is not at right angles to the axle shaft. Ensure the air pressure in any tire does not vary more than 5 psi from the pressure established. When used on seal coats and surface treatments, operate the rollers at speeds of between 3 mph and 8 mph unless otherwise specified or directed by the Engineer. Do not use pneumatic rollers for finish rolling on asphalt surface courses.

- C. Vibratory Rollers.** Wherever required and allowed by the contract, provide vibratory rollers which are adequately designed and powered to perform the required compaction. Ensure they are of sufficient size and number to keep up with roadway production while providing the required density.

Provide vibratory rollers for use on rock embankments, granular borrow and bases that generally meet the speed and frequency ranges (vibrations per minute) shown in Table 306.03-1. Operate rollers at high amplitude unless otherwise directed by the Engineer. The Engineer will allow self-propelled or towed units.

Table 306.03-1 - Base and Earthwork
Impacts Per Foot

Roller Speed VPM = Vibrations Per Minute

ft/min	1000	1200	1400	1600	1800	2000	2200	2400
88	11	14	16	18	20	23	25	27
132	8	9	11	12	14	15	17	18
176	6	7	8	9	10	11	13	14
220	5	6	6	7	8	9	10	11
264	4	5	5	6	7	8	8	9
308	3	4	5	5	6	7	7	8
352		3	4	5	5	6	6	7
396			4	4	4	5	5	6
440				4	4	5	5	5

Provide vibratory rollers for use on plant mix base and surfacing that meet the speed and frequency ranges shown in Table 306.03-2. Operate rollers at low amplitude unless otherwise directed by the Engineer. Only drum-type rollers will be accepted. Provide drum-type rollers that meet the following minimum requirements: 1600 vibrations/minute (VPM), static force on drums of 125 lb/in, and total applied force on vibrating drums (dynamic plus static) of 325 lb/in

Provide self-propelled rollers that are equipped with spray bars to prevent pickup of asphalt material. Shut off vibrators whenever the roller stops. On tender mixes, or steep grades, and whenever Engineer directed, operate rollers as a static roller until the mix is dense enough to allow vibratory compaction with minimal displacement.

Table 306.03-2 - Asphalt Paving
Impacts Per Foot

Roller Speed VPM = Vibrations Per Minute

ft/min	1600	1800	2000	2200	2400	2600	2800	3000
88	18	20	23	25	27	30	32	34
132	12	14	15	17	18	20	21	23
176		10	11	13	14	15	16	17
220				10	11	12	13	14
264							11	11

To avoid washboards, use ten or more impacts per foot.

Other types of rollers, specifically designed and manufactured for use on granular borrow, rock embankments, small areas of base and pavement and other special applications, may be approved by the Engineer provided satisfactory compaction is obtained. Grid rollers, vibratory pan compactors, tamping rollers, and various special compactors will be classed by the Department as miscellaneous rollers.

306.04 Method of Measurement. Not Specified.

306.05 Basis of Payment. Unless otherwise specified, the Department will not pay for rolling separately. The Department considers the costs to be included in the contract unit prices for other contract pay items.

SECTION 307 – OPEN-GRADED BASE

307.01 Description. Construct one or more courses of open-graded base on a prepared surface.

307.02 Materials. Provide material for open-graded base as specified in 703.

307.03 Construction Requirements. Place the first layer of open-graded base directly over Type II Subgrade Separation Geotextile in a lift of at least 12 in thick but less than 18 in thick. The minimum lift thickness is 6 in and the maximum lift thickness is 12 in above the initial lift. Compact the first layer with at least 6 full coverages, and compact subsequent layers with at least 2 full coverages for each 6 in lift thickness, with a vibratory roller meeting the following requirements:

1. A rated minimum centrifugal force of 30,000 lb per impact.

2. At least 1000 vibrations per minute.
3. Operate at a speed less than 130 ft/min.

Do not allow equipment on the geotextile before placing the first lift of open-graded base. Do not dump the open-graded base directly on the geotextile. Dump the material on the previously placed lift and push ahead.

Switch off the vibrators if there is evidence of the vibrating rollers causing excess movement, depressions or voids other than what is considered normal compaction displacement, until otherwise Engineer directed. During the compaction process, keep the open-graded base visibly moist.

Keep soil, mud or other undesirable fine material from accumulating on its surface once the open-graded base is in place. If contamination does occur during the construction operation, replace material as directed by the Engineer at no cost to the Department.

Place and compact open-graded base class III as specified in 303.

307.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard, neat line measurement of the roadway section, or by the ton.

307.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Open-graded base Class_____	CY or Ton

The Department will pay for geotextile under 640.

SECTION 400

SURFACE COURSES AND PAVEMENT

Protect private property, bridges, sign posts, guardrail, and other roadway structures from being discolored by asphalt. If structures become discolored by asphalt, remove the discoloration and, if required, repair or repaint the surfaces or both. Apply asphalt at the temperature recommended by the supplier.

SECTION 401 - TACK COAT

401.01 Description. Prepare and treat an existing surface with asphalt.

401.02 Materials. Provide asphalt of the type and grade specified in the contract. Provide asphalt as specified in 702. The Engineer will accept the asphalt at point of delivery.

401.03 Construction Requirements. Provide distributor equipment as specified in 406.03.

Patch and clean the existing surface and ensure it is without irregularities to provide a reasonably smooth and uniform surface to receive the treatment. Remove and replace unstable corrugated areas with suitable patching materials. Clean the edges of existing pavement that are to be adjacent to new pavement to permit adhesion.

Broom prior to applying tack coat. Provide brooms that are in good condition and capable of sweeping a path at least 70 inches wide without loosening or displacing embedded materials. Sweep the surface as directed by the Engineer.

Accompany each broom by a shadow vehicle if working on highways open to traffic. Equip the shadow vehicle with at least one roof-mounted high intensity rotating or strobe-type amber flasher that is readily visible from front and rear for 0.5 mi.

Lightly spray the surface of the roadway to be swept with enough water to prevent dust from becoming airborne where the brooming operations could create dust to the extent that it would violate air pollution regulations or create a safety hazard.

Do not broom from the surface onto maintained shoulder-foreslope areas where the adjacent property owner cares for the area and maintains turf or landscape.

Apply asphalt tack so the application is uniform, the limits of placement are appropriate, there is the least amount of inconvenience to traffic, and traffic will not cause pickup or tracking.

Mix approximately equal volumes of emulsified asphalt and water before application.

Do not apply asphalt if surface or weather conditions can prevent proper construction.

401.04 Method of Measurement. The Engineer will measure acceptably completed work for the tack coat as diluted emulsified asphalt by the gallon with no correction for temperature.

401.05 Basis of Payment.

The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Diluted Emulsified Asphalt for Tack Coat.....	gal

The Department will not pay for reapplication of the asphalt tack required due to time lag between the initial application and the paving operation.

The Department considers brooming and patching as incidental and the cost included in other contract pay items.

SECTION 402 - PRIME COAT

402.01 Description. Prepare and treat an existing surface with asphalt, and blotter as specified.

402.02 Materials. Provide asphalt of the type and grade specified in the contract. Provide asphalt as specified in 702. The Engineer will accept the asphalt at the point of delivery.

Provide blotter as specified in 703. The Engineer will accept material at the point of delivery from Contractor furnished sources or the Engineer will accept material in stockpile at designated sources.

402.03 Construction Requirements. Do not apply asphalt if surface or weather conditions can prevent proper construction.

Provide distributor equipment as specified in 406.03.

Shape the surface to be primed to the required grade and section, ensure it is free from ruts, corrugations, segregated material, or other irregularities; and uniformly compact.

Obtain the Engineer's approval of quantities, rate of application, temperatures, and areas to be treated before application of the prime coat.

Apply asphalt to the width of the section to be primed with a pressure distributor in a uniform, continuous spread. Do not exceed the specified asphalt application rate at the spread overlap junction.

403.02

Correct skipped areas or deficiencies.

Provide for one-way traffic on the untreated portion of the surface when traffic is maintained. Transfer traffic to the treated portion as soon as the asphalt has been absorbed by the surface and will not pick up, and prime the remaining width of the section.

Spread blotter with a self-propelled aggregate spreader supported by at least four wheels equipped with pneumatic tires on two axles, as Engineer approved, if, after the application of the prime coat, the asphalt fails to penetrate and the roadway must be used by traffic. Equip the aggregate spreader with positive controls so the required amount of material will be deposited uniformly over the full width required to absorb the excess asphalt.

402.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Asphalt will be by the ton.
2. Blotter will be by the ton or cubic yard.

402.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Emulsified Asphalt for Prime Coat.....	Ton
Blotter.....	Ton or CY

SECTION 403 - SEAL COAT

403.01 Description. Apply asphalt, and anti-stripping additive, if required, followed by an application of cover coat material.

403.02 Materials. Provide asphalt of the type and grade specified in the contract. Provide asphalt as specified in 702. The Engineer will accept the asphalt at the point of delivery.

The emulsified asphalt used for seal coating is subject to viscosity and sieve testing by the Department, in the field or at a location other than the project site. Schedule the delivery time to allow testing before usage. Expect delays up to one hour for this testing.

Provide cover coat material and choke sand as specified in 703. The Engineer will accept cover coat material and choke sand at the point of loading for delivery to the roadway.

Submit a seal coat design for each stockpile using the McLeod method. Complete the design at least two weeks before starting construction. Field verify the seal coat design for spread rate of asphalt and aggregate.

403.03 Construction Requirements.

A. General. Do not apply asphalt if the roadway surface or weather conditions can prevent satisfactory construction.

Do not start seal coating unless the pavement surface temperatures are 80 °F and rising, and do not seal coat when pavement surface temperature exceeds 140 °F, unless authorized in writing by the Engineer. If bleeding becomes apparent on the completed seal coat, initiate immediate maintenance and traffic control, and do not continue seal coating until corrective action has been initiated.

Do not apply seal coats when the wind velocity exceeds 15 mph without written approval from the Engineer.

Do not apply seal coats before June 15 or after September 1.

The following equipment or its equivalent is required by the Department:

1. Asphalt application equipment for applying asphalt as specified in 406.03.
2. A rotary power broom.
3. Rollers as specified in 306.03.B. Do not operate the rollers at a speed in excess of 8 mph. Include enough pneumatic tired rollers to cover a full spread width with one pass.
4. One self-propelled aggregate spreader supported by at least 4 wheels equipped with pneumatic tires on 2 axles, of Engineer approved design. Equip the aggregate spreader with positive controls so that the required amount of material will be deposited uniformly over the full width required.

Seal approaches before sealing the adjacent roadway.

Do not seal coat bridge decks and approach slabs without Engineer approval. Protect drains and bridge expansion joints from the seal coat application, then remove and properly dispose of material used for this protection after completion of the seal coat. Remove asphalt and aggregate that may have spilled into drains and deck expansion joints after completion of the seal coat.

Do not spread asphalt until the surface to be sealed has been cleaned as required and the section has been approved by the Engineer. Apply asphalt with

a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range specified. Design and field verify the quantity of asphalt to be used per square yard. A preliminary asphalt application of from 0.05 to 0.10 gal/SY of surface may be required by the Engineer if the texture of the surface is such that asphalt penetrates too rapidly.

Use a strip of building paper at least 3 ft wide and as long as the spray bar of the distributor plus 1 ft at the beginning of each spread. Paper may be required by the Engineer at the end of each spread if the cutoff is not positive. Remove and dispose of the paper in a satisfactory manner. Ensure the distributor is moving forward at the proper application speed when the spray bar is opened. Correct skipped areas or deficiencies. Carefully mark junctions of spreads to assure a smooth riding surface.

Do not expose asphalt for more than one minute before applying cover coat material. Limit the asphalt spread to the area that the trucks loaded with cover coat material can immediately cover.

The Department will allow meet-lines within 1 ft of lane lines or within 2 ft of center of lanes only. The Department will not allow meet lines within a wheel path.

Do not spread asphalt more than 6 in wider than the width covered by the cover coat material from the spreading device. Do not allow the asphalt to chill, set up, dry, or otherwise impair retention of the cover coat material.

Park the distributor, when not spreading, so that the spray bar or mechanism will not drip on the roadway surface.

Spread cover coat material at the designed and field verified rate immediately following the application of asphalt. Do not allow the tires of the trucks or aggregate spreader to contact the uncovered asphalt. Do not allow pilot car traffic control operations to cross the fresh asphalt meet-line onto newly applied cover coat material.

Moisten aggregate stockpiles with water 12 to 24 hours before placement to eliminate or reduce the dust coating of the aggregate.

Cover deficient areas with additional approved material immediately after the cover coat material is spread. Begin rolling immediately behind the spreading operation and continue until three complete coverages are obtained. Complete rolling within five minutes of spreading cover coat material and before allowing traffic to use the new surface. If choke sand is specified the following applies:

1. Immediately after the third roller pass, apply choke sand to the entire roadway surface at a rate of 4 lb/SY or as directed by the Engineer.
2. Do not "Tailgate" or use a spinner when applying choke sand.

Do not operate equipment at a speed that turns or displaces the cover coat material. The Engineer may require applying approved reject material over the surface to absorb any free asphalt before brooming. Sweep excess material from the entire roadway surface with rotary brooms. Complete the initial brooming by the morning following the previous day's seal coat application unless otherwise Engineer directed. Do not to displace embedded material when brooming. Pickup excess material in curb and gutter sections and dispose of as Engineer directed.

Perform second brooming approximately 24 hours after the first brooming and after traffic has been routed on the seal coated roadway, when required by the Engineer.

Provide brooms that are in good condition and capable of sweeping a path at least 70 inches wide without loosening or displacing embedded materials. Sweep the surface when Engineer directed by the Engineer.

Accompany each broom by a shadow vehicle if working on highways open to traffic. Equip the shadow vehicle with at least one roof-mounted high intensity rotating or strobe-type amber flasher that is readily visible from front and rear for 0.5 mi.

Lightly spray the surface of the roadway to be swept with enough water to prevent dust from becoming airborne when brooming operations could create dust to the extent that it would violate air pollution regulations or create a safety hazard.

Do not broom chips from the surface onto maintained shoulder-foreslope areas where the adjacent property owner cares for the area and maintains turf or landscape.

- B. Cover Coat Material in Stockpile.** Provide and place cover coat material of the class specified in stockpiles at designated locations.

Prepare the stockpile sites by clearing and smoothing as Engineer directed. Construct stockpiles that are neat and regular in form and occupy as small an area as possible.

- C. Sanding Material in Stockpile.** Place sand produced during the production

403.04

of cover coat material, from Department controlled sources, suitable for use as sanding material in stockpiles at designated locations.

Prepare the stockpile sites by clearing and smoothing as Engineer directed. Construct stockpiles that are neat and regular in form and occupy as small an area as possible.

- D. Cover Coat Material, Load, Haul, and Place.** Load cover coat material from designated sources, and haul and place the cover coat material on the asphalt treated roadbed as specified. Before loading, clean the stockpiles of vegetation or other objectionable matter.

403.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Asphalt by the ton.
2. Cover coat material placed on the roadbed, sanding material in stockpile, and cover coat material in stockpile by the ton or cubic yard.
3. Cover coat material, load, haul and place by the ton or cubic yard. The cubic yard measurements may be determined by before-and-after measurement of the stockpile or by volume of the hauling vehicle at the point of delivery to the roadway.
4. Cover coat material placed in temporary stockpiles by, and for the convenience of the Contractor by the ton or cubic yard making a deduction for material placed for a floor. Obtain the Engineer's approval of the location of any temporary stockpiles before use. Remove surplus cover coat remaining in temporary stockpiles to a permanent storage site approved by the Engineer on completion of sealing operations. Leave temporary sites in an acceptable condition after removal of material.
5. Reject material used as blotter for seal coat maintenance by the ton or cubic yard truck measure.
6. Choke Sand by the ton or cubic yard truck measure.
7. Brooming by the mile or hours of actual time consumed in brooming. No allowance will be made for time consumed in making repairs or moving to or from the work. Where brooming is by the mile, it means one complete coverage of the entire roadway surface. Physically divided highways, ramps, crossroads, etc., will be measured as separate roadways.
8. Approaches by the number sealed regardless of size. The quantities of

asphalt and cover coat material used will be included and paid for under those respective contract pay items.

403.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Asphalt Cement for Seal Coat.....	Ton
_____ Emulsified Asphalt for Seal Coat.....	Ton
Rejects	Ton or CY
Brooming.....	mi. or Hr
Approaches.....	Each
Cover Coat Material Class _____ in Stockpile.....	Ton or CY
Cover Coat, Material, Load, Haul and Place.....	Ton or CY
Cover Coat Material Class _____	Ton or CY
Choke Sand	Ton or CY

The Department will pay for brooming after the seal coat has been applied. The Department considers the cost to clean the pavement surface to be seal coated incidental and included in the cost for sealcoat contract pay items.

Where brooming is by the mile, the Department considers that the contract the unit price includes brooming approaches.

Dust abatement water will be measured and paid for under 205.04 and 205.05 or 104.02.

The Department considers the work for placing sanding materials in stockpiles at designated locations as incidental and the cost included in the contract unit prices for seal coat contract pay items, except the Department will pay for haul of sanding material required to be stockpiled more than 1 mi outside the source boundary as extra work.

The Department considers the cost to pick up excess material in curbed sections as included in the contract unit price for brooming.

SECTION 404 - SURFACE TREATMENT

404.01 Description. Construct a single or multiple course surface treatment that may consist of the application of one or more seal coats, or may consist of a prime coat followed by one or more seal coats as follows:

1. Type A: Apply a seal coat.
2. Type B: Apply a prime coat followed by the application of a seal coat.

404.05

3. Type C: Apply two seal coats.
4. Type D: Apply a prime coat followed by the application of two seal coats.

404.02 Materials. Provide asphalt of the type and grade specified. Provide asphalt and anti-stripping additive, if required, as specified in 702. The Engineer will accept the asphalt at the point of delivery.

Provide cover coat material and blotter as specified in 703. The Engineer will accept the cover coat and blotter at the point of loading for delivery to the roadway.

Submit a seal coat design for each stock pile as specified in 403.02

404.03 Construction Requirements. Apply the prime coat, when specified, in accordance with 402.

The Engineer may require a curing period of 5 days between the application of the prime coat and the next application of asphalt.

Keep the primed surface in repair during the period between the application of the prime coat and the seal coat. Patch and repair holes, ravels and areas deficient in the primed surface with aggregate-asphalt mixtures, by penetration methods, or other Engineer approved procedures. Broom off loose material before subsequent applications of asphalt.

Apply each seal coat as specified in 403. Maintain the first seal coat and allow it to cure for a period of 5 days if successive seal coats are to be applied.

Keep the highway open to traffic unless otherwise specified. The Contractor may route controlled traffic on the surface treatment as soon as the asphalt is covered.

404.04 Method of Measurement. The Engineer will measure acceptable work as follows:

1. Asphalt by the ton
2. Blotter by the ton or cubic yard.
3. Anti-stripping additive by the percentage of additive per ton of asphalt.
4. Cover coat material by the ton or cubic yard as specified in 403.04.
5. Brooming as specified in 403.04.
6. Approaches as specified in 403.04.

404.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Asphalt Cement for Surface Treatment Type _____	Ton
___ Emulsified Asphalt for Surface Treatment Type _____	Ton
Cover Coat Material Class _____	Ton or CY
Cover Coat Material Class _____ Load, Haul and Place _____	Ton or CY
Blotter _____	Ton or CY
Rejects _____	Ton or CY
___ Percent Anti-Stripping Additive for Surface Treatment _____	TOA
Approaches _____	Each
Brooming _____	mi or Hr

SECTION 405 - SUPERPAVE HOT MIX ASPHALT

405.01 Description. Construct one or more courses of Superpave Hot Mix Asphalt (HMA) plant mix, including leveling courses if applicable, on a prepared surface.

405.02 Materials. Provide Superpave HMA composed of a combination of aggregate, mineral filler (if required), Recycled Asphalt Pavement (if used), and performance graded (PG) asphalt binder material. Furnish a job mix formula (JMF) and a Superpave HMA pavement that complies with the requirements of Table 405.02-1.

Table 405.02-1 - Superpave Mixture Requirements

Mixture Type	SP2	SP3	SP5	SP6
Design ESALs ^a (millions)	< 1	1 -< 10	10 - < 30	≥ 30
Gyratory Compaction Gyrations for Nini	6	7	8	9
Gyrations for Ndes	50	75	100	125
Gyrations for Nmax	75	115	160	205
Relative Density, %Gmm@ Nini	≤ 90.5	≤89.0	≤89.0	≤89.0
Relative Density, %Gmm@ Ndes	96.0	96.0	96.0	96.0
Relative Density, %Gmm@ Nmax	≤98.0	≤98.0	≤98.0	≤98.0
Air Voids, %Va	4.0	4.0	4.0	4.0

Dust to Binder Ratio Range b	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2
Voids Filled with Asphalt (VFA)Range, c Percent	65-78	65-75d	65-75d	65-75d

^a The anticipated project traffic level expected on the design lane over a 20-year period. Regardless of the actual design life of the roadway, determine the design ESALs for 20 years.

^b For No. 4 nominal maximum size mixtures, the dust-to-binder ratio is 0.9 to 2.0. If the aggregate gradation passes beneath the PCS Control Point specified in 703.05, the allowable dust-to-binder ratio range may increase from 0.6 - 1.2 to 0.8 - 1.6.

^c For 1½ in nominal maximum size mixtures, the specified lower limit of the VFA is 64% for all design traffic levels.

^d For design traffic levels of > 3 million ESALS, ¾ in nominal maximum size mixtures, the specified VFA range is 73% to 76 % and for No. 4 nominal maximum size mixtures is 75% to 78%.

Use an approved anti-stripping additive in all mixtures Use a minimum one-half percent approved liquid anti-stripping additive by weight of asphalt or use lime as an anti-stripping additive. Determine the amount of liquid anti-stripping additive or lime required by performing stripping testing during the mix design development. If lime is used as an anti-stripping additive, the Department does not require liquid anti-stripping additive.

Recycled Asphalt Pavement (RAP). The Department will allow Recycled Asphalt Pavement (RAP) (also known as Reclaimed Asphalt Pavement), in the Superpave HMA. Provide RAP as specified in 720.07. Produce the mixture in accordance with 405.03.A when using RAP. Select the mass of RAP included in the mixture, the type of RAP used in the mixture, and the extent of RAP processing necessary to meet the specifications. The Department will not change the contract unit price if RAP is used in the mixture.

If RAP material is to be used from the project, obtain a representative sample of material for use in the mix design.

The mass of RAP used in Superpave HMA is the mass of asphalt binder, in percent, that the RAP contributes to the total mass of binder in the mixture.

1. *RAP Binder Percentages and Binder Grade Selection.* Determine the percentage of RAP used and the binder grade required to meet specifications. Select the

percentage of RAP used in the mix by determining the contribution of the RAP binder toward the total binder in the mix, by weight.

It may be necessary to use a softer virgin PG binder than is specified in the contract to compensate for the age hardened binder contributed by the RAP. Adjust the binder grade specified in the contract as needed to account for the stiffening effect of the aged binder in the RAP and that will result in a composite binder that meets the contract requirement. The method for determining the binder grade adjustment in Superpave HMA mixtures incorporating RAP is designated Level 1, Level 2 and Level 3 as shown in Table 405.02-2. Each level has a range of percentages that represent the contribution of the RAP binder toward the total binder, by weight.

Table 405.02-2 - Grade Adjustment for RAP usage

Level	RAP binder by weight of the total binder in the mixture, %	Binder Grade Adjustment to compensate for the stiffness of the asphalt binder in the RAP
1	0 to 17	No binder grade adjustment is made.
2	> 17 to 30	Unless otherwise shown on the plans, the selected binder grade adjustment for the binder grade specified on the plans is one grade lower for the high and the low temperatures designated. or; determine the asphalt binder grade adjustment as shown in Level 3.
3	>30	Determine the selected binder grade adjustment for the asphalt binder using a blending chart for high and low temperatures. Supply the blending chart and the RAP test data used in determining the binder selection to the Engineer

Table 405.02-3 identifies the typical binder grades used and the recommended binder grade adjustments for each binder grade at RAP level.

Table 405.02-3

	Level 1	Level 2	Level 3
Binder grade specified in contract	Adjusted Binder grade	Adjusted Binder grade	Adjusted Binder grade
58-28 58-34 64-28 64-34 70-28 76-28	No Adjustment is made	52-34 52-40 58-34 58-40 64-34 70-34	Use Blending Chart to select binder grade.

Use the following equation to determine the percent of RAP by weight of mix:

$$X\% = c\left(\frac{a}{b}\right)$$

- Where:
- a = optimum AC content, % in mixture to produce 4.0% air voids
 - b = % AC in the RAP (from chemical extraction and/or AASHTO T 308 burn)
 - c = percent of RAP binder by weight of the total binder desired in the mix
 - X = desired RAP percent by total weight of mix

The following is an example of the calculation:

Total RAP binder desired equals 17% of Total binder in the mixture.
 If RAP will contribute 5.1% AC and the optimum AC is 5.8% then:

$$X\% = 17\% * (5.8/5.1) = 19.3\%$$

Submittals. Submit virgin and RAP material for Bulk Dry Specific Gravity of Aggregate, Gsb determination for all classes of mix. For superpave mixtures designated as SP-2, the Department will not require HMA material samples to be submitted for mix design testing. Submit SP-2 mix designs for paper review only. For SP-2 submit a mix design that meets the requirements of 405.03.A, except for the material submittal requirement.

Provide materials as specified in:

Aggregate.....	703
Asphalt.....	702
Anti-Stripping Additive.....	702
Hydrated Lime.....	720.06

Test materials in accordance with the following applicable standard methods:

Particle Size Distribution of Aggregate	AASHTO T 27
<i>with</i>	
Materials Finer than 75um (No. 200) Sieve	
In Mineral Aggregate by Washing	AASHTO T 11
	Method A or B
Mechanical Analysis of Extracted Aggregate	AASHTO T 30
Preparing and Determining the Density of Hot-Mix-Asphalt (HMA)	
Specimens by Means of the Superpave Gyrotory Compactor.	AASHTO T312
Superpave Volumetric Design for Hot-Mix Asphalt (HMA)	AASHTO R 35
Determining the Percentage of Fracture in Coarse Aggregate	AASHTO T 335
	Method 1
Percent Air Voids in Compacted Dense	
and Open Bituminous Paving Mixtures	AASHTO T 269
Theoretical Maximum Specific Gravity and	
Density of Bituminous Paving Mixtures	AASHTO T 209
	Bowl Method
Bulk Specific Gravity of Compacted Bituminous	
Mixtures Using Saturated Surface Dry Specimens	AASHTO T 166
	Method A
Bulk Specific Gravity of Compacted Bituminous	
Mixtures Using paraffin-Coated Specimens	AASHTO T 275
Pavement Straightedge Procedures	Idaho IR-87
In Place Density of Bituminous Mixes Using the	
Nuclear Moisture-Density Gauge	WAQTC TM-8
	Backscatter mode
Determining Volume of Liquids in Horizontal or Vertical	
Storage Tanks	Idaho IT-120
Acceptance Test Strip for Hot Mix Asphalt (HMA) Pavement.....	Idaho IR-125
Standard Practice for Operating Inertial Profilers and	
Evaluating Pavement Profiles	AASHTO PP-50
Determining the Asphalt Binder Content	
of Hot Mix Asphalt (HMA) by the Ignition Method	FOP for AASHTO T 308
Sampling Bituminous Paving Mixtures	AASHTO T 168
	(See QA Manual Section 270 for sampling method)
Reducing Samples of Hot Mix Asphalt to Testing Size.....	AASHTO R 47
Moisture Content of Hot Mix Asphalt (HMA) by Oven Method ...	AASHTO T 329
Plastic Fines in Graded Aggregate and Soils By Use of the	
Sand Equivalent Test.....	AASHTO T 176
	Alternate Method #2, Mechanical, Prewet

Effect of Water on Cohesion of Compacted Bituminous Paving Mixtures (Immersion- Compression).....	AASHTO T 165
Uncompacted Void Content of Fine Aggregate, Method A.....	AASHTO T 304
Mixture Conditioning of Hot-Mix Asphalt (HMA).....	AASHTO R 30
Determining Rutting Susceptibility of Asphalt Pavement Mixture Using the Asphalt Pavement Analyzer (APA)	AASHTO T 340
Superpave Volumetric Mix Design	AASHTO M 323
Evaluation of the Superpave Gyratory Compactor (SGC)	
Internal angle of Gyration Using Simulated Loading.....	AASHTO TP 71
Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate	FOP for ASTM D4791 (ratio of length to thickness equal to or greater than 5:1)
Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method	AASHTO T 331
Standard Practice for Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus.....	ASTM D7227
Standard Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method	ASTM D6857
Specific Gravity and Absorption of Aggregate Using Automatic Vacuum Sealing Method	Idaho IT 144
Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.....	AASHTO T 164
Quantitative Extraction and Recovery of Asphalt Binder From Asphalt Mixtures	AASHTO T 319
Lime for Asphalt Mixtures.....	AASHTO T 303
Density of In-Place Hot Mix Asphalt (HMA) Pavement by Electronic Surface Contact Devices	FOP for AASHTO TP 68 Method C

405.03 Construction Requirements.

- A. Mix Design.** Develop a mix design, that includes the job mix formula (JMF), stamped by a Professional Engineer licensed in the state where the mix design was prepared. Use a qualified laboratory. The Department requires the mix design to be developed by an individual that is qualified by the Department as a Superpave Mix Design Technician.

Proportion the aggregate fractions to meet the grading and physical properties of the Engineer approved JMF.

The grade of asphalt is specified on the plans. The Contractor may choose to use a PG binder that is equal to or one grade higher on the high temperature side and that is equal to or one grade lower on the low temperature side than is specified and that produces a mixture that meets all contract requirements at no additional cost to the Department. Select the grade, brand, and source of asphalt and additives to be in the project, in the JMF. The Contractor may need to adjust the virgin asphalt PG binder grade used in the mix in order to achieve the PG binder grade called for on the plans when RAP is used.

The JMF represents the aggregate grading and optimum asphalt binder content that produces the desired mix criteria in the laboratory. Specify a single aggregate gradation, the optimal asphalt content, the theoretical maximum specific gravity, G_{mm} , and the bulk specific gravity, G_{mb} , of a specimen compacted to N_{design} . Select the optimum asphalt binder content as the asphalt binder content that results in 4.0 percent air voids at N_{design} . Provide a recommended temperature range from the asphalt binder supplier at which the mixture will be mixed and compacted for Superpave testing in accordance with the requirements of AASHTO R 35. Compact G_{mb} specimens at the recommended mixing and compaction temperatures of the PG binder shown on the plans, regardless of RAP percentage used.

Establish a single percentage of aggregate passing the following sieve sizes: 2", 1½", 1", ¾", ½", ⅜", No. 4, No. 8, No.16, No. 30, No. 50, No. 100, and No. 200 from the JMF. Report the sieve results to the nearest whole number except for the No. 200. Report the No. 200 to the nearest tenth. Ensure the single percentage passing as shown on the proposed JMF grading is within the minimum and maximum control points specified in 703.05.

Design Superpave mixes in accordance with the requirements of AASHTO R 35. Have the equipment specified in AASHTO T 312 and a Department qualified Superpave Mix Design Technician available. Provide the Brand and Model Number of the Superpave Gyrotory Compactor (SGC) to the Engineer. Use a SGC that meets the requirements of AASHTO T 312 and AASHTO TP 71 (internal angle $1.16^{\circ} \pm 0.02^{\circ}$). Provide Superpave mixes that comply with the gradation requirements of 703.05.

Condition the Superpave mixes in accordance with AASHTO R 30 except modify Section 7.1.2 so the compaction temperature range is as recommended by the asphalt binder supplier.

Compact the design mixture in accordance with AASHTO T 312 except modify Section 8.7.1 so the compaction temperature is determined by the mix designer and is used for AASHTO T 312 testing. The number of gyrations used is defined in Table 405.02-1 for the type of mix specified.

The Department will determine the bulk dry specific gravity of aggregate, G_{sb} , apparent specific gravity of aggregate, G_{sa} , and water absorption (by % weight of dry aggregate) of the coarse and fine aggregate used in the mixture using AASHTO T-85 and Idaho IT-144. The Engineer will evaluate the RAP G_{sb} , if used, using the RAP G_{se} . The Contractor and Department shall use the following procedure to determine these values as follows:

Determine a tentative trial aggregate blend from the stockpiles and provide 25 lb of blended aggregate and 25 lb of RAP to the Engineer for G_{sb} testing. Provide the Asphalt Binder/Aggregate Correlation factor for asphalt binder and gradation for each RAP stockpile. A Contractor's representative may be present during the G_{sb} testing to ensure a value that both the Department and the Contractor can agree upon, if requested. Use the established G_{sb} in the mix design calculation and report and for production paving testing. The Engineer will use the established G_{sb} during the mix confirmation process, acceptance test strip testing and verification testing. Allow the Engineer three business days for testing.

Design and compact the mixture at the N_{design} gyrations specified in Table 405.02-1. Use a 4.0 percent design air void content at the design number of gyrations (N_{design}) for mixtures as shown in Table 405.02-1. Verify N_{max} as part of the design process by compaction of at least two specimens at the design asphalt content to N_{max} to ensure the number of gyrations required in Table 405.02-1 does not produce a mixture that exceeds the relative density given in Table 405.02-1.

Ensure the Voids in the Mineral Aggregate (VMA) of the mixture during design, is at least 0.3 percent greater than the minimum value specified in 703.05 when the mixture is compacted to N_{design} . The Engineer will not accept mix designs that do not meet this criterion. Ensure the VMA of the mixture meets the specification as shown in 703.05 during production. Calculate VMA in accordance with the procedures specified in Section 260 of the department's Quality Assurance Manual.

Ensure the Voids Filled with Asphalt (VFA) criteria of the mixture is as shown in Table 405.02-1 at the design number of gyrations during design and production.

Calculate VFA in accordance with the procedures specified in Section 260 of the Department's Quality Assurance Manual.

Meet the Dust to Binder Ratio requirements in Table 405.02-1. The Dust-to-Binder Ratio or Dust Proportion (DP) is, by mass, the ratio between the percent of aggregates passing the No. 200 sieve and the effective binder content. Calculate the effective binder content in accordance with the procedures outlined in Section 260 of the department's Quality Assurance Manual.

Ensure the Superpave HMA mixture has an Index of Retained Strength (Immersion Compression) of 85 percent or more when tested in accordance with AASHTO T 165, using a minimum of one-half percent anti-strip additive or a determined mass of hydrated lime.

Perform Asphalt Pavement Analyzer (APA) testing on SP5 and SP6 mixtures. Test in accordance with AASHTO TP 63. Do not exceed a 0.2 in maximum rut depth in the tested mixture.

Perform three aggregate gradation trial blends at a single asphalt content that achieves a laboratory air void content of 3.0 percent to 5.0 percent in accordance with AASHTO R35. Include additional minus No. 200 material in each blend to account for aggregate breakdown during production or describe in the mix design the method(s) used to maintain the minus No. 200 target value throughout the project.

Determine the aggregate gradation in the asphalt mixture by an ignition burn of the asphalt mixture from a laboratory prepared sample. Batch the laboratory sample on the basis of component percentages as shown on the proposed JMF gradation. Obtain the aggregate in accordance with the requirements of FOP for AASHTO T 308. Report the sieves specified in this subsection, beginning with the maximum size for the mix.

Conduct testing during the mix design to identify hot mix aggregate subject to breakdown in the ignition furnace. Report the aggregate gradation correction factors, determined in accordance with FOP for AASHTO T 308, for specification sieves in the mix design. Apply aggregate gradation correction factors to the specification sieves when determining compliance with specifications only when breakdown was determined and reported in the mix design.

Provide four correction factor samples produced by the laboratory producing the mix design, at the design asphalt binder content, for each ignition furnace to be used on the project for mix design confirmation, acceptance, verification and dispute resolution testing. Prepare 16 correction factor samples at the same

time in accordance with FOP for AASHTO T 308. Submit 12 correction factor samples to the Engineer when submitting mix design confirmation materials and samples.

Per FOP for AASHTO T 308, each ignition furnace to be used on the project requires a unique asphalt binder correction factor determined using aggregate produced for the project. Determine the asphalt binder correction factor for each furnace where project testing will be performed.

Mix Design Documentation and Test Results. For each job mix formula submitted to the Engineer, include the following:

1. The name(s) of who is responsible for quality control of the mixture during production of the mix design. The name(s) of who is responsible for developing the mix design and the name(s) of who performed the tests.
2. Gradation data for each aggregate component of three trial blends. Include additional minus No. 200 material to account for aggregate breakdown during production. Label this item 'Breakdown' on the mix design sheet. Describe in detail in the mix design the method(s) used to maintain the minus No. 200 target value throughout the project if other mitigation methods are used. Show percent passing for the following sieves: 2", 1½", 1", ¾", ½", ⅜", No. 4, No. 8, No.16, No. 30, No. 50, No. 100, and No. 200. Report grading to the nearest one percent except for the No. 200 sieve. Report the No. 200 sieve to the nearest tenth of a percent.
3. The source, source number, and materials description (i.e. quarried or gravel), used. The proportion of each aggregate (in percent of total aggregate) from each source, and include the specified RAP records.
4. The design ESAL's when specified.
5. The composite washed gradation based on (2) and (3) above.
6. The bulk (dry), Gsb, and apparent, Gsa, specific gravities and water absorption (by percent weight of dry aggregate) of both coarse and fine aggregate for each aggregate component or for the total aggregates used in the mixture. Attach the Department documentation for Gsb determination.

NOTE: The Department will determine these values by using AASHTO T 85 and Idaho IT 144 and provide them to the Contractor. RAP Gsb, when used, will be calculated using the RAP Gse.

7. The composite gradation plotted on a 0.45 power chart.

8. The PG binder grade and percentage (in units of 0.1 percent) of asphalt binder material to be added based upon the total mass of the mixture. When RAP is used, report the adjusted virgin asphalt PG binder grade and the percentage (in units of 0.1 percent) of virgin asphalt binder material to be added based upon the total mass of the mixture in order to achieve the PG binder grade specified.
9. The design traffic level and the initial, design, and maximum number of gyrations $N_{initial}$, N_{design} , and $N_{maximum}$.
10. Report the value of the theoretical maximum specific gravity, G_{mm} and bulk specific gravity, G_{mb} of the asphalt mixture to 3 decimal places. Report Optimum Asphalt Content, Air Voids, and VMA to the nearest tenth and report VFA to the nearest whole number.
11. Plot at least four different asphalt binder contents (minimum 0.5 percent between each point), so there is at least one point above and one point below the estimated asphalt binder percentage. Pick the optimum asphalt binder content at 4.0 percent air voids from the plotted curve. Run one trial at the optimum AC binder content to verify the specimen values match the values from the curve.
12. The theoretical maximum specific gravity, G_{mm} , at each asphalt binder content. Use the G_{mm} for percent air voids determination and use the procedures outlined in Section 260 of the department's Quality Assurance Manual.
13. The test results for the individual and average bulk specific gravity, density, and heights, of at least two specimens at each asphalt binder content.
14. The percent air voids in the mixture at each asphalt binder content.
15. The percent VMA at each asphalt binder content.
16. Dust to binder ratio calculated to the nearest 0.1 percent at each asphalt binder content.
17. The Immersion-Compression results at the optimum asphalt binder content.
18. Ignition oven calibration data according to FOP for AASHTO T 308, including specimen burn temperature.
19. Graphs showing air voids, VMA, VFA, G_{mb} and G_{mm} , vs. percent asphalt

binder content for each of the asphalt binder contents submitted with trial mix.

20. The test results from the composite aggregate blend at the proposed JMF proportions indicating compliance with the Percentage of Fracture in Coarse Aggregate, Fine Aggregate Angularity, Sand Equivalent, and Flat and Elongated as shown in Table 405.02-1. When RAP is used, report the Percentage of Fracture in Coarse Aggregate and Flat and Elongated of the composite blend including RAP. Test Fine Aggregate Angularity and Sand Equivalent on the composite aggregate blend at the proposed JMF proportion without the RAP proportion.
21. Provide Laboratory mixing and compaction temperature ranges and field mixing and compaction temperature ranges by the asphalt binder supplier.
22. Label gyratory compaction tables and curves, generated by the gyratory compactor, from the trial blend.

Material and Sample Submittals. Submit the following materials and samples to the Engineer, when applicable:

1. A 50 pound uncompacted asphalt mix sample that complies with the JMF.
2. Six Gyratory briquettes compacted to Ndesign and in compliance with the JMF. Determine V_a of each specimen and clearly label the air void content (for SP5 and SP6 only).
3. Six individually packaged specimens fabricated in accordance with AASHTO T 165 except do not add the binder. Provide enough binder without anti-strip added and anti-strip additive to make six test specimens. Include enough aggregate, binder, and anti-strip additive for a “buttering batch”. The Department will prepare test specimens from the material and perform testing in accordance with AASHTO T 165.
4. A 25 lb minimum sample of the combined coarse and fine aggregate to be used for Gsb testing.
5. A 25 lb minimum sample of the RAP to be used along with the RAP stockpile records and test data.
6. One-thousand gram sample of other mineral admixtures, such as lime or fly ash, when used.

The Department will use these samples for laboratory examination, “Materials” properties evaluation, and to perform AASHTO T 340, “Determining Rutting

Susceptibility of Asphalt Pavement Mixture Using the Asphalt Pavement Analyzer (APA) on the specimens for mix design confirmation. The APA specimens must have an air void content of from 3.0 percent to 5.0 percent

The Engineer will provide the Contractor with a confirmation or rejection of the mix design five working days after receiving the job-mix formula and materials. Rejection of the mix design will require an additional five working days for re-evaluation. Additional materials and a new mix design may be required from the Contractor. Obtain Department confirmation of the Contractor's mix design before beginning acceptance test strip placement.

Previously Used Mix Designs. The Contractor may use a mix design that includes the JMF that was previously confirmed by the Department and used on other projects and meets the requirements of this subsection. When the Contractor makes slight adjustments in accordance with 405.03-H, to the asphalt content and gradation of an approved JMF during an acceptance test strip, the JMF becomes the Contractor-Job Mix Formula, (C-JMF), for the project.

A C-JMF from a previously used mixed design becomes the JMF for the project when the submittal package is approved.

Prepare a submittal that includes:

1. The original approved mix design that includes the confirmed JMF from the previous project;
2. adjustments made to the JMF that make it the C-JMF;
3. adjustments made to the C-JMF during production;
4. documentation supporting these adjustments.
5. Current Stockpile Quality Control testing that includes the following to confirm the material in stockpile is similar to the material used for the original mix design, including RAP:
 - a. Sieve analysis on the stockpiles to be used, including crusher control charts;
 - b. coarse and fine aggregate specific gravities and absorptions, (Performed by ITD).

Note: Previously used mix designs that are used during the calendar year of confirmation may omit Step 5 if the stockpiles consist of the crushed material, including RAP, from the original mix design. Previously used mix

designs that more than one calendar year has elapsed from the time of confirmation must include Step 5.

6. Ignition furnace correction factors in accordance with this subsection using the asphalt content and gradation of the proposed JMF:
 - a. Asphalt binder content correction factor per FOP for AASHTO T-308;
 - b. aggregate gradation correction factors per FOP for AASHTO T-308.

All previously used mix designs submitted by the Contractor must be forwarded to Central Laboratory for review and recommendation. To be considered acceptable as a previously used mix design, the asphalt content, type, grade, aggregate materials, gradation, and anti-strip rate, type and grade must be the same as previously approved. The decision to accept or reject a previously used mix design rests solely with the Central Laboratory.

Non-Structural and Temporary Superpave HMA. Non-structural Superpave HMA refers to paving applications that are out of trafficked areas, such as behind guardrails, gore areas, raised medians, asphalt curbs and other non-critical, non-traffic load applications. Temporary Superpave HMA refers to pavement that will be removed before the end of the project such as detours or pavement used in construction staging. Temporary Superpave HMA is not for permanent use. Remove temporary Superpave HMA before project completion. The Department considers Removal of Temporary Superpave HMA incidental and the costs included in the Superpave HMA contract pay item unless otherwise specified.

For pavement designated in the contract as Non-Structural (NS), or Temporary (T), the class of Superpave HMA mix will be identified in the bid schedule with the initials NS or T respectively. For example: SP-NS is Superpave HMA not in the travelled way and can be any class of Superpave HMA; SP-T is Superpave HMA used for temporary pavement that must be removed before completion of the project. Superpave HMA for temporary pavement may have a class of mix designated in the plans, depending on the intended use of the pavement.

The Department will not require materials and samples to be submitted for mix design confirmation testing for mixtures designated as NS or T. Submit mix designs to the Engineer for paper review only.

Mix Design Tolerance. The Engineer will apply the tolerances as shown in Table 405.03-1 to the Department's test results when evaluating the job mix formula. If the Department's test results are within the established tolerances and control points established in 703.05, the job mix formula will be confirmed

by the Engineer. The Contractor has the option to proceed to the acceptance test strip or submit another job mix formula for examination and evaluation.

Table 405.03-1 - Quality Tolerance

Quality Characteristic	Tolerance
Gradation	
No.4 sieve and larger sieves, %	JMF value \pm 6.0*
No. 8 to No. 30 sieves, %	JMF value \pm 5.0*
No. 50 to No. 100 sieves, %	JMF value \pm 4.0*
No. 200 sieve and smaller sieves, %	JMF value \pm 2.0*
Laboratory Air Voids, %	4.0 \pm 1.5
VMA, %	703.05 minimum value - 1.0
Asphalt Binder Content, %	JMF value \pm 0.4
Dust Proportion (DP)	Table 405.02-1 range \pm 0.1
VFA	See Section 260.04 of QA manual
Immersion Compression	See Section 260.04 of QA manual
Gmm, Gmb, Gsb	See Section 260.04 of QA manual

* in no case shall the upper and lower specification limits be outside the control points specified in 703.05

- B. Weather Limitations for Permanent Paving.** Do not place Superpave HMA on a wet or frozen surface or when weather or surface conditions will otherwise prevent the proper handling or finishing of the Superpave HMA material. Place Superpave HMA in accordance with the temperature limitations shown in Table 405.03-2.

Table 405.03-2 - Air And Surface Temperature Limitations

Compacted Thickness of Individual Courses	Top Course	Leveling and Courses Below the Top Course
Less than 0.10 ft	60 °F	50 °F
0.10 to 0.18 ft.	50 °F	40 °F
Over 0.18 ft.	40 °F	40 °F

Provide a paved surface for travel if the project should extend into the winter. Do not start construction on the pavement surface unless the progress schedule realistically shows that the pavement can be replaced or completed within the temperature limitations listed above.

C. Mixing Plants. Use mixing plants capable of producing a uniform mixture and that comply with the following requirements:

1. *Plant Scales.* Provide plant and truck scales that comply with 109.01.
2. *Asphalt Storage.* Provide asphalt storage tanks to heat and hold the materials at the required temperatures. Store and introduce the asphalt into the mix at the supplier recommended temperatures. Submit the supplier's recommendations to the Engineer.

Accomplish heating so that the flame is not in contact with the tank. Design the storage system for the asphalt to assure proper and continuous circulation during the operating period. Install the tank level and provide to the Engineer a calibrated measuring rod, or other Engineer approved measuring device. Make provisions for measuring and sampling contents of the storage tanks.

3. *Feeder.* Equip plants with accurate mechanical means for uniformly feeding the aggregate into the dryer. When multiple stockpiles are required, ensure the RAP and virgin cold aggregate feed equipment is capable of providing accurate metering of individual stockpiles into the mix.

Determine the moisture content of the virgin aggregates and RAP daily during production, or as necessary, and record the moisture test results. Provide equipment that electronically injects the determined moisture content of the cold feed materials (RAP and virgin aggregates) into the belt weighing systems and automatically corrects wet material weights to dry material weights.

Provide positive weight control and monitoring of the aggregate feed and interlock the RAP cold feed rate and virgin aggregate cold feed rate by use of a conveyor scale or other Engineer approved device. Weigh the material to within 0.5 percent of the intended quantity. Provide a feed system capable of rapid adjustment to maintain a consistent and uniform flow throughout the range of its calibration. Accurately proportion the aggregate through control gates from each compartment. Provide positive mechanical means to adjust one dimension of the rectangular gate. Do not screen or proportion after cold feed blending.

When RAP is used, use a scalping screen or other Engineer approved device installed ahead of any weight system to ensure that no RAP agglomerates larger than 2 inches are fed into the mixing plant.

Introduce RAP into the mixing plant at a location far enough down-stream from the burner to be away from the flame and extremely hot gases.

Provide to the Engineer the following mixing plant information:

- Dry virgin aggregate rate in tons per hour,
- dry RAP rate in tons per hour,
- binder in tons per hour,
- total virgin aggregates, RAP and binder in tons per hour.

Print the mixing plant information on a ticket at an Engineer approved time interval and submit tickets at the end of each day's production.

4. *Dryer/Mixer.* Continuously agitate the aggregates during the heating and drying process in a dryer that is capable of meeting the aggregate moisture requirements of 405.03.F Equip dryers with automatic burner controls.

Include a mixer that may be part of the dryer or a separate unit that is capable of adequate mixing. Operate the plant only within the range of calibration.

5. *Asphalt Control Unit.* Interconnect the asphalt control unit with the aggregate feed control so that it is capable of delivering asphalt to the mix within ± 0.2 percent of the intended quantity throughout the range of plant operation. Provide satisfactory means, by weighing or metering, for obtaining the quantity of asphalt delivered.
6. *Thermometric Equipment.* Provide adequate continuous thermometric recording equipment to indicate, at a minimum, the temperature of the asphalt in the storage tank, and temperature of the heated material after leaving the dryer or pug mill.
7. *Sampling Devices.* Equip crushing, screening and mixing plants with Engineer approved sampling equipment operable from the ground or a platform. Construct and operate the device so that it will move at a constant rate across the full width of the falling column of material from the discharge belt or chute. Construct the sampling equipment so that a representative sample can be taken and conveyed to the ground by a

means of a slide, chute, or other means where the sampled material can be safely and conveniently collected.

Provide a sampling device on the mixing plant's asphalt binder tank injection line and sample the asphalt binder in accordance with the department's Quality Assurance Manual.

8. *Discharge Hopper.* Equip the plant with a discharge hopper having dump gates that will permit rapid and complete discharge of the mixture.
9. *Hot Storage.* Provide continuous mix plants with sufficient hot storage capacity to ensure continuous plant operation. Do not remove material below the top level of the cone of the hot storage silo except at the end of the day's production.
10. *Plant Calibration.* Calibrate plants for accuracy requirements.

D. Hauling Equipment. Provide trucks used for hauling Superpave HMA materials that have tight, clean, smooth, metal bodies equipped with a positive locking metal gate. When necessary, cover each truck with a canvas or other suitable material to protect the mixture from the weather. The Contractor may apply a release agent, suitable for its intended use, to truck beds. After application, drain the truck bed. Do not use fuel oil or other petroleum oils as a release agent.

Provide an adequate platform to enable safe sampling when sampling from truck transports. Sample in accordance with WAQTC FOP for AASHTO T 168.

E. Paver. Provide a self-propelled paver equipped with an activated and heated vibratory screed. Activate screed extensions and heat vibratory screeds, except for minor shoulder widening not exceeding 1 foot and produce a pavement equal to that produced by the remainder of the screed. Equip the paver with a receiving hopper having sufficient capacity for a uniform spreading operation. Equip the hopper with a distribution system to place the mixture uniformly in front of the screed.

Provide extended screeds with corresponding auger and tunnel extensions to ensure a uniform head of fresh material across the entire screed. Install reverse screw augers with a minimum efficiency of 75 percent at the gear box for paving activities. Ensure equipment manuals for the paver and screed are continuously on the project for the operator's and Engineer's reference.

The Contractor may use alternate paver configurations provided they comply with the manufacturer's recommendations and can be demonstrated to produce

an acceptable pavement. The alternate configuration must be accepted in writing by the Engineer before use on the project.

Equip the screed with automatic controls that will make adjustments in both transverse and longitudinal directions. Provide a sensing device that is adaptable to picking up grade information from a string line, rail, ski, laser or other Engineer approved method. Operate the paver at a speed consistent with the delivery of Superpave HMA to provide a smooth uniform travel with the paver stopping only under unusual circumstances. Provide a paver (including when screed extensions are used) capable of producing a smooth uniform texture, dense joints and a smooth riding surface. Provide enough trucks to maintain a continuous paving operation.

- F. Mixing.** Do not exceed the control point upper and lower specification limits specified in Table 703.05-2 when applying the applicable tolerances to the acceptance test strip JMF or Contractor-Job Mix Formula (C-JMF) for Superpave HMA.

Do not exceed 0.3 percent moisture content in the mixture at the time of placement when tested by AASHTO T 329.

Mix material with the range specified in 405.03.A.2

- G. Superpave HMA Paving Plan.** Immediately before paving, the Contractor, the asphalt supplier, the Engineer, and the Department personnel involved in the paving operation will hold a pre-operational paving meeting to discuss the means that will achieve the highest quality surface.

Before the pre-operational paving meeting, submit a Superpave HMA paving plan to the Engineer. Tailor the plan to the asphalt to be supplied, the anticipated JMF, and the Contractor's equipment and operation. Include at least the following:

- Breakdown, intermediate, and finish rollers to be used
- Static or vibratory rolling for breakdown and intermediate rolling
- Frequency, amplitude, force/impact, and roller velocity for vibratory rolling
- Proximity of breakdown roller to paver with respect to horizontal displacement
- Proximity of intermediate roller to breakdown roller
- Compaction temperatures for breakdown, intermediate, and finish rolling
- Adjustments to paving/compaction operation with respect to temperature,

amplitude, frequency, lift thickness, gradation, force/impact, and roller velocity

- Rubber tired rolling with respect to pickup of pavement material
- Paving equipment and preheating and vibratory settings of the screed
- Coordination of plant production and paving operations; climate, haul distance
- Surface and air temperatures anticipated during production
- Temperature necessary to allow public traffic onto the new pavement surface
- Anticipated traffic control issues as necessary
- Additional equipment required
- Inspection, sampling and testing requirements
- Other paving issues as necessary

H. Acceptance Test Strip. Construct an acceptance test strip, in accordance with Idaho IR125. Construct one test section of the acceptance test strip using the JMF. The Department does not require acceptance test strips on projects less than one lane mile in length or for leveling courses, non-structural pavement, or temporary pavement. Lane miles are the length (in miles) multiplied by the number of travel lanes.

Construct the acceptance test strip to the same placement width and thickness as the course it represents. Perform additional acceptance test strip(s), at no additional cost to the Department, if aggregate or asphalt binder sources change or the JMF changes.

The Contractor may elect to construct additional test sections. Submit the selected changes for each additional test section to the Engineer in writing.

The Department will not make separate payment for construction, sampling or testing of the initial acceptance test strip or any additional test strips.

Obtain three mix samples from each test section in accordance with Idaho IR-125, in the presence of the Engineer. Place portions totaling at least 80 lb of mix for each mix sample in multiple 9 in x 9 in x 9 in cardboard storage containers that comply with Subsection 220.1 of the Department's Quality Assurance Manual. Properly identify the containers and immediately submit to the Engineer. The Department will combine the portions making up the samples

and split each 80 lb mix sample at the Department's testing laboratory in accordance with AASHTO R47, with half tested for acceptance and half retained for dispute resolution. See Table 405.03-3 for sampling and testing requirements.

Obtain three cold feed aggregate sample increments and immediately submit them to the Engineer for testing. See Table 405.03-3 for sampling and testing requirements. Make available at the mixing plant aggregate gradation test results and running averages of stockpiles developed before the acceptance test strip.

Obtain three RAP sample increments from the RAP feed belt, totaling at least a 50 lb sample, and immediately submit them to the Engineer for testing when RAP is used. See Table 405.03-3 for sampling and testing requirements.

Obtain five randomly located core samples from the compacted Superpave HMA placed in each test section, in accordance with Idaho IR125. The Engineer will observe the core sampling. Immediately submit the cores to the Engineer for testing to determine the density of the compacted acceptance test strip and to determine the density correction factors for density equipment. The Department will determine core densities in accordance with AASHTO T 166, Method A or AASHTO T 331. The Department may use ASTM D7227 to dry the cores. The Department will determine density correction factors for density equipment in accordance with WAQTC TM-8 or FOP for AASHTO TP 68.

The Department will require seventy-two hours from the time of receipt of Superpave HMA mix samples and core samples to perform acceptance testing. Time will begin when the Engineer is in possession of the required samples and associated paperwork needed to perform the specified testing.

The Engineer will allow off-site acceptance test strips when performed in accordance with Idaho IR125.

When off-site test strips are constructed, provide samples, as specified, to the Engineer. The Department will require seventy-two hours from the time of receipt of Superpave HMA mix samples and cold feed samples to perform volumetric and aggregate acceptance testing. After approval of volumetrics, construct a density test strip on the prepared roadway of the project not exceeding 1000 feet in length. Obtain 5 randomly located core samples as specified for on-site test strips. The Engineer will not require volumetric testing during the density test strip.

The Department will require forty-eight hours from the time of receipt of cores to perform density acceptance testing. Time will begin when the Engineer is in

possession of all of the required samples and associated paperwork needed to perform the specified testing.

Repair deficiencies created by the coring operation at no additional cost to the Department. Obtain the Engineer's approval of repair methods and materials before beginning coring.

The Engineer will base test strip acceptance on the requirements of Table 405.03-3. Do not begin production paving until properties of the acceptance test strip are accepted.

**Table 405.03-3
Superpave Acceptance Test Strip Testing Requirements**

Material	Quality Characteristic	Test Method	Number of Tests	Point of Sampling & Method	Sampled By	Tested By
Compacted Pavement	Density (Cores) ^b	AASHTO T166 Method A or T275 or T331	Per Section H Acceptance Test Strip	Roadway	Contractor	State
Mix	Asphalt Content ^e	AASHTO T308	One per Test Section (average of 3 samples)	AASHTO T168 (See QA Manual Section 270) (three random samples; locations determined)	Contractor	State
	Gradation ^c	AASHTO T30				
Material	Quality Characteristic	Test Method	Number of Tests	Point of Sampling & Method	Sampled By	Tested By
	Air Voids, VMA, VFA, Dust to Binder Ratio ^a	AASHTO T312; AASHTO T166 Method A or T275 or T331; AASHTO T269				
	Rice Gravity	AASHTO T 209 or ASTM D6857				

	Asphalt Pavement Analyzer ^f	AASHTO T 340				
	Moisture Content	AASHTO T 329				
Aggregate ^d	Fracture ^g	AASHTO T335 Method 1	One per Test Strip (test combination of 3 increments)	Cold Feed AASHTO T2 (three random increments) ^g	Contractor	State
	FAA ^g	AASHTO T304 (Method A)				
	F&E ^g	FOP for ASTM D4791				
	Sand Equivalent	AASHTO T176 (Alt. Method 2, Mechanical)				

Notes:

^a The average test results from the Superpave HMA samples for each test section must meet the requirements of Table 405.03-4, (the immersion compression test will not be required by the Department).

^b The average density of the cores for each test strip must be no greater than 96.0 percent and no less than 92.0 percent of the Maximum Theoretical Density as determined by AASHTO T 209 or ASTM D6857. The Gmm value to be used for each test strip is the average Gmm calculated from each test section of the acceptance test strip.

^c The average AASHTO T 30 gradation of three randomly selected mix samples must meet the gradation requirements of Table 405.03-4, for each individual test section.

^d The test results from combining three cold feed aggregate samples must meet the requirements of Table 405.02-1 for "Coarse Aggregate fracture face," "flat and elongated," "uncompacted void content of fine aggregate," and "sand equivalent." No tolerance is allowed. The Combined dry Specific Gravity of the Coarse and Fine Aggregate G_{sb}, is the value determined for the approved job mix formula.

^e The average asphalt binder content for each test section must meet the requirements of Table 405.03-4.

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^f Samples tested in accordance with AASHTO T 340 (asphalt pavement analyzer) must meet the requirements of 405.03.A.

^g If RAP is used, the Department will remove the asphalt from the RAP sample by means of ignition furnace. The extracted RAP aggregate will be proportionately combined according to the JMF with the virgin aggregate and tested in "d." except the FAA, Sand Equivalent, and Flat and Elongated tests will not be performed on the combined material.

Acceptance Test Strip Tolerance. The Engineer will apply the following tolerances to the Acceptance Test Strip test properties specified in Table 405.03-4.

Table 405.03-4 - Acceptance Test Strip Tolerance

Quality Characteristic	Tolerance
SP 2 mixtures	
VMA, %	None allowed
Laboratory Air Voids, %	4.0 ± 1.0
Asphalt Binder Content, %	JMF value ± 0.4
Dust Proportion (DP)	Table 405.02-1 range ± 0.1
VFA, %	Table 405.02-1 range ± 5
No.4 sieve and larger sieves, %	JMF value ± 6.0 *
No. 8 to No. 30 sieves, %	JMF value ± 5.0 *
No. 50 to No. 100 sieves, %	JMF value ± 4.0 *
No. 200 sieve and smaller sieves, %	JMF value ± 2.0 *
Density	None allowed
SP 3 – SP6 mixtures	
VMA, %	703.05 minimum value – 0.3
Laboratory Air Voids, %	4.0 ± 1.5
Asphalt Binder Content, %	Selected asphalt content ± 0.4
Dust Proportion (DP)	Table 405.02-1 range ± 0.1
VFA, %	Table 405.02-1 range ± 5

No.4 sieve and larger sieves, %	JMF value \pm 6.0*
No. 8 to No. 30 sieves, %	JMF value \pm 5.0*
No. 50 to No. 100 sieves, %	JMF value \pm 4.0*
No. 200 sieve and smaller sieves, %	JMF value \pm 2.0*
Density	92.0 – 0.3 to 96.0+0.3

* in no case shall the upper and lower specification limits be outside the control points specified in 703.05

If the Department's average test results for each characteristic fall within the tolerances provided, the acceptance test strip will be considered acceptable by the Engineer and the Contractor may proceed to production paving. Meet specification requirements when production paving begins.

The Contractor may place a new acceptance test strip or provide a new mix design to achieve specification requirements instead of proceeding, when test results fall outside the specification limits and within the tolerance limits.

If the Department's test results fall outside the tolerances provided, the Engineer will consider the acceptance test strip unacceptable and the Engineer will not allow the Contractor to proceed to production paving. The Engineer will reject an unacceptable test section for SP 3 – 6 mixtures and require removal. The Department will not pay for the removal or the applicable contract pay item quantities. An unacceptable test section for SP 2 mixtures will be subject to rejection by the Engineer. If the Engineer determines the failed SP 2 test section may remain in place, the Contractor may leave the test section in place with a 50 percent reduction in price or remove the failed material and replace it with acceptable material and receive full payment. Remove the failed SP 2 test section if rejected by the Engineer. The Department will not pay for removal or for the applicable contract pay item quantities.

If the Contractor is unable to meet the contract requirements, the Engineer may require a new mix design that meets contract specifications. Place a new acceptance test strip at no additional cost to the Department.

If the Contractor's testing determines the test strip fails, and the Contractor chooses to proceed with another test strip before receiving the Engineers results, the Engineer will complete testing of the test strip in question and report the results before accepting material from the next test strip for evaluation.

Obtain the Engineers test section acceptance before starting production paving.

After acceptance, the Department will pay for Superpave HMA Pavement and Asphalt Binder in the test strip under their respective contract pay items.

The Engineer will allow slight adjustments to the JMF to obtain the desired air voids, density, uniformity and constructability for SP-3 thru 6 mixes. The Contractor may make slight adjustments to the asphalt content and gradation of the JMF of an approved acceptance test strip. If no adjustments are required, or when the Contractor's adjustments to the JMF are used, the approved JMF will become the C-JMF. For SP-2 mixes the Contractor may select the asphalt content and gradation of a passing test section within the test strip as the C-JMF.

Submit the C-JMF intended for use during production paving in writing to the Engineer. Use the C-JMF to establish target values when producing control charts during production paving. Use the C-JMF to establish asphalt content and gradation target values for SP-2 mixes.

- I. **Tack Coat.** Apply an asphalt tack coat to the following surfaces in accordance with 401:
 1. Existing plant mix surfaces and to the surface of each course constructed, except the final course.
 2. Paint or spray a thin, uniform tack coat of asphalt before placing pavement against the surfaces of curbing, gutters, manholes, Portland cement pavement, and other structures.
 3. Contact surfaces of transverse joints and cold longitudinal joints just before additional mixture is placed against previously laid material.
- J. **Production Paving.** The Contractor may request to begin production paving in accordance with the C-JMF after the Engineer approves the acceptance test strip. Superpave HMA paving acceptance is based on the requirements in Table 106.03-1, "Material Subject to Statistical Based Acceptance" of the Quality Assurance Special Provision.
 1. Documentation (Records). Maintain documentation, including test summary sheets and control charts, on an ongoing basis. Maintain a file of gyratory specimen heights for gyratory compacted samples and test worksheets. The Department encourages the Contractor to electronically record the gyratory compactor data. File reports, records, and diaries developed during the progress of construction activities

as directed by the Engineer. These will become the property of the Department.

- a. Number test results in accordance with Department procedures and record on forms approved or supplied by the Engineer.
- b. Deliver production test results on test summary sheets to the Engineer, by 11 AM of the day following production unless otherwise directed.
- c. Include the following production test results and mixture information on a Department approved test summary sheet.
 - (1) Percent passing on sieves listed in 703.05.
 - (2) Theoretical maximum specific gravity, Gmm.
 - (3) Bulk specific gravity, Gmb at Ndes.
 - (4) Percent asphalt binder content (Pb).
 - (5) Calculated production air voids (Va).
 - (6) Calculated Voids in Mineral Aggregate (VMA) and Voids Filled With Asphalt (VFA).
 - (7) Aggregate proportions in use at the time of sampling.
 - (8) Tons of mix that were inspected, sampled, and tested.
 - (9) Cumulative tons of mix.
 - (10) Dust to Binder Ratio.
 - (11) Signature Location for ITD and Contractor representative.
 - (12) Mixture moisture content.
 - (13) Department test result. (Provide when available).
- d. Submit copies of failing test results to the Engineer daily.
- e. Provide the Engineer with asphalt loading certificates daily.
- f. Provide a daily plant diary to include a description of quality control actions taken (e.g. adjustment of cold feed percentages) and include changes or adjustments on the test summary sheets.
- g. Provide a final hardcopy summary of all quality control test summary sheets and control charts at completion of paving operations on the project to the Engineer. Submit a compact disk (CD) of the quality

control test summary sheets, control charts and density worksheets to the Engineer.

2. Documentation (Control Charts). Record the following data on standardized control charts and make them available to the Engineer daily. The Contractor should generate control charts and summary sheets with a computer using Engineer approved methods.
 - a. AASHTO T-30 gradation, include all sieves shown in 703.05 for specified mixture.
 - b. Pb
 - c. Gmm and Gmb
 - d. Va , VMA, VFA, and Dust to Binder ratio.

Plot individual test results for each test point. Connect individual points with a solid line. Show specification limits and tolerances, where applicable, on the control chart.

Plot control charts as follows:

Aggregate Gradation. Test aggregate gradation, by AASHTO T 30, at the frequency shown in Table 106.03-1 for 405 Superpave HMA of the Quality Assurance Special Provision (QA SP), and plot the results on control charts for each sieve shown in 703.05. Plot the target gradation for each sieve from the C-JMF and plot the upper and lower specification limit for each sieve on the control charts. The control charts should be used by the Contractor as an aid to control the paving operation.

Asphalt Binder Content, P_b . Test asphalt binder content, by AASHTO T 308, at the frequency shown in Table 106.03-1 for 405 Superpave HMA of the QA SP, and plot the results on a control chart. Plot the target asphalt binder content from the C-JMF and plot the upper and lower specification limit on the control chart. The control chart should be used by the Contractor as an aid to control the paving operation.

Theoretical Maximum Specific Gravity. Test G_{mm} , by AASHTO T 209 or ASTM D6857, at the frequency shown in Table 106.03-1 of the QA SP and plot the results on a control chart. Use at least two determinations that meet the "single operator" precision of 0.011 in AASHTO T-209, (Test results obtained without use of Section 11^a) for each test. The average of two determinations constitute one test result.

Bulk specific gravity of compacted mixture. Test G_{mb} at the frequency shown

in Table 106.03-1 of the QA SP and plot the results on a control chart. Determine G_{mb} using the average of two compacted gyratory specimens sampled and tested in accordance with Table 106.03-1 of the QA SP. Use this value in calculations requiring a G_{mb} value.

Production Air Voids, V_a . Calculate air voids at the frequency shown in Table 106.03-1 of the QA SP and plot the results on a control chart. Target 4.0 percent air voids during production paving. Calculate V_a by using the values of the G_{mm} and the G_{mb} determined above.

Voids in Mineral Aggregate, VMA. Calculate VMA at the frequency shown in Table 106.03-1 of the QA SP and plot the results on a control chart. The Contractor should target the VMA value from the C-JMF during production paving. Calculate VMA by using the G_{mb} value determined from samples taken during production paving and the G_{sb} value determined for the mix design. Determine Percent Aggregate Content, P_s , by subtracting the Percent Binder Content, P_b , from 100 from samples taken during production paving. The Department will not recalculate G_{sb} during the project.

Voids Filled With Asphalt, (VFA). Calculate VFA and plot the results at the frequency shown for VMA and V_a in Table 106.03-1 of the QA SP using the values for VMA and V_a . The Contractor should take action to correct mixtures that do not remain within the range specified in Table 1.

Dust to Binder Ratio, DP. Calculate Dust to Binder Ratio or Dust Proportion using the value for P_b , the value for minus # 200, and the value for G_{mm} and plot the results at the frequency shown for VMA and V_a in Table 106.03-1 of the QA SP. The Contractor should take action to correct mixtures that do not remain within the range specified in Table 1.

Production Limits. Apply the limits shown in Table 405.03-5 to the production paving test properties and plot on control charts:

Table 405.03-5 - Production Paving Quality Limits

Quality Characteristic	Limits
SP 2 mixtures	
No.4 sieve and larger sieves, %	C-JMF value \pm 5.0a
No. 8 to No. 30 sieves, %	C-JMF value \pm 4.0a
No. 50 to No. 100 sieves, %	C-JMF value \pm 3.0a
No. 200 sieve and smaller sieves, %	C-JMF value \pm 1.5a
Asphalt Binder Content, %	C-JMF value \pm 0.3
SP 3 – SP6 mixtures	
Laboratory Air Voids, % Ndesign	4.0 \pm 1.0
VMA, % at Ndesign	703.05 minimum value - 0.05b
VFA	Table 1 \pm 5
Dust to Binder Ratio, DP	Table 1 \pm 0.1

^a in no case shall the upper and lower specification limits be outside the control points specified in Subsection 703.05

^b For purposes of Quality Analysis calculations

Document corrective actions taken on summary sheets. Include tests and plots in the project files.

- K. Spreading and Finishing.** Place the mixture upon an Engineer approved surface. Use pavers to distribute the mixture over the entire width or over a partial width as practical. Do not extend partial width paving beyond one day's production unless otherwise approved by the Engineer. Unless otherwise specified, place Superpave HMA in a single lift.

Use pavement marking tape to temporarily mark roadway centerline on pavements being used by traffic in accordance with 626.03.

Equip the paver with a shoe on the outside of the paver to provide slopes as follows unless otherwise shown on the plans:

The Engineer will allow an 18 in wide shoe for depths 0.2 ft or less on initial pavement placement. The shoe must be 24 in wide for depths greater than 0.2 ft. The shoe must be 24 in wide on pavement overlays.

- L. Compaction.** Compact the Superpave HMA as quickly as possible using rollers after placing and in accordance with 306.

Provide vibratory steel wheel, or pneumatic tire type rollers, in good condition, capable of reversing without backlash, and operate at speeds slow enough to avoid displacement of the mixture. Use the number and compactive force of rollers that is sufficient to compact the mixture as specified in this subsection. Do not use equipment which results in excessive crushing of the aggregate. The Engineer will reject rollers producing pickup wash-board, uneven compaction of the surface or other undesirable results.

Rolling equipment to be used and its relative position in the compaction sequence is the Contractor's option, provided specification densities and smoothness are attained. Independently operate each roller used. Rolling equipment used for the acceptance test strip should be the same type and weight as will be used for subsequent compaction of the pavement. To accommodate full production, the Contractor may use additional rollers beyond the number used in construction of the test strip.

Do not operate vibratory rollers in the vibratory mode when the internal mix temperature is less than 175 °F or when checking or cracking of the mat occurs at a higher temperature.

Follow the paver as closely as possible with breakdown rolling. Perform intermediate rolling as near as possible to the optimum temperature for compaction as determined by written recommendation of the supplier of the asphalt product used on the project. Perform finish rolling at as high a temperature as is practical to eliminate marks from previous rolling.

Begin rolling at the sides and proceed longitudinally parallel to the road centerline, with each trip overlapping one-half the roller width, unless otherwise Engineer approved. When paving in echelon abutting a previously placed lane, roll the longitudinal joint first, followed by the regular rolling procedure. On super elevated curves, begin the rolling at the low side and progress to the high side by overlapping of longitudinal passes parallel to the centerline.

Do not displace the line and grade of the edges of the pavement.

Keep the wheels properly moistened with water or water mixed with very small quantities of detergent or other Engineer approved material to prevent adhesion of the mixture to the rollers. Do not use excess liquid. Do not apply diesel fuel, kerosene or other solvents to roller drums or tires to prevent adhesion of the mixture.

Thoroughly compact the mixture with mechanical tampers or other approved compactors along forms, curbs, headers, walls, and other places not accessible to rollers. Remove the mixture from the gutter surface before rolling.

Compact the pavement to a density corresponding to a range between 92.0 percent and 95.0 percent of Maximum Theoretical Density for Classes SP 2 through SP 6 mixes.

Following acceptance test strip approval, pavement density testing for acceptance will be performed by the Department using a gauge with the readings corrected by cores in accordance with WAQTC TM-8 or FOP for AASHTO TP 68. The Department will use the average Gmm of the test section corresponding to the Contractor's JMF to determine densities for the specified mix production paving. The Contractor is responsible for quality control testing.

The Department will base acceptance for pavement density, when an acceptance test strip is not required, on the density of cores taken from the finished pavement. Obtain five randomly located core samples from the compacted Superpave HMA in the presence of the Engineer. The Engineer will determine the random core locations. Immediately submit the cores to the Engineer for testing. The Department will determine the density of the cores according to AASHTO T 166, Method A or AASHTO T 331. In addition, obtain three randomly located mix samples during placement of the HMA, in the presence of the Engineer, and immediately submit all samples to the Engineer for testing. Obtain the samples in accordance with AASHTO T 168 (See the QA SP Table 106.03-1 Note 4). The Engineer will randomly locate the mix samples and the Department will test the mix samples to determine the Gmm value in accordance with AASHTO T 209 or ASTM D6857. The Department will use the average of the three Gmm values to compute in-place density of the cores taken for density acceptance. If paving will be performed in different construction seasons (e.g. bridge approaches), obtain five additional cores from the compacted Superpave HMA and three additional mix samples for density acceptance, as specified, when paving resumes. The Contractor is responsible for quality control testing.

Repair holes left in the pavement by the coring operation at no additional cost to the Department. Do not begin coring until repair methods and materials have been Engineer approved.

- M. Joints.** Do not roll over the unprotected end of freshly laid mixture unless authorized by the Engineer. Form transverse joints by cutting back on the previous run to expose a vertical edge the full depth of the course.

Slope cold transverse construction joints open to public traffic at 20H:1V. Remove the sloped surface (ramp) without damage to the base just before paving is resumed. Test the new joint for smoothness as specified in 405.03.P.

Construct end transitions between overlays and the adjoining pavement by milling a wedge out of the adjoining pavement, starting at the surface and continuing into the adjoining pavement on a 200H:1V slope or flatter until a vertical edge equal to 0.15 ft or depth of overlay is reached. Transitions to ramps and crossroads are transverse joints. The milled wedge is a transverse joint when the adjoining pavement is concrete. Mill the wedge from the pavement to be overlaid, with the vertical edge against the concrete when the adjoining pavement is concrete. Taper transitions between overlays and approaches to form a smooth transition while maintaining drainage.

Provide a positive bond, provide density and provide a finish surface to the new mixture at longitudinal joints that is equal in all respects to the mixture against which it is placed. The Engineer may take density tests at longitudinal joints to ensure the integrity of material in the joint area.

Locate the longitudinal joint in the top course at the centerline of the traveled way if the roadway is two lanes wide or at the lane lines if the roadway is more than two lanes wide. On the lower courses stagger the longitudinal joint and offset it 6 in to 1 ft from the centerline of the traveled way if the roadway is two lanes wide or from the lane lines if the roadway is more than two lanes wide. Match the pavement surface across a longitudinal joint with the transverse slope shown on typical sections.

Test joints, except crowns, for smoothness in accordance with Idaho T-87. Furnish and use an approved 10 ft straight edge. Complete the test and necessary corrections before the material temperature drops below 175 °F.

- N. Miscellaneous Pavement.** Place Superpave HMA miscellaneous pavement in irregular areas such as raised or depressed medians, gores, tapers, radii (excluding approach radii), and tapered paving for guardrail terminal widening. Include areas that taper from 0 ft to 8 ft maximum width and gore areas from roadway shoulders to termini in this work. Do not include pavement widening for installation of guardrail in this work.
- O. Leveling Course.** Construct the leveling course of Superpave HMA, with a compacted thickness greater than 0.2 ft, in multiple courses.

Place the leveling course on the existing surface in quantities as Engineer approved to accomplish the intended purpose. Use pavers or motor graders,

or both, and a sufficient number of pneumatic tire rollers to adequately place and compact the leveling course to the required cross section and grade. Use a steel wheel roller for final rolling if the leveling course is to be used as a wearing course or if a seal coat is to be applied.

When blade laid leveling course is specified, place Superpave HMA in wheel ruts and other surface irregularities. Blade Superpave HMA into the low areas using a motor grader. Normally, two passes is required to fill depressions. Follow each pass of the motor grader with a pneumatic tired roller to provide compaction. Position the blade of the motor grader so that light contact with the existing pavement surface is maintained. The Contractor may dispose of excess coarse aggregate resulting from placing the blade laid leveling course along the edge of the roadway unless otherwise directed by the Engineer.

When machine laid leveling course is specified, place Superpave HMA on the roadway with a paver to restore crown, super elevation, or rideability. Operate the screed close to the existing pavement surface. The Engineer will accept minor surface tears from this operation. Use both pneumatic and vibratory rolling for compaction.

- P. Surface Smoothness.** Place pavement complying with Schedule II unless otherwise specified.

For Schedule III only, perform pre-paving, quality control, and acceptance surface smoothness testing, analyze the results of this testing, and submit the results to the Engineer. Submit pre-paving results to the Engineer before starting to pave. Before paving, submit a plan to the Engineer showing how Schedule III smoothness will be achieved.

Submit quality control results to the Engineer no later than the next working day following placement.

Should the results of the quality control testing show surface smoothness is not within acceptable specification limits, suspend paving operations until it can be demonstrated that steps taken to modify operations will result in acceptable smoothness.

Perform acceptance testing on the final lift and submit the results to the Engineer before corrective action. Complete acceptance testing within one week of paving completion.

Perform quality control testing in International Roughness Index (IRI). The Contractor may use quality control testing for acceptance when the testing is

verified by the Engineer. Request to use quality control testing for acceptance before the start of paving.

Acceptance surface smoothness testing must be verified by the Engineer. The profile run must be witnessed by the Engineer and a preliminary copy of the report and the graph chart submitted to the Engineer immediately after the end of the run. The Engineer will not accept the testing unless witnessed by the Engineer. At the Engineer's request, submit the profile data in a format suitable for evaluation using Proval or other Engineer acceptable software.

The Engineer may elect to perform additional testing as verification. Should the results vary from the Contractor's IRI results by more than 10 percent, the Engineer will use the Department's IRI results for acceptance.

Use Class I or Class II profilers as defined by ASTM E950. Operate profilers in accordance with the manufacturer's instructions and AASHTO PP-50. Set the profiler as follows:

High pass or pre-filter – off or a minimum of 200 ft.

Bump detection – on

Dip detection – on

Resolution – 0.01 in

Low Pass Filter – off

All Other Filters – off

Measure the finished pavement as follows:

1. Test the surface with a 10 ft straight-edge, at locations determined by the Engineer. Identify the locations that vary more than $\frac{1}{4}$ in from the lower edge when the straightedge is laid on finished pavement in a direction parallel with centerline or perpendicular to centerline. Remove the high points that cause the surface to exceed the $\frac{1}{4}$ in tolerance by grinding.
2. Profile the surface as follows:

Profile 3 ft from and parallel to each edge of each traffic lane. The Engineer will use the average of the results for each 0.1-mile section to calculate incentive payments and determine sections requiring corrective action.

The Department requires the pavement to comply with the following surface smoothness schedule requirements:

- a. Where longitudinal grade is 6.5 percent or less, pavement on tangent alignment and pavement on horizontal curves having centerline

radius of curve 1,000 ft or more must meet the surface smoothness requirements for the smoothness schedule specified. The Engineer will add consecutive 0.1-mile sections of roadway tested together to obtain the mile section. There will be no overlapping of the 0.1-mile or 1-mile sections to change cumulative test results.

Smoothness Schedule using IRI:

Schedule I Projects: Target IRI values range from 6.0 in to 7.0 in/0.1-mile. Corrective action required above 9.5 in/0.1-mile.

Schedule II Projects: Target IRI values range from 7.1 in to 8.0 in/0.1-mile. Corrective action required above 9.5 in/0.1-mile.

Schedule III Projects: Target IRI value range defined as one of the following:

- i. For sections with a prepaving IRI less than 16.0 in/0.1-mile the final index must not exceed 8.0 in/0.1-mile.
 - ii. For sections with a prepaving IRI of 16.0 in/0.1-mile or greater use the smoother of:
 - a) A 50 percent improvement of the pre-paving index, or
 - b) a maximum final index of 10.0 in/0.1-mile. Corrective action is required above the target IRI.
 - b. The Engineer will exclude acceptance test strips, pavement on horizontal curves having a centerline radius of curve of less than 1,000 ft and pavement within the super elevation transition of such curves or pavement with a grade greater than 6.5 percent from incentive/disincentive payments. Meet the corrective action requirements for the smoothness schedule specified.
3. Profile the pavement to provide continuous uninterrupted profile data. The Department will not apply profile smoothness tolerances and incentive/disincentive payments to the following:
- a. Pavement within 50 ft of a transverse joint that separates the pavement from a structure deck, an approach slab, or an existing pavement not constructed under the contract.
 - b. Pavement for approaches and structure decks.

- c. Roadways with a speed limit less than 40 mph, unless otherwise specified.

Smoothness acceptance for these areas will be in accordance with straight-edge requirements.

Do not profile pavement for approaches.

Operate the profiler at a speed no greater than that recommended by the manufacturer. Calibrate the profiler at the beginning of the project and as needed thereafter.

Grind the finished pavement until it complies with the following smoothness requirements.

Grind individual high points in excess of 0.3-inch within a 25 ft distance or less, as determined by the California Profilograph simulation, until such high points do not exceed 0.3-inch.

After individual high point grinding has been completed, perform additional grinding in sections requiring corrective action to reduce the IRI to a maximum of 8.0 in in any 0.1-mile section along any line parallel with the pavement edge.

Grind parallel to centerline. Extend adjacent grinder passes, within any one ground area, to produce a neat rectangular area having a uniform surface appearance. Make smoothly feathered transitions at transverse boundaries between ground and unground areas. Apply a fog coat to the ground pavement surface in accordance with 408 after grinding has been completed.

Use power-driven grinding equipment that is specifically designed to smooth Portland cement concrete pavement with diamond blades. Use a machine with an effective wheelbase of not less than 12 ft and a cutting width of at least 3 ft. Instead of diamond grinding, the Contractor may use a self propelled milling machine of the type used for removal of asphalt pavement provided a special milling head is used that is designed to provide a texture similar to diamond grinding. Use a milling head with cutting teeth that do not exceed a spacing of 0.3-inch. Restrict the machine forward speed to 10-feet per minute while milling. Should the texture produced by milling be unsatisfactory, the Engineer will require diamond grinding. Provide grinding or milling equipment of a shape and dimension that does not encroach on traffic movement.

Check the pavement for smoothness after grinding, as specified in this subsection, and make any additional corrections necessary to the pavement to achieve smoothness. Submit to the Engineer a report and graph chart showing

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compliance of the final surface to the smoothness requirements. The Department will not pay for the cost of grinding or milling, or related work such as fog coat, disposal of milled material, traffic control, flagging, profiling, surface repair of ground or milled areas, and temporary striping.

If correction of the roadway as specified will not produce satisfactory results as to smoothness, or it reduces pavement thicknesses and serviceability, the Engineer may accept the completed pavement and will deduct from monies due or that may become due to the Contractor the sum of \$500.00 for each individual high point or \$3000 for each 0.1-mile section. Under these circumstances, the Engineer's decision whether to accept the completed pavement or to require corrections as described is final.

405.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Pavements, leveling courses, and asphalts by the ton. The Engineer will not permit batch weights as a method of measurement. The Superpave HMA quantity will be the weight used in the accepted pavement and will include the weight of the aggregate, asphalt, and any additives in the mixture.
2. Anti-stripping additive by the percentage of additive per ton of asphalt.
3. Miscellaneous pavement by the square yard. Final measurement will be based on plan quantities unless these quantities are significantly altered by Engineer authorized changes. Miscellaneous pavement measurement is in addition to the measurement of asphalt and Superpave HMA material.
4. Approaches per each regardless of width or length. Separate mailbox turnouts will be measured as an approach. Mailbox turnouts adjacent to an approach will be considered as part of the approach and no separate measurement will be made. Approach measurements are in addition to the measurement of asphalt and Superpave HMA material.
5. Wedge milling for the transition section by the square yard.

405.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Superpave HMA Pavement Class SP-_____	Ton
Superpave HMA Pavement (including asphalt and additives) Class SP-____	Ton
Leveling Course Class SP-____	Ton

Leveling Course (including asphalt and additives)	
Class SP-__	Ton
____ Asphalt Cement for Superpave HMA Pavement	Ton
____ Percent Anti-stripping Additive	
for Superpave HMA Pavement	TOA
Miscellaneous Pavement	SY
Approaches	Each
Wedge Milling	SY

The Department considers the cost to produce the required aggregate in each stockpile to accommodate blends incidental and included in the contract unit price for the Superpave HMA contract pay item.

When Superpave HMA includes RAP in any proportion, the Department will not include the asphalt binder contributed by the RAP in the quantity for asphalt and additives when asphalt and additives are paid for separately.

For each evaluation section the Contractor is entitled to a payment adjustment excluding acceptance test strips and Schedule III surface smoothness projects. An evaluation section is defined as a 0.1-mile per traffic lane; or fraction thereof as applicable. The Department will not pay incentive for pavement on the roadway shoulders, center turn lanes, turn bays, crossovers, tapers or other miscellaneous pavement. The Department will pay incentive in accordance with Table 405.05-1.

Table 405.05-1 - International Roughness Index

Payment \$ per 0.1 mi	Initial Index in/0.1-mile section	
	Schedule I	Schedule II
500	4.0 or less	4.5 or less
300	4.1 to 5.0	4.6 to 6.0
100	5.1 to 6.0	6.1 to 7.0
0	6.1 to 7.0	7.1 to 8.0
-100	7.1 to 7.5	8.1 to 8.5
-300	7.6 to 8.5	8.6 to 9.5
-500	8.6 to 9.5	
-\$500 and corrective action	9.6 or greater	9.6 or greater
-\$300 and corrective action	individual high points	individual high points

The Department will make only one incentive payment per evaluation section. The

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Department considers an evaluation section to run consecutively from the point paving begins to the point paving is interrupted as shown on the plans such as at bridges, the end of lane paving or areas specifically excluded by the specifications. The Department will prorate partial sections based on their percentage of a full section.

The Department will base incentive payments on initial profiles before any corrective work on the top course of paving.

SECTION 406 - ROAD MIX PAVEMENT

406.01 Description. Construct one or more courses of road mix pavement on a prepared base or road surface.

406.02 Materials. Provide asphalt of the type and grade specified in the contract.

Provide asphalt and anti-stripping additive, if required, as specified in 702. The Engineer will accept the asphalt at point of delivery.

Provide aggregate as specified in 703. The Engineer will accept the aggregate at the point of delivery from Contractor furnished sources or the crushing plant from designated sources.

406.03 Construction Requirements.

A. Season and Moisture Limitations. Do not apply asphalt if surface or weather conditions prevent proper construction.

Do not construct road mix pavement before May 15, or after September 15, unless authorized by the Engineer.

Provide scarifying, mixing, spreading, finishing and compacting equipment; an asphalt distributor; and equipment for heating the asphalt.

Ensure the distributor is designed, equipped, maintained and operated so asphalt can be applied uniformly on variable widths of surface at readily determined and controlled rates with uniform pressure. Provide distributor equipment that includes a tachometer, pressure gages, and accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Equip distributors with a power unit for the pump, and full circulation spray bars adjustable vertically.

Provide rollers as specified in 306.

B. Preparation of Roadbed. Uniformly compact the roadbed surface. Keep the prepared base in good condition in advance of placing the bituminous surface course.

Leave the prime coat undisturbed for at least 24 hours. Spread blotter as specified in 402 in an Engineer approved quantity to absorb the excess asphalt if the asphalt fails to penetrate, and the roadway must be used by traffic.

Allow the tack coat to dry until it is tacky enough to receive the road mix material.

- C. **Placing Aggregate.** Uniformly spread aggregate on the road by the use of spreader boxes or other Engineer approved mechanical spreading devices.
- D. **Application of Asphalt.** Uniformly distribute the asphalt in successive applications, in quantities and at intervals, as Engineer approved. Ensure the mixing equipment follows immediately behind the distributor after each application of asphalt to partially mix the aggregate and the asphalt and ensure the asphalt application temperature is as specified.

- E. **Mixing.** Windrow the entire mass of asphalt and aggregate on the road surface after the last application of asphalt and partial mixing, and then mix until all aggregate particles are coated with asphalt, the whole mass has a uniform color, and the mixture is free from fat or lean spots, balls, or uncoated particles.

Avoid cutting into the underlying course or contaminating the mixture with earth or other extraneous matter during the mixing operations. The Engineer may require confining the mixing process to part of the width or area of the road so as to allow traffic to pass.

Add aggregate or asphalt as required, and remix if the mixture shows an excess, a deficiency, or uneven distribution of asphalt. If the mixture contains excessive amounts of moisture or volatile matter, blade, aerate, or otherwise manipulate it until the moisture and volatile contents are satisfactory. Do not spread the mix if the surface to be covered is in unsatisfactory condition.

Blade loose material into a windrow, at the end of each day's work, or when the work is interrupted by weather or other conditions, whether mixing is completed or not, and retain in a windrow until operations are resumed.

- F. **Spreading, Compacting, and Finishing.** Spread the material by a patrol or a mechanical spreader as Engineer approved. Avoid cutting into the underlying base if spreading from the windrow.

Roll the surface after the material is spread. Perform initial rolling with a pneumatic-tire roller and final rolling with a 3-wheel or tandem-type steel-wheel roller. Roll parallel to the road centerline starting at the outer edges of the road, overlapping the shoulders and progress toward the center, overlapping on successive passes by at least one-half the width of the roller, except that

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on superelevated curves rolling progresses from the lower to the upper edge. Terminate each pass at least 3 ft in advance or to the rear of the end of the preceding pass. Blade the surface during compaction to fill ruts, remove incipient corrugations or other irregularities as necessary. Continue rolling until the surfacing is of uniform texture and specified compaction obtained.

- G. Surfacing Approaches.** Construct road mix pavement on approaches as shown on the plans or as directed by the Engineer.
- H. Surface Smoothness.** The Engineer will test the completed surface as specified in Idaho T-87. Ensure the surface does not vary more than $\frac{1}{4}$ in from a 10 ft straightedge.
- I. Aggregate for Road Mix Pavement in Stockpile.** Provide aggregate material in stockpiles at Engineer designated locations.

Prepare the stockpile site by clearing and smoothing as Engineer. Construct stockpiles that are neat and regular in form and occupy as small an area as possible. Construct by first distributing the material to be stockpiled over the entire base and building upward in successive layers at least 3 ft in depth. Do not end dump or convey materials over the sides of the pile.

406.04 Method of Measurement. The Engineer will measure acceptable work as follows:

1. Aggregate and asphalt for road mix pavement by the ton
2. Anti-stripping additive by the percentage of additive per ton of asphalt
3. Approaches by the each paved regardless of size.
4. Aggregate for road mix pavement in stockpile by the ton or cubic yard.

406.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Aggregate for Road Mix Pavement	Ton
_____ Approaches	Each
_____ Aggregate for Road Mix Pavement in Stockpile	Ton or CY
_____ Aggregate for Road Mix Pavement, Load, Haul and Place	Ton
_____ Emulsified Asphalt for Road Mix Pavement	Ton
_____ Percent Anti-Stripping Additive for Road Mix Pavement	TOA

SECTION 407 - SCRUB COAT

407.01 Description. Construct a scrub coat on the road surface.

407.02 Materials. Provide asphalt that is the type and grade specified in the contract. Provide asphalt and anti-stripping additive, if required, as specified in 702. The Engineer will determine acceptability of the asphalt at the point of delivery.

Provide aggregate for scrub coat as specified in 703.04.

The Contractor does not need to use multiple stockpiles. The Engineer will determine acceptability of the aggregate from Contractor furnished sources at the point of delivery and at the crushing plant from designated sources.

407.03 Construction Requirements.

- A. General.** Do not place scrub coat material on wet or frozen surfaces. Ensure the ambient and surface temperature is 60 °F and rising. Clean the surface by brooming or other approved methods if directed by the Engineer.
- B. Mixing.** Mix the plant mix scrub coat as specified in 405.03. Mix the road mix scrub coat as specified in 406.03. Produce mixtures at the lowest temperature that will produce a uniform workable mixture not exceeding 165 °F.
- C. Equipment.** Provide rollers as specified in 306. Operate rollers at speeds slow enough to avoid displacement of the mix.
- D. Spreading, Compacting, and Finishing.** Apply the tack coat as specified in 401, before applying the scrub coat.

Sufficiently aerate the scrub coat material before spreading. Spread and tight blade from shoulder to shoulder or as Engineer directed. Fill depressions, irregularities and cracks and smooth to create a uniform surface. Roll with pneumatic-tire rollers concurrently with the spreading. Finish roll with a steel-wheel roller unless otherwise Engineer directed.

407.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Scrub coat, asphalt and anti-stripping additive, if required, by the ton. The Engineer will not accept batch weights as a method of measurement. No deduction will be made for the weight of the asphalt or other additives in the mixtures.
2. Anti-stripping additive by the percentage of additive per ton of asphalt.

407.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Plant Mix Scrub Coat	Ton
___ Aggregate for Road Mix Scrub Coat	Ton
___ Emulsified Asphalt for Scrub Coat.....	Ton
___ Percent Anti-Stripping Additive for Scrub Coat.....	TOA
___ Plant Mix Scrub Coat (including asphalt and additives)	Ton

The Department will not make separate payment for asphalt and additives for such contract pay items as Plant Mix Scrub Coat (including asphalt and additives).

SECTION 408 - FOG COAT

408.01 Description. Apply a fog coat, and blotter if required.

408.02 Materials. Provide fog coat material that is diluted emulsified asphalt. Provide the emulsified asphalt as specified in 702.

Mix approximately equal volumes of emulsified asphalt and water before application unless otherwise specified.

Provide blotter material as specified in 703. The Engineer will determine acceptability of material from Contractor furnished sources at the point of delivery and at the source from designated sources.

408.03 Construction Requirements.

A. Equipment. Provide equipment for applying the fog coat material and for applying blotter and as specified in 406.03.

B. Application of Fog Coat. Apply fog coat material with a pressure distributor in a uniform, continuous spread. Ensure the distributor does not exceed 25 mph. Do not exceed the specified asphalt application rate at the junction of the spread overlap. Correct skipped areas or deficiencies.

Obtain the Engineer's approval for the quantities, rate of application and temperature of the fog coat material before applying the fog coat.

Do not apply the fog coat if surface or weather conditions prevent proper construction.

Apply the fog coat so there is the least amount of inconvenience to traffic and to permit one-way traffic without pickup or tracking. Apply the fog coat on the roadway in the same direction as traffic travels.

Place fog coat over a seal coat within one working day of the completed seal coat, or as conditions allow.

C. Application of Blotter. Spread blotter at the Engineer approved rate to absorb the excess asphalt if the fog coat material fails to penetrate and the roadway must be used by traffic.

408.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Diluted emulsified asphalt by the gallon after dilution with no correction for temperature.
2. Blotter by the ton or cubic yard.

408.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Diluted Emulsified Asphalt for Fog Coat.....	gal
Blotter.....	Ton or CY

SECTION 409 - PORTLAND CEMENT CONCRETE PAVEMENT

409.01 Description. Construct a Portland cement concrete pavement as shown on the plans or established. Submit a proposed mix design. The Engineer will review the mix design for compliance with the specifications:

A. Classification. Proportion the materials for concrete to produce a workable concrete mix in accordance with the parameters in Tables 409.01-1 and 409.01-2.

Table 409.01-1 - Basic Mix Design Parameters

Concrete Class in 100 psi (28 Day) (a)(b)	Minimum Cement Content Lb./yd ³ [c]	Water to Cement Ratio	Slump in	Air Content Percent
45	660	0.44 maximum	2 maximum	4-7

a. The class of concrete is the specified compressive strength when tested in accordance with applicable tests listed in 409.02.

b. A design value of 5600 psi is specified to achieve the specified compressive strength.

c. It may not always be possible to produce concrete of the required strength

using the minimum cement content. No separate payment will be made by the Department for additional cement required to meet the specified strength.

Table 409.01-2
Basic Mix Design Parameters When Fly Ash Is Required

Concrete Class in 100 psi (28 Day) ^{(a)(b)}	Cement Content Lb./yd ³ ^[c]	Minimum Fly Ash Content Lb./yd ³ (b)(d)	Water to Cement (Plus Fly Ash) Ratio ^(e,f)	Slump in	Air Content Percent
45	550 minimum	138 minimum	0.42 maximum	2 maximum	4-7

a. The Class of concrete is the specified compressive strength when tested in accordance with applicable tests listed in 409.02.

b. A design value of 5600 psi is specified to achieve the specified compressive strength.

c. It may not always be possible to produce concrete of the required strength using the minimum cement and fly ash contents. If additional cement and fly ash are needed to meet strength requirements, add at a minimum the ratio of 1 lb fly ash per 4 lb cement. No separate payment will be made by the Department for additional cement and fly ash required to meet specified strength.

d. Use Class F fly ash.

e. It may not always be possible to produce concrete using the minimum fly ash content that will ensure mortar bar expansion does not exceed 0.10 percent expansion when tested in accordance with ASTM C1567. If additional fly ash is needed to meet mortar bar expansion requirements, the Contractor may add it without a corresponding increase in cement provided the strength requirements are met. Obtain Engineer approval to add lithium or other mitigating measures in order to meet the mortar bar expansion requirement.

f. Ensure fly ash does not exceed 25 percent of the total cementitious material (fly ash + cement).

B. Acceptance. Concrete acceptance is based on compliance with parameters specified for paving concrete. Strength is accepted based on the results of 28 day compressive strength tests determined in accordance with AASHTO T 22. The Department considers average strength from three companion cylinders as one test.

When the 28-day strength for any test falls below the specified strength, concrete represented by that test is subject to rejection or price adjustment by the Engineer.

The Engineer may accept paving concrete at a reduced price provided the strength is within 10 percent of the specified strength. Concrete represented by tests more than 10 percent below specified strength is subject to rejection.

Remove unacceptable concrete at no additional cost to the Department.

The Engineer will use Table 409.01-3 to determine the unit price adjustment of failing paving concrete which is allowed to remain in place.

Table 409.01-3 - Unit Price Adjustment

Percent of Specified Strength	Pay Factor
≥100	1
≥95 < 100	0.9
≥90 < 95	0.8
< 90	Subject to rejection ¹
(1)If allowed to remain in place, the Pay Factor will be 0.50.	

The Department will pay for the accepted concrete quantity at the contract unit price multiplied by the price adjustment pay factor as determined from Table 409.01-3.

Core drilling, at no additional cost to the Department, is an acceptable alternative test to dispute test results for concrete subject to price adjustment or rejection. The Engineer will determine the location and number of cores and witness coring and testing. Repair holes left by the coring operation at no additional cost to the Department. Obtain approval from the Engineer for repair methods and materials before beginning repairs.

Cores obtained within 42 days of the time of placement will be considered by the Department as representing the 28-day strength. Cores obtained after 42 days will only be acceptable to the Engineer when the Contractor submits a correlation curve developed by a Department approved independent testing laboratory to relate strength at the actual test age to 28-day strength for the particular class and design mix represented by the cores.

Both the Contractor and the Department agree to accept the results of the tests of the drilled cores instead of the results of the test cylinders when drilled cores are approved by the Engineer as the method of determining strength.

Obtain and test cores in accordance with AASHTO T 24 with the following exceptions:

1. Protect cores from moisture gain or loss.
2. Test as soon as possible without further conditioning other than preparation of the ends, if needed.

Take at least three representative cores from each area of in-place concrete that is considered potentially deficient. Replace cores that show evidence of damage during coring or removal with a new core before testing. Tests performed by an Engineer approved independent testing laboratory on cores taken from the work may include, compressive strength, cement content by ASTM C 1084, and petrographic analysis by ASTM C856 including water cement ratio and air content.

Remove concrete represented by cores with an average strength less than the specified strength, unless accepted at a reduced price by the Engineer.

Make corrective changes in the materials mix portions, concrete fabrication procedures, or other corrective action before continuing to use concrete that does not comply with the specified compressive strength, at no additional cost to the Department. If results of 7 day strength tests are low or indicate a downward trend, predicting concrete may not meet the specified 28-day strength, make corrective changes. Changes are subject to approval of the Engineer.

409.02 Materials. Provide materials as specified:

Portland Cement	701
Aggregate.....	703
Joint Fillers and Sealers	704
Silicone Joint Sealant.....	704.05
Reinforcing Steel.....	708.02
Dowel Bars.....	708.03
Tie Bars.....	708.04
Membrane-Forming Curing Compound, System 2	709.01
Air Entraining Admixtures	709.03
Set Retarding Admixtures	709.04
Water Reducing Admixtures.....	709.05
Lithium Nitrate Admixtures	709.06

Water.....	720.01
Epoxy- Resin- Base Bonding Systems	720.04
Secondary Cementitious Materials	714

The Engineer will determine acceptability of aggregate at the concrete mixing plant.

Obtain the Engineer's approval of admixtures before use.

Determine an aggregate correction factor in accordance with AASHTO T 152 and submit with each mix design.

Test in accordance with the following standard methods:

Compressive Strength of Cylindrical Concrete Specimens.....	AASHTO T 22
Making and Curing Concrete Test Specimens in the Field	AASHTO T 23
(Use 6 in. dia. X 12 in. single use molds made of plastic.)	
Obtaining & Testing Drilled Cores & Sawed Beams of Concrete	AASHTO T 24
(Provisions of AASHTO T 24 relating to ASTM and ACI references do not apply unless otherwise specified)	
Slump of Hydraulic Cement Concrete	AASHTO T 119
Mass Per Cubic Foot (Cubic Meter), Yield, and Air Content (Gravimetric) of Concrete	AASHTO T 121
Including Cement Content.	
Making & Curing Concrete Test Specimens in the Laboratory....	AASHTO R 39
(Use 6 in. dia. X 12 in. single 3 use molds made of plastic.)	
Measuring Length of Drilled Concrete Cores	AASHTO T 148
Air Content of Freshly Mixed Concrete by the Pressure Method ...	AASHTO T 152
Measuring Texture Depth of Portland Cement Concrete	
Using a Tire Tread Depth Gage	AASHTO T 261 (modified)
(Provisions of AASHTO T 261 relating to calculations, reporting, & subdividing into sublots do not apply unless otherwise specified)	
Pavement Straightedge Procedures	Idaho T-87
Standard Method of Operation	
of the California Profilograph and Evaluation Profiles	Idaho T-140
Method of Testing Thickness of Plastic Concrete Pavement	Idaho T-130
Determination of the Rate of Evaporation	
of Subsurface Moisture from Concrete	Idaho T-133
Determining the Percentage	
of Fracture of Coarse Aggregate	AASHTO T-335 Method 1
Sampling Freshly Mixed Concrete	WAQTC TM-2
Standard Test Method for Determining the Potential Alkali-Silica Reactivity of	

Combinations of Cementitious Materials and Aggregate (Accelerated Mortar Bar Method)	ASTM C1567
Temperature of Freshly Mixed Portland Cement Concrete	AASHTO T 309
Idaho Standard Method of test for Lithium Dosage Determination Using Accelerated Mortar Bar Testing	Idaho T 145

409.03 Construction Requirements.

A. Proportioning. The concrete mix design is the Contractor's responsibility and includes making and testing compressive strength specimens. Make and test compressive strength specimens using either the Contractor's laboratory or a Department approved independent laboratory. Uniquely identify each mix design submitted.

For projects exceeding 2500 cubic yards provide the following to the Engineer at least 60 days in advance of proposed use:

1. The proposed mix design.
2. Copies of test reports.
3. Data.
4. Worksheets.
5. Samples of the proposed aggregate, cement, fly ash and admixtures.
6. "Final set" time with the mix design as measured by AASHTO T 197M / T 197.
7. Mixing water source.
8. Proposed curing compound.
9. Theoretical maximum density.

Do not produce concrete until the mix design is approved by the Department's Central Materials Laboratory.

For projects less than 2500 cubic yards provide the following at least 14 days in advance of proposed use:

1. The proposed mix design.
2. Copies of test reports.
3. Data.
4. Worksheets.
5. "Final set" time with the mix design as measured by AASHTO T 197M / T 197.
6. Mixing water source.
7. Proposed curing compound.
8. Theoretical maximum density.

Do not produce concrete until the mix design is approved.

Limit the fine aggregate by weight of total aggregate to 40 percent in the proposed mix designs. Use only angular coarse aggregate. Angular aggregate is defined as having greater than 40 percent fractured faces. The Department will base fracture on the aggregate particles retained on the No. 4 sieve with one or more fractured faces as determined by AASHTO T-335, Method 1.

The minimum mix design compressive strength is 5600 psi when tested at 28 days and is determined from the average of three specimens produced and cured in the laboratory. In addition to strength, report the air content and slump. Strength data is valid only if air content, slump, and water-cement ratios are within the required limits for the specified mix class.

Use the cement, fly ash, and other mitigative additives proposed for use in the mix design to produce laboratory specimens in accordance with ASTM C1567. Use fly ash, lithium, or other additives to limit mortar bar expansion to 0.10 percent or less. Perform Idaho T 145 to calculate lithium dosage if lithium nitrate is used to mitigate ASR. Perform testing on the coarse and fine aggregates together or separately. If testing is performed on the coarse and fine aggregates together, report the blend percentage on the test and be within plus or minus 2 percent of the blend percentage used in the mix design. If tested separately, use mitigation based on the aggregate requiring the most mitigation.

Use number 4 coarse aggregate unless otherwise approved by the Engineer. Establish the exact proportions from trial mixes from the materials to be used in the work, and make adjustments to use the least amount of sand necessary to produce concrete with the required workability and strength.

At the Contractor's option, a combined gradation number 4C may be used. Design the proposed mix using KU Mix from the University of Kansas, and submit for Engineer approval. Include documentation and worksheets in the submittal. Base the combined gradation and sand equivalent on the average of the stockpile as determined by the production quality control tests. Submit quality control charts and tests with the mix design. The Contractor may reduce minimum cementitious material contents by 20% if a combined gradation is used.

If fly ash concrete is required by the contract, provide a mix design as specified in 409.01.A, Classification, Table 409.01-2.

If the contract does not require fly ash, the Contractor may provide a mix design subject to the same requirements as if the contract requires fly ash. Do not vary CaO content more than 2 percent above that used for ASTM C1567 test-

ing where fly ash is used in the concrete mix for ASR mitigation. If the fly ash has a CaO content greater than 2 percent above the fly ash used for testing, additional ASTM C1567 testing at the higher CaO content is required by the Department.

If fly ash is used only as a mineral admixture, calculate the dosage of lithium nitrate based on Idaho T-145 testing without fly ash.

Wherever fly ash is used, use the same fly ash source (power plant), cement source (mill), and cement type throughout the project for each mix design unless a change is Engineer approved. Submit lab test reports to the Engineer to verify the revised mix design meets specification requirements.

A 3.5 in maximum slump is allowed for hand finishing if a slipform concrete paver is not used to construct concrete pavement.

A 4.5 in maximum slump and a 5 percent reduction in 28-day compressive strength is permissible for concrete medians and other non traveled surfaces, excluding shoulders.

B. Equipment.

1. Mixers and Hauling Equipment.

- a. Mixers, agitators and non-agitating hauling equipment. Mixers may be stationary mixers or truck mixers. Agitators may be truck mixers or truck agitators. Equip truck mixers and agitators with an accessible revolution counter for the drum, blades, or paddles to verify revolutions. Ensure a NRMCA standard metal plate or plates are attached to each mixer and agitator by the manufacturer and plainly marked with the various uses for which the equipment is designed, the volume of the drum, the capacity of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades. Equip stationary mixers with an acceptable timing device that will prevent discharge until the specified mixing time has elapsed. Equip truck mixers with a calibrated water flow meter or other Engineer approved measuring device to control the quantity of mixing water added in the field.
- b. Provide mixers that, when loaded to the rated mixing capacity and the concrete is mixed for the time or revolutions prescribed, combine the ingredients of the concrete into a thoroughly mixed uniform mass

and discharge the concrete with satisfactory uniformity, as specified in 409.03.D.

- c. Provide agitators that maintain the mixed concrete in a thoroughly mixed and uniform mass and are capable of discharging the concrete with a satisfactory degree of uniformity when loaded to rated capacity, as specified in 409.03 D.
 - d. Provide non-agitating equipment with bodies that are smooth, mortar-tight metal containers capable of discharging the concrete without segregation.
2. Paving Equipment. Construct pavement using paving equipment that uniformly spreads at the proper thickness for the width of the area being paved, consolidates the freshly placed concrete and produces a finished surface meeting straightedge and Profile Index requirements of 409.03 K, before grinding. If the pavement produced does not meet these requirements, suspend concrete paving operations until the deficiencies or malfunction is corrected. Use self-propelled paving machines that comply with the following (unless otherwise Engineer approved):
- a. Placer/Spreader: Receive the concrete mixture into hopper(s) adjacent to the area to be paved.
 - b. Slipform paver: Equipped with automatic screed control mechanisms that operate from stringlines erected near both the right and left side of the machine. After the stringlines are established, check, with the Engineer as observer, the specified depth of placement at 50 ft intervals to achieve the design thickness between the outside edges.

Consolidate the concrete with internal vibrators. Limit the rate of vibration to less than 3500 vibrations per minute for surface vibrators and 8000 to not more than 12,000 vibrations per minute for internal vibrators. Provide a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

Do not rest vibrators on new pavements or side forms. Connect power to the vibrators so that vibration will cease when the forward or backward motion of the machine is stopped.
- c. Machine Paving with Forms: The Contractor may finish concrete

pavement in small irregular areas as specified in 411.03.B instead of using slipform pavers, when Engineer approved.

- d. Bridge Deck Machine: The Contractor may finish concrete pavement in small irregular areas with a concrete bridge deck finishing machine as specified in 502.03 instead of using slipform pavers, when Engineer approved.

Finishing and surface test specifications apply equally to any method of placement.

3. Concrete Saws and Equipment. Provide at least three production saws, including one standby unit, adequately powered to perform the work. Provide saws that are multiple arbor, multiple blade gang saws unless otherwise specified or Engineer allowed. Mount saws operating on 3 to 4 hour old pavement (non-rigid) on a work bridge so the machine weight is not placed on the new concrete. Provide adequate artificial lighting facilities for night sawing. Maintain equipment in good working order and have it on the job before the first placement and continuously during concrete paving operations. Maintain an ample supply of saw blades on the project during the sawing operations. Do not pave until concrete sawing equipment is on site and ready for use.

C. Handling, Measuring and Batching Materials. Produce concrete that meets the Engineer approved mix design.

Submit the proportioned ingredients for each batch to the Engineer when batching.

Request changes to the mix design in and obtain approval from the Engineer for a new mix design before batching concrete. Minor adjustments due to varying moisture in the aggregates and minor adjustments of approved admixtures are not considered changes in the mix design and will not require approval of a new mix design. Report the minor mix adjustments in writing to the Engineer before batching.

1. Measure cement by weight. Weigh cement in an individual hopper and keep separate from the aggregates until released for discharge. Attach the cement hopper to a separate scale for individual weighing or to the aggregate scale for cumulative weighing. Weigh cement before adding the other ingredients, if weighing cumulatively. Use a cement scale and weigh hopper that is separate and distinct from the

aggregate weighing equipment. Provide cement batchers with a dust seal between the charging mechanism and hopper. Install the dust seal so it does not affect the weighing accuracy and is vented to permit the escape of air. Provide a self-cleaning hopper fitted with a means to assure complete discharge. Provide sufficient wind protection to prevent interference with batching accuracy. Ensure the cement, as weighed, is within one percent of the design weight.

2. Measure aggregates by weight. Weigh individual aggregates within two percent of the required weights and the total weight of the aggregate within two percent of the total required weight. Handle aggregates from stockpiles or other sources to the batching plant so uniform grading and stable moisture content is maintained. Stockpile or bin aggregates to drain for at least 12 hours before batching any aggregates produced or handled by hydraulic methods or any washed aggregates. Verify aggregate gradation meets the requirements for the proposed mix design.
3. Measure water by volume or by weight. Arrange the measuring device so that the measurements will not be affected by variable pressures in the water supply line. Do not use wash water as a portion of the mixing water. Weigh or measure water within one percent of the required amount.
4. Measure fly ash by weight. Weigh the fly ash within one percent of the design weight.
5. Measure dry admixtures by weight, and paste or liquid admixtures by weight or volume. Dispense admixtures used in small quantities in proportion to the cement, as air entraining admixtures, with the mixing water. Adjust the quantity of admixtures used in accordance with manufacturer's recommendations. Provide quantities of admixtures used within three percent of the required amount. Use admixtures that meet 709.02.

D. Mixing and Delivering.

1. Mix and deliver concrete by any of the following means:
 - b. Central mixed concrete. Mix completely in a stationary mixer and

transport the mixed concrete to the point of delivery in agitating equipment or in Engineer approved non-agitating equipment.

- c. Transit mixed concrete. Mix completely in a truck mixer at the batching plant or while in transit.
 - d. Truck mixed concrete. Mix completely in a truck mixer at the point of delivery after adding mixing water.
 - e. Shrink mixed concrete. Mix partially in a stationary mixer, and complete the mixing in a truck mixer.
 - f. Mix in an Engineer approved mixer that volumetrically measures the concrete ingredients and continuously produces concrete that meets the requirements of ASTM C 685.
2. Operate truck mixers and truck agitators within the rated capacity, and at a speed of rotation for mixing or agitating, as designated by the equipment manufacturer.
 3. The minimum mixing time for mixers of 10 yd³ or less capacity is 50 seconds when a stationary mixer is used for the complete concrete mixing. Obtain the Engineer's approval of the mixing time for mixers of 10 yd³ or more capacity. Measure mixing time from the time cement and aggregates are in the drum. Charge the batch into the mixer so some water will enter in advance of cement and aggregates, and water is in the drum by the end of the first one-fourth of the specified mixing time.
 4. The Contractor may reduce the mixing time in the stationary mixer to a minimum of 30 seconds for shrink mixed concrete. Complete the mixing in a truck mixer with between 50 and 100 revolutions of the drum or blades at mixing speed. Do not exceed a batch volume of 70 percent of the drum gross volume.
 5. When a truck mixer is used for complete mixing, mix each batch of concrete with between 70 and 100 revolutions of the drum or blades at mixing speed. Use agitating speed for additional revolutions.
 6. When a truck mixer or agitator is used for transporting concrete completely mixed in a stationary mixer, use agitating speed for mixing during transport.

7. When a truck mixer or agitator is used for transporting concrete apply the following unless otherwise approved by the Engineer:
 - a. Deliver the concrete to the project and complete discharge within 1.5 hours after the introduction of the cement to the aggregates, or before the drum has revolved 300 revolutions, whichever comes first.
 - b. In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1.5 hours may be necessary.
 - c. Begin the mixing operation within 30 minutes after the cement has been intermingled with the aggregates when a truck mixer is used for the complete mixing of the concrete.
 - d. If additional mixing water is Engineer approved, a minimum of 30 additional revolutions of the truck mixer drum at mixing speed is required before discharge of any concrete. The Engineer may allow mixing water only one time during the discharge of the concrete.
 - e. The Engineer may require tests for consistency at approximately the beginning, the midpoint, and the end of the load. If the results vary by more than 1 in, do not use the mixer or agitator until the condition is corrected.
 8. Transport central mixed concrete in suitable non-agitating equipment. Provide covers when specified. Equip bodies with smooth, mortar-tight metal containers capable of discharging the concrete at a controlled rate without segregation. Completely discharge concrete within 45 minutes after the introduction of the cement to the aggregates.
 9. Do not use aluminum pipe or aluminum truck beds to convey concrete.
 10. Provide concrete at a temperature of at least 50 °F and not more than 85 °F at the time of placing.
- E. Conditioning of Subgrade or Base Course.** Check the base or subgrade surface and correct deficiencies before placing concrete.

Place concrete pavement on the uniformly moistened surface of the completed base or subgrade. Moisten asphalt treated base surfaces immediately ahead

of the placement of concrete pavement to ensure compliance with temperature requirements. Remove excess moisture before paving.

F. Temperature Limitations. Place concrete pavement with the following precautions:

1. During cold weather, when temperatures are 40 °F and greater, produce mixed concrete with a temperature at least 50 °F and no more than 85 °F at the time of placing. The water, the aggregate, or both may need to be heated to a temperature of between 70 °F and 150 °F. The Contractor may place concrete pavement when the air temperature is below 40 °F per 409.03.M.
2. Do not place concrete on frozen subgrade or use frozen aggregates in the concrete.
3. Do not place concrete that has a temperature of more than 85 °F at time of placement. Do not place concrete when the evaporation rate is greater than 0.15 lb/ft² per hour when tested in accordance with Idaho IT-133. Night or early morning placement may be necessary to avoid excess evaporation. Ice used as a part of the mixing water must be completely melted by the time mixing is completed.
4. Do not place concrete on a surface with a temperature exceeding 90 °F.

G. Hand Placing Concrete. The following conditions allow hand placing and finishing methods unless otherwise specified:

1. Breakdown of the mechanical equipment when the concrete is already deposited on the grade.
2. Narrow widths or areas of irregular dimensions where operating mechanical equipment is impractical. Obtain Engineer approval before placing concrete in wood or metal forms.
3. Do the following when hand placing and finishing methods are allowed:
 - a. Place a test section to demonstrate the proposed operation is capable of satisfactorily consolidating and striking off the concrete to the required grade, section, and applicable smoothness requirements when Engineer requested.
 - b. Spread concrete evenly. Do not use vibrators for extensive shifing

of the concrete mass. Use surface vibrators, internal vibrators, or other methods that produce equivalent results without segregation to consolidate concrete. Thoroughly consolidate concrete against and along forms or adjoining pavement so gravel pockets along the edges of the finished pavement are prevented. Repair any gravel pockets found after removing the forms. Consolidate uniformly across the full pavement width. Strike off the concrete to the intended surface profile after consolidation.

- c. Provide a screed at least 2 ft longer than the maximum width of the slab to be struck off. Use a screed constructed of metal or other suitable material clad with metal, rigid enough to retain its shape, and is Engineer approved.
- d. Move the screed forward on the forms with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and manipulated so neither end is raised from the side forms during the striking off process. Repeat until the surface has uniform texture, is true to grade and cross section, and has no porous areas, if necessary.
- e. Smooth the concrete by floating after it has been consolidated and struck off. Do not float concrete within 30 ft of consolidation and strike off. The Contractor may use long handled floats having blades not less than 4 ft in length to smooth and fill in open textured areas in the pavement. The Contractor may use a full width float. Move ahead in successive advances of not more than one-half the length of the float. Continue floating until all irregularities are removed. Remove free water on the pavement with the float or other suitable tool.
- f. Float the surface transversely using a long handled float when the crown of the pavement will not permit using a longitudinal float. Do not work the crown out of the pavement.
- g. Remove any excess water and laitance from the pavement surface after floating. Use a straightedge at least 10 ft long with a long handle for operating at the edge of the pavement. Lap successive drags one-half the length of the blade.

- h. Finish the surface of the concrete pavement by the methods in 409.03.J. Use hand methods that result in the finish specified in 409.03.J when a self-propelled comb is not practical.
- i. All smoothness requirements apply.
- j. Do not place additional water on the concrete surface during the machine or hand finish operation.

H. Joints. Construct joints in accordance with the details shown on the plans and Standard Drawings. Use suitable guidelines or devices to assure sawing the joints at the proper location.

1. **Stress Relief Joint Sawing.** Make the initial stress relief saw cuts, to control shrinkage cracking, as soon as the concrete has hardened enough to permit sawing without raveling. Saw to the depth, width, line, and spacing shown on the plans. Continue stress relief sawing operations at night or under inclement weather conditions as required. Keep the sawing operation up to pace with the paving operation; otherwise stop paving work until the sawing operation can keep pace with the paving operation. Single cut stress relief joints, when shown on the plans, shall be $\frac{1}{4}$ inch wide and shall be saw cut to $\frac{1}{3}$ depth of the concrete pavement. Single cut stress relief joints shall be sealed with a hot poured elastomeric joint filler meeting the requirements of 704.03. Backer rods will not be used.

When a single saw cut joint is specified, thoroughly clean the sides of the joint and the adjacent pavement surface approximately 1 in on each side of the joint of all scale, dirt, dust, and other foreign material by jet water blasting immediately after sawing. Remove the residue from sawing and water blasting from the pavement surface before it is blown by traffic or wind. Prevent the residue from entering lanes used by traffic

2. **Sealant Reservoir Construction.** Allow the concrete to cure at least 72 hours, then saw the joints to the width and depth shown on the plans to accommodate sealant placement when a sealant reservoir is specified. Do not saw wider than specified. Thoroughly clean the sides of the sealant reservoir and adjacent pavement surface, approximately 1 in on each side of the joint, of scale, dirt, dust, and other foreign material by jet water blasting immediately after sawing. Remove the

residue from sawing and water blasting from the pavement surface before it is blown by traffic or wind. Prevent the residue from entering lanes used by traffic.

Repair damage to the concrete pavement, such as spalling or fracturing. Properly cure repairs before installing the joint sealant.

3. Tie Bars. Place deformed tie bars of the specified length, size, and material as shown on the plans. Place tie bars using Engineer approved mechanical equipment, rigidly secured by chairs or other supports to prevent displacement. Do not treat the tie bars; this will impair bonding with the concrete. Locate tie bar within tolerances as shown on the plans or as specified.
4. Load Transfer Devices. Incorporate load transfer devices into the concrete pavement by using dowel bar assemblies or dowel bar inserters, unless otherwise directed by the Engineer.
 - a. Dowel Bar Assemblies.
 - (1) Fabrication. Fabricate dowel bar assemblies, or baskets, in single units for appropriate lanes before being placed on grade. Use Engineer approved dowel basket manufacturers. Submit material detail sheets with basket size and complete anchoring details including analysis of basket strength and stability for prior Engineer approval.
 - (2) Anchoring. Securely anchor dowel bar assemblies at grade to prevent displacement during concrete paving. Secure baskets with at least eight pins to ensure they hold bars within tolerance. The Engineer will check dowel basket placement and anchorage before concrete placement. Cover dowel bar assemblies with fresh concrete immediately ahead of the paver. Properly realign and re-anchor dowel baskets removed to accommodate delivery of concrete before the paver arrival.
 - (3) Location. Check and document dowel bar location at least every 30 joints after placement of concrete. Locate the baskets and dowels in plastic concrete with a hand trowel, or other approved method, to verify location and accuracy. Note and mark the joint locations that are not acceptable and take action to determine and correct the deficiencies ahead of the paver.

- (4) Dowel Bars. Coat dowel bars in accordance with AASHTO M 254, Type A or B. Give Type B dowel bars in assemblies a thin coating of graphite grease, or Engineer approved equal, as a bond breaker.

On ramps, tapers, and widenings, use no more than two assembly sections in any one joint.

b. Dowel Bar Inserters.

As an alternative to dowel bar assemblies on grade, the Contractor may insert dowel bars into the plastic concrete by an Engineer approved mechanical device that ensures reconsolidation around the bars. Place the bars parallel to the pavement centerline and surface. Insert the bars before the passage of the final finishing beam or screed.

- (1) Approval. Do not use dowel bar inserters without prior Engineer approval. Use an approved method to detect and verify the location of dowel bars.
- (2) Location. Use Ground Penetrating Radar (GPR), Magnetic Tomography (MIT-scan), pacometer, or other Engineer approved device to establish the location and to ensure compliance with the tolerances of the dowel bar placement of at least 10% of the joints. The Engineer will select the joints to be inspected at random. Take a minimum of two cores to verify the calibration of the insertion equipment. When inspection shows dowel bars out of tolerance, inspect all remaining joints with the approved device.

Repair holes left in the pavement by the coring operation at no additional cost to the Department. Obtain Engineer approval for repair methods and materials before beginning repairs.

- (3) Dowel Bars. Coat dowel bars in accordance with AASHTO M 254, Type A or B. Give Type B dowel bars to be inserted a two layer bond breaker coating. Use an approved dry film such as 3M TFE on the first layer. Apply a thin layer of form oil over the dry film. Use extra precautions to prevent form oil runoff from contaminating the fresh concrete.

Locate Load Transfer Devices within tolerances as shown on the plans or as specified regardless of method of incorporation.

Dowel bars, whether placed in baskets or inserted, must have a minimum of 6 in of bar embedded in each slab. Retrofit missing dowels, or dowels out of tolerance in the wheel path area. The Engineer may accept compensation in place of retrofitting bars in areas outside of the wheel path. As compensation, missing dowel bars will be charged by the Department to the Contractor at the cost to retrofit the bars into the slabs.

Provide positive control and an Engineer approved method of marking dowel bar locations for correlation to sawed joints.

Dowels are required where the new concrete pavement abuts the existing concrete pavement. Drill holes into the existing concrete pavement at the location shown on the plans or as directed and epoxy grout dowel bars into the holes. Obtain Engineer approval of epoxy grout before use.

5. **Construction Joints.** Place construction joints at right angles to the centerline when there is an interruption of more than 45 min in the concrete paving operations.

Do not place transverse joints closer than 6 ft apart.

Place the construction joint at the same location as would be used for a transverse joint whenever possible.

6. **Random Cracks.** After sawing is completed, remove random cracks penetrating the full depth of the pavement, whether transverse or longitudinal, by replacing the cracked slabs. Remove and replace cracked slabs at no additional cost to the Department.

- I. **Tolerance in Pavement Thickness.** Construct pavement in accordance with the thickness shown on the plans and subject to the thickness price adjustment in Table in 409.05-1. The Engineer will measure the pavement thickness and make deductions for or require removal of any pavement found deficient in thickness. The Department will pay an incentive for concrete thickness in excess of that shown on the plans.

When the surface of the pavement has been finished to the final grade, the Engineer will check the completed pavement thickness of the plastic concrete by measuring the distance from the concrete pavement surface to the underlying surface with a calibrated depth probe. Restore the surface of the pavement after thickness measurements have been made. The Contractor may take cores, as Engineer approved, to dispute depth probes taken by the Engineer and the actual area of excess or deficient pavement thickness. The

Engineer will witness the coring. Core, test and repair the concrete pavement at no additional cost to the Department.

The Engineer will determine pavement thickness by average depth probe measurements in accordance with Idaho T-130. Provide the Engineer access to the paving machine to perform the measurements or provide a work bridge.

An adjusted unit price for pavement is defined as a single placement width 0.1 mi long. The Engineer will determine the average thickness of the pavement in accordance with Idaho T- 130 calculated as follows:

1. When the thickness is more or less than 0.1 in of the specified thickness, but less than 0.5 in, that section is eligible for an incentive or disincentive price adjustment in accordance with Table 409.05-1.
2. When the thickness is more than the target range of the specified thickness, no price adjustment will be made by the Engineer for the concrete left in place.
3. The average thickness applies for each section individually.

The Engineer will calculate thickness incentive or disincentive by comparing the measured average thickness to the plan thickness for the concrete paving. The Department will make an adjusted payment for the test section in accordance with Table 409.05-1.

Each depth probe set represents the pavement thickness for a distance extending one-half the distance to the adjacent depth probe set, in each direction, measured along centerline, or in the case of a beginning or ending probe, the distance will extend to the end of the pavement section.

J. Final Finish. Finish the surface of the concrete pavement by tining and use a self-propelled steel comb. Tining will be specified as longitudinal or transverse. Provide longitudinal tining if the method is not specified.

1. General. Give the pavement an initial and a final texturing in advance of the curing operations. Perform the initial texturing with a burlap drag or broom device that will produce striations parallel with centerline. Use burlap that is a coarse fabric of jute or hemp. Use a single piece burlap drag extending the entire width of the paving operations.

Install burlap drags, brooms and tine devices on self-propelled equipment having external alignment control. Maintain a constant area of burlap in contact with the pavement surface at all times when texturing. Replace the burlap drag whenever results are unacceptable to the Engineer.

Provide broom and tine devices with positive elevation control. Maintain downward pressure on the pavement surface during operation to achieve uniform texturing without measurable variations in pavement profile. Operate the self-propelled texturing machines at a constant travel speed that keeps pace with paving operations. Stop placing the concrete when the finishing equipment does not comply to these provisions. Resume when the equipment deficiency or malfunction is corrected.

Use spring steel tines on the final texturing device that have a rectangular cross section 1/8 inch wide, on 3/4 inch centers, and whose length, thickness and resilience will form grooves approximately 3/16 inch deep in the fresh concrete surface. Form the grooves in the plastic concrete without tearing the surface and without bringing pieces of the coarse aggregate to the top of the surface. Produce a final texture that has a uniform appearance with the grooves having a depth between 1/8 inch and 3/16 inch. Maintain a 1 inch gap between each tine strip to prevent overlapping the tined surface and producing a weak surface area.

Measure the groove depth according to the "Procedure" portion of AASHTO T 261. Make adjustments to the tining operation when more than three readings in a set of ten are outside the intended depth range.

Round the edges of the pavement along each side of each slab and on each side of transverse expansion joints, formed joints, and construction joints, to a radius of 1/8 in before the concrete has taken its initial set. Produce a well defined and continuous radius and a smooth dense mortar finish. Do not unduly disturb the surface of the slab by tilting the tool during use.

Eliminate tool marks appearing on the slab adjacent to the joints. In doing this, do not disturb the rounding of the corner of the slab. Completely remove concrete on top of the joint filler.

Test joints with a straightedge before the concrete has set, and make correction if one side of the joint is higher than the other, or if they are higher or lower than the adjacent slabs.

Correct areas of concrete pavement which are not finished in accordance with these requirements by retexturing.

The Contractor may retexture by cutting transverse grooves in the concrete pavement surface by means of saw blades or other Engineer approved devices. Space the grooves 3/4 in. center to center and 1/8 in.

in width and depth. Obtain Engineer approval to use alternative patterns. Do not polish the concrete pavement surface after cutting

2. Longitudinal Tining. Perform final texturing with a spring steel tine device that will produce grooves parallel with the centerline.

Tine the concrete surface within 5 inches, but not closer than 3 inches, of longitudinal pavement edges and formed joints.

3. Transverse Tining. Perform final texturing with a spring steel tine device that will produce grooves parallel to the transverse joints or perpendicular to the centerline.

Repeat the grooving pattern across the pavement. Secure the tines of a double tine comb together. Do not use the comb within 1 ft of either edge when the finishing machine causes edge slump. Comb these unfinished edges by hand.

K. Surface Test. Test the finished pavement the next working day after placement in accordance with the following requirements:

1. Use a 10 ft straightedge on the surface at locations determined by the Engineer. When the straightedge is laid on finished pavement in a direction parallel with centerline or perpendicular to centerline, locate surface areas that vary more than 1/4 in from the lower edge. Remove high points that cause the surface to exceed these tolerances by grinding.
2. Profile the surface using a California Profilograph in accordance with Idaho T-140 or functional equivalent and these provisions:

Make profiles 3 ft from and parallel to one edge of each driving lane, and in other locations as directed, with a maximum of two profiles per driving lane.

Apply the following Profile Index requirements:

- a. Profile Index of 0.5 in or less per 0.1 mi where:
 - i. The longitudinal grade is 4.5 percent or less, and:
 - a. the pavement is on tangent alignment;
 - b. the pavement is on horizontal curve with a centerline radius of curve 2000 ft or more.
 - ii. Test consecutive 0.1 mi sections of roadway with no overlapping.
- b. Profile Index of 0.7 in or less per 0.1 mi where:

- i. The longitudinal grade is greater than 4.5 percent.
- ii. The pavement is on horizontal curves that have a centerline radius of curve of 1,000 ft or more, but less than 2000 ft, and the pavement within the superelevation transition these curves.

No profile is required in the following areas of pavement, unless otherwise specified:

Pavement on horizontal curves having a centerline radius of curve less than 1000 ft and pavement within the superelevation transition of such curves.

Pavement within 50 ft of a transverse joint that separates the pavement from an existing pavement not constructed under the contract.

Pavement for ramps, approaches, structure decks, city streets or county roads.

Pavement within 50 ft of a transverse joint that separates the pavement from a structure deck or an approach slab.

Reduce individual high points in excess of 0.3 in, as determined by measurements of the profilogram in accordance with Idaho T-140, by grinding until such high points as indicated by reruns of the profilograph do not exceed 0.3 in.

After grinding has been completed to reduce individual high points in excess of 0.3 in, perform additional grinding as necessary to reduce the Profile Index to values specified above in any 0.1 mi section along any line parallel with the pavement edge.

Perform additional grinding as necessary to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines perpendicular to the pavement centerline, within any one ground area. Ensure ground areas are neat, rectangular areas of uniform surface appearance.

Produce a pavement surface that is true to grade and uniform in appearance with longitudinal corrugations that present a narrow ridge, corduroy appearance. Produce ridge peaks approximately 1/16 in higher than the bottoms of the grooves with approximately 53 to 57 evenly spaced

grooves per foot. Remove fins resulting from grinding before opening to traffic.

Use power driven, self-propelled grinding equipment that is specifically designed to smooth and texture Portland cement concrete pavement, with diamond blades. Use a machine with an effective wheel base of at least 12 ft and of a shape and dimension that does not encroach on traffic movement outside the work area. Use equipment capable of grinding the surface without causing spalls at cracks, joints, or other locations.

Smoothly feather transitions between ground and unground areas of concrete at transverse boundaries.

Do not exceed 1/8 in vertical variations in elevation between ground and unground areas of concrete. Feather out these variations with additional grinding using an appropriate cross slope adjustment.

Furnish and operate the profilograph equipment. Equip the profilograph with a recorder capable of producing a graph chart and evaluate in accordance with Idaho T-140. Give the chart to the Engineer to review and retain no later than the next working day.

Operate the profilograph at the manufacturer's recommended speed. Calibrate at the beginning of the project and as needed thereafter.

Supply a profilograph on the project, calibrated, in good working condition, and ready for operation before construction of any concrete pavement begins. Provide a competent and experienced operator to operate the equipment.

L. Curing. Cure concrete pavement with a System 2 White Pigmented Membrane Forming curing compound as specified in 709.01.

Cure the concrete with two applications of the curing compound for a total coverage of at least 1 gal / 75 ft². Apply each application of the curing compound under pressure at a rate of not less than 1gal / 150 ft² on textured surfaces of concrete pavement. Apply the second coat of membrane in the opposite direction of the first coat.

Uniformly spray the entire surface of the pavement with the two complete applications of the membrane forming curing compound after finishing the surface and sides and before the initial set has taken place by an Engineer approved machine method.

Thoroughly mix the membrane forming curing compound before use. Agitate the curing compound during application to prevent settling and separation. Demonstrate the intended method for mixing and agitating the compound before each paving usage for Engineer approval. Hand spray odd widths or shapes and slab edges. Do not apply curing compound to the inside faces of joints to be sealed. Should the film become damaged from any cause within 72 hours, immediately repair the damaged portion with additional compound at no additional cost to the Department.

Remove curing compound applied to construction joints by sandblasting before fresh concrete is placed.

The Engineer will sample, test and approve each manufacturer's identified lot of curing compound before use. Allow 3 weeks for laboratory testing of the curing compound once it has been received by the Department's Central Materials Laboratory. Quantities of curing compound over 1000 gal can be inspected and sampled by the Department at the manufacturer's plant, for acceptance testing. Direct inspection requests to the Engineer and the Department's Central Materials Laboratory Chemistry Section in writing at least 30 days before ordering material.

- M. Cold Weather Concreting Work Plan.** Submit a cold weather concreting and curing work plan to the Engineer for approval when there is a probability of air temperatures below 40 °F during the placing and curing periods. Detail the methods and equipment proposed to produce mixed concrete and deliver it with a temperature of between 50 °F and 85 °F at the time of placing. The water, the aggregate, or both may need to be heated to a temperature of from 70 °F to 150 °F. Include the methods to protect the finished concrete from freezing and cracking and address how curing will be continuously monitored to assure the required strength is developed before opening to traffic. Detail the methods and equipment proposed to assure that the required concrete temperatures are maintained at all times. Include the materials and manpower anticipated to execute the work plan. Do not place concrete until the plan is approved by the Engineer.

When the ambient temperature falls below 40 °F meet the following concreting operations requirements:

1. Provide a supply of suitable blanketing material alongside the work before placing the concrete pavement, in quantities sufficient to cover the anticipated area of concrete pavement placed during the expected period of cold weather protection.

2. Anytime the air temperature is expected to drop to 32 °F or less during the expected period of cold weather protection, spread the blanketing material provided over the surface and exposed sides of the concrete pavement to a depth sufficient to prevent freezing of the concrete. Immediately cover the concrete whenever the air temperature drops to 35 °F or lower.
3. Provide at least one calibrated recording thermometer, approved by the Engineer, for every 2,500 yd² of concrete pavement placed. Whenever the air temperature is expected to drop below 40 °F place and operate recording thermometers. Remove and replace concrete damaged by frost action at no additional cost to the Department.
4. The Contractor may remove the protection blankets in a minimum sized area for a time not to exceed ½ hour for the purpose of sawing joints.
5. Maintain a temperature at the surface of the concrete of at least 40 °F for 7 days. After 4 days the cold weather protection can be suspended if it is demonstrated with field cured cylinders or maturity method that the concrete pavement has reached a compressive strength of at least 2500 psi.
6. When protection blankets are no longer required, remove them so the temperature of the concrete does not drop more than 40 °F during the first 24 hours. Monitor the temperature with a recording thermometer attached to the edge of the concrete pavement, or as Engineer approved.
7. The Engineer will approve making, storing, and testing the field cure cylinders used to demonstrate compliance with cold weather protection. Test and submit reports from an Engineer approved testing laboratory no later than the next working day after the cylinders are tested. The Contractor may use the maturity method.

N. Sealing Joints. Construct joints in accordance with 625 unless otherwise specified or in accordance with the sealant manufacturer's recommendations. Install joint sealant after grinding for surface smoothness and before the pavement is opened to traffic. Perform joint sealing only when the ambient and pavement temperatures are 50 °F or higher, the surface, and weather conditions are dry, or as allowed per manufacturer's recommendations.

Supply sealant material as specified in 704. Submit a copy of the sealant manufacturer's recommendations for handling, storage, and application to the Engineer before beginning the work.

1. Neoprene Compression Seal. When Neoprene compression seal is used, install the sealant material into the joint in accordance with 625, using

equipment and techniques recommended by the manufacturer. Ensure the finished joint seal has the shape factor and surface recess shown on the plans or Standard drawing C-1-A.

Install the longitudinal joint seal first and then cut at the intersections of the transverse joints. Install the transverse joint seal through the cut in the longitudinal seal to form a tight intersection.

Install the transverse seal in one continuous piece. Do not stretch the seal in excess of the manufacturer's recommendations. Do not twist the seal or have any deformity that interferes with the seal making complete contact with the joint face.

2. **Silicone Joint Sealant.** Use the size backer rod shown on the plans and the type of bond breaker, if required recommended by the sealant manufacturer. Clean the joint within one hour before placing the sealant by sandblasting and air blowing with compressed air at 100 psi minimum. Provide oil and moisture free compressed air. Do not place the sealant if dust, moisture, oil, or any foreign material is present on the concrete receiving the sealant. Apply the sealant material into the joint using equipment and techniques recommended by the manufacturer. Ensure the finished joint seal has the shape factor and surface recess shown on the plans or Standard drawing C-1-A.

Remove excess joint sealing material immediately and clean the pavement surface.

Do not use sand or similar material as a cover for the seal.

The Engineer will reject the joint material for failure in adhesion or cohesion. Repair the joint to the Engineer's satisfaction at no additional cost to the Department.

Have a technical representative of the manufacturer present at the job site for at least the first two days of joint preparation and sealing when Silicone Joint Sealant or Neoprene Compression Seal is used. Follow the recommendations made by the technical representative as Engineer approved. No separate payment will be made by the Department for the services of the technical representative or for carrying out Engineer approved recommendations.

- O. Multiple Lane Construction.** Do not place concrete in adjacent lane(s) sooner than 48 hours after finishing of the first lane(s).

The Engineer may allow the operation of equipment and trucks on newly paved concrete, due to the lack of space elsewhere, if conditions are deemed justified subject to the following conditions:

1. The concrete in the new lane(s) has attained a compressive strength of 2500 psi as determined by field cured test specimens. Make, store, and cure field cured cylinders to demonstrate compressive strength is achieved as approved by the Engineer. Testing and reports are submitted to the Engineer by an approved testing laboratory and Engineer accepted. Expenses associated with the field cured cylinders shall be at no additional cost to the Department. The Contractor may determine compressive strengths by maturity testing in accordance with ASTM C1074.

Develop the maturity-strength relationship and provide maturity curves along with supporting data and field procedures for monitoring maturity for approval at least 10 days before use. Provide equipment, including thermo or maturity meters, thermocouples, wire and qualified personnel to monitor maturity and provide information to the Engineer.

2. Protect the surface of the new pavement from scarring and abrasion. Operate equipment on mats, skids or other approved protective devices. Remove any accumulation of concrete, sand and gravel, or other debris deposited on the new pavement as Engineer directed.

Replace cracked or broken panels or slabs on the new pavement that are the result of operating the equipment, at no additional cost to the Department.

- P. Protection of Pavement.** Repair or replace pavement damaged before final acceptance, at no additional cost to the Department.

Protect the edges and surface of the unhardened concrete against the effects of rain. Use metal or wood protective materials having a width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper, or plastic sheeting material for the protection of the pavement surface. Have these materials available on site at all times while paving. When rain appears imminent, stop paving operations and begin placing forms against the sides of the pavement and cover the surface of the unhardened concrete with the protective covering.

- Q. Opening to Traffic.** Do not allow full use of the pavement by all classes of traffic until field cured test specimens have attained a compressive strength of 3500 psi or more. Clean the pavement before opening to traffic. The Contractor

may substitute maturity test specimens in accordance with ASTM C1074 to determine compressive strengths. Develop the maturity-strength relationship and provide maturity curves along with supporting data and field procedures for monitoring maturity for Engineer approval at least 10 days before use. Provide equipment, including thermo or maturity meters, thermocouples, wire and qualified personnel to monitor maturity and provide information to the Engineer.

409.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

Concrete pavement by the square yard. The square yard measurement will be based on the width of the top surface of the pavement as shown on the typical section on the plans and additional widening where specified or Engineer directed. The length will be measured horizontally along the centerline of each ramp or roadway. Pavement areas will be computed to the nearest 0.1 yd².

The Engineer will not make a final measurement of the completed pavement except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The Engineer will then compute a revision or correction and add to or deduct from the contract quantity.

409.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Concrete Pavement	SY

The Department considers drilling holes for the dowels as incidental and the cost included in the contract unit price.

Verifying dowel bar location is incidental and the cost included in the contract unit prices.

The Department will not pay for field cured cylinders.

The Department will not pay for grinding and related expenses including disposal of ground material, traffic control, flagging, profiling, and temporary striping, The Department will not make additional payment for corrective treatment to meet smoothness requirements.

Thickness price adjustment. The Department will make the following price adjustment to the contract unit price for each evaluation section quantity exceeding the thickness shown on the plans. If thickness measurements show deficient thickness, the Contractor has the option of removing and replacing the pavement at no

additional cost to the Department or leaving the pavement in place and receiving the deductions specified in Table 409.05-1.

Table 409.05-1 - Thickness Price Adjustment

Excess or Deficiency in Thickness, in.	Price Adjustment, Percent of Contract Unit Price
Over +0.50"	100
+0.35" to +0.50"	102
+0.25" to +0.34"	103
+0.11" to +0.24"	105
+0.10" to -0.10"	100
-0.11" to -0.24"	85
-0.25" to -0.34"	70
-0.35" to -0.50"	50
Over -0.50"	0

The Department will not pay an incentive for thickness in evaluation sections where pavement grinding has occurred to achieve smoothness.

The Engineer will evaluate areas of pavement found deficient in thickness by more than 0.5 in and determine if the deficient area is sufficient to seriously impair the anticipated service life of the pavement. Remove the affected areas of pavement within the limits specified and replace it with concrete of the specified quality and thickness at no additional cost to the Department. Remove the sections of pavement the full length between transverse joints.

If, in the opinion of the Engineer, a deficiency in excess of 0.5 in will not seriously impair the anticipated service life of the pavement, the Contractor may elect to leave the pavement in place, but will receive no compensation from the Department for the deficient area of pavement.

When the pavement contains no longitudinal joint, the area of such pavement for which no payment will be made by the Department is the product of the full width of the strip placed as a unit, multiplied by the distance between probes, on both sides of the deficient measurement that shows measurements within the thickness limits. Where the pavement contains longitudinal joints, the width used by the Department is the width between longitudinal joints and the edge of the pavement.

The Engineer may order the Contractor to core drill the finished pavement to

determine thickness of the pavement in areas where smoothness corrections are made. The Engineer will determine the pavement thickness by coring after all smoothness corrections have been completed.

Profile incentive. The Contractor is entitled to an incentive payment for each evaluation section, where the profile index before grinding is less than 0.5 in per 0.1 mi. An evaluation section is a 12 ft wide placement, 0.1 mi long or fraction as applicable, with profiles in the driving lanes only. The 0.1 mi long sections runs consecutively from the point paving begins to the point paving is interrupted as shown on the plans such as at bridges and end of lane paving or areas specifically excluded by the specifications. The Profile Index requirements are specified in 409.03.K. The Department will not pay incentive payment for pavement on the roadway shoulders, turn lanes, or other miscellaneous pavement. The Department will pay incentive in accordance with Table 409.05-2.

Table 409.05-2 - Profile Incentive

INITIAL PROFILE INDEX In per 0.1 mi section	Payment \$ per 0.1 mi
≤ 0.20 in	\$1200.00
>0.20 – 0.30	\$800.00
> 0.30 - 0.40	\$240.00
>0.40	No payment

The Department will make only one incentive payment, whichever payment is greatest according to the Initial Profile Index reading above.

When more than one profile run is made in an evaluation section, the Department will use the roughest profile index to calculate the incentive payment.

The Engineer may reject the pavement when the Initial Profile Index exceeds 0.5 in per 0.1 mi section or 5 in in a mile.

If grinding is required in accordance with 409.03.K, make a profile run after grinding to assure minimum specifications have been met.

SECTION 411 URBAN CONCRETE PAVEMENT

411.01 Description. Construct Portland cement concrete pavements on streets or urban highways as specified in 409.01.

411.02 Materials. Provide materials as specified in 409.02.

Test in accordance with the test methods listed in 409.02.

411.03 Construction Requirements.

A. Proportioning. Meet the requirements as specified in 409.03.A with the following exceptions:

1. Use number 3 coarse aggregate or 3C combined aggregate gradation unless otherwise directed by the Engineer.
2. The Contractor may increase maximum slump to 3 in if finishing machines that provide only surface vibration are used, and 4 in if hand methods are used.
3. The Engineer may require Type III cement where earlier pavement strengths are necessary.

B. Equipment.

1. Mixers and Hauling Equipment. Meet the requirements specified in 409.03.B.1.
2. Paving Equipment. Meet the requirements specified in 409.03.B.2.
 - a. Placer/Spreader. Meet the requirements specified in 409.03.B.2.a.
 - b. Slip Form Paving. Use equipment as specified in 409.03.B.2.b.
 - c. Machine Paving with Forms. Provide forms so the constructed pavement meets the specified thickness, cross section, grade and alignment shown on the plans. Adequately support forms to prevent deflection or movement. Do not allow the top of the forms to deviate more than 1/8 in in 10 ft and do not allow the alignment of the forms to deviate more than 3/16 in in 10 ft. Allow the concrete to set sufficiently to withstand form removal without chipping or spalling when forms are removed the day after placement. Spray the edges of the concrete with curing compound if forms are removed before the expiration of the curing period. Clean, oil, and examine used forms for defects before they are used again.

Use any machine or combination of machines capable of consolidating the concrete across the full width of the placement into a uniform and homogeneous mass, without rock pockets, and without separation of mortar and aggregates. Machine may be subject to Engineer approval. The Engineer may request a test section placed to demonstrate the capability of the equipment to satisfactorily strike off and compact the concrete to the required density, grade, and sections.

The Contractor may use internal, pan, beam or roller type vibrating units. Do not operate the vibration equipment when the machine is not in motion.

Run machines to consolidate, finish to the established grade and cross section, and establish a smooth even surface so only a very moderate amount of hand finishing is necessary.

Do not overwork the concrete and bring an excess of fines to the surface. Remove any water or laitance from the surface with a grout rod or scraping straightedge at least 10 ft wide with a long handle and operated from the pavement edge. Perform the finishing operations when pavement surface existing conditions necessitate

- d. Bridge Deck Machine. Use equipment as specified in 409.03.B.2.d.

Use the following sequence of operations for placing concrete with any of the methods described in this section:

- i. strike-off
- ii. consolidate
- iii. float
- iv. remove laitance
- v. straightedge
- vi. final surface finish.

Do not add water to the surface of the concrete during this sequence of operations.

3. Concrete Sawing Equipment. Meet the requirements specified in 409.03.B.3.

C. Handling, Measuring and Batching Materials. Meet the requirements specified in 409.03 C.

D. Mixing and Delivering. Meet the requirements specified in 409.03.D.

- E. **Conditioning of Subgrade or Base Course.** Use the requirements specified in 409.03.E.
- F. **Temperature Limitations.** Use the requirements specified in 409.03.F.
- G. **Hand Placing Concrete.** Use the requirements specified in 409.03.G.3. Limit hand methods to irregular areas, irregular sections, and pavement placed in confined work areas

Moisten the forms and surface of the base immediately ahead of the placement of concrete pavement.

Place concrete in a continuous operation between construction joints. Deposit concrete so rehandling is minimized. Spread concrete evenly. Do not use vibrators for extensive shifting of the mass of concrete. Use surface vibrators, internal vibrators, or other equivalent method to produce consolidation without segregation. Assure adequate consolidation next to forms and uniformly across the full pavement width. Strike off concrete to the intended surface profile after consolidation.

Smooth concrete by floating after it has been struck off and consolidated. Do not move ahead in successive advances more than one-half the length of the float. Continue floating until irregularities are removed. Float the concrete within 30 ft of the consolidation effort. Remove free water on the pavement with the float or other suitable tool.

Thoroughly consolidate concrete against and along forms or adjoining pavement so gravel pockets along the edges of the finished pavement are prevented. Repair any gravel pockets found after removing the forms.

Place reinforcing steel around hardware such as manholes and valve covers as shown on the plans or as Engineer directed.

Allow local traffic access by placing concrete in intermittent areas or leaving temporary gaps in the pavement.

The Engineer may request a test section to demonstrate that the proposed operation is capable of satisfactorily consolidating and striking off the concrete to the required grade and section.

Scrape the surface of the concrete with a grout rod after floating. Use a grout rod at least 10 ft long with a long handle for operating at the edge of the pavement. Use the grout rod to correct irregularities in the pavement surface and remove water and laitance.

- H. Joints.** Transverse and longitudinal joints for urban pavement may be contraction joints or construction joints as shown on the plans and as specified. Where possible, place all longitudinal joints on lane lines except through transitions and in intersections. Refer to Standard Drawing C-1-A

For intersections and other irregular areas, place joints in accordance with the joint location plan or as Engineer directed.

1. **Stress Relief Joints.** Form or saw transverse and longitudinal contraction joints.
 - a. Construct formed contraction joints by imbedding a pre-formed joint material. Cut filler to the exact sections of the joint. Extend the length of the pre-molded joint filler to within 3/16 in of both edges of any panel.
 - i. **Transverse Contraction Joints.** Place transverse contraction joints (dummy joints) after consolidation and finishing of concrete have been completed and before initial set. Cut a groove into the surface at the location of joint, using a tool provided with stops (tee iron) to prevent cutting the groove deeper than the planned depth of the joint filler. Insert joint filler into the groove until the top is flush with the pavement surface, with a deviation of not more than 1/8 in below the surface. Ensure joint filler is at right angles to the surface and always in a straight line.
 - ii **Longitudinal Contraction Joints.** Construct longitudinal contraction joints in true alignment with respect to their proper location on centerline or parallel to the plan joint location. Should multiple lanes be constructed simultaneously, use a sawed joint instead of the preformed joint material.

Restore the surface finish of the pavement against the filler strip with hand floats after the joint filler has been embedded in the concrete. While performing this operation, maintain filler strip in a vertical or normal position, true to alignment. After finishing, ensure the entire area of the joint is true to grade and smoothness without any irregularities.

- b. Use the requirements specified in 409.03.H for sawed contraction joints.

2. Sealant Reservoir Construction. Use the requirements specified in 409.03. H.2.
3. Tie Bars. Use the requirements specified in 409.03. H.3.
4. Load transfer Devices. Use the requirements specified in 409.03. H.4.
5. Construction Joints. Place construction joints as follows:
 - a. Transverse Construction Joints. Make transverse construction joints at the end of each day's paving, or when placing of concrete is discontinued for more than 45 minutes. Place the construction joint at the same location as would be used for a contraction joint, if possible. If the joint occurs at any other location, construct a joint using tie bars at least 6 ft away from the nearest contraction joint.
 - b. Longitudinal Construction Joints. Locate longitudinal construction joints in accordance with the joint location plan, or as Engineer directed.
6. Random Cracks. Use the requirements specified in 409.03.H.6.

I. Tolerance in Pavement Thickness. Provide as specified 409.03.I.

J. Final Finish. Float slab after screeding if necessary to produce a uniform surface free from porous spots, irregularities, depressions, small pockets, or rough spots. Use a steel tine to finish the surface. Provide tines that are approximately 4 in long and spaced at approximately 1/2 to 3/4 in intervals.

Use nominal tine width 1/8 in. Ensure the depth of tined grooves is between 1/8 in to 3/16 in. Check groove depth according to the "procedure" portion of AASHTO T261. Make adjustments to the tining operation when more than three readings in a set of ten are outside depth range.

Perform the tining in such a way as to minimize surface tearing or aggregate removal. Tine with stroke transverse to the roadway centerline and full width of the roadway except for troweled smooth strips 1 ft wide along curb faces. Do not overlap adjacent strokes.

K. Surface Test. Use the requirements specified in 409.03.K.1 to test the pavement and applicable sections for grinding.

L. Curing. Use the requirements specified in Subsection 409.03.L.

M. Cold Weather Concreting Plan. Provide as specified 409.03.M.

N. Sealing Joints. Provide as specified 409.03.N.

- O. Multiple Lane Construction.** Provide as specified 409.03.O
- P. Protection of Pavement.** Provide as specified 409.03.P.
- Q. Opening Pavement to Traffic.** Provide as specified 409.03.Q, except as follows:

Protect curbs cast separately from the pavement for 72 hours by either keeping traffic off the adjacent pavement or by barricades placed along the curb.

411.04 Method of Measurement. The Engineer will measure acceptably complete work as follows:

- Urban concrete pavement will be by the square yard. Measurement will be based on the width of the top surface of the pavement as shown on the typical cross section of the plans with additional widening where specified or directed. The length will be measured horizontally along the centerline of the roadway. Pavement areas will be computed to the nearest 0.1 SY. The Engineer will not make a final measurement of the completed pavement except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The Engineer will compute a revision or correction and add to or deduct from the contract quantity.

411.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Urban Concrete Pavement.....	SY

The Department considers drilling holes for the dowels incidental and the cost included in the contract unit prices of other concrete pavement items. Verifying dowel bar location is incidental and the cost included in the contract unit prices of other concrete pavement items. The Department will not pay for field cured cylinders. The Department will not pay for grinding and related expenses including disposal of ground material, traffic control, flagging, profiling, and temporary striping.

Thickness price adjustment. The Department will make the following price adjustment to the applicable contract unit prices for each evaluation section quantity exceeding the thickness shown on the plans in accordance with Table 411.05-1. If thickness measurements show deficient thickness, the Contractor has the option of removing and replacing the pavement at no additional cost to the Department or leaving the pavement in place and receiving the following deductions in payment.

Table 411.05-1 - Thickness Price Adjustment

Excess or Deficiency in Thickness, in.	Price Adjustment, Percent of Contract Unit Price
Over +0.50"	100
+0.35" through +0.50"	102
+0.25" through +0.34"	103
+0.11" through +0.24"	105
+0.10" through -0.10"	100
-0.11" through -0.24"	85
-0.25" through -0.34"	70
-0.35" through -0.50"	50
Over -0.50"	0

The Engineer will evaluate areas of pavement found deficient in thickness by more than 0.5 in and determine if the deficient area is sufficient to seriously impair the anticipated service life of the pavement. Remove the affected areas of pavement within the limits specified and replace it with concrete of the specified quality and thickness at no additional cost to the Department. Remove the sections of pavement the full length between transverse joints.

If, in the opinion of the Engineer, a deficiency in excess of 0.5 in will not seriously impair the anticipated service life of the pavement, the Contractor may elect to leave the pavement in place, but will receive no compensation from the Department for the deficient area of pavement.

When the pavement contains no longitudinal joint, the area of such pavement for which no payment will be made by the Department is the product of the full width of the strip placed as a unit, multiplied by the distance between probes, on both sides of the deficient measurement that shows measurements within the thickness limits. Where the pavement contains longitudinal joints, the width used by the Department is the width between longitudinal joints and the edge of the pavement.

The Engineer may order the Contractor to core drill the finished pavement to determine thickness of the pavement in areas where smoothness corrections are made. The Engineer will determine the pavement thickness by coring after all smoothness corrections have been completed.

SECTION 500 - STRUCTURES

SECTION 501 - STRUCTURES

501.01 Description. Construct structures.

501.02 Materials. Not Specified.

501.03 Construction Requirements.

A. General. Before placing concrete obtain the Engineer's approval for the excavation depth and the foundation materials.

B. Cofferdams and cribs. Construct cofferdams and protect fresh concrete against damage from a sudden stream rise or from erosion. Do not place timber or bracing inside cofferdams or cribs that cannot be removed without damage to the concrete. Use cofferdam or crib material of sufficient length to allow a 2 ft lowering of footings.

Prevent concrete materials from being carried away when pumping from the foundation enclosure interior. Do not pump when placing concrete or for at least 24 hours thereafter, unless it is done from a suitable sump or well point separated from the concrete work.

Remove cofferdams, cribs, sheeting and bracing down to the elevation of the original ground line or to the new stream bed elevation for a channel change or to the top of footings in dry holes. Remove so there is no damage to the new structure.

C. Foundation Seal. Construct a concrete foundation seal when specified.

Pump out the foundation enclosure and place the masonry in the dry. Ensure the seal has set sufficiently to withstand the hydrostatic pressure before pumping to dewater a sealed cofferdam.

When weighted cribs are used and the weight is used to partially overcome the hydrostatic pressure acting against the bottom of the foundation seal, provide special anchorage such as dowels or keys to transfer the entire weight of the crib into the foundation seal.

D. Drainage of Substructure. Thoroughly and effectively drain the material behind abutments, retaining walls and wing walls by using granular backfill.

E. Bearing and Anchorage. Set bearing plates in exact position so as to have a full and even bearing upon the masonry. Ensure that anchor bolts are in

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the correct location and elevation. Adjust the position of expansion bearings to correspond with the temperature at the time of installation.

- F. Placing Concrete.** Place the concrete in slab spans, T-beams, or deck girders in one continuous operation, unless otherwise specified.

If continuous placement of concrete girders or decks of a multi-span continuous structure is required, or Engineer approved, the Department may require a set retarding admixture. If a set retarding admixture is required, submit a placing schedule for approval showing the proposed amount of admixture to be used. Provide chemical set retarding admixtures that meet AASHTO M 194, Type B or Type D. The Department will not allow a reduction in the concrete 28-day strength.

- G. Construction Joints.** Make construction joints only where located on the plans, or shown on the placement schedule, unless otherwise approved.

Place construction joints as Engineer directed, if not detailed on the plans or in the case of emergency. Use shear keys where necessary to transmit shear. Extend reinforcement beyond the construction joint at least the splice length of the reinforcing bar as shown on the plans.

Re-tighten the forms before placing new concrete on or against concrete that has hardened.

Roughen the concrete to a depth of at least $\frac{1}{4}$ in where shear keys are not provided. Roughen the surface of the hardened concrete so that there are no loosened particles of aggregates or damaged concrete at the surface.

Thoroughly clean construction joints of foreign matter and laitance, and saturate with water before fresh concrete is placed against the joint. Continuously place concrete from joint to joint. Carefully finish, true to line and elevation, the joint face edges exposed to view.

501.04 Method of Measurement. Not Specified.

501.05 Basis of Payment. Not Specified.

SECTION 502 - CONCRETE

502.01 Description. Provide Portland cement concrete.

- A. Classification.** Provide the classes of concrete specified in Table 502.01-1 and Table 502.01-2 where required on the plans.

Table 502.01.1 - Basic Mix Design Parameters

Concrete Class in (100psi) (28 day) ^(a)	Minimum Cement Content lb./yd ^{3(b)}	Max. Water Cement Ratio	Air Content Percent
45 and greater ^{(c)(d)}	660	.44	0-6.0
35 to less than 45 ^{(c)(d)}	560	.44	0-6.0
30	560	.49	6.5 ±1.5
22	470	.60	0-6.0
15	380	.60	0-6.0
Seal Concrete	660	.60	0-6.0

^a Numerical part of class designation is the specified compressive strength when tested in accordance with applicable test listed in 502.02.

^b It may not always be possible to produce concrete of the specified compressive strength using the minimum cement content. No separate payment will be made by the Department for additional cement required to meet the specified compressive strength.

^c Concrete classes designated as "A" shall have an air content of 6.5±1.5 percent.

^d Concrete classes designated as "C" shall have a maximum water cement ratio of 0.40, (water reducer required), and air content of 6.5±1.5 percent.

Table 502.01-2
Basic Mix Design Parameter When Fly Ash Concrete is Used

Concrete Class in 100 psi (28 Day) ^(a)	Minimum Cement Content lb./yd ^{3(b)}	Minimum Secondary Cementitious Material (SCM) Content lb./yd ³ (b)(e)(f)	Max. Water to Cement (Plus Fly Ash) Ratio	Air Content Percent
45F and greater ^{(c)(d)}	550	Note ^(b)	.42	0-6.0
35F to less than 45F ^{(c)(d)}	467	Note ^(b)	.42	0-6.0

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30 F	467	Note ^(b)	.47	6.5±1.5
22 F	392	Note ^(b)	.58	0-6.0
15 F	317	Note ^(b)	.58	0-6.0
Seal Concrete W/Fly Ash	550	Note ^(b)	.58	0-6.0

a Numerical part of class designation is the specified compressive strength when tested in accordance with the applicable test listed in 502.02.

b Minimum SCM content varies by product, for fly ash and slag cement (slag) minimum content is 20% by weight of total cementitious material (cement + SCM). For Silica Fume minimum content is 7.5% by weight of total cementitious material. Ternary blends shall contain a minimum of 20% SCM.

It may not always be possible to produce concrete of the specified compressive strength using the minimum cement and SCM contents. If additional cement and SCM are needed to meet strength requirements, add at the minimum ratio of 1 lb. fly ash or slag per 4 lb cement. For Silica fume the minimum ratio is 1 lb silica fume per 13.33 lb cement. No separate payment will be made by the Department for additional cement and SCM required to meet the specified compressive strength.

c Concrete classes designated as "CF" will have a maximum water cement ratio of 0.38 (water reducer required), and air content of 6.5±1.5 percent.

d Class F fly ash shall be used.

e If additional SCM is needed to meet the mortar bar expansion requirements, add it without a corresponding increase in cement provided the strength requirements of AASHTO T 303 are met. Lithium or other mitigating measures may be required, as Engineer approved, in order to comply with this requirement.

f Do not exceed 25 percent fly ash of the total cementitious material (fly ash + cement). Do not exceed 30 percent slag of the total cementitious material (GGBFS + cement). Silica fume shall not exceed 10 percent of the total cementitious material (silica fume + cement). Do not exceed 30 percent total SCM content of the total cementitious material (all SCM + cement).

Provide Class 30 concrete for any class of concrete and use coarse aggregate size Nos. 2a, 2b, 3 or 2c or 3c combined gradations except for Class 40A concrete and prestressed girders, unless otherwise specified. Use No. 2a, 2b or 2c coarse aggregate for Class 40A Concrete and prestressed girders. Minimum

cement content may be reduced 20 percent by the Contractor when using a combined gradation.

Ensure the slump does not vary more than 1 in. from the average during placement. Should an increase in slump be desirable for the concrete as batched, maintain the ratio of the weight of water to cement by either making proportional increases of cement with increases in water or by reducing the total weight of aggregates incorporated in the mixture.

The Department will not require AASHTO T 303 mitigation testing as part of the mix design and will not require the use of ASR mitigation measures for Class 22, Class 15, and Seal Concrete, except when used in structural foundation and bridge applications.

- B. Acceptance.** The Department will base acceptance of concrete on parameters specified for the given concrete class. The Department will base acceptance of strength from the results of 28-day compressive strength tests performed in accordance with 502.02, on cylinders made from concrete samples being placed. The Department will consider average strength from three companion cylinders as one test.

Precast, Prestressed and Cast-In-Place Post-Tensioned Concrete. Provide precast, prestressed and cast-in-place post-tensioned concrete meeting the release strength and 28 day strength as specified.

Conventionally reinforced Concrete. The Engineer may accept conventionally reinforced concrete provided the strength is not more than 10 percent below the specified strength.

Replace unacceptable concrete at no additional cost to the Department.

The Engineer will use the price adjustment for concrete that does not meet the intended strength, but is allowed to remain in place, as shown in the following table:

Percent of Specified Strength	Pay Factor
≥ 100.....	1.00
≥ 95 < 100.....	0.90
≥ 90 < 95.....	0.80
< 90	Subject to rejection. 1
(1)If allowed to remain in place, the Pay Factor will be 0.50.	

The Department will pay for the acceptable concrete quantities at the contract unit price multiplied by the applicable pay factor.

The Contractor may core drill concrete subject to price adjustment or rejection as an alternative test for acceptance at no additional cost to the Department. The Engineer will determine the core locations and how many, and witness coring and testing. Limit the coring to one set of three if the Engineer determines that taking multiple cores will be detrimental to the integrity and quality of the work. Repair holes left by the coring operation at no additional cost to the Department. Obtain the Engineer's approval of repair methods and materials before beginning repairs.

The Department will consider cores obtained within 42 days of placement as representing the 28-day strength. Cores obtained after 42 days will only be accepted when the Contractor submits a correlation curve developed by a Department approved independent testing laboratory to relate strength at the actual test age to 28-day strength for the particular class and design mix represented by the cores.

The Contractor and the Engineer will accept the test results of the drilled cores instead of the test cylinders results when the Contractor elects to supply drilled cores and submits acceptable drilled cores, as specified.

Obtain and test cores in accordance with AASHTO T 24 except protect the cores from moisture gain or loss and test as soon as possible without further conditioning other than preparing the ends, if needed. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. If, before testing, one or more of the cores shows evidence of having been damaged subsequent to or during removal, replace with a new core. Tests by the Contractor may include compressive strength, cement content by ASTM C 1084, and petrographic analysis by ASTM C856 (including water cement ratio and air content).

If the average strength of the cores from conventionally reinforced concrete is less than the specified strength for the area represented, the Engineer will require the concrete be removed or accept at a reduced price, as specified in this subsection.

The Engineer may reject the member and require replacement with a new member at no cost to the Department if the average core strength of the pre-cast, pre-stressed, or post-tensioned member is less than the required strength. In some cases, the Engineer may perform additional engineering analysis to determine if the concrete may be allowed to remain in place and accepted at a reduced price. Tests by the Engineer may include compressive strength, cement

content by ASTM C 1084, and petrographic analysis by ASTM C856 including water cement ratio and air content.

Make corrective changes in the materials mix portions, concrete fabrication procedures, or other corrective action before continuing at no cost to the Department should concrete used in the work fail to meet the specified compressive strength. Make Engineer approved corrective changes if 7-day strength test results are low or show a downward trend predicting concrete may not meet the specified 28-day strength.

The Engineer may accept concrete with specified strength of 3000 psi or less (including seal concrete) from qualified aggregate material suppliers by certification. The Department requires concrete mix designs including strength test data for acceptance by certification. Test the first load, then test once every 50 yd³ until quantity exceeds 100 yd³. After 100 yd³, test once every 100 yd³. Include test results for slump, unit weight, air content, and compressive strength to verify the certification. For precast concrete products test once every 40 yd³ of concrete used. Include test results for slump, unit weight, air content, and compressive strength to verify the certification.

Use only manufacturers that furnish precast concrete products that hold current certification under the NPCA Plant Certification Program, the ACPA Q-Cast Plant Certification Program or PCI Plant Certification Program.

502.02 Materials. Provide material as specified in:

Portland Cement	701
Aggregate.....	703
Permanent Metal forms.....	708.31
Membrane Forming Curing Compounds.....	709.01
Air Entraining Admixtures.....	709.03
Set Retarding Admixtures.....	709.04
Water Reducing Admixtures.....	709.05
Lithium Nitrate Admixtures.....	709.06
Water.....	720.01
Secondary Cementious Materials.....	714

Obtain the Engineer's approval of admixtures before use.

Determine an aggregate correction factor for the concrete aggregate for each mix design in accordance with AASHTO T 152.

Conduct testing in accordance with the following standard methods:

Compressive Strength of Cylindrical Concrete Specimens.....AASHTO T 22

Making and Curing Concrete Test Specimens in the Field.....	AASHTO T 23
(Except cylinders shall be molded only in 6 in dia. x 12 in single use molds made of plastic.)	
Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	AASHTO T 24
(Provisions of AASHTO T 24 relating to ASTM and ACI references do not apply unless otherwise specified.)	
Slump of Hydraulic Cement Concrete.....	AASHTO T 119
Mass Per Cubic Meter (Cubic Foot), Yield, and Air Content (Gravimetric) of Concrete.....	AASHTO T 121
(including cement content.)	
Making and Curing Concrete Test Specimens in the Laboratory	AASHTO R 39
(Except cylinders shall be molded only in 6 in dia. x 12 in single use molds made of plastic.)	
Measuring Length of Drilled Concrete Cores	AASHTO T 148
Air Content of Freshly Mixed Concrete by the Pressure Method.....	AASHTO T 152
Measuring Texture Depth of Portland Cement Concrete Using a Tire Tread Depth Gage	AASHTO T 261 (modified)
(Provisions of AASHTO T 261 relating to calculations, reporting, and subdividing into sublots do not apply unless otherwise specified)	
Pavement Straightedge Procedures	Idaho T-87
Determination of the Rate of Evaporation of Subsurface Moisture From Concrete	Idaho T-133
Determining the Percentage of Fracture of Coarse Aggregate ...	AASHTO TP-61
(Method 1)	
Sampling Freshly Mixed Concrete	WAQTC TM-2
When concrete is delivered by means of a concrete pump, obtain samples at the final point of placement (discharge pipe).	
Provide a safe and accessible platform for sampling the fresh concrete in close proximity and elevation to the final point of placement.	
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction.....	AASHTO T 303
Temperature of Freshly Mixed Portland Cement Concrete	AASHTO T 309

502.03 Construction Requirements.

- A. Proportioning.** Provide concrete mix design and include compressive strength data from either the Contractor's laboratory or an approved independent laboratory. Uniquely identify each submitted mix design. Submit the pro-

portion of the ingredients for each mix design for Engineer review. Submit the theoretical maximum density and “final set” time with the mix design. Measure final set by AASHTO T 197M / T 197. Proportion each batch as specified in 502.03. Test the proposed mix design in accordance with applicable listed test procedures and AASHTO T 126.

Ensure basic mix strength equals or exceeds the design mix strength calculated for the specified class of concrete. Classes 15 and 22 are exempt from this requirement.

Determine the basic mix strength by one of the following methods:

1. Average of at least 15 consecutive field production tests using the proposed mix design, provided that the tests cover a period at least 45 days and occurred during the last 12 months.
2. Average strength of three test cylinders from a laboratory prepared trial mix based on the proposed mix design and prepared during the last 12 months.

In addition to strength, report the air content for each test. The Department considers strength data obtained by either method valid only if all air content tests are within required limits for the specified mix class.

Determine design mix strength by one of the following methods:

1. (Method 1) Product of the specified strength (class) of concrete multiplied by the appropriate factor obtained from Table 502.03-1. Calculate coefficient of variation from at least 15 consecutive field production tests using the proposed mix design, or a similar mix design, provided that the tests cover a period at least 45 days and occurred during the last 12 months. The mathematical definition of coefficient of variation appears in the ACI Manual of Concrete Practice, Section 214. The Department allows interpolation.

Table 502.03-1 - Strength Factor

Similar Mix, percent	5	10	15
Factor for concrete except cast-in-place girders	1.07	1.15	1.24
Factor for cast-in-place girders	1.09	1.20	1.33

Coefficient of variation is a statistical measure of the variation in strength

among specimens from a given plant. If coefficient of variation is above 15 percent, review plant operations and develop an appropriate factor.

If fewer than 30 test results are available, multiply the calculated coefficient of variation by the following factor in Table 502.03-2 before using the Table 502.03-1. The Department allows interpolation.

Table 502.03-2 - Coefficient of Variation Strength Factor

No. of Tests	30 or More	25	20	15	Less than 15
Factor for Modified C.V.	1.00	1.03	1.08	1.16	Use Method 2

- (Method 2) Sum of the specified strength (class) of concrete plus the value obtained from Table 502.03-3.

Table 502.03-3 - Strength Value

Concrete Class	Location	Design Mix Strength
Specified Strength 3000 psi thru 5000 psi	All concrete Except cast in-place girders	Specified Strength +1200 psi
	Cast-in-place girders	Specified strength + 1600 psi
Specified Strength Over 5000 psi	All concrete	Specified Strength + 2000 psi

The Department requires that the laboratory specimens, produced in accordance with ASTM C1567 or Idaho T145, be prepared using the cement, fly ash, and other mitigative additives proposed for use in the mix design. Do not allow expansion of mortar bars to exceed 0.10 percent with the addition of fly ash, slag, or other additives. Determine lithium dosage per Idaho T 145 when using lithium for ASR mitigation. The Contractor may test the coarse and fine aggregates together or separately. If testing is performed on the coarse and fine aggregates together, report the blend percentage on the test and be within plus or minus 2 percent of the blend percentage used in the mix design. When tested separately, base mitigation actions on the aggregate requiring the most mitigation.

When SCM concrete is required, provide a mix design as specified in 502.01.A, Classification, Table 502.01-2 – SCM Concrete.

When SCM concrete is not required, the Contractor may elect to use it subject to the same requirements as when the contract requires SCM.

Ensure the fly ash used in the concrete mix for ASR mitigation does not have a CaO content more than 2 percent above the CaO content of the fly ash used for AASHTO T303 testing. If the fly ash used in the concrete mix for ASR mitigation has a CaO content greater than 2 percent above the fly ash used for testing, the Department will require additional AASHTO T303 testing at the higher CaO content.

If fly ash is used only as a mineral admixture, calculate the dosage of lithium nitrate based on Idaho T145 testing without fly ash.

Whenever fly ash is used, provide the same fly ash source (power plant), cement source (mill), and cement type throughout the project in any individual mix design unless a change is Engineer approved. The Engineer will only approve a change upon submission of laboratory test reports by the Contractor to verify that the revised mix design meets specification requirements.

The Contractor may use high range water reducers (superplasticizers) meeting ASTM C494, subject to the following additional requirements:

1. Do not exceed water/cementitious materials ratio design parameters shown in Tables 502.01-1 and 502.01-2 excluding water contained in the admixtures. Cementitious materials are the sum of cement, fly ash, silica fume, ground slag or any other pozzolans.
2. Any time segregation is evident, stop placement and take corrective action. Do not allow slump to exceed 8 ½ in.

Superplasticizer redosing to maintain slump may be completed up to two times. Slump, concrete temperatures, and air content must remain within the specification limits after redosing. The Engineer may allow additional drum revolutions beyond the limit in a redosing situation.

When concrete is pumped to the point of placement, adjustments to basic mix proportions may be required to ensure concrete meets specifications at the placement end. Be responsible for such adjustments, at no additional cost to the Department. Notify the Engineer in writing before implementing such adjustments. The Department requires laboratory verification as a new mix design for changes other than admixture dosage adjustments.

B. Equipment.

1. Mixers and Agitators. Mixers may be stationary or truck mounted. Agitators

may be truck mixers or truck agitators. Equip truck mixers and agitators with a means of counting of the drum, blades, or paddle revolutions and can be readily verified. Ensure each mixer and agitator has a metal plate or plates attached that plainly identifies the various uses the equipment is designed for, the drum volume, the drum capacity or container in terms of the mixed concrete volume, and the rotation speed of the mixing drum or blades. Ensure plates meet NRMCA standards. Equip stationary mixers with timing device that will not permit discharge until the specified mixing time has elapsed. Equip truck mixers with a calibrated water flow meter or other Engineer approved measuring device to control the quantity of mixing water added in the field.

2. Provide mixers that, when loaded to the rated mixing capacity and the concrete mixed for the time or revolutions prescribed, combine the concrete ingredients into a thoroughly mixed and uniform mass and discharge the concrete with satisfactory uniformity as specified in 502.03.D.
3. Provide agitators that, when loaded to rated capacity, maintain the mixed concrete in a thoroughly mixed and uniform mass and discharge the concrete with satisfactory uniformity as specified in 502.03.D.

C. Handling, Measuring and Batching Materials. Produce concrete that meets the Engineer approved mix design.

Submit the proportion of the ingredients for each batch to the Engineer at the time of batching.

Prepare a batch ticket on an acceptable form for each batch of concrete delivered to the project. Show on the ticket the project name, project number, supplier name, mix design number, date and time batched, load number, truck number, percent moisture in aggregate, volume batched, and the weight measurement of each individual component of the mix added to the batch. Deliver the batch ticket to the Engineer at the point of discharge before incorporating the concrete into the work.

Request changes to the mix design for Engineer approval. Minor adjustments due to varying moisture in the aggregates and minor adjustments of approved admixtures are not considered changes in the mix design and will not require approval of a new mix design. Report minor adjustments to the Engineer before batching.

1. Measure Cement by weight. Weigh cement in an individual hopper, when measuring by weight, and keep separate from the aggregates until released for discharge. Attach the cement hopper to a separate scale for

individual weighing or to the aggregate scale for cumulative weighing. If cement is weighed cumulatively, weigh it before the other ingredients. Ensure the scale and weigh hopper for cement is separate and distinct from aggregate weighing equipment. Provide cement batchers with a dust seal between the charging mechanism and hopper, installed in such a way as not to affect the weighing accuracy and vented to permit the escape of air. Ensure the hopper is self cleaning and fitted with means to assure complete discharge. Provide sufficient wind protection to prevent interference with batching accuracy. Ensure the cement, as measured, is within 1 percent of the design weight.

2. Measure aggregates by weight. Weigh aggregate within 2 percent of the required weights and the total weight of the aggregate within 2 percent of the total required weight. Handle aggregates from stockpiles or other sources to the batching plant so uniform grading and stable moisture content is maintained. Stockpile or bin aggregates for draining at least 12 hours before being batched when produced or handled by hydraulic methods or washed.
3. Measure water by volume or by weight. Arrange the measuring device so that the measurements will not be affected by variable pressures in the water supply line. Do not use wash water as a portion of the mixing water. Weigh or measure water within 1 percent of the required quantity.
4. Measure SCMs by weight. Weigh the SCM within 1 percent of the design weight.
5. Measure dry admixtures by weight, and paste or liquid admixtures by weight or volume. Dispense admixtures used in small quantities in proportion to the cement, as air entraining admixtures, with the mixing water. Adjust the quantity of admixtures used in accordance with manufacturer's recommendations. Provide quantities of admixtures used within 3 percent of the required quantity. Ensure admixtures used, meet 709.
6. If batches must be transported to the mixer, transport cement and aggregates from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required.

D. Mixing and Delivery.

1. Mix and deliver concrete by any of the following means:
 - a. Central mixed concrete. Mixed completely in a stationary mixer and

the mixed concrete transported to the point of delivery in agitating equipment or in Engineer approved nonagitating equipment.

- b. Transit mixed concrete. Mixed completely in a truck mixer at the batching plant or while in transit.
 - c. Truck mixed concrete. Mixed completely in a truck mixer at the point of delivery following the addition of mixing water.
 - d. Shrink mixed concrete. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer.
 - e. Mixed in an Engineer approved mixer that volumetrically measures the concrete ingredients and continuously produces concrete that meets ASTM C 685.
2. Operate truck mixers and truck agitators within the rated capacity and at a speed of rotation for mixing or agitating as designated by the manufacturer of the equipment.
 3. The minimum mixing time for mixers of 10 yd³ or less is 50 seconds for central mixed concrete. Mixing time for mixers of more than 10 yd³ capacity requires Engineer approval. Measure mixing time from the time all cement and aggregates are in the drum. Charge the batch into the mixer so some water will enter before cement and aggregates, and all water is in the drum by the end of the first one-fourth of the specified mixing time.
 4. For shrink mixed concrete the Contractor may reduce mixing time in the stationary mixer to a minimum of 30 seconds. Complete mixing in a truck mixer with 50 to 100 revolutions of the drum or blades at mixing speed. Do not exceed a batch volume of 70 percent of the drum gross volume.
 5. When a truck mixer is used for complete mixing, mix each batch of concrete with 50 to 100 revolutions of the drum or blades at mixing speed. Use agitating speed for additional mixing.
 6. When a truck mixer or agitator is used for transporting concrete that has been completely mixed in a stationary mixer, use agitating speed for mixing during transport.
 7. When a truck mixer or agitator is used for transporting concrete apply the following unless otherwise approved by the Engineer:
 - a. Deliver the concrete to the project site and complete discharge within

- 1.5 hours after the introduction of the cement to the aggregates, or before the drum has revolved 300 revolutions, whichever comes first.
- In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1.5 hours may be Engineer directed.
 - Begin mixing operation within 30 minutes after the cement has been intermingled with the aggregates when a truck mixer is used for the complete mixing of the concrete.
 - If additional mixing water is Engineer approved, at least 30 additional revolutions of the truck mixer drum at mixing speed are required before discharge of any concrete. The Engineer may allow additional mixing water one time during the discharge of the concrete.
 - The Engineer may require tests for consistency at approximately the beginning, the midpoint, and the end of the load. If the results vary by more than the tolerance specified in Table 502.03-4, do not use the mixer or agitator until the condition is corrected.

Table 502.03-4 - Load Slump Variance

When Average Slump Is	Tolerance
4 in or Less	1 in
More than 4 in	1.5 in

- Transport central mixed concrete in suitable non-agitating equipment. Provide covers when required. Equip bodies with smooth, mortar-tight metal containers capable of discharging the concrete at a controlled rate without segregation. Completely discharge concrete within 45 minutes after the introduction of the cement to the aggregates.
- Do not use aluminum pipe to convey concrete.
- Provide concrete at a temperature of at least 50 °F and not more than 80 °F at the time of placing.

E. Falsework and Forms.

- General. Submit to the Engineer working drawings, loading assumptions, allowable material stresses used in design, and final design calculations for proposed falsework and formwork. Working drawings and approval for footings or walls are not required unless either is more than 4 ft high. The Engineer will measure the wall height from the top of footing. Ensure the

working drawings and design calculations are stamped by a Professional Engineer licensed in the State of Idaho.

If required, submit plan sheets to the Railroad for review and approval showing railroad falsework clearances. When falsework crosses or is adjacent to traffic, the Department requires the design to include a positive barrier between the construction and traffic to prevent the possibility of dropping construction items into the roadway.

The Engineer's approval of the falsework or formwork working drawings, or any inspection performed by the Engineer, will in no way relieve the Contractor of full responsibility for the falsework and forms.

Do not start the construction of falsework or formwork until the drawings for that unit are reviewed and approved by the Engineer.

Field verify ground elevations shown on the plans at the proposed falsework footing locations for falsework design.

2. Plans. Submit four sets of falsework or formwork drawings and design calculations. Ensure working drawings identify materials used, including grades of lumber, in sufficient detail to permit accurate checking.

The Contractor may revise the working drawings provided at least four weeks are allowed for Engineer review before construction is started on the revised portions.

The Department requires working drawings to include a placing diagram showing the concrete placing sequence, rate of pour, and construction joint locations. When a schedule for placing concrete is shown on the plans, no deviation will be permitted unless Engineer approved.

Submit, with the working drawings, manufacturer's catalog data listing the weight of construction equipment that will be supported by the falsework.

When footing type foundations are to be used, determine the bearing value of the soil and show the values assumed in the falsework design on the falsework drawings. Show assumed values for both wet and dry soil conditions.

Show anticipated total settlements, deflections or both of falsework and forms on the working drawings including falsework footing settlement, joint take up and deflection of beams or girders. Settlement and deflection of falsework greater than 1 in will not be accepted. Design falsework and forms supporting deck slab and overhangs on girder bridges so there is

no differential settlement between the girders and the deck forms during of deck concrete placement.

3. Design.

a. General. Design falsework and formwork that meets AASHTO Guide Design Specifications for Bridge Temporary Works and incorporate into these Specifications with the following exceptions:

- (1) If in conflict with the contract specifications, the contract specifications will govern.
- (2) Where other codes and standards are referenced in the guide, use the most current edition of that code or standard, unless otherwise Engineer directed.
- (3) Show the falsework and formwork design calculations for the stresses and deflections of load supporting members.
- (4) Design, furnish, and install camber strips to compensate for beam deflection, vertical alignment, and anticipated structure deflection if necessary.
- (5) Falsework and forms supporting concrete work on steel structures.
 - (a) Loading of Girder Webs: Construct falsework and forms supporting the concrete work on steel structures so loads applied to girder webs are within 6 in of a flange or stiffener and distributed so no local distortion is produced.
 - (b) Lateral Loading of Girder Flanges: Provide temporary struts and ties as necessary to resist lateral loads applied to the girder flanges and to prevent relative vertical movement (1/8 in maximum) between the edge of deck form and the adjacent steel girder.
- (6) Add the following procedure for determining the lateral pressure of fluid concrete if pozzolans or admixtures are used in the concrete mix:

For concrete made with pozzolans or admixtures and placed with normal internal vibration to a depth of 4 ft or less, formwork can be designed for a lateral pressure as follows:

$$p = \text{lateral pressure, psf}$$

R = rate of placement, ft/hr

T = temperature of concrete during placing, deg F

Cc = chemistry coefficient;

1.2 for cement type I and III with a retarder*

1.2 for blends containing fly ash without a retarder*

1.4 for blends containing fly ash with a retarder*

(* retarders include any admixture that delays setting of concrete)

For columns:

$$p = Cc [150 + 9000 R / T]$$

with a maximum of (3000)(Cc) psf, at least 600 psf, but in no case greater than wh (density of concrete times total height of placement).

For walls:

$$p = Cc [150 + 43,400 / T + 2800 R / T]$$

with a maximum of (2000)(Cc) psf, at least 600 psf, but in no case greater than wh.

For applying the pressure formulas, columns are defined as elements with no plan dimension exceeding 6.5 feet. Walls are defined as vertical elements with at least one plan dimension greater than 6.5 feet.

Note: This specification is a modification of *Manual of Concrete Section 347, Subsection 2.2.2, Lateral pressure of concrete, published by ACI.*

- b. Permanent Metal Concrete Forms. Do not use permanent metal forms for decks unless specified. Ensure materials meet 708.31.

Design permanent metal forms to meet the following criteria and the loads specified in this subsection.

- (1) The unit working stress in the steel sheet is 0.725 or less of the specified minimum yield strength of the material furnished, but not to exceed 36000 psi.
- (2) The maximum deflection under the weight of the forms, plastic concrete, and reinforcement, or a load of 120 psf, whichever is

greater, shall not exceed $1/180$ of the form span or $1/2$ in, whichever is less.

- (3) Ensure the form span for computation of stress and deflection is at least the clear span of the corrugated form material plus 2 in.
- (4) Compute physical design properties in accordance with AISI Specifications for the Design of Cold formed Steel Structural Members, latest published edition.
- (5) Ensure reinforcement has a minimum concrete cover of 1 in. Center bars in the bottom layer of the main reinforcement over the valleys of the forms when necessary to achieve the minimum 1 in concrete cover.
- (6) Provide positive lateral support by the use of concrete haunches formed against the top flanges of steel beams or girders except where shear connectors are provided.
- (7) Do not locate longitudinal deck construction joints between stringers where permanent metal forms are used.
- (8) Cut off support angle legs extending into the deck concrete in excess of $1/2$ in.

Install forms in accordance with Engineer approved detailed fabrication plans. Ensure the fabrication plans meet 502.03.E.2, and include the grade of steel used and the moment of inertia calculations for the form.

Do not rest form sheets directly on the tops of the stringer or floor beam flanges. Securely fasten sheets to form supports and provide a minimum bearing length of 1 in at each end. Place form supports in direct contact with the stringer flange or floor beam. Attachments are to be made by bolts, clips, or other Engineer approved means. Submit the method of attachment for approval with the fabrication plan.

Thoroughly clean, wire brush, and then paint damaged galvanized coating on exposed form metal with one coat of Paint Formula No. 2 in accordance to Section 627.03.

Locate transverse construction joints at the bottom of a flute with $1/4$ in weep holes field drilled at least 12 in on center along the line of the joint.

Remove at least one section of the forms at a location and time selected for each concrete placement on each span as Engineer directed. Remove forms for inspection as soon after placing the concrete as practical to provide visual evidence that the concrete mix and the Contractor's procedures are obtaining the desired results. Remove an additional section each time the concrete mix or the Contractor's procedures are changed, if Engineer directed.

After the deck concrete has been in place for at least 2 days, test the concrete for soundness and bonding of the forms by sounding with a hammer. If areas of doubtful soundness are disclosed remove the forms from such areas for visual inspection after the concrete has attained adequate strength, at no additional cost to the Department.

At locations where sections of the forms are removed, the Department will not require replacement of forms, but will require repair of the adjacent metal forms and supports to present a neat appearance and assure their satisfactory retention. Remove unsatisfactory concrete or repair as Engineer directed.

4. Construction.

- a. General. Provide tell-tales attached to the soffit forms that are readable from the ground in enough systematically placed locations to determine the total settlement of the entire portion of the structure where concrete is being placed.

Should unanticipated events occur, including settlements that deviate more than $\pm 3/8$ in from those shown on the falsework drawings, stop placing concrete until corrective measures are provided. When Engineer directed to suspend placing concrete, construct a temporary bulkhead at a location determined by the Engineer. Remove unacceptable concrete at no additional cost to the Department.

- b. Bracing. Provide temporary bracing as necessary, to withstand imposed loads during erection, construction and removal of falsework whose height exceeds its clear distance to the edge of sidewalk or shoulder of roadway which is open to the public. Show provisions on the falsework drawing for temporary bracing or methods to be used to meet this requirement during each phase of erection and removal. Include wind loads in the design of temporary bracing methods. Set the falsework to give the finished structure the camber specified. In

addition to the specified camber, make allowance for settlement of the falsework using 1/8 in for each contact of timbers.

- c. Expansion Joints. At the ends of bridge deck expansion joints, securely fasten joint material (or the armor angles of compression seals) to the overhang forms to prevent relative movement during concrete placement. On deck rehabilitation work, the Department may require shimming, tack welding new steel joint elements, or both, to existing armor angles, or parts.
- d. Bridge Rail, Curbs, and Parapets. Cast in place the concrete portions of bridge rails, curbs, and parapets using conventional fixed formwork unless otherwise shown on the plans.
- e. Form Fasteners. Use form fasteners consisting of form bolts, clamps, or other devices as necessary to prevent spreading of the forms during concrete placement. Do not use ties consisting of twisted wire loops to hold forms in position.
- f. Anchor Devices. The Contractor may use anchor devices cast into concrete for supporting forms or for lifting precast members may be used. Do not use driven types of anchorages for fastening forms or form supports to concrete. Use the type of form fasteners and anchors that can be removed without chipping, spalling, heating, or otherwise damaging the concrete surface.

Remove form bolts, metal ties or anchors, or any other metal placed for Contractor's convenience to a depth of at least 1 in below the surface of the concrete except as specified. Clean and fill the resulting holes or depressions with mortar. Remove form bolts projecting into the cells of box girders flush with the surface of the concrete.

- g. Mortar. Provide and place mortar in recesses and holes, on surfaces, under structural members, and at other locations as specified.

Provide mortar composed of Portland cement, sand, and water. Use a 1 to 2 ratio for the proportion of cement to sand, measured by volume, unless otherwise specified. Provide material that meets 701.01. Ensure the maximum size of sand is not larger than one half the size of the recess, hole, or space where the mortar is to be placed. Use only enough water in the mortar to permit placing and packing.

Clean concrete areas to be in contact with the mortar of loose or

foreign material that would prevent bond between the mortar and the concrete surfaces. Flush with water and allow to dry to a surface dry condition immediately before placing the mortar.

Completely fill and tightly pack the mortar into recesses and holes, on surfaces, under structural members, and at other locations as specified. After placing, cure surfaces of mortar by the water method in accordance with 502.03.J for at least 3 days.

Ensure keyways, spaces between structural members, holes, spaces under structural members, and other locations where mortar could escape are mortar tight before placing mortar.

Do not allow loads on mortar that has been in place less than 72 hours, unless otherwise Engineer approved.

Remove improperly cured or defective mortar and replace at no additional cost to the Department.

For exposed surfaces, add white cement to the mortar in a quantity sufficient to result in a patch that matches the surrounding concrete when dry.

- h. Forms. Clean the forms inside surfaces of dirt, mortar, and foreign material. Thoroughly coat forms, which will later be removed, with form oil before use. Use commercial quality form oil or other equivalent coating that will permit the ready release of the forms and not discolor the concrete.

Ensure concrete forms are mortar tight; true to the dimensions, lines, and grades of the structure; and of sufficient strength to prevent deflection during the placing of the concrete.

Do not discharge concrete into the forms until work connected with constructing the forms has been completed, materials required to be embedded in the concrete have been placed for the unit to be poured, and the Engineer has inspected the forms and materials. This work includes the removal of dirt, chips, sawdust, water, and other foreign material from the forms.

Control the rate of depositing concrete in forms to prevent deflections of the forms or form panels in excess of the deflections specified. The Department requires forms for concrete surfaces that are not completely enclosed or hidden below the permanent ground surface

meet the same requirements as forms for exposed surfaces. The Department considers interior surfaces of underground drainage structures to be completely enclosed surfaces.

Form exposed surfaces of each element of a concrete structure with the same forming material or with materials that produce similar concrete surface textures, color, and appearance.

Face forms for exposed surfaces with form panels. A form panel is the continuous section of form facing material, unbroken by joint marks, against which the concrete is placed.

Provide and place form panels for exposed surfaces in uniform widths of at least 3 ft and in uniform lengths of at least 6 ft, except where the width of the member formed is less than 3 ft. When the width of the panels is less than 3 ft, provide and place panels that are the width of the member. Arrange panels in symmetrical patterns conforming to the general lines of the structure. Place panels for vertical surfaces with the long dimension horizontal and with horizontal joints level and continuous, except where otherwise specified or shown on the plans. Place panels with the long dimension parallel to the footing for walls with sloping footings, which do not abut other walls. Precisely align form panels on each side of the panel joint, by means of supports or fasteners common to both panels, to result in a continuous, unbroken concrete plane surface.

Construct forms for exposed surfaces with triangular fillets at least $\frac{3}{4}$ in x $\frac{3}{4}$ in attached so as to prevent mortar runs and to produce smooth, straight chamfers at sharp edges of the concrete.

5. Removal of Falsework and Forms.

Do not remove forms and falsework without the Engineer's approval. This approval does not relieve the Contractor of responsibility for the safety of the work. Remove blocks and bracing at the time the forms are removed including any portion of the wood forms left in the concrete. Include falsework removal procedures for continuous or cantilevered structures with the working drawings. If the Contractor intends to remove falsework and forms before 28 days, proportion and design the concrete mix to provide the minimum strengths required at the proposed removal time, as specified. Do not remove the falsework and forms before the minimum

number of days and minimum strength for the applicable structural element. Comply with 502.03.F.

Cast test cylinders to determine compressive strengths for form removal and loading and test at an approved independent laboratory. Casting will be witnessed by the Engineer. Field cure test cylinders adjacent to the member represented by the cylinders. Ensure curing location represents the most unfavorable field conditions.

Determine compressive strength values for form removal and loading by averaging two companion cylinders.

The Contractor may use maturity testing in accordance with ASTM C1074 instead of test cylinders to determine compressive strengths for form removal and loading. Develop the maturity-strength relationship and provide maturity curves along with supporting data and field procedures for monitoring maturity for Engineer approval at least 10 days before use. Furnish equipment, including thermo or maturity meters, thermocouples, wire and qualified personnel to monitor maturity and provide information to the Engineer. Ensure maturity testing represents the concrete in the most unfavorable field conditions.

Loading of a member is defined as any additional horizontal or vertical load being applied other than loads from formwork and reinforcing steel of further concrete placements.

For post-tensioned concrete bridges, release the falsework supports, which might continue to remain engaged after structure units are pre-stressed, to allow the concrete to accept its own weight and distribution of stresses uniformly and gradually. Sequence disengagements so fixed connections at tops of piers will not be subjected to damaging forces.

Sequence falsework support disengagement as specified on falsework drawings. The stressing operation in pre-stressed units must be completed and Engineer approved before removing supporting falsework.

Apply a membrane forming curing compound or a water cure in accordance with 502.03.J, to exposed surfaces, except for construction joints if any forms are removed before 7 days have elapsed. Cure construction joints using a water cure as specified in 502.03.

Leave the forms in place for footings constructed within cofferdams or cribs if their removal would endanger the safety of the cofferdam or crib,

and where the forms left in place will not be exposed to view in the finished structure. Remove forms whether above or below the ground line or water level. Remove forms from the cells of box girders.

Remove forms and falsework in a manner to permit the concrete to uniformly and gradually take the stresses due to its own mass.

The Contractor may remove forms and falsework or place subsequent loads when both conditions of Table 502.03-5 for the activity involved are met.

**Table 502.03-5
Form And Falsework Removal And Loading Of Concrete**

Part 1: Removal of Forms and Falsework Structural Element	Min. Days 1,2	Percent of De- sign Strength 5
Side forms for: footings, abutment caps, pier caps, traffic and pedestrian barriers, and any other side-forms not supporting the concrete mass.	1	-----
Columns, abutment backwalls, and retaining walls	3	50
Cantilever bridge deck sidewalks	7	-----
Bridge decks, top slabs of concrete box culverts or stifflegs	10	8
Crossbeams, caps, box girders, T-beam Girders, and flat slab superstructures ³	7	80
Signal, Luminaire, and Sign Support Foundations (If applicable)	7	80
Part 2: Subsequent Loading⁴ of: Structural Element	Min. Days1	Percent of De- sign Strength5
Footings and abutments	3	80
Approach slabs, and bottom slabs of box girders with falsework in place.	5	80
Columns and walls	5	100
Bridge decks, top slabs of concrete box culverts or stifflegs and all other members	10	100
Signal, Luminaire, and Sign Support Foundations (If applicable)	7	100

¹ From the time of the last placement in the forms or falsework supports and excluding the days when the surrounding temperature is below 40 °F for a total of four hours or more. Requirements of Subsection 502.03, Part G - Cold Weather Concreting, shall still apply. The Contractor shall monitor the temperature during curing time by continuous recording thermometers.

² Do not remove forms until the concrete has sufficient strength to prevent damage to the surface or cause over stressing of the concrete.

³ Where continuous spans are involved, the time for spans will be determined by the last concrete placed affecting any span.

⁴ Except loads from formwork and reinforcing steel of further concrete placements.

5 Standard concrete mix designs will typically not achieve strength in the minimum days shown.

F. Placing Concrete.

1. General. Do not place concrete until forms and metal reinforcement have been inspected. Clean the forms of debris and foreign material before concrete is placed. Avoid segregation of the concrete and displacement of the reinforcement. When placing operations involve dropping the concrete more than 5 ft, deposit concrete through sheet metal or other Engineer approved tubes. Keep tubes full of concrete during placing and their lower ends buried in the newly placed concrete, as much as practical. Control the rate of depositing concrete in forms to prevent deflections of the forms or form panels in excess of the deflections specified.

Place concrete in the forms as soon as possible after mixing. Keep the concrete plastic and workable. The concrete placement is to be continuous, with no interruption longer than 30 minutes between adjoining layers, unless a longer time is Engineer approved. Fill each part of the form carefully by depositing the concrete as near the final position as possible. Place and consolidate each layer before the preceding layer takes initial set. Do not jar the forms or allow strain to be placed on the ends of projecting reinforcement after initial set of the concrete.

Do not place bridge decks and other concrete flatwork when the evaporation rate is greater than 0.15 psf per hour when tested in accordance with Idaho T-133, unless otherwise Engineer approved. Flatwork is a surface not cured in contact with a form and that is not part of a construction joint. Surfaces essentially vertical are excluded from the definition.

Use the proper mix design and combination of low shrink materials, low

temperature concrete, proper curing techniques, or other procedures necessary to eliminate or minimize the development of cracks.

The Engineer will determine surface crack intensity after completion of concrete cure and before pre-stressing or release of any forms or false-work. The surface crack intensity of concrete bridge decks is determined by the number and size of cracks in the top surface of the concrete. Remove equipment and material from the deck and clean the surface as necessary for the Engineer to measure the crack intensity. Fill cracks in any 60 yd² portion of deck when there are more than 50 ft of cracks whose width at any location exceeds 1/8 in with a two component modified methacrylate penetrating sealer or equal, as Engineer approved. Fill the cracks in accordance with the penetrating sealer manufacturer's product recommendations at no additional cost to the Department. Decks that have excessive cracking or cracking that jeopardizes the structural integrity of the deck may be determined unacceptable by the Engineer and require removal.

The Department considers work after the placement incidental and the cost included in the contract unit price for concrete.

2. Vibrating. Consolidate the concrete with suitable vibrators operating within the concrete. Supplement vibrating by hand spading with suitable tools to assure proper and adequate consolidation, especially around obstructions.

Use vibrators that transmit vibrations to the concrete at frequencies of at least 5,000 impulses per minute. Use vibrators in concrete containing epoxy coated reinforcement that have a resilient covering to prevent damage to the epoxy coating.

Vibrate deck concrete with internal vibrators turning at least 10,800 rpm in air and are fully submerged. Space the vibrator in the concrete mix approximately 18 in to 24 in measured in longitudinal and transverse directions.

Work the concrete thoroughly around the reinforcement and imbedded fixtures and into corners and angles of the forms with vibrators.

Do not use vibrators to cause the concrete to flow or run into position instead of placing. Ensure vibration at any point is sufficient to accomplish thorough consolidation, but not prolonged to the point where segregation

occurs. The Vibrators are not required for seal concrete or concrete in shell piles.

3. Underwater Concrete. Use seal concrete in or under water unless otherwise Engineer approved.

Carefully place concrete in a compact mass, in its final position, by means of a tremie, a bottom dump bucket, or other Engineer approved method to prevent segregation. Do not disturb concrete after being deposited.

Do not place concrete in running water. Construct the forms for underwater concrete to provide still water inside the forms. Continuously place the concrete until the required depth is reached and keep the surface of the concrete as nearly level as possible.

Comply with the following requirements for placing if a tremie is used:

Use a watertight tube having a diameter of at least 10 in with a hopper at the top.

Provide a device that will prevent water from entering while charging the tube with concrete.

Support the tremie to permit free movement of the discharge end over the entire top surface and to permit rapid lowering, when necessary to retard or stop the flow of concrete.

Use a method to fill the tremie that will prevent washing of the concrete.

Completely submerge the discharge end in concrete and maintain sufficient concrete in the tremie tube to prevent water entry.

When concrete is dumped into the hopper, induce the flow of concrete by slightly raising the discharge end, always keeping it in the deposited concrete.

4. Massive Placement. Placements thicker than 4 ft are massive placements. Take special measures to minimize the possibility of drying shrinkage cracks developing in placements during placing and curing the concrete.

The maximum temperature difference between all points across the top surface of a placement during placing and throughout the full 7 day curing period of the concrete is 35 °F. Use approved construction methods that will achieve uniformity of temperature and if these methods prove inadequate, adopt different or additional measures as necessary to achieve the uniformity.

G. Cold Weather Concreting.

1. Heating and Placing Concrete. Obtain the Engineer's approval for a cold weather concreting and curing plan detailing the methods and equipment to ensure that the required concrete temperatures are maintained before placing concrete when there is a probability of air temperatures below 40 °F during the placing and curing periods. Meet the following cold weather concreting operation requirements when the ambient temperature falls below 40 °F.
 - a. Completely remove ice, snow and frost before placing concrete.
 - b. Provide concrete that will have a temperature of at least 50 °F and less than 80 °F at the time of placing.
 - c. Do not place concrete against any material with a temperature of 32 °F or less.
 - d. Heat the mix water or the aggregates, or both, when necessary, before batching to produce concrete of the specified temperature. Heat in a manner that is not detrimental to the mix and does not prevent the entrainment of the required amount of air. Heat the materials uniformly.
 - e. Do not heat aggregates directly by gas or oil flame or on sheet metal over fire.
 - f. Do not heat aggregates or water to over 150 °F. If either is heated to over 100 °F, mix together before adding the cement so that the cement does not come into contact with materials that are in excess of 100 °F.
2. Protection of Concrete. Maintain a concrete temperature of at least 50 °F for 7 days or 70 °F for 3 days after placement except when steam curing is used. When fly ash is used, increase the time to 10 days for 50 °F and 5 days for 70 °F. Maintain the temperature of uniform surfaces of concrete, such as decks, at the temperatures and the times shown. Do not allow the water to freeze during the curing period when water cure is required for concrete as specified in 502.02.J.

Protecting and curing concrete under water is allowed provided the temperature of the water does not fall below 35 °F and at least 6 in of water is maintained over the concrete for at least 10 days.

Block up combustion heaters off the surface of the concrete and vent to the outside of the enclosure.

Do not allow the maximum temperature within the enclosure to exceed 120 °F when the concrete is protected by any means other than steam.

The maximum drop in temperature of the concrete throughout the first 24 hours after the end of protection shall be 50 °F for protection methods other than the use of steam.

Meet the requirements of 502.03.J when steam is used in the protection of the concrete.

Provide calibrated recording thermometers with the range of 0 °F to 212 °F.

Continuously record temperatures on a chart for at least 24 hours. Provide a sufficient number of recording thermometers to keep adequate records of temperatures.

On small quantities used in minor structures, sign foundations, and non-stress placement such as sidewalks and curb and gutter, protect the concrete from freeze damage by covering the concrete with suitable blanketing material. Maintain protective covering for at least 5 days. Use recording thermometers to show that concrete used in minor structures was not exposed to freezing temperatures.

- H. Hot Weather Concreting.** Do not allow the temperature of concrete to exceed 80°F at time of placement. Take measures to slow evaporation to tolerable limits, such as, erecting sunshades or placing at night or early morning when the combination of ambient air temperature, concrete temperature, humidity, and wind promotes rapid evaporation of moisture from the concrete surface. Ice may be used as a part of the mixing water if it has completely melted by the time mixing is completed.

Ensure the temperature of the surface to be covered by concrete does not exceed 90 °F.

- I. Finishing Concrete.** Provide formed surfaces with an Ordinary Surface Finish, plus, if further finishing is required, a type of finish as specified. Provide a Rubbed Surface Finish on exposed surfaces, except the soffits of superstructures and the interior faces and bottoms of concrete girders unless otherwise specified. Concrete surfaces are defined as follows:

1. Ordinary Surface Finish. Remove form bolts and tie wires immediately after the forms have been removed. If rock pockets materially affect the strength of the structure or endanger the life of the steel reinforcement, the Engineer may declare the concrete defective and require the removal and replacement of that portion of the structure affected. Clean, thoroughly wet, and fill holes and depressions with a cement mortar composed of one part of cement and two parts of sand. The Department may require an Engineer approved bonding agent. Remove fins caused by form joints and other projections above the ground line. Ensure the resulting surface is reasonably smooth and uniform in texture and color. Provide a Rubbed Surface Finish on an ordinary surface with an unsatisfactory finish.
2. Rubbed Surface Finish. Thoroughly wet and rub the entire surface with a carborundum stone or other Engineer approved method after the pointing has set sufficiently. The Department may require an Engineer approved bonding agent. Spread the paste formed by rubbing uniformly over the surface and finish by floating or rubbing to attain a uniform color and texture.

Thoroughly clean concrete which has been discolored by the drip from the abrasive by using a dilute solution of muriatic acid, then washing thoroughly with clean water.

The Engineer may waive the requirement for a Rubbed Surface Finish if the uniformity of color and texture obtained with Ordinary Surface Finish are essentially the equal of a Rubbed Surface Finish when metal forms, fiber forms, lined forms, or plywood forms in good condition are used. Grinding with powered disc grinders or light sandblasting with fine sand, or other Engineer approved means, may be used in conjunction with Ordinary Surface Finish.

3. Slab Finish. Finish and straightedge deck slabs and wearing surfaces as follows:

Finish deck slabs greater than 40 ft in length and other wearing surfaces subject to highway traffic that are greater than 40 ft in length by the machine method. Finish other deck slabs and wearing surfaces using either machine or hand methods.

Do not use additional water on the concrete surface during machine or hand finishing operations.

Straightedge the concrete surface, broom finish, and meet the completed

surface requirements of the following in paragraphs c, d and e, after finishing by either machine or hand methods.

- a. **Machine Method.** Use a self-propelled finishing machine for striking off and finishing the surface of the concrete. Provide to the Engineer information for the location and method of rail support, the size of rails, and a detailed description of the finishing machine.

Before beginning concreting operations, operate the finishing machine over the full length of the bridge segment to be finished. Make this test run with the screed adjusted to its finishing position. Check the screed rails for deflection and proper adjustment, the cover on slab reinforcement, and form alignment while operating the finishing machine in this test.

Make necessary corrections before placing concrete. Ensure the concrete carried ahead of the screed does not cause slipping of the finishing machine wheels on the rails.

Orient the transverse axis of the finishing machine parallel to the bearing centerline on prestress and steel girder spans. Ensure the concrete placement heading and the strike-off heading are parallel so equal loads are produced on each girder.

- b. **Hand Method.** Strike the concrete off with a template or a vibrating screed after it is placed. Finish concrete to an even surface by means of both longitudinal and transverse floats. Do not use a power trowel.
- c. **Straightedging.** Test the surface of the concrete for trueness while the concrete is still plastic. Use an Engineer approved 10 ft straightedge. Hold the straightedge in contact with the surface in successive positions parallel to the centerline and go over the whole area from one side of the slab to the other as necessary. Advance along the surface in successive stages of less than one half the length of the straightedge. Immediately fill depressions found with freshly mixed concrete, strike off, consolidate, and refinish. Cut down high areas and refinish. Ensure the concrete surface across joints meets the requirements for smoothness. Perform straightedging and surface correction from foot bridges resting on the side forms and spanning, but not touching, the concrete. Continue straightedge testing and surface corrections until the entire surface is without observable

departures from the straightedge and the slab conforms to the required grade and cross section.

- d. **Final Finish.** Float the deck slab after screeding to produce a uniform surface without porosity. Give the surface a steel tine finish if necessary. Use tines 1/8 in wide, spaced at 1/2 in to 3/4 in intervals, and producing grooves 1/8 in to 3/16 in deep. Check groove depth in accordance with the "procedure" IAW portion of AASHTO T 261. If more than three readings in a set of ten are outside the intended depth range, make adjustments to the tining operation.

Minimize surface tearing or aggregate removal when tining.

Tine stroke transverse to the roadway centerline and the full width of the roadway except for troweled smooth strips 12 in wide along curb faces. Do not overlap adjacent strokes. Finish the surface without porous spots, irregularities, depressions, small pockets, or rough spots.

The Contractor may saw-cut grooves instead of the steel tine finish with Engineer approval. Use a width and spacing of the grooves 1/8 in to 1/4 in. Do not perform saw-cut grooving until after the curing duration. Continuously and completely remove residue from the grooving operation.

Screed or float finish structures that will receive a deck membrane and asphalt overlay. Complete surface without porous spots, irregularities, depressions, small pockets, or rough spots.

- e. **Surface Smoothness.** The Engineer will test the slab surface for smoothness in accordance with Idaho IT-87, at the end of the curing period. Ensure the surface does not vary more than 1/4 in in 10 ft from the lower edge of the straightedge and 90 percent of the readings do not exceed 1/8 in in 10 ft. Grind concrete surfaces that do not meet surface smoothness requirements or replace as Engineer directed at no additional cost to the Department.

- J. **Curing Concrete.** Keep concrete surfaces completely and continuously moist until a curing method is applied. Do not apply membrane forming curing compound to concrete surfaces before the finishing has been accepted by the Engineer. Do not apply membrane forming curing compound to construction joints or to the inside faces of joints to be sealed.

Table 502.03-6 - Concrete Placement Type

Placement No. 1	Bridge Decks, including sidewalks on bridges, bridge curbs or parapets.
Placement No. 2	-Sidewalks, urban approaches, curbs, or curb and gutter. -Approach slabs, and concrete slope paving.
Placement No. 3	-Pre-stressed Girders. -Concrete placements such as beams, caps, columns, footings, catch basins, manholes, median barrier, median curbs, box girders excluding the deck portion, signal, luminaries, and sign support foundations and other concrete. -Concrete Guardrail -Sound Walls

Cure concrete required to be painted by one of the following methods: A) Water, B) System 1 membrane-forming curing compound C) Form, or D) Steam, Prepare the concrete surface before painting if System 1 is used. Refer to 627.03.E.

Cure concrete as specified in Tables 502.03-6 and 502.03-7.

Table 502.03-7 - Cure Methods

	A	B	C	D
Placement Number	Water Cure	Membrane forming Curing Compound	Form Cure	Steam Cure
1	X	X-System 2		
2	X	X-System 1		
3	X	X-System 1	X	X

Cure concrete by one of the following methods:

Method A. Water Cure. Make a single application of a membrane forming curing compound immediately after surface finishing is completed on each individual portion of the placement. Apply the membrane forming curing compound under pressure at a rate of at least 1 gal per 150 ft². Use System 1 membrane forming curing compound on Placement Numbers 2 & 3. Use System 2 membrane forming curing compound on Placement Number 1. Start water curing after the

concrete surface has set up enough so it will not be damaged, but not later than four hours following application of the curing compound.

Keep the concrete surfaces in Placement 1 continuously wet for at least 10 days. Keep the concrete surfaces in Placement 2 and 3 continuously wet for at least 5 days.

Parapet finishing may be performed during the wet cure period. The Contractor may have the burlap removed for finishing small isolated areas of the parapet provided the surface of the concrete is not allowed to dry out.

Keep the concrete surface wet using cotton mats, rugs, carpets, burlap, or other approved coverings as a reservoir medium. Saturate the reservoir medium before placement on the concrete surface. Ensure the reservoir medium is in a saturated state, drained of free water, when initially placed. Add water as necessary to keep it from drying out during the curing period. Cover the reservoir medium with white plastic sheeting to reduce evaporation. Do not use plastic sheeting alone as a reservoir medium. Clear the surface of reservoir mediums at the end of the curing period.

Show ability to provide the water cure as specified before placing concrete.

The Engineer will immediately suspend the concrete placing operations for failure to provide sufficient cover material, or sufficient water to adequately take care of water curing and other associated requirements.

Method B. Membrane Forming Curing Compounds. Apply membrane forming curing compounds in accordance with 709.01 to the finished concrete, immediately after the bleed water or free water sheen leaves the surface of the finished concrete surface.

Thoroughly mix membrane forming curing compounds before using and agitate it during application to prevent settling or separation.

Uniformly apply the membrane.

Apply the second coat of membrane at right angles to the first coat when two coats of are used, if possible.

Immediately apply the same type of membrane material to any membrane surface that is marred or damaged by scuffing or wear before completion of the curing period or water cure the area for the remaining cure period.

Each manufacturer's identified lot of curing compound is required to be sampled, tested and, Engineer approved before use. Allow three weeks for laboratory

testing of the curing compound once it has been received by the Department's Central Materials Laboratory. Quantities of curing compound over 1000 gal may be inspected and sampled by the Department at the manufacturer's plant for acceptance testing. Request inspection from the Engineer and the Department's Central Materials Laboratory, Chemistry Section, in writing 30 days before ordering material.

1. System 1 – AASHTO M 148, Type 1 D, Class B with Fugitive Dye. Provide two applications of the curing compound for a total coverage of 1 gal per 150 ft² to concrete cured by this method. Apply each application of the curing compound under pressure at rate of at least 1 gal per 300 ft². Thoroughly wet the concrete with water and apply the curing compound just as the surface film of water disappears if the surface under the forms has dried. Apply the first coat immediately after stripping the forms and before acceptance of the concrete finish. Apply the second application immediately after the first application has set. Keep unsprayed exposed surfaces wet with water during curing operations.
2. System 2 – AASHTO M 148, Type 2, Class B, White Pigmented. Apply curing Compounds under pressure at a rate of at least 1 gal per 150 ft² on surfaces.

Method C. Form Method. Protect concrete with forms for at least 7 days. Intermittently moisten and protect forms from the sun during daytime periods of hot weather. Cure exposed surfaces by water or Engineer approved membrane cure.

Method D. Steam Curing. When steam curing is used, protect the concrete for a minimum 2 hr period when the temperature is 50 °F to 100 °F. Following this initial period, increase the temperature at a maximum rate of 40 °F per hour, to a temperature between 100 °F and 175 °F.

Continue curing at this temperature until cylinder strengths are above the release strength for prestressed reinforced concrete or above 80 percent of the intended 28-day strength, whichever is greater.

Cool the beam gradually by decreasing its temperature at a rate of 40 °F per hour or less until the temperature differential between the beam and outside air is 25 °F or less at the end of the cure cycle, when ambient air temperatures are below 40 °F.

Do not expose member to below freezing temperatures until at least 6 days after fabrication, or until the 28-day strength has been achieved.

502.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Precast stringers, prestressed stringers and concrete parapets by the foot.
2. Approach slabs by the square yard including the exposed finished surface of the concrete deadman.
3. Other concrete by the cubic yard in accordance with the dimensions shown on the plans or ordered except that the volume of concrete placed under water and formed Class 15 concrete may be based on batch design volumes. The volume occupied by the reinforcing steel, anchors, conduits, weep holes, H piling, or chamfers will not be deducted. The volume of concrete displaced by culverts or piles, other than H piling, will be deducted.
4. Deck concrete by the square yard or cubic yard to the dimensions shown on the plans.

502.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Concrete Class _____	CY
Concrete Class ____ Schedule No. ____	CY or SY
Seal Concrete	CY
Precast Stringers ____ (Beam)	ft.
Prestressed Stringers ____ (Beam)	ft.
Concrete Parapet	ft.
Approach Slab	SY
Prestressed Slabs (w ____ x d ____)	ft
Prestressed T Beam w ____ x d ____	ft.
Prestressed Box Beam w ____ x d ____	ft.

Concrete. At the contract price per cubic yard or square yard for concrete of the class and schedule specified. Payment for Schedule 2 concrete will be made on "plan quantities," as specified in 109.01.

Precast and Prestressed Stringers, Slabs and "T" Beams. At the contract price per foot. The Department considers the contract price to include reinforcing steel, epoxy coating of steel entirely or partially embedded in the precast elements if required, prestressing if required, and structural steel that is cast in

503.02

and included with precast elements. Payment will be made on “plan quantities,” except for authorized additions.

Concrete Parapet. At the contract unit price per foot and include reinforcing steel and epoxy coating, if required, that is cast within the parapets in whole or in part.

Approach Slabs. At the contract unit price per square yard including site preparation (e.g. excavation or other shaping), reinforcing steel, joint sealers, sleeper beams, concrete deadman, and curbs.

Price Adjustment. The Department will adjust the contract unit prices for strength deficiency in accordance with 502.01.B. The Engineer will apply a price adjustment to the unit price of the concrete class of required for the quantity represented by the individual strength tests. The Department will apply this price adjustment provision to the contract unit price of other items of work by their respective units of measurement and payment that incorporate concrete under 502. Should concrete be at incidental cost or included in the overall cost of an item, the Engineer will establish a value of the concrete proportional to the total contract price for purposes of establishing a price reduction on the concrete that does not meet specified strength, but is allowed to remain in place.

SECTION 503 - METAL REINFORCEMENT

503.01 Description. Provide and install reinforcing steel.

The contract pay item “Metal Reinforcement, Schedule No. 1” includes metal reinforcements placed in substructures. The contract pay item “Metal Reinforcement, Schedule No. 2 includes metal reinforcement placed in superstructures. The Department will show the schedules on the plans for the structures involved.

503.02 Materials. Provide materials as specified in:

Reinforcing Steel.....	708.02
Epoxy Coated Metal Reinforcement	708.02
Dowel Bars.....	708.03
Tie Bars.....	708.04

Accompany each shipment of reinforcing steel delivered to the project with a completed form ITD0914 and a copy of the mill test report attached for each heat included in the shipment. The Engineer will obtain field samples for each heat number and bar size from material delivered to the project. Submit proper identification with each shipment delivered to the project to allow the Department to readily identify each bar

size by heat number. The Engineer will reject reinforcing steel delivered that cannot be identified by heat number. Replace rejected material at no cost to the Department.

Order additional bars to compensate for the field sampling. Do not cut and splice bars to obtain samples. Complete fabricated bars are to be sampled and replaced. If the bar configuration is such that two 36 in long test specimens can be cut from one bar, then only one such bar constitutes a field sample. Otherwise, two complete fabricated bars constitute a single field sample.

Provide reinforcing steel spirals with additional length to accommodate sampling. Do not cut and splice material to obtain samples.

Replace bar from failing heat numbers at no additional cost to the Department.

503.03 Construction Requirements.

- A. Bar List and Bending Schedule.** The plans will show the bar list and bending schedule to arrive at an estimate of quantities. Verify the quantity, size and shape of the bar reinforcement against the structure drawings and make necessary corrections before ordering. The Department will not adjust the contract unit price because of errors in the bar list and bending schedule.
- B. Protection of Material.** Protect steel reinforcement from damage. When placed in the work, ensure that the steel reinforcement does not have dirt, detrimental scale, paint, oil, or other foreign substance. Do not store epoxy-coated reinforcing steel outdoors for more than two months. When stored outdoors, cover the bars to protect them against the elements and against condensation forming on the bars.
- C. Bending.** Field bend reinforcing bars only when the bars conflict with pre-stressing ducts, or are within anchorage recesses, or specified.

Do not field bend:

1. Bar sizes larger than No. 7, unless Engineer approved.
2. When the application of heat is required and the ambient temperature is lower than 50 °F and wind velocity at the bending site exceeds 15 mph.
3. By means of hammer blows or other impact loading.

Do the following when field bending steel reinforcing bars:

1. Make the bend gradually.
2. Apply heat as described in these specifications in bending bars sizes No.6 and No. 7 or in bending bar sizes No. 5 and smaller when those bars have

been previously bent. Previously unbent bars of sizes No. 5 and smaller may be bent without heating.

3. Use a bending tool equipped with a 'bend inside diameter / bar diameter' ratio of 8.
4. Limit any bend to a maximum of 90 degrees.
5. Straighten by moving a hickey bar (if used) progressively around the bend.

Do the following in applying heat for field bending steel reinforcing bars:

1. Use only rosebud type torch tips, designed to give a diffused flame.
2. Insulate any concrete within 6 in of the heated bar area.
3. Ensure by means of temperature indicating crayons or other suitable means that the steel temperature at the end of a heating operation will be as follows:

1200 °F to 1250 °F for bar size No. 4

1350 °F to 1400 °F for bar sizes No. 5 and No. 6

1400 °F to 1445 °F for bar size No. 7;

4. Heat the entire length of the bend plus a 2 in additional length on each side of the bend.
5. Maintain the steel temperature within the required range shown above during the entire bending process.
6. Bend the bar immediately after the required temperature has been reached.
7. Never cool bars artificially with water, forced air, by placing them on the ground or a concrete floor or other means.
8. Transport or install hot, bent bars after they have reached the ambient temperature.

Submit a 'field bending plan' for Engineer approval describing the proposed methods, tools, materials and handling of the field bent reinforcement, in accordance with the contract before bending bars in the field.

- D. Placing and Fastening.** Firmly hold reinforcing steel in the position shown on the plans while placing concrete. Maintain reinforcement position by means of stays, blocks, ties, hangers, or other approved supports. Do not space the supports for metal reinforcement more than 4 ft apart transversally or longitudinally.

If concrete blocks are used, embed the appropriate tie wires or coated tie wires during their forming stage and tie each block to the reinforcing bar it supports to hold the block in place. Ensure concrete blocks have approximately the same strength quality as the concrete placed around them. The Department requires plastic coated tie wire and plastic coated metal bar supports whenever they will be in direct contact with epoxy coated reinforcing. Do not use pebbles, pieces of broken stone, broken concrete, metal pipe or wooden blocks. Tie down top layers or mats of metal reinforcement in bridge decks to stirrups, shear studs, or as Engineer approved. Locate tiedowns so that there is at least one tiedown per 16 ft² of deck surface. Provide tiedowns strong enough to prevent upward movement of reinforcement from any cause. Do not deviate more than ± 0.25 in in the vertical direction from the position shown on the plans for concrete deck reinforcing steel.

Do not place concrete until the Engineer has inspected the reinforcement. Repair damage to epoxy coating of reinforcing steel, occurring during installation before placing. Remove rust and contaminants from the steel surface and adjacent coating, by wire brushing, immediately before applying patching material. Use a patching material certified to meet AASHTO M284 and apply it in accordance with the manufacture's recommendations.

Tie reinforcing bars at intersections unless spacing is less than 1 ft in each direction, then tie the alternate intersections. Where bundled bars are shown on plans, tightly tie bundles at intervals not exceeding 3 ft with No. 16 or larger black or plastic coated steel wire. Do not weld reinforcing steel unless shown on plans, or Engineer approval has been obtained. Weld in accordance with AWS D1.4 "Structural Welding Code - Reinforcing Steel."

The Contractor may weld reinforcing steel assemblies, if approved for pre-cast items instead of tying, as follows:

1. Weld at locations shown on the approved shop drawings.
2. Do not weld at the casting bed when pre-stress reinforcement is on the bed.
3. The Contractor may tack weld design bars shown on the plans to extra No. 4 bars for positioning. Do not exceed 1 in weld length tack welds, and locate only at the very ends of design bars. Show the extra bars on the shop drawings and identify as bars whose only function is to position the design bars. Extra bars and design bars have the same concrete cover requirement. Locate extra bars to not interfere with pre-

stress reinforcement or other design details. The Contractor may weld positioning bars to each other.

4. Epoxy coat the positioning bars if epoxy coated bars are specified. Clean welds and weld-damaged coating with wire brush and coat with a patching compound recommended by the epoxy supplier.

- E. Splices.** Furnish reinforcement in the full length shown on the plans except for column spirals. Do not splice bars, except where shown on the plans and in the column spirals, unless Engineer approved. Rigidly clamp or wire bars at splices in a manner Engineer approved.

Do not field splice column spirals in the lower one-fourth or the upper one-fourth of the spiral. At other locations in the column the Contractor may provide welded splices in column spirals that meet AWS D1.4 or provide Engineer approved mechanical splices for field splices in column spirals.

Form mechanical splices for epoxy and non-epoxy coated bars with an Engineer approved system, using mechanical couplers that complies with this section at locations where mechanical splices are required. Do not weld splices. Epoxy coat or protect exposed splice components used for the epoxy-coated bars from corrosion by other approved means.

Provide the Engineer with the following information for each shipment of splice material before splicing:

1. The type of series identification (and heat treatment lot number for threaded-sleeve splices).
2. The grade and size of the bar to be spliced.
3. A manufacturer's catalog with complete data on material and procedures.
4. A written statement from the Contractor that the system and materials will be used according to the manufacturer's instruction and requirements of this section.

Make one tension test specimen splice to represent each lot of bars spliced in the field. A lot consists of every 50 epoxy coated or every 50 non-epoxy coated bars spliced in the field, of one size, by one operator. Tension test each specimen to destruction or to the specified ultimate strength, whichever is less. Perform tests in a qualified laboratory. Furnish reports promptly to the Engineer. Cut out two production splices from the lot represented by the specimen and test them if any test specimen does not meet the tensile strength requirements. The Engineer will accept the splices in a lot if both retests meet

tensile requirements. The Engineer will reject the splices in the lot if one or both retests fail to meet the requirements. Remove, test, and replace at no additional cost to the Department.

Ensure mechanical splices meet the following criteria:

1. Develops at least 125 percent of the yield tensile strength specified for the unspliced bar. The ultimate tensile strength of the sleeve exceeds that of the other parts of the completed splice.
2. Slippage for AASHTO M31 grade 60 bars within a splice sleeve is limited to a maximum of 0.045 in. Measure the slippage between gage points clear of the splice sleeve. Take measurements at initial load of 3000 psi and again after loading to 90 percent of the minimum specified yield strength for the unspliced bar and then relaxed to 3000 psi.

Compensation. The Department will not provide separate compensation for the cost of providing and installing mechanical splices, or for testing where required. The Department considers these costs incidental and included in the contract unit prices for metal reinforcement.

503.04 Method of Measurement. The Engineer will measure acceptably completed work by the pound, based on the theoretical pound unit weight.

The Engineer will measure epoxy coated metal reinforcement by the pound of reinforcing steel before coating, based on the theoretical unit weight.

503.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Metal Reinforcement	lb
Metal Reinforcement, Schedule No. ____	lb
Epoxy Coated Metal Reinforcement	lb

No allowance will be made for clips, wire, or other material used for fastening reinforcement in place.

No allowance will be made for plastic coated wires, supports or other material used for fastening epoxy coated reinforcement.

The Department will include the weight of the splice bars for which payment is made, if the splice bars are shown on the plans or ordered installed by the Engineer. The Department will not pay for bars installed for the Contractor's convenience.

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The Department will pay for Schedule 2 Metal Reinforcement using “plan quantities” as specified in 109.01.

SECTION 504 - STRUCTURAL METALS

504.01 Description.

- A. **General.** Provide, fabricate, erect and paint structural metals.
- B. **Fabricator Certification.** Fabricators of structural components for vehicular bridges, other than unspliced rolled beam bridges are to be certified under the AISC Quality Certification Program, intermediate or advanced Steel Bridge categories. Fabricators of structural components for unspliced rolled beam vehicular bridges and steel pedestrian bridges are to be certified under the AISC Quality Certification Program, Simple Steel Bridge Structures category. Fabricators of fracture critical members are to hold a fracture critical endorsement in addition to the above requirements. This does not apply to incidental sub-assemblies such as drainage components, expansion joints, handrails, lighting supports, or items of similar nature.
- C. **Notice of Rolling and Fabrication.** Give 90 days notice to the Engineer before beginning work at the mill or shop so that the Department may provide inspection. Do not manufacture material, or perform work in the shop, before the Engineer has been notified.
- D. **Inspection.** The Department will inspect structural steel at the fabrication site. Provide four copies of all mill orders, certified mill test reports and shipping statements. On mill test reports, show the chemical analysis and physical test results for each heat of steel used in the work.

Provide certificates of compliance instead of mill test reports for material that normally is not supplied with mill test reports, and for some items such as fills, minor gusset plates and similar material when quantities are small and the material is taken from stock.

Provide certified mill test reports for steels with specified impact values that include, in addition to other test results, the results of Charpy V-notch impact tests. When fine grain practice is specified, include confirmation that the material was so produced. Furnish copies of mill orders at the time orders are placed with the manufacturer. Provide certified mill test reports and certificates of compliance before starting material fabrication covered by these reports. Provide the certificate of compliance signed by the manufacturer certifying

that the material is in compliance with the specifications to which it has been manufactured.

Make available to the Engineer material to be used so that each piece can be examined. Provide the Engineer with safe access to the fabrication site where the material is stored or where work on the material is being performed.

- E. Quality Control Inspection.** Be responsible for quality control inspection and testing. Perform inspection and testing at least to the extent specified and in accordance with the ANSI/ AASHTO/ AWS D1.5 *Bridge Welding Code, Inspection*.

Include nondestructive testing in addition to visual inspection, testing to base metal, production welds, weld repairs, procedure qualification test weldments and welder, welding operator and tacker qualification test weldments. This work is incidental and the costs are to be included in the contract unit prices for the structural steel.

Provide facilities to inspect material and workmanship.

- F. Shop Plans.** Submit working drawings for fabricating the steel.

Supply six sets of the plans and four additional sets for each affected railroad company on grade separation structures that carry a railroad over a highway.

The Department accepts only the nature and scope of the details without validating dimensions in approving working drawings.

Do not make changes in any drawing after Engineer approval, without the Engineer's written approval.

Provide a 22 in x 34 in three mil minimum thickness mylar of the as-built shop plans and one more set for each affected railroad company on any grade separation structure that carries a railroad over a highway before project completion.

Provide working drawings that are 22 in x 34 in in size and include on each drawing and calculation sheet the project name as shown on the plans, District-County-Route, bridge number, contract number, and contract drawing number.

Submit welding procedures for approval with shop drawings. Include the type of equipment to be used, electrode selected, preheat requirements, base materials, and joint details. When the procedures are not prequalified by AWS or AASHTO, submit evidence of qualification tests.

- G. Erection Plans.** Submit the proposed erection plan for Engineer approval.

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The Department requires the erection procedure be reviewed by the steel fabricator before being submitted to the Engineer.

Include in the submittal, maximum stress calculations that each member will be subjected to during erection. Use these calculations to determine the necessity of using strongbacks or erecting the girders in pairs with cross frames installed to prevent the possibility of buckling the compression flange during girder erection. Stamp the calculations and plans by a Professional Engineer licensed in the State of Idaho. Ensure falsework or temporary structures meet the requirements of 502.03.E.

Supplement the erection procedure with necessary drawings to clearly describe the method proposed. Include details of falsework bents, bracing, guys, temporary anchors, lifting devices, attachments to the bridge members, sequence of erection, location of lifting points on the bridge members, and weights of the members. Provide the plan and drawings in detail for anticipated phases and conditions during erection.

Submit plans of temporary members or devices which affect stresses in the permanent members of the structure. Remove temporary or extra material. The Department will not pay for extra material required due to the Contractor's erection procedures or method or for any material required in the permanent structure due to the Contractor's erection scheme.

Be responsible for the practicality and safety of the erection schemes used and carrying out the work as specified.

Be responsible for material ordered or shop drawings prepared before the Engineer reviews the erection scheme.

Submit the plan and drawings for approval as specified in 502.03.E.4.

- H. Camber Diagram.** Submit to the Engineer a camber diagram from the fabricator, showing the camber at each panel point of trusses or arch ribs, and at the location of field splices and tenth points of span length of continuous beam and girder or rigid frames. Show calculated cambers to be used in preassembly of field connections on the camber diagram.

504.02 Materials.

- A. Structural Metals.** Meet the requirements shown on the plans and as specified in 708.06.

Meet the additional fabrication, inspection and certificate requirements of the current AASHTO Guide Specifications for Fracture Critical Non-redundant

dant Steel Bridge Members and current Interim Specifications for members identified on the plans as “Fracture Critical Member(s)”.

Do not use universal mill plates for flange plates in designated tension stress or stress reversal areas.

Use structural steel classified as:

1. Structural carbon steel (use wherever the plans do not specify another classification). Meet AASHTO M 270, Grade 36.
2. Structural low alloy steel. Meet AASHTO M 270, Grade 50 and 50W.
3. Structural high strength steel. Meet AASHTO M270 Grade 70W.

The Department classifies the following as structural carbon steel unless otherwise shown on the plans or specified:

1. Shims; ladders; stairways; anchor bolts and sleeves; pipe fittings and fastening used in handrails; and other metal parts, even if made of other materials, for which payment is not specified.

B. Painting. When required on the plans, paint the structural steel as specified in 627. Provide paint as specified in 707.

C. Handling, Storing, and Shipping of Materials. Apply markings at the mill to distinguish structural low alloy steel from structural carbon steel. Keep the two classes of steel separated.

Protect material from rust, dirt, oil, and other foreign matter. The Engineer will not accept rust-pitted material.

Ensure structural steel arrives at the job in good condition. The Engineer may require thorough cleaning by high pressure water, flushing steel damaged by saltwater shipment, chemical cleaning or sandblasting, and repainting with the specified shop coat.

Prevent rust and loss of small parts when storing material. Do not rest piled material on the ground or in water. Use skids or platforms.

Conduct the loading, transporting, unloading, and piling of the structural steel material so that the metal is kept clean and not injured from rough handling.

Keep girders and beams upright after fabrication during shipment, handling and storage unless otherwise approved in writing by the Engineer. Support long members, such as columns and chords, on skids placed near enough together to prevent damage from deflection.

504.03

Use methods and equipment not likely to twist, bend, deform, or otherwise injure the metal in field assembly of structural parts. Correct any member slightly bent or twisted before it is placed. The Engineer may reject any member that is damaged.

Repair scratches and gouge marks caused by handling and lifting, and located in tension or stress reversal regions, by grinding to a surface finish of ANSI 125 or better, and inspect by the dye penetrant or magnetic particle method. If the marks are located in an area where they will be covered or partly covered by a structural weld, grind and test before welding.

Handle girder sections to prevent damage. Laterally support girders during shipment by blocking, removable flange bracing, bolting in pairs, or other Engineer approved method. Show the method of lateral support for the girders on the shop drawings.

Mark the weight on members weighing more than 6000 lb and remove after erection is completed.

- D. Castings.** The specifications for structural steel (including painting requirements) also apply to castings.

Provide castings that are:

1. True to pattern in form and dimensions.
2. Without pouring faults, sponginess, cracks, blow holes, and other defects in places that would affect strength, appearance, or value.
3. Clean and uniform in appearance.
4. Filleted boldly at angles.
5. Formed with sharp and perfect arises.

Anneal iron, steel castings, and forgings before matching, unless the plans state otherwise.

504.03 Construction Requirements.

- A. Identification of Steels During Fabrication.** Submit for the Engineer's approval a written plan for visibly marking the material so that it can be traced. Ensure these marks remain visible at least through the fit-up of the main load-carrying tension members. Provide a marking method that allows the Engineer to verify:

1. Material specification designation.
2. Heat number.

3. Material test reports to meet any special requirements.

Include the heat numbers on the reproducible copies of the as-built shop plans for steel in main load-carrying tension members and in tension components of flexural members.

- B. Edge Finishing.** Finish rolled, sheared, and flame cut edges true to line and without rough corners and projections. Round corners along exposed edges to a radius of 1/16 in or greater. Plane, mill, grind or thermal cut to a depth of 1/4 in sheared edges on material more than 5/8 in thick.

Do not exceed 250 micro-inches as defined by ANSI specifications for surface roughness of flange plates in designated tension stress or stress reversal areas (rolled, sheared, and flame cut edges). The Contractor may obtain this roughness on flame cut edges after cutting by grinding or other Engineer approved methods.

Do not exceed 1000 micro-inches surface roughness of other rolled, sheared and flame cut edges, unless otherwise shown on the plans.

- C. Thermal Cutting.** Take steps to ensure that the flame cut edges of main material are not hardened by the cutting process. The Contractor may achieve this by preheating, post heating or control of the burning process. Edge hardness for AASHTO M270, Grade 50 and 50W plates after flame cutting found to have a Rockwell Hardness Value of C30 or greater will be considered unacceptable. Determine hardness by AASHTO T 80. Test plate edges at least once for each fabrication piece or as Engineer directed. Remove unacceptably hard surfaces by grinding, machining, or heat treating procedures, as Engineer approved.

Preheat to the following temperatures when flame cutting AASHTO M 270, Grade 50/50W and above, or other high strength low alloy steels as shown in Table 504.03-1.

Table 504.03-1 - Preheat Temperature

Thickness (t) of Thickest Part at Point of Cutting, in.	Temperature °F
$t \leq 0.75$	50
$0.75 < t \leq 1.5$	70
$1.5 < t \leq 2.5$	150
$t > 2.5$	225

Preheat the plate so that the required temperature is obtained through the full thickness of the plate ahead of and laterally from the cut a distance of 3 in, or the plate thickness, whichever is greater.

Show preheat temperatures on the shop drawings.

- D. Fit and Bearing.** Mill ends of columns that bear on base and cap plates to true surfaces and accurate bevels.

When assembled, ensure caps and base plates of columns and the sole plates of girders and trusses have full contact. Heat straighten, plane, or correct the plates in some other way to produce accurate, even contact if plates are warped or deformed. If necessary for proper contact, plane or mill bearing surfaces that will contact other metal surfaces. Rough finish surfaces of warped or deformed base and sole plates that will contact masonry.

On the surface of expansion bearings, ensure the cut of the planer is in the direction of expansion.

Face abutting ends of compression members accurately so they bear evenly in the structure. On built-up members, face or mill the end after fabrication.

Rough finish ends of tension members at splices to produce neat, close joints. The Department does not require a contact fit.

Ensure floor beams, stringers, and girders having end connection angles are flush with each other and set accurately in relationship to the position and length of the member. Unless the plans require it, do not finish end connection angles. If faulty assembly requires them to be milled, do not reduce milling thickness by more than 1/16 in.

Ensure the various pieces forming one built member are straight and close-fitting, true to detailed dimensions, and without twists, bends, open joints, or other defects.

Do not exceed 3/8 in clearance between web plates for field-bolted splices.

Mill bearing stiffeners so they will bear evenly against the flange. Fit intermediate stiffeners tightly enough to exclude water after painting.

- E. Grinding.** Grind plates so that the direction of grinding is parallel with the direction of tensile or compressive stress. Show the direction of grinding on the shop plans.

- F. Camber.** Do not camber in the plane parallel to the strong axis of the girder by the use of heat or mechanical bending. For plate girders, cut the web to

the prescribed camber with suitable allowance for shrinkage due to cutting, welding, and heat curving.

- G. Curvature.** Produce girder curvature in an axis parallel to the girder web as shown on the plans by fabrication methods that meet AASHTO Specifications for Highway Bridges, Division II-Construction, or as Engineer approved.
- H. Pins and Rollers.** Make pins and rollers of the class of forged steel specified. Turn accurately to detailed dimensions, smooth, straight, and flawless. Produce the final surface by a finishing cut.

Forge and anneal pins and rollers more than 9 in diameter. The Contractor may either forge and anneal, or cold finish carbon steel shafting pins and rollers 9 in or less in diameter.

In pins larger than 9 in diameter, bore a hole at least 2 in diameter full length along the axis after the forging has been allowed to cool to a temperature below the critical range and before being annealed. Cool under conditions which will prevent injury by cooling too rapidly.

Bore pin holes true to detailed dimensions, smooth and straight, and at tight angles to the axis of the member. Ensure holes are parallel with each other unless the plans specify otherwise. Always make a finishing cut.

Do not vary from detailed dimensions the distance between holes by more than 1/32 in. Measure the distance in tension members, from outside to outside of holes; and in compression members, inside to inside.

Ensure each pin is 1/50 in smaller in diameter than its hole. Number pins after being fitted into their holes in the assembled member. Magnetic particle test pins in accordance with ASTM A275 using an independent testing laboratory. The Engineer will reject pins with inner defects.

Provide two pilot and two driving nuts for each size of pin unless the plans state otherwise.

- I. Machine Finished Surfaces.** As soon as possible and before they leave the shop, cover with grease machine-finished surfaces on abutting chord splices, column splices, and column bases. After erection, clean and paint the steel as specified.

Paint surfaces of iron and steel castings milled to smooth with the primer called for in the specified paint system.

While still in the shop, ensure machine-finished surfaces and inaccessible surfaces of rocker or pin-type bearings receive the full paint system.

Do not paint surfaces of pins and holes machine-finished to specific tolerances. Coat with grease as soon as possible.

J. High Strength Bolt Holes.

1. General. The Contractor may punch or sub-punch and ream, drill or sub-drill and ream, or form by numerically controlled drilling operations, holes subject to the condition described in this section.

Ensure the hole for each high strength bolt is 1/16 in larger than the nominal diameter of the bolt less than 1 in diameter and 1/8 in larger for bolts with diameters greater than 1 in.

The fabricator may drill holes full size from the solid with thickness of material assembled in proper position in forming any connection. If the fabricator chooses not to use this method, then the following methods apply:

- a. Sub-punch or sub-drill holes, then ream full size after assembly in connections and splices in the main members of trusses, arches, continuous beam spans, bents, towers, plate girders, box girders, and rigid frames.
- b. Drill holes full size unassembled to a steel template for splices of rolled beam stringers that continue over floor beams or cross frames.
- c. Sub-punch and ream holes full size to a steel template or reamed full size while assembled for end connections of rolled beam stringers and floor beams or cross frames.

If steel templates are used to ream or drill full size connection holes, position and angle the templates with extreme care and bolt firmly in place. Use duplicate templates for reaming matching members or the opposite faces of one member. Locate templates for connections on like parts or members with such accuracy that match-marks are not needed.

The Contractor may punch or drill bolt holes full size in cross frames, gussets, lateral braces, and other secondary members from the solid while assembled.

2. Punched Holes. For punched holes, ensure the die diameter does not exceed punch diameter by more than 1/16 in. Ream any hole requiring enlargement to admit the bolt. Cut holes clean with no torn or ragged edges. The Engineer will reject components having poorly matched holes.

Ensure after shop assembly and before reaming, punched, sub-punched, and sub-drilled holes meet the following standard of accuracy:

- a. At least 75 percent of the holes in each connection permit the passage of a cylindrical pin $1/8$ in smaller in diameter than nominal hole size.
- b. The pin passes through at right angles to the face of the member without drifting.
- c. Holes permit passage of a pin $3/16$ in smaller in diameter than nominal hole size.

The Engineer will reject pieces that fail to meet these standards.

3. Reamed and Drilled Holes. Use drills for reaming and drilling, producing cylindrical holes perpendicular to the member. Reamers and drills are to be directed mechanically, not hand-held.

Assemble connecting parts that require reamed or drilled holes and hold securely as the holes are formed, then match-marked before disassembly.

Provide the Engineer a diagram showing these match-marks. The Engineer will reject components having poorly matched holes.

Remove burrs on outside surfaces and mating surfaces. Disassemble parts to remove burrs if Engineer required.

Ensure at least 85 percent of holes in a connection of reamed or drilled holes show offsets of $1/32$ in or less between adjacent thicknesses of metal, with no hole having an offset greater than $1/16$ in.

Inscribe centerlines from the connection on the template and locate holes from these centerlines. Use centerlines for accurately locating the template relative to the milled or scribed ends of the members.

Insert templates with hardened steel bushings into each hole. The fabricator may omit these bushings if the fabricator satisfies the Engineer that:

- a. The template will be used no more than 5 times; and
- b. Use will produce no template wear.

Ensure each template is at least $1/2$ in thick. If necessary, use thicker templates to prevent buckling and misalignment as holes are formed.

3. Numerically Controlled Drilled Connections. The fabricator may use

numerically controlled (N/C) drilling or punching equipment in forming any hole described in this subsection if it meets the following requirements.

Submit for Engineer approval a detailed outline of proposed N/C procedures. Include:

- a. Steps from initial drilling or punching through check assembly.
- b. The specific members of the structure to be drilled or punched, hole sizes, locations of the common index and other reference points, make-up of check assemblies, and other information needed to describe the process fully.

The fabricator may drill or punch to size through individual pieces or through any combination of tightly clamped pieces.

Show that the N/C procedures consistently produce holes and connections meeting these specifications when required by the Engineer.

5. Fitting for Bolting. Well pin, and draw firmly together parts of a member before drilling, reaming, and bolting begins. If necessary, take assembled pieces apart to permit removal of any burrs or shavings produced as the holes are formed. Ensure the member is without twists, bends, and other deformation.

Blast clean contacting metal surfaces in shop-bolted connections before assembly. Blast in accordance with the (SSPC) Specifications for Commercial Blast Cleaning (SSPC-SP 6).

Ensure drifting done during assembly does no more than enough to bring the parts into place and that drifting does not enlarge the holes or distort the metal.

K. Assembly.

1. Progressive Truss or Girder Assembly. Use progressive truss or girder assembly methods described as follows unless otherwise specified:
 - a. Obtain the Engineer's approval of both the shop assembly and the erection methods before work begins.
 - b. Assemble each truss or girder in stages over the full length of the superstructure.
 - c. For trusses, include at least three contiguous panels in the first stage.

- d. For girders, include at least three contiguous shop sections in the first stage.

After stage one has been completed, assemble each next stage to include at least one panel or shop section of the previous stage, repositioned, if necessary, and pinned to ensure accurate alignment; and add two or more panels or shop sections at the advancing end.

If the bridge is longer than 150 ft, ensure each stage is at least 150 ft long, regardless of the length of individual continuous panels or shop sections.

Perform the assembly sequence in the same order that the structure will be assembled in the field.

2. Check of Shop Assembly. Check each assembly for alignment, accuracy of holes, fit of milled joints, and other assembly techniques. Do not begin drilling or reaming until the Engineer has given approval. If the Contractor uses N/C drilling, obtain the Engineers approval before the assembly or stage is dismantled.
3. Blasting Cleaning. For painted structures after fabrication, blast clean structural steel (except machine-finished surfaces) to a "Near White" finish in accordance with the Steel Structures Painting Council SSPC-SP10. The "Near White" surface is shown in the pictorial standards of SSPC-Vis 1 A, B or C. After blasting and before painting, remove loose dust and dirt that remains on the steel. Do not use acid to remove scale or stains.

For unpainted weathering steel structures, after fabrication, blast clean steel surfaces in the shop, except those to be embedded in concrete, in accordance with SSPC Specification for Commercial Blast Cleaning (SSPC-SP-6). Provide a blasted appearance that is equal to, or better than, SP-6 as shown in the pictorial standards of SSPC-VIS 1.

Blast clean after erection as specified in 504.03.N.4.b

Blast clean faying surfaces as specified in 504.03.L and 504.03.J.5.

Comply with 504.03.N.4.

L. Bolted Connections.

1. General. High strength bolted connections are slip critical unless specified otherwise. Type 1 or Type 2 bolts are required for painted structures and Type 3 bolts for unpainted structures. Type 3 weathering steel is required for direct tension indicators.

Provide bolts, nuts, hardened washers, and direct tension indicators as specified in 708.06.

Clean metal surfaces before fitting and bolting of the connection. Ensure assembled joint surfaces, including surfaces adjacent to the bolt head and nut, are free of dirt, road oil, and other foreign material. When splices are designated Class B, slip-critical on the plans, field inspect the contact surfaces of splices immediately before assembly to ensure the surfaces are free of mill scale, dirt, road oil, and other foreign material.

Remove burrs that would prevent solid seating of the connected parts in the snug tight condition.

Do not paint the faying surfaces of slip-critical connections. Protect areas closer than one bolt diameter, but at least 1 in from the edge of any hole and areas within bolt pattern from paint including any inadvertent overspray.

Provide steel material within the grip of the bolt with no compressible material such as gaskets or insulation within the grip. Ensure bolted steel parts fit solidly together. Bolted steel parts may be coated or uncoated. Ensure the slope of the surfaces of parts in contact with the bolt head or nut does not exceed 1:20 with respect to a plane normal to the bolt axis.

Protect fasteners from dirt and moisture at the job site. Take only as many fasteners as are anticipated to be installed and tightened during a work shift from protected storage. Return fasteners not used to the protected storage at the end of the shift. Do not clean fasteners of lubricant that is present in as-delivered condition. Clean and re-lubricate fasteners for slip-critical connections which accumulate rust or dirt resulting from job site conditions, before installation.

Use a tension measuring device (a Skidmore-Wilhelm calibrator or other Engineer acceptable bolt tension indicating device) at project sites where bolts in slip-critical joints or connections subject to direct tension are being installed and tightened. Use the tension measuring device to confirm:

The suitability to satisfy the requirements of Table 504.03-2 of the complete fastener assembly, including lubrication if required, to be used in the work;

- a. Calibration of the wrenches, if applicable;

- b. The understanding and proper use of the method to be used by the bolting crew.
- c. Confirm the accuracy of the tension measuring device through calibration by an approved testing agency at least annually in accordance with AASHTO T-67/ASTM E-4.

Calibrate wrenches daily in accordance with Idaho IR-12.

The Engineer will inspect bolting and testing operations to determine the approved installation procedure is used and that the correct tension has been achieved. The Engineer may reject testing operations completed without the presence of the Engineer.

Store high strength bolts, nuts, washers, and Direct Tension Indicators (DTIs) under cover to protect them from rain, snow, dirt or other adverse conditions, and ensure the identification of heat number or production lot number remain with each type of bolting parts. The Engineer will not accept any bolting parts that are rusty, dirty, or have damaged threads.

Before bolts are installed in the field or at the shop, subject the bolts to a rotational-capacity test. Perform the rotational-capacity test on each rotational-capacity lot. Hardened steel washers are required as part of the test although they may not be required in the actual installation procedure.

Provide bolt, nut, washer and DTI (when required) combinations as installed from the same rotational-capacity lot.

Perform the rotational-capacity test as specified in 708.06.2.B.4.

Locate nuts wherever practical, on the side of the member that will not be visible from the traveled way. Locate nuts for bolts that will be partially embedded in concrete on the side of the member that will be encased in concrete.

Turn tight the nut while the bolt is prevented from rotating. Provide each bolt with a hardened washer under the nut. A M 164 bolt may be re-used one time if Engineer approved. The Department does not consider re-tightening a bolt loosened by the tightening of nearby bolts reuse.

To begin bolting any connection, install and tighten to snug-tight enough bolts to bring parts into full contact with each other. "Snug-tight" means either the tightness reached by (1) a few blows from an impact wrench, or (2) the full effort of an individual using a spud wrench.

After this initial tightening, install and bring to snug-tight remaining bolts in the connection. Then, beginning with bolts in the most rigid part of the joint and working out to its free edges, systematically tighten bolts to specified tension.

When all bolts in a joint are tight, ensure each bolt carries at least the proof load shown in Table 504.03-2.

Table 504.03-2 - Bolt Tension

Minimum Bolt Tension (lbs.)

Bolt Size inches	ASTM A325	AASHTO M253 ASTM A490
0.5	12050	14900
0.625	19200	23700
0.75	28400	35100
0.875	39250	48500
1.0	51500	63600
1.125	56450	80100
1.25	71700	101800
1.375	5450	121300
1.5	104000	142500

2. Tightening Methods. Unless otherwise shown on the plans, tighten using the direct-tension-indicator method.
 - a. Direct Tension Indicator Tightening (DTI).
 - (1) Installation. Locate the Direct Tension Indicator (DTI) at the opposite end of the bolt from the part being tightened where possible. When the DTI is used next to a slotted or oversized hole, place a hardened flat washer between the DTI and the part being tightened; do not reuse the DTI after tension has been applied to the bolt.
 - (2) Bolt Tension. Meet the following:
 - (a) Verify DTI performance before the start of installation of bolts in the bridge. Test in accordance with Procedure for Verification and Installation of High Strength Bolts with Direct Tension Indicators. This procedure is in Appendix

A6 of Report No. FHWA-SA-91-031 dated May 1991, revised April 1992.

- (b) Ensure the measured gap for DTIs is at 0.005 in or less. Refusal of the feeler gauge in all slots is defined as a nil gap and may be cause for rejection by the Engineer. The Engineer may require any bolt with nil gap to be removed from the work and the bolt thread examined at no additional cost to the Department. If no necking of the bolt thread is observed and the nut can run down the full length of the thread, then the bolt may be reinstalled with new DTIs.
- b. Turn-of-Nut Method. After bolts in the joint have been brought to snug tightness, further tighten the nuts by the amount of rotation shown in Table 504.03-3.

Before final tightening and after snug tightening, match-mark with crayon or paint the outer face of each nut and the protruding part of the bolt. To ensure this tightening method is followed, the Engineer will:

- (1) Observe as the Contractor installs and tightens bolts;
- (2) Inspect each match-mark.

Place three bolts of the same grade, size, and condition as those under inspections individually in a device calibrated to measure bolt tension. Perform this calibration at least once each inspection day. Provide a washer under the part turned in tightening each bolt if washers are used on the structure. If washers are not used on the structure, provide material abutting the part turned that is the same as specified for use on the structure. In the calibrated device, tighten each bolt by any convenient means to the specified tension. Apply the inspecting wrench to the tightened bolt to determine the torque required to turn the nut or head 5° or approximately 1 in at a 12 in. radius in the tightening direction. Take the average of the torque for the three bolts as the job-inspection torque.

Inspect, in the presence of the Engineer, the tightened bolt using an inspection torque wrench.

Select ten percent (at least two) of the tightened bolts on the structure represented by the test bolts at random in each connection.

Apply the job-inspection torque to each with the inspecting wrench turned in the tightening direction. If this torque turns no bolt head or nut, the Engineer will accept the connection as being properly tightened, but if the torque turns one or more bolt heads or nuts, apply the job-inspection torque to all bolts in the connection. Tighten and re-inspect bolts whose head or nut turns at this stage. The Contractor may retighten the bolts in the connection and resubmit for inspection.

Table 504.03-3 - Turn-Of-Nut Tightening Method

Nut Rotation ¹ from Snug-Tight Condition			
Bolt Length 1 (Measured from underside of head to extreme end of point)	(Both faces at right angles to bolt axis)	(One face at right angle to bolt axis, once face sloped no more than 1:20, without bevel washer)	(Both faces sloped no more than 1:20 from right angle to bolt axis, without bevel washer)
$1 \leq 4D$	120° or 1/3 turn	180° or 1/2 turn	240° or 2/3 turn
$4D \leq 8D$	180° or 1/2 turn	240° or 2/3 turn	300° or 5/6 turn
$8D \leq 12D$	240° or 2/3 turn	300° or 5/6 turn	360° or 1 turn

¹ Nut rotation is relative to the bolt regardless of which element (nut or bolt) is being turned. Tolerances permitted: plus or minus 30° for final turns of 180° - 1/2 turn or less; plus or minus 45° for final turns of 240° - 2/3 turn or more.

² D = nominal bolt diameter of bolt being tightened.

³ When bolt length exceeds 12D determine, the rotation by actual tests that a suitable tension device simulates actual conditions.

M. Welding.

1. General. The Department requires weld fabrication to meet ANSI/ AASHTO/ AWS D1.5 *Bridge Welding Code* and Interim Revisions published by AASHTO as of the bid opening date except as modified in the rest of this subsection or as shown on the plans.

Weld tubular members in accordance with the current addition of AWS D1.1 *Structural Welding Code-Steel*.

Weld sheet steel not exceeding 1/8 in in thickness in accordance with current addition of AWS D1.3 (*Structural Welding Code-Sheet Steel*.)

Weld aluminum in accordance with to the current addition of AWS D1.2 *Structural Welding Code-Aluminum*.

Weld structural steel only to the extent shown on the plans. Do not weld, including tack and temporary welds, in the shop or field unless the location of the welds is shown on the Engineer approved shop drawings or approved by the Engineer in writing.

Obtain the Engineer's approval of shop plans before welding, as specified in 504.01. Include in the shop plans procedures for welding, assembly, and any heat-straightening or heat-curving.

2. Preheating. Comply with the preheat and interpass minimum temperatures as specified in Section 4 of the ANSI/ AASHTO/ AWS D1.5 *Bridge Welding Code*.

Show preheat temperatures on the shop drawings.

Pre-heat web and flange plates, bearing stiffeners, bearing plates, and heavy sections (restrained when welded) to at least 250 °F.

3. Welding Procedures. Perform welding on main members and attachments using only shielded metal arc, submerged arc, or stud welding unless otherwise Engineer approved. Weld butt splices and flange to web welds using the automatic submerged arc process with uninterrupted continuous passes. The Contractor may request approval to substitute flux core welding in areas where automatic submerged arc welding is not feasible. The Engineer may approve complete joint penetration groove welds made by flux cored arc welding only after submittal of performance of the joint qualification test specified in Section 5.7 and tested in accordance with Section 5.12 of the ANSI/ AASHTO/ AWS D1.5 *Bridge Welding Code*. Perform joint qualification tests and submit on each individual project. Submit the test coupons to an independent testing laboratory for testing. The Department considers the work associated with the making of the test coupons incidental and the costs included in the contract unit prices for other contract items.

Use low-hydrogen electrodes in shielded metal-arc welding.

Oven-dry flux for submerged-arc welding at 550 °F for at least 2 hours,

then store in ovens held at 248 °F or more. If not used within 4 hours after removal from a drying or storage oven, re-dry the flux before use.

Do not:

- a. Weld with gas metal arc, electrogas or electroslag methods;
- b. Weld when ambient temperature is below 20 °F; or
- c. Use coped holes in the web for welding butt splices in the flanges unless shown on the plans.

Place tack welds so that they are incorporated into the final weld. The same quality requirements apply for tack welds as the final welds except that discontinuities such as undercut, unfilled craters, and porosity need not be removed before the final submerged arc welds. Make tack welds with electrodes meeting the requirements of the final welds and clean thoroughly. Provide multiple-pass tack welds with cascaded ends.

If groove welds (web-to-web or flange-to-flange) have been rejected by the Engineer, they may be repaired no more than twice. If a third failure occurs:

- a. Trim the members, if the Engineer approves, at least ½ in; or
- b. Replace the members at no cost to the Department.

End welds at the end of the joint so that sound welds are ensured. Whenever possible, do this by using extension bars and runoff plates configured to duplicate the joint detail being welded. Remove extension bars and runoff plates upon completion and cooling of the weld, and grind the ends of the welds smooth and flush to minimum surface finish of ANSI 125. Inspect 100 percent of the groove welds ends using dye penetrant or magnetic particle testing techniques and include splices in individual flanges and webs, transverse and longitudinal stiffeners, floor beams, and stringers.

The Engineer may reject a member if there are arc strikes outside the weld joint, on metal not incorporated in a weld joint. Report arc strikes on surfaces carrying tensile or reversal stress in writing to the Engineer. Do not repair arc strikes on surfaces carrying tensile or reversal stress without written Engineer authorization. Accomplish repair of arc strikes by grinding the area containing the arc strike to a minimum surface finish of ANSI 125. Inspect the ground area by the magnetic-particle test (yoke method) and test for heat-affected-zone hardness. If the testing specified reveals

cracking, hardness or both in excess of Rockwell C23, weld repair the area in accordance with ANSI/AASHTO/AWS D1.5 *Bridge Welding Code*.

4. Fillers. For multipass welds of unpainted AASHTO M270, Grade 50W Bridge steel, use filler metal meeting the requirements of Table 4.2 of the current AWS Specifications.

When a bolted splice is used to join plates of differing thickness, do not weld filler plates used to compensate for the thickness difference into place unless Engineer approved in writing.

5. Shear Connectors. Weld shear connectors using automatically timed stud welding equipment unless otherwise Engineer approved in writing.

For any welded shear connector longer than 8 in, the Contractor may join two shorter shear connectors with full-penetration welds.

6. Welding Inspection. Comply with Current ANSI/AASHTO/AWS D1.5 *Bridge Welding Code* for welding inspection procedures, techniques, and inspector qualification except as modified in this subsection or as shown on the plans.

Use certified welding inspectors to inspect welds as follows:

- a. Visual Inspection. Inspect 100 percent of welds.
- b. Radiographic Inspection. Inspect 100 percent of full-penetration groove welds subject to tension or reversal using radiographic inspection. Include those in the tension area of webs, inspect the greater of these two distances: 15 in from the tension flange, or one-third of the web depth from the tension flange.
- c. Magnetic Particle Inspection. Inspect fillet welds, and longitudinal butt welds in webs. Test using the yoke method only.
 - (1) Flange-to-Web Connections. Inspect 100 percent of fillet welds in flange-to-web connections of built-up members until the Engineer accepts the Contractor's record of quality control. After acceptance, inspect 30 percent of each weld with 10 percent of this inspection occurring at each end of the welds length. The remaining 10 percent will be randomly selected by the Engineer.
 - (2) Boxed Members of Trusses. Inspect 100 percent of each fillet weld in boxed members of trusses.

- (3) End and Intermediate Pier Diaphragms. Inspect 100 percent of each fillet weld in end and intermediate pier diaphragms.
 - (4) Longitudinal Butt Weld in Web. Inspect each longitudinal butt weld in the web as specified for flange-to-web connections.
 - (5) Stiffeners and Connection Plates. Inspect thirty percent of each fillet weld in transverse and longitudinal web stiffeners and connection plates with 10 percent occurring at each end of the weld. Inspect the remaining 10 percent randomly at points selected by the Engineer.
 - (6) Miscellaneous Weldments. Inspect 100 percent of each fillet weld in miscellaneous weldments (such as bridge bearing assemblies).
- d. Ultrasonic Inspection. Inspect full-penetration groove welds ultrasonically.
- (1) Transverse Flange and Web Splices. Inspect 100 percent of each transverse groove weld.
 - (2) End and Intermediate Pier Diaphragms. Inspect 100 percent of each groove weld.
 - (3) Other Weldments. Inspect 100 percent of each groove weld in other weldments, unless the plans state otherwise.
- e. Dye-Penetrant or Magnetic-Particle Inspection. Inspect 100 percent of the end of each groove weld at plate edges.
- f. Other Inspection. Perform additional testing as shown on the plans.

N. Erection.

1. Erection Marks. The Contractor may paint erection marks on surfaces to permit identification of members in the field that are to be painted in the field. For unpainted AASHTO M270, Grade 50W, stamp erection marks with low stress intermittent dot steel die stamp in an area visible after completion of the structure. Ensure the maximum depth of the impression does not exceed 0.010 in and the tool meets the requirements in Table 504.03-4.

Table 504.03-4 - Tool Specification

Character Size (in)	Minimum Character Face Radius (in)
1/8	0.007175
3/16	0.008200
1/4	0.010250

2. Ensure impressions are not near the edge of tensile-stressed plate members.

Alignment and Camber. Before beginning field bolting:

- a. Adjust the structure to correct grade and alignment;
- b. Regulate elevations of panel points (ends of floor beams); and
- c. Delay bolting at compression joints until adjusting the blocking to provide full and even bearing over the whole joint.

On truss spans, the Engineer will allow a slight excess camber as the bottom chords are bolted. Correct camber and relative elevations of panel points before the top chord joints, top lateral system, and sway braces are bolted.

Provide the Engineer with a diagram for each truss that shows camber at each panel point and display actual measurements taken as the truss is being assembled.

Do not place forms, steel reinforcing bars, or concrete on steel spans until the girders in spans for a given stage of construction, as shown on the plans, are completely erected with girder splices complete, cross frames installed, and temporary shoring released. After shoring is released and masonry plates have been grouted and before subsequent loading of the spans, measure the elevations along the tops of girders and floor beams at each tenth point of the spans. Determine and make the adjustment to the top-of-web to top-of-deck dimensions as necessary to meet the requirements of the plans, and submit the adjustments and elevations for Engineer approval.

3. Field Assembling and Bolting. To begin bolting any field connection or splice, install and tighten to snug-tight, enough bolts to bring all parts into full contact with each other before tightening these bolts to the specified minimum tension. "Snug-tight" means either the tightness reached by a

few blows from an impact wrench or the full effort of an individual using a spud wrench.

Complete bolting a field connection using one of the following methods:

- a. Method A. As erection proceeds, securely drift pin and bolt field connections and splices for each member in accordance with the following before the mass of the member can be released or the next member is added. Specify on field erection drawings pinning and bolting requirements that meet or exceed the following minimums:
 - (1) Joints in Normal Structures. Fill 50 percent of the holes in a single field connection and 50 percent of the holes on each side of a single joint in a splice plate with drift pins and bolts. Pin thirty percent of the filled holes. Bolt and tighten 70 percent of the filled holes to snug-tight. Once these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. "Systematically tightened" means beginning with bolts in the most rigid part, which is usually the center of the joint, and working out to its free edges. Locate the fully tensioned bolts near the middle of a single field connection or a single splice plate.
 - (2) Joints in Cantilevered Structures. Fill 75 percent of the holes in a single field connection and 75 percent of the holes on each side of a single joint in a splice plate with drift pins and bolts. Pin 50 percent of the filled holes. Bolt and tighten 50 percent of the filled holes to snug-tight. Once these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. Locate the fully tensioned bolts near the middle of a single field connection or a single splice plate. A joint in a cantilevered structure is defined as to be a field connection or splice that is on the unsupported or cantilevered side of a support. Joints that fit this description whether in final position or temporary position (during erection) are considered joints in cantilevered structures.

Place drift pins throughout each field connection and each field joint with the greatest concentration in the outer edges of a splice plate or member being bolted.

To complete a joint, fill remaining holes of the field connection or splice plate with bolts and tighten to snug-tight. Once these bolts are

snug-tight, systematically tighten each bolt to the specified minimum tension. After these bolts are tightened to the specified minimum tension, replace the drift pins with bolts, tightened to the specified minimum tension.

- b. Method B. The Contractor may complete a field bolted connection or splice in a continuous operation before releasing the mass of the member or adding the next member. Use drift pins to align the connection. For alignment drift pins, fill between 15 and 30 percent of the holes in a single field connection and between 15 and 30 percent of the holes on each side of a single joint in a splice plate. Once the alignment drift pins are in place, fill remaining holes with bolts and tightened to snug-tight starting from near the middle and proceeding toward the outer gage lines. Once these bolts are snug-tight, systematically tighten these bolts to the specified minimum tension and then replace the drift pins with bolts. Tighten each of these bolts to the specified minimum tension.

Place bolts with heads toward the outside and underside of the bridge. Install and tighten high-strength bolts before the falsework is removed.

The Contractor may erect metal railings as erection proceeds, but do not bolt or adjust permanently until the falsework is released and the deck placed.

Do not begin painting until the Engineer has inspected and accepted field bolting.

4. Surface Condition. As the structure is erected, keep steel surfaces clean and without dirt, concrete, mortar, oil, paint, grease, and other stain-producing foreign matter. Clean surfaces that have become stained as follows:
 - a. Clean painted steel surfaces by methods required for the type of staining. Submit the method to be used for Engineer approval.
 - b. Weathering steel surfaces. After the deck is placed, remove concrete stains and other foreign matter from the exposed surfaces of structural steel members by power cleaning or other Engineer approved method that will provide a surface for the formation of patina (oxide coating).

505.03

504.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Structural metals will be by the pound, foot, or on a lump sum basis. Where payment is on a weight basis, the Engineer will compute the weights of rolled shapes and of structural steel plates on the basis of their nominal weights and dimensions.
2. Steel forgings will be by the pound based on the plan dimensions and the theoretical weight of 0.2833 lb/in³ "plan quantity."
3. Structural steel handrail, two tube curb mount rail, pedestrian/bicycle railing, and combination pedestrian/bicycle railing will be by the foot.

504.05 Basis of Payment. The Department will pay for acceptable quantities at contract unit price as follows:

Pay Item	Pay Unit
Steel Bridge.....	L S
Structural Steel.....	lb or L S
Steel Forgings.....	lb
Structural Steel Handrail.....	ft
Two Tube Curb Mount Rail.....	ft
Pedestrian/Bicycle Railing.....	ft
Combination Pedestrian/Bicycle and Traffic Railing.....	ft

The Department will pay using "plan quantities" as specified in 109.01.

SECTION 505 - PILING

505.01 Description. Provide and drive piles, including test piles.

505.02 Materials. Provide materials as specified in:

Concrete.....	502
Steel H-Piles.....	708.08
Steel Shell Piles.....	708.30
Timber Piles.....	710.05

505.03 Construction Requirements.

- A. **General.** Provide test piles of the same material, cross section and type as the piles shown on the plans, and drive with the same pile driving hammer type and size as will be used for driving the rest of the piling. Do not drive test piles with vibratory hammer.

Do not order the balance of the piling when test piles are required until the test pile driving results have been analyzed and the required pile lengths determined by the Engineer. Notify the Engineer at least seven (7) calendar days before driving each test pile. The Engineer will require two (2) business days after each test pile is driven to evaluate each test pile result and determine the required pile length for the production piles. Drive test piles to refusal or 1.5 times the estimated pile penetration as shown on the plans, whichever comes first. If the required bearing capacity is not achieved when the test pile is driven to 1.5 times the estimated pile penetration, then continue driving the test pile until the required bearing capacity has been achieved as determined by the Engineer.

Complete the foundation excavation before driving piles. Drive piles to the specified bearing capacity or refusal as shown on the plans and as determined by the Engineer. Drive piles to the highest tip elevation or minimum penetration as shown on the plans.

If the minimum pile penetrations are not shown on the plans, then they will be one third of the pile length for pile bents 10 feet in dense or hard soils, 20 feet in soft or loose soil, or as determined by the Engineer. If a pile does not have the required bearing capacity at the highest tip elevation or minimum penetration, then keep driving pile until it achieves the required bearing capacity.

If the required minimum penetration or the highest tip elevation cannot be obtained with a hammer having the highest energy rating permitted, the Department may require pre-drilling.

The Contractor may drive steel shell piles with a mandrel except on exposed pile bents.

Provide a suitable light for shell pile inspection.

- B. Caps and Collars.** Cut off pile butts square and chamfer the edges before placing timber piles into the leads. Provide timber pile heads with Engineer approved metal caps or collars, to prevent splitting. Use a cast steel helmet assembly with a suitable hammer cushion for driving steel H-piles and shell piles. Fit the helmet assembly closely to the top of the steel H-pile or shell pile. Provide a helmet assembly design that has been proven satisfactory and is properly sized for driving of the pile being used.
- C. Hammer Cushion.** Remove the hammer cushion from the helmet and inspect in the presence of the Engineer before beginning pile driving at each structure or after each 100 hours of pile driving. If there is reduction of the hammer

cushion thickness of 25 percent or more of the original thickness, replace the hammer cushion before continuing the pile driving.

- D. Pile Tips and Cutting Shoes.** Fit the piles with pile tip protectors or shoes as shown on the plans or as Engineer directed. Carefully shape the pile toe to provide uniform, even bearing on the tip or shoe. Use AWS certified welders to install pile tips or shoes in accordance with the manufacturer's written instructions.
- E. Gravity Hammers.** Provide gravity pile hammers with a ram mass of at least 3,000 lb, with the hammer ram mass equal or greater than the combined mass of the helmet assembly and the pile. Regulate the hammer fall to avoid damage to the piles, and do not exceed 15 ft.
- F. Steam, Air, and Diesel Hammers.** Provide steam, air and diesel hammers that develop an energy of at least 7,000 ft-lbs per blow for timber piles and at least 15,000 ft-lbs per blow for all other pile types unless otherwise Engineer approved, or shown on the plans. Furnish the hammer type and hammer operation specifications to the Engineer fifteen days before pile driving for review. Operate pile driving hammers at the pressure and speed recommended by the manufacturer. Ensure the hammer operator's manual is available on site during pile driving.
- G. Pile Bearing Capacity.** The Engineer will develop the pile driving criteria using a wave equation analysis for determining the pile bearing capacity.

The Engineer will use the following dynamic formula to determine the required capacity for piles with ultimate bearing capacity less than 200 Kips. .

ENGLISH

$$R_U = 1.75 [E^{0.5}(\log(10Nb))] - 100$$

Where: R_U = ultimate pile capacity (Kips).

E = hammer energy (Foot-pounds) at the field observed ram stroke, equals field ram stroke (ft.) multiply by ram weight (lbs.).

Nb = number of hammer blow per inch of pile penetration.

H. Splicing.

9. Timber Piles. Do not splice timber piles unless Engineer approved.
10. Steel Piles. Use AWS certified welders to make splices as shown on the plans when splices are required for steel piles, or as directed by the Engineer. Do not make more than two field splices on any individual pile before

driving. The minimum pile section length for pile splicing is 10 feet, unless Engineer approved.

- I. **Followers.** Use followers when Engineer approved. When followers are used, drive one long pile without a follower for every 10 piles and use this one as a test pile to determine the pile group capacity. The Department requires at least one test pile per group.
- J. **Loading Tests.** Determine pile capacities by static loading tests when required. Perform these tests in accordance with ASTM D 1143.
- K. **Storage and Handling of Piles.** Store and handle piles so as to avoid damaging the piles. Take special care to avoid breaking the surface of treated timber piles.
- L. **Cutting Piles.** Carefully shape and remove brooming, splintering, or other damage to timber piles driven to near the cutoff elevation.

Neatly cut the piles on a horizontal plane at the cutoff elevation(s) shown on the plans after the piles have been driven, inspected and Engineer accepted.

- M. **Concreting.** Completely fill shell piles with concrete after the cutoff has been removed unless otherwise shown on the plans.

Before placing concrete in shell pile satisfactorily remove debris and water from inside the pile.

Do not place concrete in shell piles until piles within a radius of 15 ft have been driven.

- N. **Alignment, Location, and Orientation.** Drive piles with a variation in plumbness of not more than $\frac{1}{4}$ in from the vertical or from the batter shown on the plans. Drive piles for trestle bents so that the bent cap may be placed without inducing excessive stresses in the piles as determined by the Engineer. The Engineer will determine excessive stresses based on the loading conditions, pile type, and unsupported length. Ensure pile locations at cutoff are within 6 in of plan location. Ensure the as-driven centroid for any pile group is within 5 percent of the plan location of the designed centroid as measured from any edge of pile cap. Ensure the orientation of H-piles is within 15 degrees of that shown on the plans. If the location or alignment tolerances specified in this paragraph are exceeded, evaluate the extent of overloading and if, in the judgment of the Engineer, corrective measures are necessary, design and construct suitable measures at no additional cost or time to the Department.
- O. **Heaved Piles.** Check pile heave after driving at the start of pile driving operations and continue until the Engineer determines checking is no longer required. Take

level readings immediately after the pile has been driven and again after piles within a radius of 15 ft have been driven. If pile heave is observed, take accurate level readings referenced to a fixed datum on piles immediately after installation and periodically thereafter as piles within a 15 ft radius are driven to determine the pile heave range. Re-drive piles that have been heaved vertically more than 1/4 in to the required pile capacity, at no additional cost to the Department.

- P. Installation Sequence.** Start driving individual piles in pile groups from the center of the group and proceed outwards in both directions or start at the outside row and proceed progressively across the group.
- Q. Defective Piles.** Do not subject piles to excessive and undue abuse that may result in crushing and spalling of the concrete; splitting, splintering, and brooming of the wood; or deformation of the steel. Manipulation of piles to force them into proper position will require prior Engineer approval. Correct piles that have been damaged by internal defects or by improper driving, driven out of its proper location or driven below the pile cutoff elevation at no additional cost to the Department. Make corrections by one of the following methods, as Engineer approved, for the damaged or out of position piles:
1. Remove and replace the pile with new and, if necessary, a longer pile.
 2. Drive a new pile adjacent to the defective pile, at a minimum distance of 1 ft.
 3. Splice or build up the pile or widen a sufficient portion of the footing to properly embed the pile.

Other correction methods may also be used if Engineer approved.

- R. Driving Pile Next To Concrete Less Than 28 Days Old.** Do not drive pile closer to new concrete than the distance determined from the following formula:

$$D = C \times E^{0.5}$$

Where: D = distance (feet)

E = rated energy of pile driving hammer (foot-pounds)

C = coefficient shown in Table 505.03-1 based on the number of days of curing time.

Table 505.03-1 - Curing Time Coefficient

Curing Time (days)	Coefficient C	Curing Time (days)	Coefficient C
1	0.34	6	0.12
2	0.23	7-9	0.11
3	0.18	10-13	0.10
4	0.15	14-20	0.09
5	0.13	21-28	0.08

505.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Provide and drive piles and test piles will be by the foot of pile below cutoff elevation.
2. Pile shoes or tips, splice attachment, and field splice will be by each.

505.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Provide & Drive Timber Piles	ft
Provide & Drive Steel Shell Piles	ft
Provide & Drive Steel H-Piles ____ x ____	ft
Provide & Drive Test Piles	ft
Provide & Install Pile Shoes or Tips	Each
Steel Shell or H-Pile Splice Attachment to Driven Pile	Each
Field Splice Before Driving	Each

The Department will pay for steel and timber pile cutoffs and leftovers at 50 percent and 100 percent, respectively, of the purchase cost of material as shown on the seller's invoice, including freight charges. Pile cutoff is the property of the Contractor and must be removed from the site.

The Department considers pile-driving criteria developed by wave equation analysis, seal Concrete, Concrete Class 30, and Steel Reinforcement used with Steel Shell Piles as incidental to pile and the cost included in the contract unit price for piling contract pay items.

The Department considers splices required for pile lengths up to the plan estimated length as incidental to the cost of Provide and Drive Piles contract pay items and

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included in the contract unit price. The Department will pay for additional splices required if pile lengths exceed the plan estimated length at the contract unit price.

The Department will pay for pile pre-drilling as extra work in accordance with 109.03, unless a contract pay item is provided for this work in the contract.

SECTION 506 - PRE-STRESSING CONCRETE

506.01 Description. Provide, place and tension pre-stressing steel in precast or cast-in-place concrete.

Pre-stressing includes the providing and installation of appurtenant items necessary for the particular pre-stressing system to be used, including ducts, anchorage assemblies, and grout used for pressure grouting ducts.

For cast-in-place pre-stressed concrete, the term "member" means the concrete which is to be pre-stressed.

Perform pre-stressing using either pre-tensioning or post-tensioning methods unless the plans show only pre-tensioning details. If the plans show only pre-tensioning details, the Contractor may use a post-tensioning system only if complete details of any necessary modifications are Engineer approved.

506.02 Materials. Provide pre-stressing reinforcement that meets 708.05. The Engineer will reject any member with failing strand or steel.

506.03 Construction Requirements.

A. General. Submit for Engineer review and approval, complete details of the method, materials and equipment proposed for use in the pre-stressing operations, including any additions or rearrangement of reinforcing steel or pre-stress reinforcing strands from that shown on the plans. Outline the method and sequence of stressing and include complete specifications and details of the pre-stressing steel and anchoring devices, working stresses, anchoring stresses, types of ducts and other data pertaining to the pre-stressing operation, including the proposed arrangement of the pre-stressing steel in the members, pressure grouting materials and equipment. Submit elongation calculations based upon the sequence of stressing. Do not cast any member to be pre-stressed before Engineer review of the shop detail drawings is complete. Provide a 22 in x 34 in three mil minimum thickness mylar of the approved drawings.

Pre-cast, pre-stressed concrete manufacturing plants are required to be certified by the Prestressed Concrete Institute plant certification program, in category B2 (pre-stressed miscellaneous bridge products), B3 (pre-stressed straight

strand bridge members), or B4 (pre-stressed draped strand bridge members), corresponding to the products specified. Provide proof of current certification to the Engineer before beginning production.

For the fabrication of pre-cast, pre-stressed members, provisions of the *Manual for Quality Control for Plants and Production of Pre-cast, Pre-stressed Concrete Products* as published by the Prestressed Concrete Institute (edition current at time of bid opening) are incorporated by reference in these Specifications, with the following exceptions:

1. The contract specifications govern where there are conflicts.
2. If a wire in a pre-tensioning strand fails the Engineer will reject.
3. If a wire in a post-tensioning tendon fails the Engineer may reject.

Retain a professional post engineer, who is experienced in post-tensioning operations and registered in at least one state of the United States. The Contractors' Professional Engineer is to be in charge of post-tensioning operations and be present during tensioning and grouting operations. Two weeks before the start of the post-tensioning operations, submit to the Engineer in writing the name of the Professional Engineer, the state(s) in which the Professional Engineer is registered including registration number(s); and the date and place of post-tensioning.

- B. Sampling and Testing.** Sample and test in accordance with ASTM A 416 and ASTM A 421 and as specified in this section.

Provide samples from each size and each heat of pre-stressing bars, each manufactured reel of pre-stressing steel strand, each coil of pre-stressing wire, and each lot of bar couplers to be used for testing. With each sample of pre-stressing steel wires, bars or strands provided for testing, submit a certification stating the manufacturer's minimum guaranteed ultimate tensile strength of the sample.

Provide materials for testing at no cost to the Department. The Department will not provide additional compensation in the event the Contractor's work is delayed waiting approval of the materials provided for testing.

Assign an individual lot number to each bar size from each mill heat, from each wire coil, and each strand manufactured reel to be shipped to the site and tag so that each such lot can be accurately identified at the project site. Likewise identify each lot of anchorage assemblies and bar couplers to be installed at the

project site. The Engineer will reject unidentified pre-stressing steel, anchorage assemblies, or bar couplers received at the site.

Provide to the Engineer well before anticipated use the following samples of materials and tendons, selected by the Engineer from the pre-stressing steel at the plant or job site.

1. For wire, strand, or bars, one 5 ft long sample; two 2 ft long samples for bars. Provide samples of each size for each heat or reel.
2. If the pre-stressing tendon is a bar, furnish one 5 ft length and in addition, if couplers are to be used with the bars, provide two 2 ft lengths of bar equipped with one coupler and fabricated to fit the coupler.

Provide to the Engineer a calibration of the post-tensioning jacking system and provide the appropriate display settings for the state's electrohydraulic pressure cell system. Prepare a graph showing the gauge pressure in pounds per square inch, and force in thousands of pounds, kips, plotted through the whole range of the post-tensioning calibration. The Engineer will require re-calibration of the jacking system at intervals not exceeding three months or at any time it appears to the Engineer that the equipment is producing erratic results. For each calibration, provide a new set of charts from the calibration to the Engineer. The specified regular interval for re-calibration of equipment may be extended at the discretion of the Engineer upon conclusive evidence that there is no substantial change in the performance, but in no case will the intervals exceed six months.

The release of any material by the Engineer does not prevent subsequent Engineer rejection if the material is damaged in transit or later damaged and found to be defective.

- C. Shipment and Rust Protection.** Protect pre-stressing steel against physical damage and rust and other results of corrosion from manufacture to grouting or encasing in concrete. The Engineer will reject pre-stressing steel that has sustained physical damage. The Engineer may reject pre-stressing steel if visible rust or other results of corrosion develop.

Package pre-stressing steel in containers or other shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. Place a corrosion inhibitor which prevents rust or other results of corrosion in the package or form, or when Engineer approved, apply directly to the steel. The Department requires the corrosion inhibitor to have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Immediately

replace or restore to original condition packaging or forms damaged from any cause.

The Contractor may elect to use a corrosion inhibitor carrier type packaging material meeting the provisions of federal specification MIL-P-3420.

Clearly mark the shipping package or form with a statement that the package contains high-strength pre-stressing steel, the care to be used in handling, the type, kind and quantity of corrosion inhibitor used, including the date when placed, and safety orders and instructions for use.

If directed by the Engineer, submit the following for the corrosion inhibitor:

1. A sample, a list of chemicals and their proportions, and instructions for use.
2. Evidence that the pre-stressing steel will be protected from rust and other results of corrosion.
3. A Certificate of Materials as specified in 106.04.

If steam curing is used, do not install pre-stressing steel for post-tensioning until the steam curing is completed.

Where Engineer acceptable pre-stressing steel for post-tensioning is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 calendar days after the installation of the pre-stressing steel, the Engineer will not reject steel because of rust which may form during said 10 days. The Engineer will not require the use of a corrosion inhibitor in the duct following installation of the pre-stressing steel for pre-stressing steel installed, tensioned and grouted in this manner, within 10 calendar days. Pre-stressing steel installed this way but not grouted within 10 calendar days is subject to the requirements in this section pertaining to corrosion protection and Engineer rejection because of rust.

When acceptable pre-stressing steel for pre-tensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours before encasement in concrete, take adequate measures, as Engineer approved, to protect said steel from contamination or corrosion. Do not weld or ground the welding equipment on the forms or on the steel in the member after the pre-stressing steel has been installed.

Clean and paint the exposed ends of pre-tensioned members that will not be encased in concrete. Cover the surfaces with two applications of zinc-rich paint that meet the requirements of Paint Formula No. 2 in accordance to 627.03.

Recess the anchoring devices so the ends of the pre-stressing steel and parts of the anchoring devices will be at least 2 in inside the end surface of the members, or a greater embedment if shown on the plans.

Abrasive blast clean the surfaces of concrete against which concrete encasement over anchorage assemblies is to be placed and clean aggregate exposed after grouting of the ducts has been completed. Fill the recesses with concrete and finish flush. Provide concrete that is the same as that specified for superstructure concrete.

- D. Allowable Stresses and Losses.** Unless otherwise specified or shown on the plans, the Department requires the average working stress in the pre-stressing steel not to exceed 80 percent of the yield point stress of the pre-stressing steel and the maximum temporary tensile stress (jacking stress) in pre-stressing steel not to exceed 75 percent of the specified minimum ultimate tensile strength of the pre-stressing steel. Anchor the pre-stressing steel at stresses (initial stress) that will result in the ultimate retention of working forces of at least those shown on the plans. The Department requires the initial stress at the anchor to not exceed 70 percent of the specified minimum ultimate tensile strength of the pre-stressing steel.

The Department considers the working force and working stress as the force and stress remaining in the pre-stressing steel after losses, including creep and shrinkage of concrete, elastic compression of concrete, creep of steel, losses in post-tensioned pre-stressing steel due to sequence of stressing, friction and take-up of anchorage, and other losses peculiar to the method or system of pre-stressing have taken place or have been provided for.

Ensure the stress loss in post-tensioned pre-stressing steel due to elastic shortening, shrinkage and creep of concrete, and relaxation of pre-stressing steel is as shown on the plans.

Use the following formula and friction coefficients to calculate friction losses in tendons:

$$T_0 = T_x e^{(Ua + Kl)}$$

T_0 = steel stress at jacking end

T_x = steel stress at any point x

e = base of Napierian logarithms

U = friction curvature coefficient (See Table 506.03-1)

A = total angular change of pre-stressing steel profile in radians from jacking end to point x

K = friction wobble coefficient (See Table 506.03-1)

l = length of pre-stressing steel from jacking end to point x

Table 506.03-1 - Steel Coefficient

Type of Steel	Type of Duct	K	U
Wire or strand	Galvanized-rigid	0.0002	0.25
Plain bars	Galvanized	0.0002	0.15
Deformed bars	Galvanized	0.0003	0.30

- E. **Equipment.** Tension pre-stressing steel by means of hydraulic jacks so the force in the pre-stressing steel is at least the value shown on the plans.

The Contractor may equip each jack used to stress tendons with a pressure gage or a load cell for determining the jacking stress. Provide a pressure gage, if used, with an accurately reading dial at least 6 in in diameter.

Provide a load cell, if used, that has an indicator by means of which the pre-stressing force in the tendon may be determined and the range is such that the lower 10 percent of the manufacturer's capacity is not used in determining the jacking stress.

- F. **Preparation and Stressing.** For pre-tensioning, accurately hold in position the pre-stressing elements during stressing. The Contractor may cast in one continuous line several units and stress at one time. Do not transfer bond stress to the concrete until the concrete has attained the compressive strength shown on the plans for such transfer of load. Cut and release the elements in an order that minimizes lateral eccentricity of stress.

Before placing forms for closing slabs of box girder cells, show to the Engineer's satisfaction that ducts are unobstructed.

For post-tensioning, install the pre-stressing steel after the concrete has been placed. Show to the Engineer's satisfaction that the ducts are without water and debris immediately before installation of the pre-stressing steel. During installation, ensure that the pre-stressing steel is laid out in an orderly manner corresponding with its final positioning in the ducts, without overlaps and kinks. After installation and before post-tensioning any member, show to the Engineer's satisfaction that the pre-stressing steel is free and un-bonded in the duct.

Except as specified in this section, do not pre-stress cast-in-place concrete until at least 10 days after the last concrete has been placed in the member to be pre-stressed and until the compressive strength of said last placed concrete has reached the strength specified for the concrete at the time of stressing.

Conduct the tensioning process so that tension being applied and the elongation of the pre-stressing steel may be measured. Keep a record of gage pressure and elongations at all times and submit to the Engineer for approval.

For pre-stressing tendons in continuous post-tensioned members, tension by jacking at each end of the tendon unless noted otherwise on the plans. The Contractor does not need to jack both ends simultaneously.

Re-tension the unit before grout is placed if slippage of pre-stressing steel after tensioning is greater than 1/8 in of the amount assumed in elongation calculations in any unit.

For post-tensioning, do not stress more than one-half of the pre-stressing force in any girder before an equal force is stressed in the adjacent girders. During the stressing operations do not apply more than 1/6 of the total pre-stressing force eccentrically about the centerline of the structure.

Unless otherwise specified, distribute the pre-stressing force with an approximately equal value in each girder and place symmetrically about the centerline of the structure. In slabs, uniformly distribute the pre-stressing force across the slab.

G. Ducts.

1. Size.
 - a. Provide ducts for tendons made up of a number of multiple wires, bars, or strands that require an area of at least twice the net area of the pre-stressing steel.
 - b. Provide ducts for prestressing bars with a minimum inside diameter 3/8 in larger than the diameter of the bars to be used.
2. Placement. Accurately place ducts at the locations shown on the plans or Engineer approved, and securely fasten at close enough intervals to avoid displacement during concreting.

After installation in the forms, cover the ends of ducts as necessary to prevent the entry of water or debris.
3. Grout Openings. Vent ducts for continuous structures over each intermediate support, as shown on the plans. Use a 1/2 in minimum diameter standard pipe and connect to ducts as shown on the plans. Seal vents mortar-tight and tape as necessary. Remove the ends of vents 1 in below the roadway surface after grouting has been completed.

Install mechanical shutoff valves capable of withstanding grout pumping pressure at vents and the inlet and outlet of the ducts.

4. Forming. Use rigid galvanized ferrous metal ducts. The contractor need not galvanize duct transition couplings connecting to anchoring devices.

The Contractor may fabricate rigid ducts with welded or interlocked seams. Galvanizing the welded seam is not required. Provide rigid ducts that have sufficient strength to maintain their correct alignment during placing of concrete. Provide joints between sections of rigid duct that are positive metallic connections that do not result in angle changes at the joints. Use waterproof tape at the connections.

- H. **Anchorage Devices.** Secure post-tensioned pre-stressing steel at the ends by means of approved permanent type anchoring devices. Do not deviate from the equivalent anchor set as shown on the plans more than plus 1/8 in.

Use anchorage devices for post-tensioning that hold the pre-stressing steel at a load producing a stress of at least 95 percent of the specified ultimate tensile strength of the pre-stressing steel.

Distribute the load from the anchoring device to the concrete by means of Engineer approved devices that will effectively distribute the load to the concrete. Use devices that meet AASHTO *Standard Specification for Highway Bridges, Division I-Design, Article 9.21*, and *Division II-Construction, Section 10*.

- I. **Grouting.**

1. Equipment. Provide grouting equipment capable of continuous mechanical mixing that will produce a grout without lumps and undispersed cement and be able to pump the mixed grout that complies with provisions of this recommended practice. Provide accessory equipment such as scales and liquid measures to accurately batch materials and a pump able to produce an outlet gage pressure of at least 100 psi with seals adequate to prevent introduction of oil, air or other foreign substances into the grout, and also to prevent loss of grout or water.

Place a pressure gage readable in 20 psi increments having a full-scale reading of not more than 300 psi at some point in the grout line between the pump outlet and the duct inlet. Provide the system with an effective control, either manual or automatic, to limit the build up of excessive pressure.

Provide grouting equipment containing a screen having clear openings of

0.07 in maximum size to screen the grout before its introduction into the grout pump with the screen easily accessible for inspection and cleaning.

Use gravity feed to the grouting equipment pump inlet.

Provide grouting equipment capable of continuously grouting the largest tendon on the project in 20 minutes or less under normal conditions.

Provide standby water flushing equipment separate from the grouting equipment that uses a different power source than the grouting equipment, is capable of developing a gage pressure of at least 250 psi and has sufficient capacity to flush out any partially grouted enclosures due to blockage, breakdown of grouting equipment or inability to maintain one-way grout flow.

2. Preparation of Ducts. Clean ducts and ensure the ducts are without water and deleterious materials that would impair bonding of the grout or interfere with grouting procedures.

Use water for flushing ducts that contains either quick lime (calcium oxide) or slaked lime (calcium hydroxide) at 1.5 lb/gal, if Engineer required. Ensure compressed air used to blow out ducts is oil free.

3. Injection of the Grout. Fill the entire void space between the duct and the tendon with grout.

Pump the grout through the ducts by pumping continuously from one end of the duct. Ensure all valves are open when pumping starts. Close the valve at the first vent first after a continuous stream of grout emerges. Close the remaining vents, in sequence, in the same manner.

Pump grout through the duct and continuously waste at the outlet until no visible slugs or other evidence of water or air are ejected and the efflux time of ejected grout is at least 11 seconds. Close the outlet pipe; hold the pumping pressure momentarily and then close the valve at the inlet while maintaining this pressure. Do not remove or open valves until the grout has set.

4. Cold Weather. Keep ducts free of water to avoid damage due to freezing.

Concrete Temperature - Do not grout unless the temperature of the concrete is 45 °F or higher and maintained at this temperature until job cured 4 in cubes reach a minimum compressive strength of 800 psi.

Grout Temperature – Ensure grout temperature is less than 90 °F during mixing or pumping.

- J. Transportation and Storage.** Transport pre-cast, pre-stressed stringers in an upright position, and ensure points of support and directions of the reactions with respect to the stringer are approximately the same during transportation and storage as when the stringer is in its final position.
- K. Camber.** Check and record the vertical deflection (camber) of each girder. Girder camber is the measured variation between the girder center elevation and a straight line between the girder end elevations. Check and record the camber within 72 hours after transfer of the pre-stressing force, and within a two-week period before shipment, but no less than three days before shipment.

Perform and record each camber check when the alignment of the girder is not influenced by temporary differences in surface temperature. Compare the actual camber measured with the required camber values and the permissible tolerances.

The following are allowable tolerances from the design camber:

1. $\pm 1/2$ in for up to 80 ft in length
2. ± 1 in for over 80 ft in length

Meet the specified girder camber values in the contract documents within the allowable tolerances when girders are erected.

Make provisions to control the camber growth. Control the vertical deflection of pre-stressed concrete girders by scheduling fabrication or other means. Use a method to control the vertical deflection that does not cause damage to the girders or over stress when checked in accordance with the AASHTO specifications. Show the method of controlling the vertical deflection on the shop drawings.

The Department may reject girders not meeting these minimum requirements in accordance with 105.03.

Make data from any intermittent camber checks that the Contractor performs available to the Engineer upon request.

Ensure the recorded measurements of the girder camber accompany the girder to the construction site as documentation that the girder complies with the specifications.

Control girder deflection at no additional cost to the Department.

506.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Pre-stressing of cast-in-place concrete will be by lump sum.

506.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Pre-stressing Cast-in-Place Concrete	LS

The Department considers providing and placing additional deformed bar reinforcing steel required by the particular system used, ducts, anchoring devices, distribution plates or assemblies and incidental parts; for furnishing samples for testing and working drawings; and for pressure grouting ducts as incidental and the cost included in the contract unit price.

When there are no contract pay items for pre-stressing pre-cast concrete in the contract, the Department considers pre-stressing concrete members as incidental and the costs included in the contract unit price for providing pre-cast members as specified in 502.

SECTION 507 - BEARING PADS AND PLATES

507.01 Description. Provide and place bearing pads and plates.

507.02 Materials. Provide bearing pads and plates as specified in:

Self-Lubricating Bronze Bearing Plates	708.29
Elastomeric Bearings	720.02
Polytetrafluoroethylene (TFE/PTFE) Bridge Bearing Pads	720.03

507.03 Construction Requirements. Place the bearing material perpendicular to the longitudinal axis of the beam with the sides flush with the outside edges of the stringer.

Level the concrete surfaces in contact with the bearing pad or plate transversely with stringer and ensure the concrete surfaces are uniform and smooth. Do not allow coarse aggregate above the surface of the beam seat. Place the bearing units so that uniform bearing is obtained over the full surface of the plate or pad.

507.04 Method of Measurement. Not Specified.

507.05 Basis of Payment. The Department considers the work incidental to the contract unit prices for other contract pay items, and the cost included in the contract unit prices.

SECTION 508 - CORRUGATED PLATE PIPE

508.01 Description. Construct corrugated plate pipe.

508.02 Materials. Provide material as specified in 708.20.

508.03 Construction Requirements.

A. General. Curve each plate to the proper radius, and punch the bolt holes so that sections, except the end plates, are interchangeable in the erection process.

Unless otherwise specified, fabricate bolt holes in accordance with AASHTO M167, section 6.

When the completed structure is to be a full circle pipe, curve the plates so when they are bolted together they form true circles of the required diameter. When the completed structure is to be a multi-centered pipe or arch, curve the plates to the radii shown.

Cut plates for forming skewed or sloped ends to give the angle of skew or slope specified. Ensure burnt edges do not have oxide or burrs, and present a well-made finish.

B. Assembly. Assemble the pipe according to the manufacturer's instructions. Hold the unsupported edges of plates in position by temporary props. Extend each row of side plates far enough to support the plate above until the first complete ring has been assembled. Install a sufficient number of bolts to hold the plates in position. Do not tighten bolts until the entire structure has been erected. After the plates are in place, insert the remaining bolts and tighten all bolts. (Division 2, Article 11.5.6). Apply at least 100 ft-lb or no more than 300 ft-lb of torque to 0.75 in dia. High strength steel bolts (ASTM A449) for assembly of steel structural plate. Apply at least 100 ft-lb or no more than 150 ft-lb torque to 0.75 in diameter aluminum bolts (ASTM F468) or standard strength steel bolt (ASTM A307) for assembly of aluminum structural plates. Exercise care in the use of drift pins or pry bars to prevent chipping or injury to the galvanized coating.

C. Backfill. Deposit backfill material evenly on both sides of the pipe as shown on the plans, to a depth of 2 ft over the top of the pipe. The Contractor may fill the rest from one direction, as Engineer approved.

508.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Corrugated plate pipe by the foot.

509.01

When the ends of a corrugated plate structure are cut on a skew or slope, the length of the structure will be the bottom length measured along the structure centerline and grade.

508.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Corrugated Plate Pipe Culvert ___ Thickness	ft
___ x ___ Corrugated Plate Pipe Arch ___ Thickness.....	ft
___ x ___ Corrugated Plate Arch ___ Thickness.....	ft

SECTION 509 – NON-STRUCTURAL CONCRETE

509.01 Description. Provide non-structural Portland cement concrete. Non-structural Portland cement concrete is concrete used in curb, sidewalk, gutter, small sign post foundations or other applications where long term structural durability is not critical.

Submit a proposed mix design to the Engineer for review. The Engineer will review the mix design for compliance with specifications before approving use of the proposed mix design.

Use the class concrete shown on the drawings or as specified in the corresponding items on the bid schedule.

A. Classification. Provide the following classes of concrete shown in Table 509.01-1 where required on the plans.

Table 509.01-1 - Basic Mix Design Parameters

Concrete Class in 100 psi (28 day) (a)	Max. Water To Cement Ratio (b)	Air Content Percent
35 and greater (c)	.45	0-6
30	.50	6.5±1.5
22	.60	0-6
15	.60	0-6

- Numerical part of class designation is the specified compressive strength when tested in accordance with applicable test listed in 509.02.
- Cement + Secondary Cementitious Materials, if used.

- c. Ensure concrete classes designated as:
1. "A" air content of 6.5 ± 1.5 percent.
 2. "C" to have a maximum water cement ratio of 0.38, (water reducer required), and air content of 6.5 ± 1.5 percent.

Use Secondary Cementitious Materials (SCM) for concrete use when designated with an "F". This designation shows a mix containing SCM and meeting the requirements for an "A", "B" or "C" mix as specified when used with the above designations.

Meet requirements of 714. If fly ash is used, do not exceed 35 percent of the total cementitious material (fly ash + cement). If Ground Granulated Blast Furnace Slag, is used, do not exceed 35 percent of the total cementitious materials. If a combination of GGBFS and fly ash used, ensure the combination is not less than 20 percent or more than 50 percent of the total cementitious materials.

Provide concrete Class 30 and use size Nos. 2a or 2b coarse aggregate in any class of concrete. Ensure the slump does not vary more than 1 in from the average during any placement. Should an increase in slump be desirable for the concrete as batched, maintain the weight ratio of water to cement by either making proportional increases of cement with increases in water or by reducing the total weight of aggregates incorporated in the mixture.

- B. Acceptance.** Provide certification for concrete classes of concrete required to meet 509 from qualified aggregate material supplies. Test the first load, then once every 50 CY until quantity exceeds 100 CY. After 100 CY, test once every 100 CY. Test for slump, unit weight, air content, and compressive strength so that the Engineer can verify the certification.

Acceptable concrete is based on compliance with parameters specified for the given concrete class. The Engineer will determine acceptable strength from the results of 28-day compressive strength tests performed on cylinders made from samples of the concrete being placed, as specified in 509.02. The Department will consider the average strength from three companion cylinders as one test.

Should the 28-day strength test for concrete fall below the specified minimum strength, the concrete of that class represented by the test is subject to rejection or price adjustment, if the Engineer allows the concrete to remain. The Department considers concrete subject to rejection or price adjustment to be represented by the test that falls below the specified strength.

Replace unacceptable concrete at no additional cost to the Department.

If the concrete does not meet the intended strength or air content, and the Engineer allows the concrete to remain in place, the Engineer will adjust the price as follows:

Percent of Specified Strength	Pay Factor
≥ above 90 to < 100	0.75
< 90	Subject to rejection.*

*If allowed to remain in place, as determined by the Engineer, the Pay Factor will be 0.50.

Above or Below Specified Air Content	Pay Factor
Less than 0.25 %	0.99
0.50 to 0.25%	0.90
Above 0.50 %	Subject to rejection.*

*If allowed to remain in place, as determined by the Engineer, the Pay Factor will be 0.50.

The Department will pay for acceptable quantities at the contract unit price multiplied by the pay factor as determined above. The Department will apply the larger price adjustment should air content and strength both be out.

Should concrete used in the work fail to comply with the specifications, make corrective changes in the materials mix portions, concrete fabrication procedures, or other corrective action before continuing, at no additional cost to the Department. Obtain Engineer approval to make corrective changes, if results of 7-day strength tests are low or show a downward trend predicting concrete may not meet the specified 28-day strength. The Department requires manufacturers furnishing precast concrete products shall hold current certification under the NPCA plant certification program, the ACPA Q-cast Plant Certification Program or the PCI Plant Certification program.

509.02 Materials. Provide materials requirements as specified in 502.02 and 714.

Test in accordance with the test methods specified in 502.02.

509.03 Construction Requirements. Ensure proportioning, equipment, handling, measuring, batching, mixing, delivery, forming, placing, finishing and curing of concrete are in accordance with 502.03 except as modified by the subsection.

A. Proportioning. For aggregates with an AASHTO T303 expansion less than 0.30 percent, low alkali cement is adequate for Alkali Silica Reactivity (ASR) mitigation.

For aggregates having an AASHTO T303 expansion between 0.30 and 0.50 percent, a mix containing at least 20 percent fly ash meeting the requirements for fly ash as a mineral admixture as specified in 714 is adequate for ASR mitigation.

For Class 22 aggregates with an AASHTO T303 expansion greater than 0.50 percent:

1. Test in accordance with ASTM C1597 using the cement, fly ash and other mitigative measures proposed for use in the mix design. Do not exceed 0.10 percent expansion of the mortar bars with the addition of fly ash, lithium or other additives.
2. Use a concrete mix containing 30% class F fly ash approved for use in mitigating ASR.

Class 22 and class 15 concrete will not require ASR mitigation measures.

- B. Discharge.** The Contractor may use a set stabilizer meeting ASTM C494. If a set stabilizer is used, the Contractor may extend discharge time to 3 hours but do not exceed 500 total revolutions.
- C. Temperature.** Provide concrete that has a temperature of at least 50 °F and not more than 90 ° F at the time of placement.

509.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Concrete by the cubic yard or by the square yard in accordance with the dimensions shown on the plans or Engineer directed. The volume occupied by the reinforcing steel, anchors, conduits, weep holes, H piling, or chamfers will not be deducted. The volume of concrete displaced by culverts or piles, other than H piling, will be deducted.

509.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Non-Structural Concrete Class _____	CY or SY

SECTION 510 – CONCRETE OVERLAY

510.01 Description.

Provide and place a latex modified concrete or a silica concrete overlay as shown on the plans.

510.02 Materials. Provide materials as specified in:

Aggregate.....	703
Portland Cement.....	701
Water for Concrete.....	720.01
Air-Entraining Admixtures.....	709.03
Water-reducing Admixtures.....	709.05
Silica Fume.....	714
Fly Ash.....	714

- A. Certification.** Provide certification of the silica fume or latex modifier stating the results of tests made on samples of the material taken during production or transfer and indicating that applicable requirements of this specification have been met by material used on the project. Provide certification and test reports before use of the material. Submit test reports indicating typical values when the Engineer reviews the mix design.
- B. Sampling and Testing.** The Engineer will sample the material proposed for use on the project. The Engineer will test concrete in accordance with 502.02.
- C. Acceptance.** The Engineer will reject Portland cement, latex modifier, or silica that fails to comply with this specification. The Engineer will report the rejection to the Contractor promptly. In case of dissatisfaction with the test results, the Engineer will allow the contractor additional sampling and retesting.

The Engineer's acceptance of the concrete overlay will be based on compliance with parameters specified. The Engineer will determine acceptance of strength from the results of 28-day compressive strength tests performed in compliance with 502.02 on cylinders made from samples of the concrete being placed. The Department considers the average strength from three companion cylinders to be one test.

Should the 28-day strength for any test fall below the specified minimum strength, the Engineer may reject the concrete represented by the test, or require a price adjustment if allowed to remain in place. The Engineer will base acceptance on an evaluation of the necessary durability requirements of the concrete overlay.

The Engineer may accept concrete which does not meet the specified minimum strength at a reduced price provided the strength is not more than 10 percent below the specified minimum strength. The Engineer will reject concrete represented by tests falling more than 10 percent below the specified minimum strength. Remove rejected concrete at no additional cost to the Department.

The Engineer will adjust the price for the concrete overlay which does not meet the specified strength, but is allowed to remain in place, as presented in Table 510.02-1.

Table 510.02-1 - Price Adjustment

Percent of Specified Strength	Pay Factor
≥95 to < 100	0.90
≥ 90 to < 95	0.80

The Department will pay for the quantity of acceptable concrete overlay at the contract unit price multiplied by the pay factor.

- D. Storage.** Store the material so as to permit easy access for proper inspection and identification of each shipment. Provide access to every facility to the Department for careful sampling and inspection, either at the source or at the site of the work. Protect material from freezing and from prolonged exposure to temperatures in excess of 75 °F. Cover containers stored at the bridge site completely with suitable insulating blanket material to avoid excessive temperatures.
- E. Packaging.** When material is delivered, plainly mark the name and brand of the manufacturer, and the material weight on each container. Identify shipments by source and lot number. The Department considers only one manufacturing source acceptable on a project. Provide similar information on the shipping invoices accompanying the material shipment. Ensure containers are in good condition at the time of inspection.

Provide size No. 1 coarse aggregate for latex modified concrete.

Ensure the latex modifier contains at least 46 percent solids. Determine the percent solids by tests using Idaho T-121. Provide certification from the producer indicating that the material furnished is identical to that furnished to the FHWA Fairbanks Highway Research Station.

Provide latex modified concrete that meets the following properties:

Mix Design Item	Requirement
Cement content.....	660 lb/ yd ³
Latex emulsion admixture	25 gal/ yd ³
Approx. added water ¹ , including free moisture in the FA & CA.....	150 lb/ yd ³
Air content, percent of plastic mix	0-6.5
Slump ²	4 - 6 in
Percent fine aggregate as percent of total	

510.03

aggregate by weight (rounded CA)	55 ± 5
Percent fine aggregate as percent of total aggregate by weight (crushed CA).....	60 ± 5
Weight ratio of Cement-FA-CA- (Rounded CA) ³	1:2.5:2.0 dry basis
Weight ratio of Cement-FA-CA- (Crushed CA) ³	1:2.7:1.8 dry basis
Twenty-eight Day compressive strength (Min.)	4000 psi ¹

NOTES:

1. This is in addition to the latex. Adjust the water added to control the slump and to produce net water-cement ratios of 0.35-0.40 by weight.
2. Measure the slump 4-5 minutes after discharge from the mixer or immediately ahead of the finisher.
3. The Contractor may adjust the dry-weight ratios within limits as Engineer approved. The contractor may increase the FA ratio by as much as 0.2 if the CA is reduced by an equivalent amount.

Provide silica fume concrete that has the following properties:

Mix Design Item	Requirement
Cement Content, Type II, (Minimum)	560 lb/ yd ³
Water/(Cement + Silica Fume) Ratio, (Maximum).....	0.40
Course Aggregates	Size No. 1
Slump-millimeters.....	5 in plus or minus 2 in
Air Content	6% plus or minus 2%
High Range Water Reducers	ASTM C494
Seven-Day Compressive Strength (Minimum).....	3,500 psi ¹
Twenty-eight-Day Compressive Strength (Minimum).....	4,500 psi ¹
Percent Silica Fume by Weight of Cement.....	7.5%
Percent Fly Ash (if used) of total cementitious.....	minimum 15%

¹Note: Overdesign is limited to a maximum 6,500 psi when produced in a laboratory. Cementitious material content may be reduced to meet the overdesign limits. The Engineer will waive the overdesign if the Contractor reduces the cementitious materials content by at least 10 percent.

Provide the silica fume admixture as a densified powder.

510.03 Construction Requirements.

- A. General.** The Department will require the Contractor and a technical representative from the silica fume/latex modified concrete supplier to meet with the Engineer for a pre-placement conference at a time mutually agreed upon. At or

before this conference, present the mix design and methods of accomplishing all phases of the concrete overlay work. Allow the Engineer 15 calendar days to review the mix design.

Ensure the services of a technical representative of the latex admixture manufacturer/silica fume supplier and high range water reducer are present during the proportioning, mixing, placing, and finishing of the concrete overlay. One person may perform both of these functions. Ensure this technical representative has expertise in the proper installation of the materials and is available to the Engineer for consultation. Adhere, at no cost to the Department to recommendations made by the technical representative and Engineer approved. The Department considers the services of these technical representatives as incidental and the cost included in the unit price of contract items.

Before placement, prepare, place, and cure a trial batch of at least 3 yd³ to verify the mix design, show ability to perform curing operations, and check quality control. Make additional trial batches as necessary to verify changes in design or procedure at no additional cost to the Department.

Provide rails for the finishing machine to travel on that are sufficiently rigid so they do not deflect under the weight of the machine. Attach the rails to the surface so that they may be removed without damage to the edge of the new overlayment. Provide rails that are vertically adjustable (not shimmed) and adjust using a level and level rod to ensure proper depth and matching of joints.

Set the screed control to obtain the nominal overlay thickness specified as well as finished surface smoothness requirements. Verify the thickness before the placement of the concrete by attaching a filler block to the bottom of the screed. With the screed guides in place, pass the finishing machine over the surface to be overlaid. After the overlay thickness has been verified, adjust the profile grade as directed or Engineer approved. Do not change the finish machine elevation controls.

- B. Equipment.** Use an Engineer approved power-driven finishing machine complying with the following requirements for finishing large areas of work. Do not use motorized power screeds except as specified in this section.

Provide a self-propelled finishing machine capable of forward and reverse movement under positive control for placing, striking off and finishing the bridge deck surface, with provisions for raising screeds to clear the surface. Have available at least two, hand operated, spud type internal vibrators available at all times for use as Engineer directed. Submit to the Engineer a request for

approval of the specific equipment to be used at least 15 calendar days before the start of work.

Equip the machine with vibrating screeds designed to consolidate the modified composition. The Department requires the vibration frequency be variable with positive control between 3,000 and 11,000 vpm and the bottom face of the screeds be at least 4 in wide and be metal covered. Provide screeds with positive control of the vertical position.

The Engineer will waive the preceding paragraph if a Gomaco C450 or equivalent finishing machine with one or more rollers, augers, and 1,500 or 2,500 vpm vibratory pans is used. Modification to the Gomaco C450 or equivalent is subject to Engineer approval.

For bridge deck widenings of 20 ft or less, or where conditions as Engineer determined, do not allow the use of conventional configuration finishing machines described above, the Contractor may propose the use of a hand operated motorized power screed such as a "texas", "allen", or "bunyon" screed. The Department requires this screed to be capable of finishing the deck to the same standards as the finishing machine. Do not begin placing deck concrete until the screed and placing procedure is Engineer approved.

- C. Deck Preparation.** Remove the concrete deck surface in accordance with 632 before placing the concrete overlays. Use Engineer approved temporary bridge drain plugs during preparation and placement to prevent waste materials from entering drainage systems. Protect expansion joints and barrier curbs by approved means from damage due to construction operations.

Not more than 24 hours before placing the overlay, clean surfaces that the overlay is to bond to, including exposed reinforcing and structural steel, the work face of the previously placed material, and the faces of curbs and barriers up to a height of at least 1 in above the proposed overlay surface, by abrasive blasting or an Engineer approved method of waterblasting with 7,000 psi minimum pressure. Blow the deck with compressed air to remove excess water and debris. After the deck has been airblasted, cover the deck with unused, 4 mil plastic sheeting. Clean steel surfaces to meet the requirements of 708.01. Ensure concrete surfaces are made without spalls, laitance, and contaminants detrimental to achieving adequate bond. Provide water and oil traps on the compressors. After the surface is properly prepared, do not allow vehicular traffic, other than equipment required to place the overlay, on the prepared surface. Do not exceed construction loads of 8,000 lb wheel load or 16,000 lb

axle load. The Department considers any combination of axles placed closer than 4 ft center-to-center to be one axle.

Operate equipment required on the deck for placing the overlay on plastic sheeting or diaper the equipment to prevent dripping fluids from contaminating the prepared surface.

D. Mixing. Latex Modified Concrete:

Use continuous-mixing type mixers complying with the following:

1. The mixer carries sufficient cement, fine aggregate, coarse aggregate, latex modifier and water to produce on the site at least 6 yd³ of concrete.
2. The mixer is capable of positive measurement of cement being introduced into the mix. A visible recording meter equipped with a ticket printout to show the quantity accurately is required.
3. The mixer provides positive control of the flow of water and latex emulsion into the mixing chamber. Water flow is shown by flow meter and is readily adjustable to provide for minor variations in aggregate moisture.
4. The mixer is calibrated to automatically proportion and blend components of shown composition on a continuous or intermittent basis as required by the finishing operation, and discharges mixed material directly in front of the finishing machine.
5. At least two mixers are used for each placement if the total volume of concrete to be placed exceeds the material storage capacity of a single mixer. The Engineer may require additional mixers if conditions require that materials be stockpiled away from the job site. Have sufficient mixers on hand to assure a consistent and uniform delivery and placement of concrete.
6. The mixer is equipped with a bypass valve to enable calibration of the water valves or flow meters.
7. Verify the fine aggregate bin vibrators are operating satisfactorily.

Calibrate mixers to accurately proportion the specified mix. The Engineer will accept certification of the calibration by an Engineer approved testing authority as evidence of this accuracy if the yield is shown to be true within a tolerance of 1.0 percent according to the following test:

1. With the cement meter set on zero and controls set for the desired mix, activate the mixer, discharging mixed material into a 0.3 yd³ container.

2. When the container is level-struck full, making provision for settling the material into corners, the Department requires the cement meter show a discharge of 1.8 sacks of cement for latex modified concrete, 7 sacks/yd³.

Ensure the concrete as discharged from the mixer is uniform in composition and consistency and the mixing now is such that finishing operations can proceed at a steady pace with final finishing completed before the formation of the plastic surface film.

Silica Fume:

Calibrate mixers to accurately proportion the specified mixture. Ensure the silica fume manufacturer's technical representative advises the Engineer in writing of proper batching sequence, mixing time, mixing speed, and other handling procedures necessary for a uniform, homogeneous mixture meeting the requirements of this subsection. Include procedures relating to the high range water reducer. Follow the written recommendations unless otherwise Engineer approved.

Do not exceed 4 yd³ of silica fume concrete on a truck mixer.

Unless otherwise Engineer approved, if a truck mixer or agitator is used for transporting silica fume concrete, complete discharge within 1 hour and 45 minutes or before the drum has revolved more than 325 revolutions, whichever comes first, after introduction of cement and water. If a set stabilizer is used, the Contractor may increase revolutions to 500 revolutions and discharge time increased to 3 hours

If a slurry is used, adjust mix water to account for the water in the silica fume slurry and store the product in a tank with an agitator so the product can be mixed according to the manufacturer's recommendations. If placement is done during cold weather either insulate or protect, the tank against freezing.

- E. **Placing and Finishing.** During placement of the overlay, ensure the surface of base concrete is in a saturated surface dry condition. Achieve this by thoroughly wetting the surface at least 12 hours before placement and maintaining it in a moist condition until placement. Maintaining a moist condition by covering with visqueen, use of fog spray or soaker hoses, or both provided that complete moisture coverage is attained. Blow out standing water in depressions, holes or low areas with compressed air before the application of the bonding coat.

Promptly deliver and deposit on the deck a bonding coat consisting of a portion of the overlay mix on the deck then scrub by brooming onto the wetted, prepared surface. Do not use separately mixed bonding coats. Exercise care to ensure that vertical and horizontal surfaces receive a thorough, even coating. Limit the rate of progress to no more than 6 ft ahead of the screed so the brushed material does not become dry before it is covered with the finish course. Dispose of materials intended for brushing that have started initial set, dried, or show evidence of loss of paste from the sand. Dispose of coarse aggregate remaining after the brushing operation.

Manipulate the material and strike off to approximately 1/4 in above final grade. Consolidate the material and finish at final grade with the vibrating screeds.

Hand-finish with a wood float along the edge of the pour or on small areas of repair. In areas requiring hand finishing and areas adjacent to curbs and joint bulkheads, use vibrators to ensure proper consolidation.

Install a construction dam or bulkhead in case of major delay in the placement operation. During minor delays of one hour or less, protect the end of the placement from drying with several layers of wet burlap.

Construct longitudinal joints at or within 1 ft of lane lines. When concrete is to be placed against concrete in a previously placed lane or strip, saw the previously placed concrete back the necessary distance to provide a straight and vertical edge. The Contractor may omit sawing of the joint if bulkhead produces a straight, smooth, vertical surface. Sandblast, clean, and apply a bonding coat before placing new concrete. Do not place concrete against the edge of an adjacent lane or strip that is less than 24 hours old.

Take adequate precautions to protect freshly placed material from sudden or unexpected rain. The Engineer may order removal of any material damaged by rainfall.

Do not place the concrete overlay when the evaporation rate is greater than 0.15 lb/ft² per hour when tested in accordance with Idaho T-133, unless the Contractor can show by reducing the spread width or by other means that a satisfactory surface finish can be obtained. Do not place the concrete overlay at ambient temperatures lower than 45 °F or higher than 75 °F.

When a tight uniform surface has been achieved, texture the surface of the concrete perpendicular to the longitudinal centerline of the structure with an Engineer approved grooving tool. Ensure nominal groove width is 1/8 in, with spacing of 1/2 in to 3/4 in and the depth of tined grooves is 1/8 in to 3/16 in.

Check groove depth according to the "Procedure" portion of AASHTO T 261. If more than three readings in a set of ten are outside the intended depth range, make adjustments to the tining operation. The Contractor may apply an approved wire tine texture providing it leaves a finish comparable to the groove depth and spacing specified, and causes only minimal surface tearing or aggregate removal. Finish the surface adjacent to the curb to a smooth-troweled texture approximately 1 ft from the face of the curb.

- F. Curing.** Promptly cover the surface with a single layer of clean, wet burlap. Exercise care so the burlap is not dragged or dropped on the fresh surface. Ensure that the burlap is drained of free water and that it is placed as soon as the surface will support the covering without deformation. Do not wait until the surface will support foot traffic. The concrete overlay forms a plastic film at the surface upon drying, usually within 20 minutes in hot, dry weather. Protect the plastic film from over-drying and cracking by prompt covering with the wet burlap. Maintain the burlap in a wet condition throughout the duration of the wet cure. Unplug the deck drains to allow drainage to pass through.

Place within one-half hour of covering with wet burlap, a layer of 4 mil polyethylene film on the wet burlap for the required wet-cure period. The contractor may substitute Engineer approved burlap-polyethylene sheets for the polyethylene film.

Wet-cure the latex modified concrete at least for 48-hours. Remove the curing material for an additional 72-hour dry cure period. Extend the dry curing period in case of rainfall or dampness to assure that the surface of the concrete has a total of 72 hours of dry curing.

Wet-cure the silica fume concrete for at least 4-days

Use a work bridge to place the burlap and polyethylene. Do not walk on the overlay during placement of these items.

Do not allow traffic on the silica fume concrete surface until the 4 day wet cure is complete and the silica fume has a minimum compressive strength of 3,500 psi. Do not allow traffic on the latex concrete surface until completion of the dry-cure period. The Engineer may require a longer curing period at temperatures below 55 °F.

Upon completion of the wet cure of the last section overlaid, immediately treat visible cracking with a two component modified methacrylate penetrating sealer. Spread sand over areas on surface where sealer has puddled in an amount to ensure adequate skid resistance. The Department considers SikaPronto 19 and Transpo Sealate T70-X acceptable sealers.

Meet the smoothness requirements specified in 409 for the finished concrete overlay surface.

After the concrete overlay has cured, the Engineer will use a chain drag or other appropriate tool or device to determine if any delaminations exist between the new overlay and the mating concrete surface. Remove and replace delaminated areas. The Department will require vertical edges and rectangular-shaped patching if removal is necessary.

510.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard as recorded on approved batch tickets. The Engineer will correct batch tickets for unacceptable material or excessive waste quantities.

510.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Concrete Overlay	CY

Should the volume used exceed the "neat line" volume by more than 10 percent, the Department will pay for the volume exceeding 10 percent of the neat line volume at 50 percent of the contract unit price.

The Department will pay for concrete overlay that does not meet the specified minimum strength, but which is allowed to stay in place by the Engineer as specified in 510.02. The Engineer will deduct from the contract unit price of the concrete overlay and apply the adjusted contract unit price to the quantity of concrete overlay represented by the individual strength test.

SECTION 511 – CONCRETE WATERPROOFING SYSTEMS

511.01 Description.

Provide concrete waterproofing systems and install on bridge decks, or other designated surfaces. The system may be a hot-applied elastomeric liquid asphalt sealant, a fabric membrane sheet system, a penetrating water repellent, or pre-coated preformed membrane sheet system.

511.02 Materials. Provide materials that meet the following requirements:

Liquid Asphalt Sealant	Type A System	ASTM D 3406
Asphalt Roll Roofing	Type A System	ASTM D 224 Type II
Primer for Liquid Membrane System ..	Type A System	702.03
Asphalt Cement	Type B System	702.01
Fabric	Type B System	718.02
Sand	Membrane Protection Blanket.....	703.02

Pre-coated Preformed Membrane Sheet ...Type D System Tapecoat M860,
Phillips Petrotac,
Polyguard nw-75,
or PavePrep GeoTac

Penetrating Water RepellentType C System.....as follows:

Provide penetrating water repellent that is an emulsion; or solution of silane or siloxane or approved generic equivalent that when applied, does not stain, discolor, darken the concrete surface, or form a coating on concrete surfaces. Ensure the repellent material complies with the following minimum testing requirements, for qualification purposes:

1. Maximum Water Absorption
 - a. Water immersion.....ASTM C-642
 - b. Duration 48 Hrs.
 - c. Maximum Absorption 1.00% by Wt.
2. Percent Reduction of Water Weight Gain
 - a. Water immersion/(15%NaCl) NCHRP Rep. #244 Series II
 - b. Duration 21 Days
 - c. Min. % Reduction of Water Weight Gain versus control 75%
3. Chloride Ion Penetration

Test No. 1

- a. Chloride Ion Absorbed @ 1 in Depth NCHRP Rep. #244 Series II
- b. Duration 21 Days
- c. Min. % Reduction Based on Untreated 75%

Test No. 2

- a. Chloride Ion Absorbed @ 1 in Depth NCHRP Rep #244 Series IV
- b. Duration 24 Weeks
- c. Min. % Reduction Based on Untreated 90%

4. Penetration Depth (ITD Test) 5/32 in minimum
5. Alberta Transportation Waterproofing Test BT001
 - a. Waterproofing before sandblast.....82.5% min.
 - b. Waterproofing after sandblast.....75.0% min.

Use an independent testing laboratory for tests 2, 3, and 5 at no cost to the

Department. Provide certified laboratory reports for tests 2, 3, & 5 to the Engineer at least 30 calendar days before intended application of the product. Submit a certification statement attesting that the sealer provided to the project has the same formulation as the material represented by laboratory reports.

Tests 1 and 4 are the responsibility of the Department, and either or both may be waived based on previous testing or product acceptance by other states.

The Engineer may take project samples to verify the certification.

511.03 Construction Requirements.

A. Surface Preparation. For new construction, clean, dry, fully cure and finish the concrete surface as specified in 502.03.1.3. Sandblast new concrete surfaces where penetrating water repellent is to be applied. The Contractor may clean the surface with a hydroblast unit using water with a minimum nozzle pressure of 7,000 psi as an alternative to sandblasting.

For rehabilitation of a structure, ensure the concrete surface to receive the membrane application is without foreign materials, sharp concrete edges are corrected to the Engineer's satisfaction, and repairs and patches are fully cured. Sandblast the entire surface and the sides of curbs for a height of 1 in above the thickness of the overlay before application of the membrane.

B. System Types. General System Types are:

1. Type A, Liquid Membrane consists of an emulsified asphalt prime coat covered with a hot-applied membrane layer and a layer of asphalt roll roofing.
2. Type B, Fabric membrane consists of a prime coat with a layer of fabric embedded into it.
3. Type C, Penetrating Water Repellent consists of a sealant which penetrates the deck surface and forms a water repellent layer within the concrete.
4. Type D, Pre-coated Pre-formed Membrane consists of prefabricated sheets which may be self-adhesive or may require a separate bonding agent.

Type-A Application of Liquid Membrane System. Evenly apply emulsified asphalt prime coat to the concrete at a rate of 0.06 gal yd². Cure from one to three hours, depending on air temperatures, before applying the elastomeric liquid asphalt membrane.

Thoroughly dry the concrete surface before applying the membrane. Apply the hot membrane material to the prepared surfaces at a uniform rate to yield at least 0.1 in thickness (approximately 0.5 gal yd²). Strictly adhere to the application temperature, equipment, and procedures recommended by the membrane manufacturer. Extend membrane application at curbs to a height 1 in above the thickness of the overlay; do not splatter the membrane or discolor the curbing above this point.

Small pinholes in the cooled membrane are not detrimental. Do not allow vehicles on the bare membrane.

Following application and curing of the membrane, cover the entire treated surface with asphalt roll roofing. Lay roofing parallel to the centerline of bridges, unless otherwise Engineer approved. Butt or overlap roofing joints, with a maximum gap of 3/8 in or a maximum lap of 4 in. Use a suitable mastic or cement at lap joints and as needed to tack the roofing to the membrane surface. Ensure the entire roofing application is essentially free of wrinkles, bubbles or other placement defects. Slit and remove or lap and cement together defects rising over 1/2 in above the surface. Bond the roofing to curbs by applying a bead of the hot membrane the full length of the curb at the edge of the roofing.

Type-B Application of Fabric Membrane Sheet System. Uniformly apply primer over surfaces receiving the fabric. Use the primer type, rate of application, concrete moisture, and drying time in accordance with the fabric manufacturer's recommendations. If an asphalt cement prime coat is used, use the same type and grade as used in the plant mix overlay and apply at a rate of 0.22 gal yd². Thoroughly dry the concrete surface before applying the asphalt cement prime coat.

The Contractor may apply fabric by hand from a spindle or a truck-mounted reel. Apply fabric in straight longitudinal layers beginning from curbs and progressing to the roadway centerline. Apply the fabric in a continuous sheet when possible, against curb and joint faces to a height 1/2 in above the plant mix overlay.

Lap Splices at least 3 in. Slit, flattened, and patch with a strip of membrane material at least 2 in wide any irregularity or defect rising over 1/2 in above the surface or covering more than 1 ft² of area.

Type-C Application of Penetrating Water Repellent System. Uniformly apply the penetrating water repellent material over surfaces to receive this treatment. Apply the penetrating water repellent compound on a completely cleaned and

sandblasted surface. Ensure concrete moisture is as recommended by the manufacturer of the water repellent material.

Spray apply the repellent using equipment and application pressure recommended by the manufacturer. Treat bridge deck and horizontal surfaces using a spray bar system approved by the manufacturer.

Apply and use the sealing penetrant according to the manufacturer's recommendation, except do not apply the material when ambient or surface temperature is below 40 °F nor above 100 °F, or when wind exceeds 15 mph. On surfaces exposed to foot or vehicle traffic, ensure the application rate is not lighter than that used to pass the Alberta sandblast test. On other surfaces, the Contractor may use the manufacturer's normal recommended application rate.

Type-D Application of Pre-coated Pre-formed Membrane Sheet System. Apply pre-coated, pre-formed membrane sheets to the surface receiving the membrane.

Ensure application, surface preparation and primer (if required) is in accordance with manufacturer's recommendations.

Lap joints between sheets of the membrane at least 2 in. Ensure the membrane sheet system does not have wrinkles.

- C. Protection and Overlaying.** Only use rubber-tired vehicles necessary for construction of overlays on the completed membrane system. Do not allow public traffic. The Contractor may place a thin dusting coat of Portland cement by hand to prevent paver or truck tires from sticking to the membrane during overlay work.

Uniformly place a 1.2 in. layer of sand over the membrane surface if a base aggregate or borrow course is to be placed on the waterproof membrane.

Construct plant mix overlays as soon as practical after completing the membrane and as specified in 405, except the minimum plant mix temperature when compaction begins is 234 °F. Roll using steel wheel rollers with no vibration. Use special compactors or rollers to achieve adequate compaction adjacent to curbs, deck drains, etc when necessary.

- D. Acceptance Testing.** The Engineer may test the waterproofing effectiveness of the membrane-pavement system after completion of the plant mix overlay. A minimum electrical resistance of 500 000 ohms when tested in accordance with ASTM D3633 is required. Repair areas having a resistance less than 500 000 ohms, as Engineer determined at no additional cost to the Department. If more

512.03

than 30 percent of the surface area is determined to be defective, the Engineer may require the repair to consist of removal and replacement of the entire pavement overlay and membrane at no additional cost to the Department.

The electrical resistance test, ASTM D3633, is not required on penetrating water repellent systems.

511.04 Method of Measurement. The Engineer will measure acceptable work by the square yard in place as determined from the plans and include horizontal and vertical surfaces.

The Engineer will measure the placement of pavement overlays under their respective contract pay items.

511.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Concrete Waterproof System.....	SY

The Department will pay for the placement of pavement overlays under their respective contract pay items.

SECTION 512 – GABION STRUCTURE

512.01 Description. Construct gabion structure of rock filled wire gabion baskets. Gabion structure can be either a Concept Design or a Plan Detailed Design as shown on the plans.

A. Concept Design. Provide a detailed design of the gabion structure based on the information provided in the concept design. Provide a design in accordance with the latest version of AASHTO LRFD Bridge Design Specifications at design time and that is stamped and signed by a Professional Engineer licensed in the State of Idaho. Construct in accordance with the design.

B. Plan Detailed Design. Construct as shown on the plans.

512.02 Materials. Provide gabion materials as specified in 715.

512.03 Construction Requirements.

A. Preparation of Foundation. Excavate the foundation materials for gabion structure to the lines and grades shown on the plan or as directed.

Where soft, yielding material is encountered, remove the material below the structure foundation to a depth of at least 2 ft or as directed. Ensure the width of the excavation is at least 6 in greater than the bottom width of the gabion

structure. Backfill the excavated area below the structure bottom with granular material and compact in layers not to exceed 6 in in uncompacted depth to form a uniform foundation. Repair any slipouts caused by the Contractor's operations to the Engineer's satisfaction at no additional cost to the Department.

- B. Assembly, Erection and Filling Gabion Baskets.** Fifteen calendar days before the construction of the gabion structures, submit a detailed, step-by-step construction procedure prepared by the gabion structure manufacturer to the Engineer for review and approval. Do not start the gabion structure construction until the submitted procedure is approved in writing by the Engineer.
- C. Backfilling the Gabion Structure.** Backfill the area behind the gabion structure with granular borrow.

If required, spread geotextile uniformly over the back of the gabion structure as shown on the plans. Overlap joining edges of the geotextile at least 1 ft and anchored in position with approved anchoring devices. Place the backfill material so geotextile does not tear, puncture, or shift.

Place the granular backfill material in layers and compact until a uniform density of at least 95 percent of the maximum density is attained as determined by AASHTO T 99, Method C or D. Do not exceed 1 ft thickness before compaction. Decrease this lift thickness, if necessary, to obtain the specified density.

512.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard.

512.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Gabion Structure.....	CY

The Engineer will measure and the Department will pay for structure excavation, and compacting backfill, as specified in 210. The Engineer will measure and the Department will pay for geotextile, when used, as specified in 640.

SECTION 600 – INCIDENTAL CONSTRUCTION

SECTION 601 - CONDUITS, GENERAL

601.01 Description. Construct culverts, siphons, irrigation lines, sewers, under-drains and embankment protectors.

601.02 Materials. Provide one or more of the several materials and classes of pipe that may be used at each installation, including gaskets if required, as shown on the plans.

Provide pipe extensions of the same material type or class as the existing pipe.

Provide mortared joints or gasketed joints for concrete pipe, unless otherwise specified.

The Contractor may substitute class II reinforced concrete pipe for either type of non-reinforced pipe.

Provide siphon type metal pipes that meet the following:

1. Spot welded and riveted pipe: asphalt coated with seams double welded or close riveted.
2. Lock seam pipe: asphalt coated, unless a gasket is incorporated into the lock seam. Ensure producers of gasket lock seam pipe are qualified under the Washington State Department of Transportation Qualification Program for Lockseam Storm Sewer Pipe with Seam Sealant, or equivalent qualification. Submit qualification documentation to the Engineer.
3. Continuous welded seam pipe: Asphalt coating is not required unless otherwise specified on the plans.

601.03 Construction Requirements. Install pipe as specified under the item that it is used.

Conduit installation details are as shown on Standard Drawings D-12 and D-13.

601.04 Method of Measurement. The Engineer will measure acceptably completed work as specified in the various contract pay items. The Department will list pipe by diameter and total estimated length in the bid schedule. Each diameter category may include one or a combination of types, thickness, or class of material.

601.05 Basis of Payment. The Department will pay for accepted quantities of the various kinds of pipe at the contract unit price shown on the bid schedule. The Department will not adjust the contract unit price because of normal minor adjustments in length of individual kinds of pipe.

SECTION 602 - CULVERTS

602.01 Description. Provide and install culverts.

602.02 Materials. Provide materials as specified in:

Concrete Pipe for Irrigation or Drainage	706.03
Reinforced Concrete Pipe	706.04
Corrugated Metal Pipe	706.06
Gaskets for Concrete Pipe	706.11
Rubber Gaskets for Corrugated Metal Pipe	706.12
Ribbed Polyvinyl Chloride (PVC) Pipe	706.15
Corrugated Polyethelene (PE) Pipe	706.16
Ribbed Polyethelene (PE) Pipe.....	706.17
Steel Reinforced Ribbed Polyethylene (SRRPE) Pipe.....	706.18
Polypropylene Pipe	706.19

602.03 Construction Requirements. Lay the corrugated metal pipe with the outside laps of the circumferential joints pointing upstream and with the longitudinal laps on the sides. Place the lugs on the coupling metal pipe bands to one side of the pipe top centerline so that they will not extend above the pipe.

Lay concrete pipe beginning at the lower end with the receiving end upstream, with the ends fully and closely joined. Construct joints using one of the following methods:

1. **Mortared Joints.** Before the succeeding sections of pipe are laid, clean and plaster on the inside lower portion of the receiving end of the preceding pipe using enough cement mortar to bring the inner surfaces of the abutting pipes flush and even. After the section is laid, fill the rest of the joint with mortar and use additional mortar to form a bead around the joint. Wipe the inside of the joint and finish smooth. Immediately after laying the mortar, protect the outside from the sun and air with a moist covering for at least 3 days.

Use cement mortar composed of 1 part Portland cement and 2 parts approved sand by volume. Discard mortar that is not used within 30 minutes after mixing with water.

2. **Gasketed Joints.** Lubricate the bell end of each pipe section laid with an approved type of vegetable compound soap, or bentonite mixed with water, to form a soft paste, or as recommended by the manufacturer. Keep the joint free of sand or dirt after the bell has been lubricated. Lubricate the pipe spigot end after the gasket has been placed on the pipe in contact with the seating shoulder. Insert the spigot end squarely into the bell and push the two sections

603.02

of pipe together so that the end of the spigot is in full contact with the bell socket shoulder. Do not roll the gasket into position.

Install Polyvinyl Chloride (PVC) pipe and Polyethylene (PE) pipe in accordance with the manufacturers' recommendations. Anchor exposed culvert ends with headwalls or standard metal end sections.

Install water tight coupling bands for corrugated metal pipes as shown on Standard Drawing D-4-A.

602.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along pipe centerline. The Engineer will allow an additional 1 ft for each connecting band used in making an authorized extension of existing corrugated metal pipe. The Engineer will include culvert sections attached to aprons in the measurement of culverts.

Pipe aprons required solely because of the use of Polyvinyl Chloride (PVC) or Polyethylene (PE) pipe will not be measured or paid for separately when other pipe material is acceptable.

602.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
__ Pipe Culverts	ft
__ x __ Pipe Arch	ft

The Department will pay for structural excavation and compacting backfill, including the removal of unsuitable material below the established grade, as specified in 210.

SECTION 603 - PIPE SIPHONS

603.01 Description. Provide and install pipe siphons.

603.02 Materials. Provide materials as specified in

Reinforced Concrete Pipe	706.04
Corrugated Metal Pipe	706.06
Gaskets for Concrete Pipe	706.11
Rubber Gaskets for Corrugated Metal Pipe	706.12
Class PS 46 Polyvinyl Chloride (PVC) Pipe	706.14
Ribbed Polyvinyl Chloride (PVC) Pipe	706.15
Steel Reinforced Ribbed Polyethylene (SRRPE) Pipe	706.18
Polypropylene Pipe	706.18

603.03 Construction Requirements. Install metal pipe siphons as specified in 602.03 and assemble the coupling bands with band gaskets as shown on the plans.

Install concrete pipe siphons as specified in 602.03.

Install Class PS 46 and Ribbed PVC pipe siphons as specified in 602.03.

Completely fill the siphon with water and repair any leaks that develop before back-filling, using Engineer approved methods. If there are leaks around joints in rubber gasketed concrete pipe, encase the joint using a reinforced concrete collar approved by the Engineer. Only two collar and joint repairs are allowed for each 150 ft of pipe. Empty the siphon of water before making repairs unless otherwise Engineer approved, and then refill, retest and obtain Engineer approval before backfilling.

603.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along pipe centerline. The Engineer may calculate the length from the dimensions of the approved siphon layout.

603.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
__ Pipe Siphon.....	ft

The Department will pay for structural excavation and compacting backfill, including the removal of unsuitable material below the established grade as specified in 210.

SECTION 604 - IRRIGATION PIPE LINES

604.01 Description. Provide and install irrigation pipe lines.

604.02 Materials. Provide materials as specified in:

Concrete Pipe for Irrigation or Drainage	706.03
Reinforced Concrete Pipe	706.04
Corrugated Metal Pipe	706.06
Gaskets for Concrete Pipe	706.11
Rubber Gaskets for Corrugated Metal Pipe	706.12
Class PS 46 Polyvinyl Chloride (PVC) Pipe	706.14
Ribbed Polyvinyl Chloride (PVC) Pipe	706.15
Steel Reinforced Ribbed Polyethylene (SRRPE) Pipe.....	706.18
Polypropylene Pipe	706.19

Use Corrugated Polyethylene (PE) as specified in 706.16 with the following additions:

1. Use Type S pipe.

605.02

2. Do not exceed a working pressure of 10 psi.
3. Use couplings and fittings that meet ASTM D-3212.
4. Use baskets that meet ASTM F-477.

604.03 Construction Requirements. Excavate and backfill as specified in 210, except that the Department waives the compaction requirements for those portions of the line which are not within the roadway prism.

Compact backfill outside the roadway prism by puddling, tamping or rolling.

Install concrete irrigation pipe as specified in 602.03.

Install corrugated metal pipe as specified in 602.03.

Install PVC pipe as specified in 602.03.

Test for leaks by closing off a convenient section with suitable water bulkheads, filling the line with water, and applying pressure to the line equal to the maximum static head the finished line will be subjected to at the point of testing. Locate and repair leaks as Engineer approved.

604.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along pipe centerline. The Engineer will allow an additional 1 ft for each connecting band used in making an authorized extension of existing corrugated metal pipe. The Engineer will not measure structure excavation & compacting backfill.

604.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
___ Irrigation Pipe	ft

Structure excavation and compacting backfill is incidental and the cost included in the contract unit price for irrigation pipe.

SECTION 605 - SEWERS

605.01 Description. Construct sewers with manholes, inlets, connections, and other appurtenances to carry storm water or sewage.

605.02 Materials. Provide materials as specified in:

Concrete Sewer Pipe	706.02
Concrete Pipe for Irrigation or Drainage	706.03
Reinforced Concrete Pipe	706.04

Corrugated Metal Pipe	706.06
Gaskets for Concrete Pipe	706.11
Rubber Gaskets for Corrugated Metal Pipe	706.12
ABS Composite Sewer Pipe	706.13
Class PS 46 Polyvinyl Chloride (PVC) Pipe	706.14
Ribbed Polyvinyl Chloride (PVC) Pipe	706.15
Manhole Covers and Rings, Grates, Catch Basins, Inlets, etc.	708.22
Steel Reinforced Ribbed Polyethylene (SRRPE) Pipe.....	706.18

Corrugated Polyethylene (PE) pipe may only be used for storm sewers as specified in 706.16 and with the following additions:

1. Use Type S pipe.
2. Do not subject a pipe line with couplings to pressure flow.

Use only manufacturers that furnish precast concrete products that hold current certification under the NPCA Plant Certification Program, the PCAA Plant Certification Program, the ACPA Q-cast Plant Certifications Program or PCI Plant certification Program.

605.03 Construction Requirements. The Contractor may tunnel or jack to cross under cross walks and house drives, or under service pipes. Excavate and compact backfill as specified in 210.

Lay concrete pipe for sanitary sewer lines beginning at the lower end with the receiving end upstream, with ends fully joined using suitable means to prevent the circulation of air within the pipeline. Provide and install rubber gasketed joints as specified in 602.03.

Install concrete and Polyethylene pipe for storm sewer lines as specified in 602.03.

Install corrugated metal pipe as specified in 602.03.

Install Polyvinyl Chloride as specified in 602.03 .

Install spiral rib corrugated steel pipe and ABS pipe in accordance with the manufacturer's recommendations.

Test the line for leaks before accepting the sewer line as follows:

1. Close off a convenient section with suitable watertight bulkheads.
2. Fill the line with water.
3. Apply 4 ft of head pressure to the line measured from the top of the pipe

605.05

at the upstream end, and supplying water to the section under test so that the loss may be measured.

The Engineer will not accept the sewer line if the water loss exceeds 200 gal/in of pipe dia/mi/day. Locate and correct the leak or leaks if the loss is in excess of the volume allowed.

The Contractor may test by the low-pressure air method as an acceptable alternate to hydraulic testing as follows:

1. Perform test on runs or sections of the installation. The Department will allow preliminary testing before backfilling as a guide to quality of material and workmanship. Test when the pipe is in a wet condition.
2. Use an apparatus and method recommended by the pipe manufacturers and Engineer approved.
3. Prepare the installation being tested, between its plugged ends, by pressurizing it to an internal pressure of 4 psi. Air pressure is defined as the pressure in excess of back pressure on the installation, such as would occur if the pipe were submerged in water. Hold an air pressure of 4 psi for at least two minutes and longer as necessary to indicate pressure stabilization.
4. The tested section, when tested on the air pressure drop method, will be acceptable to the Department if the time required for the pressure to drop from 3.5 psi to 2.5 psi coincides with ASTM C-924.

The Contractor may test connections to inlet and outlet structures by blocking off a section of the pipe outlet, filling the structure with water and observing the drop of water surface. To be acceptable, water loss must not exceed 0.002 gal/in inside perimeter of connection per foot of structure height or length per hour with no outside back pressure.

Construct manholes, catch basins, inlets, sediment and oil trap manholes, and sediment control catch basins in accordance with 609.

605.04 Method of Measurement. The Engineer will measure the acceptably completed work as follows:

1. By the foot along pipe centerline, excluding the distance across catch basins, manholes, inlets, and other structures where the pipe, or a portion of it, is not actually incorporated in the finished product.
2. Manholes, catch basins, and inlets by the each.

The Engineer will not measure structure excavation and backfill.

605.05 Basis of Payment. The Department will pay for acceptable quantities at contract unit price as follows:

Pay Item	Pay Unit
_____ Storm Sewer Pipe	ft
_____ Sanitary Sewer Pipe.....	ft
Manholes, Type __	Each
Catch Basins, Type __	Each
Inlets, Type __	Each
Sediment and Oil Trap Manhole.....	Each
Sediment Control Catch Basin	Each

Structure excavation and compacting backfill are incidental and the cost is included in the contract unit prices for sewers.

SECTION 606 - PIPE UNDERDRAINS, URBAN EDGE DRAINS, AND RURAL EDGE DRAINS

606.01 Description. Provide, place, and inspect pipe underdrains, rural edge drains and urban edge drain pipes.

606.02 Materials. Provide materials as specified in:

Coarse Aggregate for Concrete (Drain Rock)	703.02.C
(Coarse Agg. Size 1, 2a, 2b)	
Subgrade Separation Geotextile, Type III	718.07
Corrugated Polyethylene Drainage Tubing,	
Perforated and Unperforated	706.10
Fittings for Polyethylene Drainage Tubing	ASTM F405
Grout (mortar)	705.04
Metallic Coated Corrugated Steel Underdrains.....	706.07
Corrugated Aluminum Pipe for Underdrains	706.08
PVC pipe, Perforated and Unperforated	706.14
Corrugated Steel Pipe, Metallic Coated,	
For Sewers and Drains	AASHTO M36
Rodent Protection Devices for Trench Drain.....	ASTM F449
Edge Drain Markers	712.10

Provide drain rock that is clean angular quarried or crushed rock.

The Department will accept drain rock by certification using form ITD-0851. Submit quality control test results to the Engineer that represent each 500 ton of drain rock

606.03

placed, with at least one test per project, including gradation (AASHTO T-27 with no wash required) and sand equivalent (AASHTO T-176) test results to verify the certification. Perform quality control sampling and testing using a qualified independent laboratory and submit the test results to the Engineer.

The Contractor may provide a grout product that is on the Qualified Products List or submit proposed mix design for Engineer approval before use. Provide a completed certification form ITD-0851.

606.03 Construction Requirements.

- A. General.** Lay perforated pipe with the perforations down, unless otherwise Engineer directed. Line the trench with geotextile as shown on the plans. Place drain rock around the pipe and to the elevation over the pipe as shown on the plans. Fold geotextile over the drain rock and overlap at least 2 ft on the top and at the drain ends. When shown on the plans, place approved backfill material to the top of the trench and compact.

Install geotextile, drainage pipe or tubing, and aggregate backfill at the locations shown on the plans or as Engineer directed.

Place the materials shown on the plans over pipe underdrains, urban edge drains, and rural edge drains.

- B. Urban Edge Drains.** Field verify locations of urban edge drains in the presence of a Department inspector for approval.

At locations where a storm sewer exists or is to be constructed, the following applies:

1. Place the edge drains on the low side of the roadway, unless otherwise specified.
2. Install edge drains to discharge into storm sewer catch basins as shown on the plans.
3. Cap edge drain inlets in storm sewer catch basins and make their outlet pipes drain to a storm sewer catch basin.
4. Construct the edge drain slope to follow the grade of the roadway except where side street grades will not allow.
5. Slope side street edge drains in the direction shown on the plans or as directed by the Engineer.
6. Where the plans show edge drain pipe connecting to storm sewer catch

basins, make the connection by coring the concrete wall of the catch basin, place the end of the edge drain pipe in line with the inside wall of the catch basin.

7. Seal the gap between the edge drain and the concrete wall of the catch basin with grout (mortar) and ensure a strong watertight connection.

C. Rural Edge Drains and Pipe Underdrains. Excavate for rural edge drains and pipe underdrains as specified in 210.

Install rodent protection devices for outlet pipes and mark them with edge drain markers as shown on Standard Drawing G-3 Delineators, Type 4R or 4F, and bear the letters UD. Use white reflective sheeting.

Place the outlet pipes in 10 ft long corrugated steel pipe sleeves extending from the rodent protectors as shown on the plans and with the diameter of the corrugated steel pipes just large enough to allow the outlet pipes to fit through.

Ensure the maximum depth of trench excavation for pipe underdrains is less than 5 ft.

D. Drain Rock. Place drain rock within designated areas as shown on the plans.

E. Inspection. Before final acceptance of the project, prove to the Engineer that the drains and outlet pipes are in good condition and have not been damaged during or after installation of the drains. Use video inspection equipment to record the drains condition and provide the Engineer with copies of the videos in an approved format. Notify the Engineer at least 24 hours before the video inspection so that the Engineer may witness the videotaping. Provide video inspection equipment capable of superimposing the date, time, and location on the picture at the time of inspection. If the video inspection shows any damage to the system, repair the damage at no additional cost to the Department.

606.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

606.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Pipe Underdrain	ft
Urban Edge Drain	ft
Rural Edge Drain.....	ft

The Department considers concrete coring, grout (mortar), or any other items neces-

607.05

sary to complete the installation incidental and the cost included in the contract unit price for urban edge drain.

Video inspection is incidental and included in the contract unit prices for other items. The Department will pay for materials placed over pipe underdrains, urban edge drains, and rural edge drains under their respective contract pay items.

SECTION 607 - EMBANKMENT PROTECTORS

607.01 Description. Provide and install corrugated metal embankment protectors.

607.02 Materials. Use entrance and exit sections that meet the requirements of AASHTO M 36 or AASHTO M 196.

Provide the discharge pipe as specified in 706.06. Use all steel or all aluminum for each assembly.

607.03 Construction Requirements. Install the entrance device to prevent water from percolating under or around the structure.

Embankment protectors are shown on Standard Drawings D-1-A and D-1-B

Install discharge pipe as specified in 602.03. Securely anchor the pipe to the ground surface as shown on the plans where it is not possible to provide a trench for the installation.

607.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Embankment protectors will be by each unit. An entrance and an exit section is one unit.
2. Discharge pipe will be by the foot.

607.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Embankment Protector, Type _____	Each
Discharge Pipe	ft

The Department will measure and pay for materials necessary to pave the inlet area as specified in 405 or 406.

Excavation, backfill, outlet protection, and anchorage are incidental and the cost included in contract unit price.

SECTION 608 - APRONS FOR PIPE

608.01 Description. Provide and install aprons as specified to the inlet and outlet ends of pipe culverts.

608.02 Materials. Provide material for aprons as specified in:

Concrete.....	509
Metal Aprons	708.21

Use galvanized or stainless steel bolts, nuts, and washers. Galvanize other material to meet AASHTO M232. Fabricate safety, longitudinal, and optional bars from steel pipe meeting the requirements of ASTM A53 Schedule 40 and hot dipped galvanize the bars after fabrication for Metal Safety aprons.

Use galvanized steel that meets AASHTO M 111.

Use class 30 concrete for apron cutoffs.

Use concrete aprons that meet the design requirements for reinforced class III concrete pipe.

Provide metal or concrete aprons for installation, except that the Engineer will not accept pipes and attached aprons of dissimilar material.

608.03 Construction Requirements. Shape area occupied by the apron to conform to the bottom of the structure and to provide a firm and uniform support over its entire area. Backfill cutoff walls and areas adjacent to the apron to prevent undercutting or erosion.

Aprons are as shown on Standard Drawings D-3-C, D-5, and D-5-A.

608.04 Method of Measurement.

The Engineer will measure acceptably completed work by the each. The Engineer will include the culvert sections attached to aprons in the measurement of the culverts.

608.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Aprons for Pipe.....	Each
___ Metal Safety Apron (Parallel)	Each
___ Metal Safety Apron (Cross Drainage)	Each

The Department will not measure or pay for structure excavation and compacting backfill on metal aprons nor for any excavation or backfill within the limits of "Dimension B" as shown on the Standard Drawing D-5-A. This work is incidental and the

cost included in the contract unit price for other items. Concrete for the cutoff is incidental and the cost included in the contract unit price for aprons.

SECTION 609 - MINOR STRUCTURES

609.01 Description. Construct minor structures, such as drops, weirs, checks, diversion boxes, culvert and siphon headwalls, and inlet and outlet structures for canals and pipes.

609.02 Materials. Provide materials as specified in.

Concrete.....	509
Reinforcing Steel.....	708.02
Timber.....	710

Use Class 30 Concrete unless otherwise specified.

Accompany each shipment of reinforcing steel delivered to the project with a completed form ITD-0914 with a copy of the mill test report attached for each heat included in the shipment. The Department will take field samples for each heat number and bar size from material delivered to the project. Ensure the supplier submits proper identification with each shipment delivered to a project worksite to allow the Department to readily identify each bar size by heat number. The Engineer will reject reinforcing steel delivered that cannot be identified by heat number. Replace rejected reinforcing steel at no cost to the Department.

Sample complete fabricated bars and order additional bars to compensate for the field sampling. Do not cut and splice bars to obtain samples. The Engineer will accept following for field samples:

1. If the bar is configured so two 36 in long test specimens can be cut from one bar, then only one bar constitutes a field sample.
2. Otherwise, two complete fabricated bars constitute a single field sample.

Fabricate reinforcing steel spirals with additional length to accommodate sampling. The Engineer will not allow cutting that would require splicing to obtain samples.

The Engineer will reject bars with failing heat numbers. Replace rejected material at no additional cost to the Department.

Use metal that meet the requirements of ASTMA 36 for the grates. Meet the requirements of the American Welding Society D1.1 when welding the grates. Used grates for the inlet headwalls only when shown on the roadway plans. Grates need not be painted or galvanized.

609.03 Construction Requirements. Excavate and backfill as specified in 210. Construct minor structures as specified in 509 and 503.

Minor Structures are shown on Standard Drawings D-2-A and D-6 thru D-10.

609.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Concrete by the cubic yard as specified in 509.
2. Metal Reinforcement by the pound of reinforcing steel as specified in 503.
3. Timber and lumber by the 1000 board foot measure (MFBM).
4. When minor structures are by each, material is incidental.

609.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Concrete.....	CY
Metal Reinforcement.....	lb
Timber, Treated.....	MFBM
Timber, Untreated.....	MFBM
Minor Structures.....	Each

Structure excavation, compacting backfill, grates and other related hardware is incidental and the cost included in the contract unit prices for other contract pay items.

SECTION 610 - FENCES

610.01 Description. Provide and erect wire fence and gates. Comply with 107.19.

610.02 Materials. Provide materials as specified:

Non-Structural Concrete	509
Barbed Wire	708.09
Woven Wire.....	708.10
Hardware for Barbed or Woven Wire Fence	708.11
Metal Fence Posts	708.12
Chain Link Fence	708.13
Wood Fence Posts.....	710.08

610.03 Construction Requirements. Remove trees, brush and other obstacles along the fence line. Remove and dispose of material as specified in 201.

610.04

Wire fence types are as shown on Standard Drawings F-2-A, F-2-B, F-2-D, and F-2-E. Gate types are as shown on Standard Drawing F-2-C. See Standard Drawing Notes for additional construction requirements for each specific fence and gate type.

Set posts plumb to the spacing and depth shown on the plans, backfill, and firmly tamp. Set posts for chain link fence in concrete. After the posts are set, stretch and fasten the wire fencing to wooden posts with staples or to steel posts with wire clamps.

Use Class 22 Concrete for post and brace bases. Crown the surface of the concrete to drain.

When drilling into rock is required to set a post, the Contractor may shorten the post, provided at least 12 in of post is grouted in the rock.

Consider the air temperature when stretching wire; in hot weather stretch the wire just tight enough to eliminate sags; in cold weather stretch the wire very tight. In either temperature condition do not stretch the woven wire so tight that the pre-formed kinks in the horizontal wires are straightened.

Provide 4 in x 4 in No. 2 Common Douglas Fir or Larch horizontal and inclined wood braces. Dap posts to receive the braces, and anchor the ends of the brace with three 16d nails or a $\frac{3}{8}$ in x 4 in steel dowel. Apply a coat of pentachlorophenol solution, chromated copper arsenate (CCA) or ammoniacal copper zinc arsenate (ACZA) to daps on the posts and the ends of the braces before assembly. Provide brace wires that consist of two loops of 9-gage wire placed as shown on the plans and twisted to form a taut cable. Lightly notch the posts to position the wire, and drive 3 staples at each notch to secure the wire.

When using metal braces, securely splice the tie wires to the fence on both sides of the posts so that there are two loops behind the post and one loop in front, or wrap the fence wires around the post and tie off. Locate the concrete blocks for the angle braces so that at least 6 in of the angle brace are embedded in the concrete.

610.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Fence will be along the slope of the bottom wire by the foot, excluding the length between gateposts except for Type 1 Gates.
2. Gates will be by each for of the size and type specified except for Type 1 Gates.
3. Type 1 Gates will be per each, including the braces and fasteners for all

sizes of gates. The Engineer will include the length of Type 1 Gates in the measurement for Wire Fence.

4. Two Type 2 Gates installed in a single opening will be measured as two gates.
5. Braces will be per each and include line braces, corner braces and terminal braces constructed of metal or wood.

Gate braces are included in the cost of the gate item. Sag braces are included in the fence item. The Engineer will not measure braces for chain link fence separately and consider them included in the contract unit price.

610.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Fence, Type _____	ft.
Gates, Type 1	Each
Gates, Type _____	Each
Braces	Each

Clearing for fence is incidental and the cost included in the contract unit prices for fence items.

When barb arm/security attachment for Type 4 fence is specified, the Department considers the work incidental and included in the contract unit price for the fence item.

SECTION 611 - CATTLE GUARDS

611.01 Description. Construct cattle guards.

611.02 Materials. Provide material as specified in:

Metal Reinforcement	503
Structural Metals	504
Non-Structural Concrete	509
Culverts	602
Fences	610

Use Class 30 Concrete.

611.03 Construction Requirements. Complete roadway grading at the location of the cattle guard before excavating for the cattle guard. Backfill the structure with granular material as specified in 210.

612.03

Cattle Guard Type A is shown on Standard Drawing F-1-A. Cattle Guard Type B is shown on Standard Drawing F-1-B. Painted Cattle Guard is shown on Standard Drawing F-1-C.

611.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Cattle guards will be by the each. The Engineer will include the end panels and posts with the cattle guard and exclude the distance between the posts from measurement for fence.

611.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Cattle Guards, Type ___	Each

Structural excavation and compacting backfill are incidental and the cost included in the contract unit price for cattle guards. The Department will pay for culverts, as specified in 602.

SECTION 612 - GUARDRAIL

612.01 Description. Provide and install guardrail.

612.02 Materials. Provide materials as specified in:

Concrete.....	502 (for Concrete Rail)
Non-Structural Concrete	509
Reinforcing Steel.....	708.02
Steel Guardrail and Fittings.....	708.14
Aluminum Rail and Fittings	708.25
Wood Guardrail Posts and Wood Spacer Blocks	710.03
Steel Guardrail Posts	708.07

Provide wire rope that is $\frac{1}{2}$ in diameter pre-formed 6 x 19 or 6 x 25 improved plow steel with independent wire rope core or $\frac{3}{8}$ in diameter pre-formed 6 x 19 improved plow steel with independent fiber core. Provide wire rope with a minimum breaking strength of 19,200 lb force. Galvanize the wire rope.

612.03 Construction Requirements.

- A. Metal Guard Rail.** Space posts as shown on the plans, set plumb and to established lines and grades. Place backfill material in layers and thoroughly tamp. Boring of wood posts should be done before treating. The Department will

permit field boring provided the hole is treated with a wood preservative as specified in 710.09 before driving the bolts.

Unless otherwise specified, the Contractor may use galvanized steel rail or aluminum rail. Use only one type on the work unless otherwise Engineer approved. Match the type of material in place when extending existing installations.

The Contractor may drive the posts if it can be done without damage to posts, pavement, shoulders, or adjacent slopes. If pilot holes are necessary to prevent such damage, fill remaining voids between post and soil with dry sand or pea gravel. Remove, replace or reinstall misaligned, loose, or damaged posts and repair damage to the existing pavement, shoulders or adjacent slopes at no additional cost to the Department.

B. Concrete Rail. Galvanize exposed metal and wire rope.

Provide metal reinforcing, and ensure bends have a 2 in radius.

Cure concrete rail as specified in 502.03.

Provide one connecting pin with each 10 ft section that complies with the following: 1 in x 30 in Hot Rolled Steel Bar, Merchant Quality ASTM A 575 or Structural Steel ASTM A- 36/36M with a 1 in washer welded to the end as shown on the plans.

Provide one 1¼ in x 36 in drift pin, pointed on one end, with each end section and one 1 in x 30 in connecting pin with two end sections with a 1 in washer welded to the end as shown on the plans.

Pre-cast concrete guardrail units upside down to include connector and transition section and finish the concrete with an ordinary surface finish as specified in 502.03. Set concrete rail to the line and grade shown on the plans.

612.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Concrete guardrail will be by the foot not including the terminal sections.
2. Concrete terminal section Type A, pre-cast concrete parapet connector, pre-cast concrete guardrail connector and pre-cast concrete guardrail transition will be per each.
3. Metal guardrail and metal median barrier will be by the foot not including the terminal sections.

Metal terminal sections will be per each.

613.03

612.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Metal Guardrail.....	ft
Metal Median Barrier, Type ____	ft
Metal Terminal Section, Type ____	Each
Concrete Guardrail.....	ft
Concrete Terminal Section, Type A	Each
Pre-cast Concrete Parapet Connectors	Each
Pre-cast Concrete Guardrail Connector.....	Each
Pre-cast Concrete Guardrail Transition.....	Each

Terminal plates, spacers, additional posts, post blocks and appurtenances as shown on the plans are incidental and the cost included in the contract unit prices for terminals.

SECTION 613 - SIDEWALKS

613.01 Description. Construct sidewalks.

613.02 Materials. Provide materials as specified in:

Superpave Hot Mix Asphalt.....	405
Road Mix Pavement.....	406
Non-Structural Concrete	509

Use Class 30 Concrete.

613.03 Construction Requirements. Grade and compact the designated areas to 90 percent density as specified in 205.

Compact Aggregate base, if required, with at least two passes of a lightweight mechanical tamper, roller, or vibratory system.

Construct bituminous sidewalk as specified in 405 and 406.

Provide Portland cement concrete as specified in 509 with the following exceptions:

1. Finish as specified in 614.
2. Construct joints as shown on the standard drawings.
3. Cure as specified in 502.03.J.
4. Protect the concrete from damage during freezing weather as specified in 502.03.G.

Sidewalks are as shown on Standard Drawings H-1-B, H-2-A, B, and C, and H-3.

613.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard of finished surface.

613.05 Basis of Payment. The Department will pay for acceptable quantities at contract unit prices as follows:

Pay Item	Pay Unit
Concrete Sidewalk	SY
Bituminous Sidewalk	SY

The Department will pay for aggregate base, if required, as specified in 303.

SECTION 614 - URBAN APPROACHES

614.01 Description. Construct urban approaches.

614.02 Materials. Provide materials as specified in:

Superpave Hot Mix Asphalt	405
Road Mix Pavement	406
Non-Structural Concrete	509
Use Class 30 Concrete.	

614.03 Construction Requirements. Grade and compact the designated areas to 90 percent density as specified in 205.

Compact the aggregate base with at least two passes of a lightweight mechanical tamper, roller, or vibratory system, if required.

Construct Bituminous urban approaches as specified in 405 and 406.

Urban Approaches are shown on Standard Drawing H-3.

Provide Portland cement as specified in 509 with the following exceptions:

1. Float-finish the concrete so the surface is slightly rough, but uniform. Work the slab edges and joints with a $\frac{1}{4}$ in radius edging tool. Correct any honeycombed or rough spots using mortar consisting of one part cement and two parts Engineer approved sand immediately after removing the forms.
2. Place earth or other Engineer approved material against the edge of the driveway and shape and compact as shown on the plans.
3. Construct joints as shown on the standard drawings.
4. Cure as specified in 502.03 J.

615.02

5. Protect the concrete from damage during freezing weather as specified in 502.03.G.

614.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Bituminous or concrete urban approaches will be by each.
2. Concrete for urban approaches will be by plan quantities in cubic yard.

614.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Urban Approaches	Each
Concrete for Urban Approaches.....	CY

The Department will pay for bituminous surfacing as specified in 405 or 406. Aggregate base, if required, will be paid as specified in 303.

SECTION 615 - CURB AND GUTTER

615.01 Description. Construct curb, gutter, combination curb and gutter, or traffic separators.

The four types of curb, gutter and traffic separators are as follows:

1. Type A, sections: cast-in-place Portland cement concrete.
2. Type B, sections: pre-cast Portland cement concrete.
3. Type C, sections: extruded Portland cement concrete.
4. Type D, sections: extruded asphalt concrete.

The Contractor may construct any type specified if more than one type is shown on the plans at a specified location.

Curb and gutter shapes are shown on Standard Drawing H-1-A.

615.02 Materials. Provide materials as specified in:

Non-Structural Concrete	509
Superpave Hot Mix Asphalt.....	405
Aggregate.....	703.09
Reinforcing Steel.....	708.02

For Type A, B, and C Portland cement concrete curb, use Class 30 concrete. For

Type D extruded asphalt concrete curb, use $\frac{1}{2}$ in Nominal Maximum Aggregate Size (NMAS) SP2 or SP3 non structural mixture that meets 405.

615.03 Construction Requirements.

A. Formed Sections. Provide forms of wood or metal, straight and not warped, and strong enough to resist springing while placing concrete. Where a section must be constructed on a curve, ensure straight lengths of the section are short enough so that the middle ordinate to the curve from the face of the section does not exceed $\frac{1}{2}$ in, or construct a continuously curved section.

Construct curbs, gutters, or combination curb and gutter in uniform sections 10 ft long, except where shorter sections are necessary for closures or on curves. Do not construct sections less than 3 ft long. Separate these sections by steel templates conforming to the cross section of the curb, set perpendicular to the face and top of the curb, or combined curb and gutter, and held securely in position so as not to become displaced during placing of concrete. Use templates that are at least $\frac{1}{8}$ in and no more than $\frac{3}{16}$ in thick, and have a length, depth and cross section that will completely separate the sections and allow their removal. Leave the templates in place until the concrete has set and will hold its shape, and then carefully remove without injury or marring the concrete. Lightly tool the joints along the face and top of the curb immediately after removing the templates. Thoroughly clean and oil the templates before using. Remove the forms within 24 hours of placing the concrete.

1. Type A Sections. While the concrete is still green, thoroughly float the top and front face or other exposed portions of the curb, gutter, or combination curb and gutter, with a moist wooden float to produce a uniform even surface. Remove form marks and other irregularities.

Round the back edge of the curbs and the edge of the gutter adjacent to the pavement with a $\frac{1}{4}$ in radius edging tool. Patch honeycombed areas in the back of the curb that are detrimental to the curb.

2. Type B Sections. Provide a smooth, glassy finish on the exposed surfaces of curbs and separators. The Engineer may reject a section for excess honeycombing in the back of the curb.

Provide the curb and separators to the dimensions and shapes shown on the plans within a tolerance of $\frac{1}{4}$ in in length and $\frac{1}{8}$ in in alignment.

Make the curb in pieces at least 5 ft but no more than 9 ft in length, except in special instances where shorter lengths are required. Make circular curbing for radii of 10 ft or less as called for on the plans. For radii from

10 ft to 600 ft, cast the curb in straight pieces with beveled ends that vary in length between 1 ft and 8 ft as required to keep the middle ordinate $\frac{1}{4}$ in or less. Bevel the ends of the pieces so that the spaces between adjacent pieces vary no more than $\frac{1}{8}$ in in width. For any radius larger than 600 ft, provide curb pieces that are straight with square ends.

The Department requires that there be no more than:

1. Two percent of the top area in any one piece of curb defective.
2. Thirty air holes in any 1 ft of curb or fifty in any 3 ft of curb.

An air hole is any hole $\frac{1}{8}$ in or larger in diameter and depth.

Except where expansion joints are to be placed, fill joints between adjacent pieces of curb or separator with bedding mortar.

Firmly bed the curb or separator for its entire length and breadth on a mortar bed composed of 1 part Portland cement and 2 parts of approved sand.

Before the cement mortar bed is laid, clean dirt from the pavement surface by washing.

When bonding to hardened Portland cement concrete, use an epoxy resin system meeting the requirements of AASHTO M 235, Type I or IV.

- B. Extruded Sections.** Pass the material for extruded sections through an orifice or plate by the pressure from an auger feed or other Engineer approved methods.

Mount the machine used for Portland cement concrete either on casters or on wheels which can be steered.

Heat the machine used for asphalt concrete by ducting exhaust gases or heat from auxiliary burners over the surface of the orifice. Mount the machine on skids to apply sufficient resistance to movement to properly compact the curb or traffic separator.

1. Type C Sections. Feed concrete uniformly to the machine and in a consistency that after extrusion the concrete will maintain the designated shape.

Unless otherwise Engineer approved, use concrete coarse aggregate size No. 1 or No. 2.

Construct contraction joints at 10 ft intervals to a minimum depth of 2 in for exposed surfaces by sawing or cutting through the newly placed concrete with a plate or similar Engineer approved device.

Touch up the surface as necessary with a trowel and then finish with a fine brush using brush strokes parallel to the sections line.

When bonding to hardened Portland cement concrete, use an epoxy resin system meeting the requirements of AASHTO M 235, Type II or V.

2. Type D Sections. Tack the surface with asphalt.

Mix the asphalt mixture at the temperature recommended by the supplier in an Engineer approved pugmill type mixer for at least 40 seconds. Provide a mixer that has a capacity of at least 3 ft³. Heat the aggregate to the temperatures specified for the mixture so that it contains less than 1 percent moisture. Uniformly feed the asphalt concrete to the machine at a temperature that will avoid sloughing of the material or tearing of the surface.

Cure Type A and C concrete sections immediately after finishing as specified in 502.03.J.

Protect the concrete from damage by using additional cover or heating devices.

Place Engineer approved backfill material in layers behind curbs and thoroughly compact.

615.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Curb and combination curb and gutter will be by the foot along the face of the curb.
2. Traffic separators and gutters will be by the foot along the centerline of the units.
3. Raised channelization and treatment will be per each.

No deductions in length will be made for embankment protectors installed in the curb or for catch basins or drop inlets installed in the gutters.

615.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Curb, Type _____	ft
Gutter, Type _____	ft
Combination Curb and Gutter, Type _____	ft
Traffic Separator, Type _____	ft
Raised Channelization End Treatment.....	Each

616.02

The epoxy resin system is incidental and the cost included in the contract unit prices for other contract pay items.

The Department will pay for the asphalt and asphalt mix under the appropriate contract items in 400.

Reinforcing steel is incidental and the cost included in the contract unit price.

The Department considers excavation, backfill and asphalt for tack coat incidental and the cost included in the contract unit price of curb and gutter items.

SECTION 616 - SIGNS AND SIGN SUPPORTS

616.01 Description. Provide and install signs and sign supports.

The Department classifies signs as the following:

- A. **Type B** - Sheet aluminum with a reflective sheeting background. The legend and border consist of digitally printed or silk screened ink, direct applied reflective sheeting, or direct applied non-reflective sheeting.
- B. **Type C** - Extruded aluminum panels with a reflective sheeting background and direct applied reflective legend and border.
- C. **Type E** - A ½ in or ⅝ in plywood with a reflective sheeting background. The legend and border consist of digitally printed or silk screened ink, direct applied reflective sheeting, or direct applied non-reflective sheeting.

Sign supports may include wood or steel post, luminaire poles, signal poles, or structures.

616.02 Materials. Provide materials as specified in:

Concrete.....	502
Non-Structural Concrete	509
Steel and Aluminum Sign Supports.....	708.17
Hardware for Signs	708.18
Extruded Aluminum	708.26
Sheet Aluminum	708.27
Wood Sign Posts	710.02
Plywood for Type E Signs	712.01
Reflective Sheeting	712.02
Silk Screen Opaque Inks.....	712.07
Silk Screen Transparent Inks	712.08
Direct Applied Non-Reflective Sheeting and Transparent Films	712.09

Use 502 Concrete, Class 40A for overhead sign and structure foundations and use 509 Concrete, Class 30 for all other sign structure foundations.

Submit for Engineer approval a list of materials proposed for installation.

616.03 Construction Requirements.

A. Sign Fabrication. Fabricate signs ensuring the design meets the requirements of the Department's Traffic Manual, Sign Chart, and Sign Design Manual and the Manual on Uniform Traffic Control Devices (MUTCD) as adopted by the State.

A sign that is not shown on the Department's sign chart, or is not an allowable variation in size or legend of a standard sign shown on the Department's sign chart is considered to be a special sign and is designated as SR, SG, SW, or SI on the plans. For permanent special signs provide one set of final manufacturer's sign design files on CD/DVD or other Engineer approved electronic media to the Engineer. Provide the files in one of the following unlocked and editable file formats; list is in order of preference:

1. SignCAD.sgn
2. Encapsulated PostScript (EPS)
3. Portable Document Format (PDF)

Before the application of sheeting and films, remove grease, dirt or wax by one of the following methods:

1. Clean metal and wood substrates before applying sheeting per manufacturer's recommendations to ensure bonding between materials.
2. Clean background sheeting and films per manufacturer's recommendations before application of additional sheeting and films. Do not use cleaners that attack or soften the surface.

B. Sign Supports

1. Ground Mounted Sign Supports. Install sign supports as shown on the plans or as Engineer approved. The Department requires the design parameters for ground mounted sign assemblies meet a design wind speed of 90 mph.
2. Overhead Sign Supports. Design sign supports and submit for Engineer approval when specified. Provide a design that complies with AASHTO *Standard Specifications for Structural Supports for Highway Signs, Lumi-*

naires, and Traffic Signals in effect at the time of bid opening. Install sign supports as shown on the plans or as Engineer approved.

The Department requires the design parameters for signs to meet the following:

1. Overhead Sign Bridges:
 - a. Design Life – 50 years
 - b. Design Wind Speed – 90 mph
 - c. Fatigue Category – 1 (Fatigue design shall include natural wind gust and truck-induced gust loads based on a truck speed of 65 mph.)
2. Overhead Cantilever Sign Structures/Tee Sign Structures:
 - a. Design Life – 50 years
 - b. Design Wind Speed – 90 mph
 - c. Fatigue Category – I (Include in the fatigue design natural wind gust; periodic galloping forces; and truck- induced gust loads based on a truck speed of 65 mph.)
3. All other Sign Supports:
 - a. Design Life – 25 years
 - b. Design Wind Speed – 90 mph
 - c. Fatigue Category – (not required)

Unless otherwise Engineer approved, the Department requires that the design of supports or check of plans, be performed by a Professional Engineer licensed in the State of Idaho and that the Professional Engineer affix his, or her, seal, signature, and date to each sheet of plans and the design calculations, and provide the design at no additional cost to the Department.

Before fabrication, submit six sets of shop drawings and three sets of design calculations for Engineer approval. The Engineer will require at least 10 working days to review and approve the design and shop drawings.

Provide one set of approved shop drawings on mylar.

Provide one set of final manufacturer's shop drawings on CD/DVD or other Engineer approved electronic format. Provide the drawings in one of the following file formats; list is in order of preference:

1. Microstation.dgn

2. Auto CAD/D.dwg
3. .dxf

If a roadway luminaire is to be installed on a vertical member of the sign support, include the luminaire arm as part of the sign support. Assume the luminaire to weigh 50.7 lb. Assume sign panels to weigh 4 psf. Assume sign lighters to weigh 55 lb each.

Weld and inspect as specified in latest AWS D1.1 Structural Welding Code and AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. The Department requires that the verification inspection be the responsibility of the fabricator, and that the fabricator employs an independent inspection agency who is completely separate from the organization performing fabrication inspection and testing and that the independent inspection agency submit copies of verification inspection reports directly to the Engineer.

- C. Foundations.** If the material encountered in excavating a foundation hole cannot be satisfactorily augered, the Contractor may use a formed cylindrical foundation or alternate square foundation when Engineer approved.

Where solid rock is encountered and cannot be augered or excavated to the required depth, the Contractor may drill the rock to accept the vertical reinforcing steel and grout the anchor bolts in place as Engineer approved.

Protect concrete from freezing for at least 7 days.

Install anchor bolts plumb, plus or minus one degree. Use three nuts, two washers on each anchor bolt; one leveling nut and washer below the base plate, two nuts, and one washer above the base plate. Ensure leveling nuts with washer bear against the underside of the base plate before tightening of the top nuts. Tighten the lower top nut beyond snug-tight as specified in Table 616.03-1.

Table 616.03-1 - Nut Rotation beyond Snug Tight

Anchor Bolt Diameter (in)	F1554 Grade 36	F1554 Grades 55 and 105
< or = 1.5"	1/6 turn	1/3 turn
> 1.5"	1/12 turn	1/6 turn

Tighten the upper top nut against the lower top nut snug-tight. The Department defines snug-tight as either the tightness reached by a few blows from an impact wrench, or the full effort of an individual using a 12 in spud wrench. Ensure at least three threads of the anchor bolt are visible above the second nut.

616.05

Tighten high strength structural bolts as specified in 504.03.L.2

Place and compact backfill for formed foundations as specified in 210.

616.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Signs. Signs will be to the nearest 0.1 square foot of the sign face area. The sign area is the smallest rectangular shape that will encompass the sign panel except for triangular signs, which will be by a triangular shape.
2. Breakaway Sign Posts. Each specified type of breakaway steel sign post will be by the pound, based on calculated weights of the total length of post, exclusive of galvanizing. Each specified wood sign post type will be by the 1000 foot board measure – MFBM, installed.
3. Sign Brackets and Brace Angles. Sign brackets and brace angles will be by the pound based on the calculated weights of the sign brackets and brace angles. Calculated weights of sign brackets and brace angles will be based on the tables shown on the plans. The calculated weights will be exclusive of galvanizing.
4. Breakaway Steel Sign Post Installation. Breakaway steel sign post installations will be per each. Type A and Type B steel sign post installations will include the breakaway hinge below the sign on two post installations, the breakaway base assembly, the foundation, drilling, galvanizing, miscellaneous hardware and refinishing the ground surface. Type E steel sign post installations will include the foundation, galvanizing, miscellaneous hardware, and refinishing the ground surface.
5. Overhead Sign Structures. Overhead sign structures will be per each, including the foundations.

616.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Signs, Type _____	SF
Overhead Sign Structure.....	Each
Sign Brackets and Brace Angles.....	lb
Breakaway Steel Sign Posts, Type ____	lb
Breakaway Wood Sign Posts, Type ____	MFBM
Breakaway Steel Sign Post Installation Type ____	Each

Covering and uncovering signs installed before they are needed will be at no additional cost to the Department.

SECTION 617 – DELINEATOR AND MILEPOST ASSEMBLIES

617.01 Description. Provide and install delineator and milepost assemblies.

617.02 Materials. Provide materials as specified in:

Non-Structural Concrete	509
Milepost Plates.....	708.15
Rigid Posts for Delineators, Snow Poles, and Mileposts	708.16
Sheet Aluminum	708.27
Reflective Sheeting	712.02
Reflector Unit for Delineators	712.04
Silk Screen Opaque Inks.....	712.07
Silk Screen Transparent Inks	712.08
Flexible Post Delineators	712.10

Submit for Engineer approval a list of materials proposed for installation. The Department requires that each barrier or ground mount delineator be the same manufacturer brand and style throughout the project.

Use Class 30 Concrete.

617.03 Construction Requirements. Set delineator posts and milepost plumb to the established lines and grades.

If the milepost location is within 50 ft of an established delineator, remove the delineator installation.

Mileposts are shown on Standard Drawing I-20. Delineators are shown on Standard Drawing G-3-A.

Remove existing delineators, mileposts, reflectors, plates or assemblies that are specified for replacement, and replace with new installations. The removed material is the property of the Contractor.

Provide barrier mount or ground mount delineators that are the same manufacturer brand and style throughout the project unless otherwise specified or Engineer approved.

A. Rigid Post Delineator Type 1, 2, 3, or 4. Rigid Post Delineator assemblies consist of an installed delineator post and a delineator reflector unit.

Drive posts using a metal driving cap that fits snugly around the post. The Engineer may allow minor bending and twisting to align the post.

617.05

Complete the installation by attaching the delineator reflector unit(s) to the driven post.

- B. Barrier Mounted Stub Post Delineators Type 5, 6, 7, or 8.** Barrier Mounted Stub Post Delineator assemblies consist of an installed delineator post and a delineator reflector unit.

Install stub post delineators mounted to the barrier as shown on the plans.

- C. Barrier Mounted Delineators Type 9.** Attach either side mount or top mount delineator reflector unit to the barrier guardrail in accordance with manufacturer recommendations.

Before the installation, provide the Engineer with the manufacturer recommendations.

- D. Flexible Post Delineators.** Flexible Post Delineator consists of an installed flexible delineator post assembly that was driven according to manufacturer recommendations.

Before the installation, provide the Engineer with the manufacturer's recommended installation procedures.

- E. Milepost Assembly.** A milepost assembly consists of a concrete foundation, Type E post, and milepost plate. The Contractor may use either pre-cast or poured in place concrete foundation. Provide a square concrete foundation. Complete the installation by attaching the milepost plate after the concrete has set.

If a pre-cast foundation is used, the Contractor may excavate the foundation hole to a dimension larger than the concrete foundation and then backfill with Engineer approved material and tamp.

When solid rock is encountered, anchor posts and anchor post sleeves that provide the specified mounting height may be grouted 4 in. minimum diameter by 18 in. deep drilled holes. Keep the interior of the anchor post sleeves free of foreign material.

617.04 Method of Measurement. The Engineer will measure acceptably completed work per each.

617.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Delineators, Type ____	Each
Mileposts, Type ____	Each

SECTION 618 - MARKER POSTS, WITNESS POSTS, AND STREET MONUMENTS

618.01 Description. Provide and place posts for right-of-way; reference and project markers; witness posts; and street monuments.

618.02 Materials. Provide concrete for the posts and street monuments as specified in 509. Use white Portland cement for project markers.

After the project markers have dried thoroughly, add the letters in conformance with the plans using two coats of an approved black paint. Allow the first coat to dry thoroughly before applying the second coat.

If light weight aggregates are used, provide aggregates as specified in ASTM C 330.

Provide brass caps as specified in 708.28.

Provide steel witness posts as specified in 708.16, except that for steel witness posts the holes may be omitted.

Provide cast iron casings that meet the requirements of AASHTO M 306. An Engineer approved equal for the cover and casting is acceptable.

Provide wood witness posts of cedar or fir that are well seasoned, straight, and sound. Treat the posts as specified in 710.

Paint wood witness posts white, with one coat of Formula No. 11, and two coats of Formula No. 12 as specified in 627.03.

Provide fiberglass witness posts that are single piece markers capable of simple, permanent installation by one person using a manual driving tool, and resist displacement from wind and vehicle impact forces when properly installed. Provide posts that are a constant "T" cross section design which provides a flat surface for sheeting application and a reinforcing rib incorporated longitudinally along the back midsection to provide structural rigidity. Put a point on the bottom end of the markers for easier ground penetration.

Provide fiberglass witness posts complying with the properties of Table 618.02-1.

Table 618.02-1 - Fiberglass Post Criteria

Property	ASTM Test Method	Minimum Value
Ultimate Tensile Strength	D-638	20,000 psi
Specific Gravity	D-792	1.7
Weight Percent Glass Reinforcement (Ignition Loss)	D-2584	50 percent
Barcol Hardness	D-2583	47

Fabricate fiberglass witness posts of a durable, UV resistant, continuous glass fiber and marble reinforced, thermosetting composite material that is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40 °F to 140 °F. Color the posts uniformly throughout the entire cross section. Incorporate ultraviolet resistant material to inhibit fading or cracking of the markers upon field exposure. Ensure the markers exhibit negligible color fading after 2,000 hours in accordance with ASTM G-26, Xenon Arc Exposure.

618.03 Construction Requirements. Marker Posts and Witness Posts are shown on Standard Drawing I-2-A and Street Monuments are shown on Standard Drawing I-2-B. See Standard Drawings for additional details.

Set right-of-way markers, reference markers, witness posts, and street monuments where shown on the plans. Make markings and file recordings under the supervision of a Land Surveyor licensed in the State of Idaho when required by Idaho code. No separate payment will be made by the Department for endorsements or filing fees when work is specified for contract surveying.

Excavate hole of sufficient size to permit adjustment of the marker post to the lines required. Align the posts as directed by the Engineer and backfill the hole with suitable material. Carefully tamp in place.

Give the upper 3 ft of the posts for project markers and the upper 12 in of the posts for right-of-way markers a rubbed surface finish as specified in 502.03.1. Cure for a minimum period of 14 days before use.

Place the Brass cap in a casing with cover when it is in areas where heavy traffic is encountered.

618.04 Method of Measurement. The Engineer will measure acceptably completed work per each.

618.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Project Markers	Each
Right-of-Way Markers	Each
Reference Markers	Each
Witness Posts	Each
Street Monuments	Each

SECTION 619 - ILLUMINATION

619.01 Description. Provide and install illumination of one of the following types:

- A. **Type 1** - Multiple circuit, high pressure sodium sign lighting that operates with the use of individual lamp ballasts.
- B. **Type 2** - Multiple circuit, high pressure sodium street lighting that operates with the use of individual lamp ballasts.

Installations may include electrical conduit, wiring, luminaires, poles, pole foundations, and electrical equipment necessary for the construction of a complete lighting system as shown on the plans.

619.02 Materials. Provide materials that bear the seal of approval of the Underwriters Laboratories, Inc., or other testing organization approved by the Engineer, such as National Electrical Manufacturer's Association. Materials must also meet the National Electrical Code and local codes and requirements of the connecting utility.

Provide materials as specified in:

Concrete.....	502
Non-Structural Concrete	509
Illumination Poles and Bases	708.19
Service Poles for Illumination	710.06
Pole Keys	710.07
High Pressure Sodium Vapor Luminaires	713.01
High Pressure Sodium Vapor Ballasts	713.02
Rigid Steel Conduit	713.03
Plastic Conduit	713.04
Concrete Junction Boxes	713.05
Composite Junction Boxes.....	713.06
Electrical Conductors	713.07

619.03

Illumination pole foundations require structural concrete as specified in 502.

Electrical service pedestal foundations require non-structural concrete as specified in 509.

Submit for Engineer approval a list of equipment and materials proposed for installation. For each item listed include manufacturer's name, size and catalog number.

Submit design of non-standard poles for Engineer approval before use.

619.03 Construction Requirements. Provide workmanship that meets the National Electrical Code and local codes and requirements of the connecting utility.

Where soil conditions allow, excavate for pole foundations to the neat lines of the foundation, and place the concrete directly against the sides of the excavation.

Where soil conditions prohibit the procedure in this section, form the foundations, and place the concrete as specified in 502.

Place backfill and compact as specified in 210.

A. Conduit Installation. Resurface with material equal to that removed.

Place underground conduit at least 24 in below the finished surface unless otherwise shown on the plans. Ensure underground conduit does not conflict with poles, guardrail or posts, sign foundations, other underground utilities, etc.

Provide rigid steel conduit for exposed service conduit.

Attach conduit to utility company poles as directed by utility company.

Use standard factory fittings (elbows, bends, tees, couplings, etc.) throughout the conduit runs.

Make turns in conduit runs by bending the conduit without kinking or flattening by using the largest radius practical, or by using standard factory fittings.

Obtain the Engineer's approval of conduit installation before starting backfill.

Separate conduit runs with at least 3 in of sand or soil cushion.

Place underground hazard tape in the fill 12 in above conduits. Provide tape for AC electrical circuits that is red in color, 6 in wide and has the legend "Caution Caution Caution Electrical Line Buried Below" imprinted in black. Provide tape for low voltage or fiber optic cable that is orange in color, 3 in wide, without legend.

1. Rigid Steel Conduit. Cut conduit ends square and ream well to remove burrs and rough edges. Thread and cap conduit ends with standard

conduit caps until wiring installation is started. When the caps are removed, provide the threaded ends with insulated metallic conduit bushings.

Install expansion fittings with at least 4 in of expansion per fitting, where conduit crosses an expansion joint in a structure.

When the trench bottom consists of unsuitable material such as rock, hardpan, or other unyielding material, place conduit on at least a 3 in bedding of tamped sand or soil.

Provide backfill that passes a 3 in screen.

2. **Plastic Conduit.** Securely fasten conduit joints together by solvent welding. Bend conduit carefully avoiding damage and without using an open flame. The Department requires elbows, risers, and bends greater than 45° to be rigid steel.

To allow for expansion and contraction of plastic conduit during installation of long runs, leave one end unconnected, or insert an O- ring expansion coupling near one end of the run until final covering of the conduit is in progress.

Cap free ends of conduit to prevent the entry of moisture, dirt, or rocks.

Place conduit on at least a 3 in bedding of tamped sand or soil. Backfill with sand or soil without rocks or hard lumps to a compacted depth of 6 in above, and 6 in to each side of, the conduit. The remaining cover over the conduit shall pass a 3 in screen.

- B. Junction Boxes.** Place at least 6 in of clean sand and gravel, $\frac{3}{4}$ in maximum, under junction boxes for drainage.

Place junction boxes subject to traffic loads on a concrete base.

Ensure the outside dimensions of the concrete base is 6 in larger than the outside dimensions of the junction box with at least a thickness of 4 in and a drain hole approximately 4 in in diameter through the center of the base.

Do not install the concrete base until conduits under the base have been installed, backfilled and compacted as specified in 210.

Ensure the top of the box is 1 in above the surrounding ground elevation or is flush with the surrounding surface when located in a sidewalk or roadway.

- C. Conductors.** Before proceeding to pull wire in underground conduit runs,

clean dirt or accumulations of moisture from conduit runs. Use powdered soapstone, talc, or other approved lubricants when inserting conductors in conduit.

Splice conductors using Engineer approved connectors. Do not splice conductors except in pole bases or junction boxes.

Interconnect poles on an underground service system and attach to the service ground by means of a No. 8 AWG THWN soft drawn stranded copper wire.

- D. Poles.** Fit each anchor bolt with one leveling nut and washer below the base plate and two nuts and one washer above the base plate. Ensure leveling nuts with washer bear against the underside of the base plate before tightening of the top nuts. Tighten the lower top nut beyond snug-tight as presented in Table 619.03-1.

Table 619.03-1 - Nut Rotation beyond Snug Tight

Anchor Bolt Diameter (in)	F1554 Grade 36	F1554 Grades 55 and 105
< or = 1.5"	1/6 turn	1/3 turn
> 1.5"	1/12 turn	1/6 turn

After the lower top nut has been tightened, tighten the upper top nut against the lower top nut snug-tight. The Department defines snug-tight as either the tightness reached by a few blows from an impact wrench, or the full effort of an individual using a 12 in spud wrench. Ensure at least three threads of the anchor bolt are visible above the second nut.

Attach slip base breakaway devices to the foundation anchor bolts with hex nuts and flat washers. Connect the lighting standard to the slip base with high strength bolts with hexagon nuts and plate washers. Use a plate to retain the bolts in the proper position. Torque the bolts according to the manufacturer's recommendation.

Install the support coupling device in accordance with manufacturer recommendations. Plumb each pole after pole mounted items and service conductors are in place. Level luminaires per the manufacturer's recommendations after the pole has been placed.

Surround the support couplings with an aluminum skirt fastened with stainless steel sheet metal screws.

If it becomes necessary to drill a hole or if the galvanizing is damaged on galvanized steel poles before or during installation, thoroughly wire brush the

exposed metal to remove loose and cracked spelter coating, then paint the cleaned area with two coats of Formula No. 14 as specified in 627.03.

- E. Field Testing.** The Department will require field testing for 14 consecutive days of normal operation. Give written notice to the Engineer when the lighting system is complete and before starting the field test.

619.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

619.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Illumination, Type _____	Lump Sum

The Department considers excavation, backfilling, surfacing and materials incidental and the cost included in the contract pay items for illumination.

SECTION 620 - PLANTING

620.01 Description. Provide and plant trees, shrubs, vines and ground cover.

620.02 Materials. Provide materials as specified in.

Plants	711.06
Commercial Fertilizer	711.07
Soil Conditioner	711.08
Select Topsoil	711.09
Mulch.....	711.10
Irrigation Water.....	711.12

620.03 Construction Requirements. Ensure adequate and proper care of plant material. Adequate and proper care includes keeping plant materials in a healthy, growing condition by appropriate handling, storing, watering, cultivating, pruning and spraying.

Unless otherwise Engineer approved, perform planting operations between September 15 and May 15, and take advantage of favorable planting conditions. Plant bare root plants before the leaves open or new needles have started forming. If planting during other seasons is permitted, apply Engineer approved organic wetting agents or anti-transpirants in accordance with manufacturer recommendations at no additional expense to the Department. Do not apply wetting agents or anti-transpirants after April 15.

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Promptly clean up and dispose of soil, discarded branches, rejected plants or other debris, twine, rope, transit guards, or wrappings.

Grade, level, or both the irrigated or sodded area(s) to be planted before staking or marking planting locations. Disk natural or unmaintained area(s) or leave in a roughened condition before staking planting locations. Mark out and stake tree locations and the general layouts of planting areas for shrubs, vines, and ground cover. Do not begin planting until the area(s), tree locations and general layouts of the planting site(s) are approved by the Engineer.

Cultivate planting areas for shrubs and vines to at least 4 in deep. Remove and dispose of weeds and other vegetative growth, large clods, rocks, and other debris encountered in the cultivating work.

When excavating holes for planting, keep topsoil separate from subsoil and make loose and friable. Remove and dispose of soils containing a pH greater than 8, a pH less than 4, gravel, stones, or other detrimental material encountered in the excavation. A soil auger may be used if Engineer approved. Adequately barricade excavated planting holes that are left open when the work is not in progress with appropriate warning devices. Sufficiently roughen glazed surfaces inside planting holes before backfilling.

For containerized plants, mix soil conditioner into 6 in of loose topsoil in the bottom of planting holes, but do not mix with the soil to be used in backfilling. Use approximately 1 ft³ of soil conditioner per tree, and 0.5 ft³ of soil conditioner per shrub or vine, or as Engineer directed.

Remove plants from plastic, metal, or biodegradable containers before planting. Take care to prevent disturbance of the root systems or earth. For bare-root plants, spread out their roots in a natural position, without bunching, kinking or circling.

Fill holes and cavities between plantings and the surrounding soil. In their final position, plant the plants to the depth of the root collar or to the depth of the finished grade when grown in the nursery or container. Finish grading of planting areas as shown on the plans after the soil has settled. After planting is completed, re-cultivate the soil surface to a depth of 2 in or more.

Incorporate commercial fertilizer uniformly into the surface of the soil around trees and shrubs. Use approximately 1 lb of fertilizer per tree, and 0.5 lb of fertilizer per shrub or vine or in amounts as Engineer directed.

Mulch planted areas immediately after planting work in each area is complete and the ground is smooth and clean. Place mulch 3 in to 4 in thick using wood chips or

small bark. Cover the entire area of shrub and vine root systems as well as around trees as shown on the plans.

Remove mulch from plants, structures, roadway areas and grassed areas not to be covered.

Provide select topsoil as shown on the plans, and meeting 711.09, and as shown on the plans.

Thoroughly water trees, shrubs, vines and ground cover during and immediately after planting. Repeat watering as often as necessary until the work is accepted by the Engineer. Exercise care to prevent puddled soil conditions and avoid compaction around the plants after watering.

Obtain water without charge from state-owned or state-controlled water supply systems on the project, if such exist; otherwise obtain water at no cost to the Department.

Prune trees and shrubs when planting and remove broken or damaged twigs, branches, or roots in a manner that retains or encourages plants natural growth characteristics. Paint cut surfaces with a diameter of 1 in or greater immediately with Engineer approved tree wound dressing.

Ensure the establishment of plantings by watering, cultivating, replacing plants or mulch, and other work necessary to maintain the plants in a healthy condition, throughout the plant establishment period of one year or as specified in the special provisions.

If herbicides are used to control weeds, replace and maintain plants and lawn damaged by its use at no additional cost to the Department.

At completion of the original planting, the Engineer will perform an inspection with the Contractor of plant material to note and correct discrepancies. Remove and replace dead plants. Leave plants that do not show expected growth, but retain green leaves, stems, or buds and the Engineer will inspect again during the plant establishment period.

After the original planting the Engineer will periodically inspect the condition of plants and planting areas. The Engineer will notify the Contractor of apparent defects, faults and conditions, and dead plants discovered by the inspection. Correct apparent defects, faults and conditions, and remove, dispose and replace dead plants within 10 days after notification or as Engineer directed.

If immediate replacement of dead or rejected plants is impossible due to seasonal conditions or the lack of specified plants, place a marker at the spot of replacement

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and replace plants next planting season. The Department will require a plant establishment period of six months for replacement plants. Ensure the establishment of the new plantings as specified.

If infestation by insects or disease occurs, treat plants using effective remedial measures that are good horticultural practices and in accordance with best management practices.

620.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Trees, shrubs, vines, or ground cover of the specified sizes and kinds will be by each.
2. Select topsoil will be by the cubic yard.
3. Mulch will be by the cubic yard or ton.
4. Fertilizer will be by the ton or hundred-pound weight (cwt).
5. Soil Conditioner will be by loose cubic yard, using the manufacturer's certification of loose cubic yard when bagged or balled.

620.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Select Topsoil	CY
Mulch.....	CY or Ton
Planting Trees (Seedlings or Container)	Each
Planting Shrubs (Bare-root or Container).....	Each
Planting Vines (Bare-root or Container)	Each
Planting Ground Cover.....	Each
Fertilizer (Commercial).....	Ton or cwt
Soil Conditioner.....	CY

The Department will make progress payments for plants at 80 percent of the contract unit price at the completion of the original planting. The Department will pay the remaining 20 percent at the completion of the plant establishment period when defective plants have been replaced.

SECTION 621 - SEEDING

621.01 Description. Apply seed including: seed bed preparation, fertilizing, seeding, soil amendments, mulch mixtures, mulching, mulch anchoring (mechanical

or tackifiers), hydraulically applied erosion control products, erosion blankets, and watering in the areas shown on the plans.

The Department may require seeding operations in conjunction with 212.

621.02 Materials. Provide materials as specified in:

Seed	711.05
Commercial Fertilizer	711.07
Mulch.....	711.10
Erosion Blankets	711.11
Water.....	711.12
Mulch Tackifier.....	711.16
Mulch plus Tackifier	711.17
Soil Amendments	711.18
Mulch Mixture.....	711.19
Hydraulically Applied Erosion Control Products	711.22

621.03 Construction Requirements.

A. General. Perform seeding operations as specified.

Perform seeding during the season(s) designated in the contract except for seeding used as a temporary erosion and sediment control measure.

If seeding is performed during season(s) designated for seeding, do not perform drill seeding when soil is too wet or dry, frozen or otherwise unillable.

Use drill seeding on areas with slopes 3:1 or flatter, and areas without excessive rock, gravel, or hardpan soil. Unless otherwise specified in the contract, apply fertilizer, seed, and mulch in separate operations, one following the other in this order, with the exception that fertilizer may be applied with a fertilizer attachment at time of seeding or with water when watering is specified. Perform cultivating tilling and drill seeding operations in a cross-slope direction (horizontal) and ensure furrows remain open.

Perform hydro-applications involving combinations of seeding, fertilizing, soil amendments, mulch mixtures, mulching, mulch anchoring (tackifier), and hydraulically applied mulch, with hydro-application equipment, equipped with appropriate pump (preferably centrifugal) and engine size, mechanical agitation (preferably paddle-type) and independent liquid bypass circulation capable of handling and applying a thick homogenous slurry.

B. Seedbed Preparation. Maintain areas to be seeded reasonably free of weeds throughout the growing season using mechanical methods, or by applying

appropriate chemicals, or both until seeding time. Keep weeds from going to seed. Apply chemicals for treating weeds in accordance with manufacturer recommendations.

Cultivate areas to be drill-seeded at least 3 in deep. Work the soil to obtain a surface that permits proper operation of drill seeding equipment.

Cultivate areas to be broadcast seeded immediately before seeding at least 2 in deep and leave in a rough condition, similar to that obtained by walking a cleated-crawler tractor up and down the slopes. Where slopes are benched or serrated, the Department will not require additional preparation.

Roughen and serrate or cross-rip slopes in a horizontal direction for slopes 3:1 or flatter that includes topsoil application before placement of the topsoil. After topsoil has been spread, prepare the surface for seeding.

On areas subject to severe erosion, ensure the extent of seedbed preparation does not exceed the area on which the entire seeding and mulching can be applied within a one-day operation. If conditions occur that prevent seeding at specified furrow depths, or if the roughened condition is destroyed, prepare the seedbed again at no cost to the Department.

C. Fertilizing (Commercial). Provide the type and application rate of fertilizer as specified. Apply fertilizer by the most appropriate of the following methods:

1. Fertilizer drill
2. Broadcast
3. Water applied

Wherever physically possible, place fertilizer with the seed at time of drill seeding using a fertilizer attachment. Fertilizer may be broadcast (wet or dry) or with drill attachment. Fertilizer may be applied with irrigation water as Engineer approved. Dry fertilizers may be applied directly to the soil and lightly incorporated into the soil surface (not for slopes greater than 3:1) followed by the seed application. Apply fertilizer when average noontime temperatures are 60 °F or lower on established stands.

D. Seeding. Unless otherwise specified, the Department will provide seed at no cost to the Contractor. Use the mix and rate of seeding specified. Apply native shrub and forb species separately from grass species. If seed is applied using broadcast seeding, rake the soil or mechanically roughen the soil before applying seed, mulch mixture, or both.

Apply seed uniformly over the seeded area by the most appropriate method (as determined by slope, soil or site conditions) using one of the following methods:

1. Drill seeding (no-till drill, double disc with agitator or spinning disc) - for slopes 3:1 or flatter.
2. Broadcast seeding:
 - a. Hydro-seeder.
 - b. Dry (whirlwind) - for embankment slopes or cut slopes as approved by the Engineer.

When drill seeding, without using mulch, set drill row depth not to exceed $\frac{1}{2}$ in deep according to the size and dimension of seed, and place seed on the bottom of the furrow. Regulate the speed and spring pressure of the drills so that $\frac{1}{2}$ in of soil covers the seed and the furrows are left open. Do not use drag chains.

For drill seeding applications, apply soil conditioner before seeding and lightly incorporate into the soil wherever possible.

When mulch is applied or used after drilling, place seed as shallow in the soil as possible and cover well. Do not perform seeding applications when wind interferes with mulch or seed placement. Broadcast native seeds in the mix immediately ahead of the drill or seed separately. Ensure drill spacing does not exceed 9 in. Seed legume seed through a separate box from the grass seed, with seed spouts out, or broadcast ahead of the drill. Thoroughly mix seed before placing in the drill or seeder box.

If area to be seeded is impractical for drill seeding method, broadcast the seed using a hydro-seeder or dry broadcast equipment. Apply seed, fertilizer, mulch or combined fertilizer and mulch in separate applications. Do not mix fertilizer with the seed in the hydro-seeder. Apply seed to the seeded area first followed by the fertilizer, mulch, or fertilizer mulch combined application second. Ensure agitation of seed in hydro-seeder does not exceed 12 minutes. Do not apply hydroseeding mixture if rainy conditions are anticipated outside manufacturer's application recommendations. In the event of unanticipated rainy conditions, re-apply the hydroseeding mixture to uncured areas at no additional cost to the Department.

Do not allow trucks or equipment to drive on the area after seed is in place.

E. Mulch, Mulch Anchoring, and Hydraulically Applied Erosion Control Products.

1. Mulch. Do not use hydro-mulch applications on slopes flatter than 3:1 or in conjunction with drill seeding applications. Do not perform mulching when

wind interferes with mulch placement. Apply straw, grass hay, wood fiber, soil amendments, mulch mixture, or any combination of these materials as Engineer directed. Ensure material applied to the ground allows for the absorption and percolation of moisture. Apply at the following rates:

- a. Straw or grass hay (air dry). 2 Ton/Acre
- b. Wood fiber. 1 Ton/Acre
- c. Soil Amendments.....As specified

2. Mulch Anchoring.

- a. Mechanical. Use mechanical mulch anchoring on slopes 3:1 or flatter as Engineer directed. Anchor mulch into the soil by use of a heavy disc with flat scalloped discs approximately $\frac{1}{4}$ in thick, having dull edges and spaced at least 9 in apart. Ensure anchoring to a depth of at least 2 in with no more than one pass of the equipment on the same surface.

Install mechanical anchoring in a horizontal direction to the slope.

- b. Tackifier. Use mulch tackifiers on slopes 2:1 or steeper. Anchor mulch using a tackifier applied in accordance with the manufacturer's written instructions and at a rate for the material, soil types, conditions, and degree of slope.

If applied separately, incorporate a method to differentiate between the tackifier and mulch material, by color or tracer material, during tacking operations. Do not apply tacking when wind interferes with tackifier placement.

3. Hydraulically Applied Erosion Control Product.

Provide a mixture that is nontoxic to animals, soil microorganisms, and aquatic and plant life and that does not interfere with or impede seed germination or vegetative growth and establishment.

- a. Hydraulic Mulch. Mix and apply the mixture, in accordance with the manufacturer's written instructions and at a rate for the soil type, roughness of surface, conditions and degree of slope.
- b. Stabilized Mulch Matrix. Mix and apply the mixture, in accordance with the manufacturer's written instructions and at a rate for the soil type, roughness of surface, conditions and degree of slope.

- c. Bonded Fiber Matrix. Mix and apply the mixture, in accordance with the manufacturer's written instructions and at a rate for the soil type, roughness of surface, conditions and degree of slope.
 - d. Fiber Reinforced Matrix. Mix and apply the mixture, in accordance with the manufacturer's written instructions and at a rate for the soil type, roughness of surface, conditions and degree of slope.
- F. Erosion Blankets.** Install erosion blankets on slopes in a vertical direction and in accordance with the manufacturer's recommendations or as Engineer directed.
- G. Watering.** Provide a temporary water delivery system by use of either sprinklers or trucks.

Apply water by the acre unit (AU) when Engineer directed. Keep pipe connections tight to avoid leakage and washing. Maintain sprinklers in proper working order. Should runoff begin, stop watering and apply the balance after earlier water has penetrated the soil. The Department considers the standard application rate is 16,000 gal/acre which constitutes the quantity of water that saturates the soil to a depth of 4 in under average conditions.

The Engineer will inspect for the 4 in depth of saturation by excavating to a depth of 4 in and observing wetness. The Department intends that the locations of inspection for wetness be reasonable and not on "slick spots" or in unrepresentative areas.

621.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. For determining areas: measurements taken at right angles to the roadway centerline will be on slope distances. Measurements parallel to the centerline will be horizontal.
2. Seedbed preparation will be by the acre
3. Seeding, mulching, mulch anchoring, soil amendment, mulch mixture, and fertilizing will be by the acre for each time this work is performed. Provide weight measurements of the materials used to verify that appropriate rates were applied.
4. Mulch plus tackifier will be by the acre; or by the square yard for each time this work is performed.

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5. Hydraulically applied erosion control products will be by the acre; or by the square yard for each time this work is performed.
6. Erosion blankets will be by the square yard.
7. Water delivery system will be per lump sum.
8. Watering will be by the acre unit. The Department defines an acre unit (AU) as that quantity of water required for saturating a 1-acre area to at least 4 inches deep.

621.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows.

Pay Item	Pay Unit
Seedbed Preparation	Ac
Seed	Ac
Seeding	Ac
Mulching	Ac
Mulch Anchoring (Mechanical)	Ac
Mulch Anchoring (Tackifier)	Ac
Soil Amendments	Ac
Mulch Mixture	Ac
Mulch plus Tackifier	SY or Ac
Hydraulically Applied Erosion Control Products	SY or Ac
Erosion Blanket	SY
Fertilizing	Ac
Provide Water Delivery System	Lump Sum
Watering	AU

The Department considers weed control the responsibility of the Contractor and to be provided at no additional cost to the Department. Obtain the Engineer's approval for the method of weed control.

SECTION 622 - PRE-CAST CONCRETE HEADGATES

622.01 Description. Provide and install pre-cast concrete headgates.

622.02 Materials. Provide material as specified in 509.

622.03 Construction Requirements. Shape the area to be occupied by the headgate to conform to the structure and to provide a firm and uniform bearing over its entire area. Backfill and compact the dike or ditch around the structure to avoid undercutting or erosion.

622.04 Method of Measurement. The Engineer will measure acceptably completed work per each, including one length of pipe in addition to the pipe cast in the headwall.

622.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Pre-cast Concrete Headgate.....	Each

Structure excavation, backfill, and compacting backfill are incidental and the cost included in the contract unit price for pre-cast concrete headgate item.

SECTION 623 - CONCRETE SLOPE PAVING

623.01 Description. Construct concrete slope paving around structures and on embankments.

623.02 Materials. Provide materials for concrete slope paving as specified in 509. Provide No. 5 coarse aggregate for those portions of slope paving designated as "exposed aggregate," unless otherwise designated on the plans. Provide Class 22 concrete for slope paving with 4 percent to 7 percent entrained air.

When colored concrete is specified, provide colorants and submit a color panel for Engineer approval.

Where exposed aggregate slope paving is specified, submit the method of obtaining the finish and an exposed aggregate panel for Engineer approval.

Provide preformed-expansion joint fillers in accordance with 704.01. The Contractor may use sound cedar or redwood unless other types are specified.

623.03 Construction Requirements. Construct as specified in 509.

Grade the slope paving area and compact to 90 percent density as specified in 205.

As soon as the desired exposed aggregate surface has been attained and washed, cure the concrete surface as specified in 509.

623.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard of finished surface, measured in the plane of the finished surface.

623.05 Basis of Payment. The Department will pay for the accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Concrete Slope Paving	SY

SECTION 624 - RIPRAP

624.01 Description. Provide and place riprap.

The Department will specify riprap as loose riprap, or hand placed riprap.

624.02 Materials. Provide material as specified in:

Loose Riprap	703 and 711.04
Hand Placed Riprap	703 and 711.04

624.03 Construction Requirements. Excavate the toe trench for riprap below probable scour elevation or to the elevation specified. Excavate the trench 2 ft below channel grade where scour elevation cannot be determined and no elevation is shown on the plans. Do not lay stone or place concrete until the toe trench and slopes are Engineer approved.

- A. Loose Riprap.** Place loose riprap so the larger stones are in contact with each other and the voids are filled with the finer materials, producing a well graded compact mass. Place the stone on the slope in a way that ensures the specified thickness in one operation. Do not disturb the underlying material when placing the riprap. Do not place in layers parallel to the slope.
- B. Hand Placed Riprap.** Lay the stones by hand on prepared slopes to the thickness specified or Engineer directed. Start by placing a course of the largest stones in the toe trench. Place each stone so that it rests partly on the prepared slope and not completely on the stone below and thoroughly tamp or drive into place. Make the exposed face of hand placed riprap as smooth as the shape and size of the stones will permit, and ensure it does not vary more than 3 in from a plane surface on the required finished slope.

624.04 Method of Measurement. The Engineer will measure acceptably completed work by the ton or cubic yard of riprap.

624.05 Basis of Payment. The Department will pay for the accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Loose Riprap	Ton or CY
Hand Placed Riprap	Ton or CY

The Department will pay for excavation of toe trenches below the level of the

intersection of the slope to be riprapped and the adjacent final ground or channel floor as specified in 210.

Riprap/Erosion control geotextile, if used, will be paid for as specified in 640. Preparation of the slope to receive riprap above the level of the intersection of the slope to be riprapped and the adjacent final ground or channel floor is incidental and the cost included in the contract unit price for riprap items.

SECTION 625 - JOINTS

625.01 Description. Provide and install joint material.

625.02 Materials. Provide materials as specified in:

Pre-formed Expansion Joint Filler	704.01
Joint Sealer for Asphalt and Concrete Pavements.....	704.02
Hot Poured Elastomeric Type Concrete Joint Sealer	704.03
Neoprene Compression Seal	704.04
Silicone Sealant	704.05

625.03 Construction Requirements. Place pre-formed expansion joint filler accurately in the positions and to the lines and elevations shown on the plans. Firmly anchor the pre-formed expansion joint filler to the surface of the concrete on one side of the joint with 30d wire nails or 9 gage wire cast into the concrete.

Mix and apply hot poured sealers in accordance with the manufacturer's recommendations. Apply silicone sealant in accordance with the manufacturer's recommendations.

Clean the joint. Properly repair spalls or breaks before sealing. Install neoprene compression seals by first coating either the sealer or the sides of the joint, or both, with the adhesive lubricant. Push the sealer down so that it is at least $\frac{1}{4}$ in and no more than $\frac{3}{8}$ in below the surface of the bridge deck at the edge of the joint, and at least $\frac{1}{8}$ in and no more than $\frac{1}{4}$ in below the surface of concrete pavement at the edge of the joint. Install the joint material to extend from edge to edge of the slab in one continuous length. Do not stretch the sealer more than 8 percent of its original length during installation.

625.04 Method of Measurement. Not Specified.

625.05 Basis of Payment. Providing the material and performing the specified work is included in the contract unit prices for the structure or pavement items.

SECTION 626 - TEMPORARY TRAFFIC CONTROL DEVICES

626.01 Description. Provide, install, maintain, and relocate temporary traffic control devices.

The Department considers temporary traffic control devices provided by the Contractor to remain the property of the Contractor and be removed from the project when no longer required. The Department requires temporary traffic control devices provided by the Department be returned to the Department when no longer required on the project.

626.02 Materials. Submit for Engineer approval a list of materials proposed for installation. Provide traffic control devices as specified in 107.06. The Engineer may sample and test the materials at their point of manufacture, upon arrival at the project site, or at any point during the life of the project.

Ensure the reflectorized traffic control devices meet the requirements specified in 712.02.

Use drums for traffic control devices constructed of yielding materials. The Department considers metal drums unacceptable for use as traffic control devices. Ensure the design of the drums limits rolling to a minimum if upset by outside forces. Ensure drums have retroreflective markings on the bottom and top unless the base and top are designed to separate on impact. Do not use sandbags or weights on top of the drums.

- A. Barricades.** Provide barricades that have the following minimum lengths unless otherwise Engineer approved:
1. Type I - 6 ft
 2. Type II - 2 ft
 3. Type III - 7 ft
- B. Temporary Marking Tape.** Provide Retroreflective Temporary Pavement Marking Tape that is pre-coated with pressure sensitive adhesive, 4 in wide, thin, flexible, formable, durable, capable of conforming to the texture of the pavement surface, and adheres tightly to the roadway surface. The tape must be manufactured for use as temporary pavement markings suitable for use on concrete or asphalt surfaces in white or yellow as specified. Ensure the tape has no protective liner and does not require activation. Ensure the tape remains removable without sandblasting, solvents, or grinding.
- C. Arrow Boards.** Provide Advance Warning Arrow Boards that meet the following:

1. Solid construction with a non-reflective black finish.
2. If vehicle-mounted, then with remote controls.
3. With an hour meter that records only actual hours of operation.
4. Three mode selections:
 - a. A Flashing Arrow, Sequential Arrow, or Sequential Chevron mode;
 - b. A flashing Double Arrow mode; and
 - a. A flashing Caution or Alternating Diamond mode.
5. Minimum element on-time of 50 percent for the flashing mode and 25 percent for each sequential phase.
6. A flashing rate of not less than 25 or more than 40 flashes per minute.
7. Capable of dimming to a minimum of 50 percent from full brilliance for nighttime operation only.
8. Meeting the requirements of Table 626.02-1.

Table 626.02-1 - Arrow Board Criteria

ARROW BOARD TYPE	MINIMUM SIZE	MINIMUM NUMBER OF BOARD LAMPS	MINIMUM LEGIBILITY DISTANCE
A	48 in. x 24 in.	12	1/2 mi.
B	60 in. x 30 in.	13	3/4 mi.
C	96 in. x 48 in.	15	1 mi.

- D. Flexible Pavement Markers.** Provide temporary flexible raised pavement markers (seal coat tabs) that meet the following:
1. Are configured as follows:
 - a. A yellow body with yellow reflective tape on two sides and a single or double protective cover, or
 - b. A white body with white reflective tape on one side and a single or double protective cover.
 2. Are manufactured from a flexible polyurethane material with a factory applied adhesive on the marker base with release paper.

626.02

3. Is metalized polycarbonate micro-prismatic retro-reflective material with acrylic backing.
4. Meets the retroreflectivity requirements for reboundable sheeting in 712.02.
5. Have covers attached to the vertical part of the marker so that it will not come off due to traffic, but can be easily removed manually.

E. Rigid Pavement Markers. Provide temporary rigid raised pavement markers that meet the following:

1. Are non-snowplowable with no studs or mechanical attachments.
2. Are configured as follows:
 - a. Two-way centerline applications — yellow markers that have a bi-direction retro-reflective configuration;
 - b. Edge line applications — yellow or white marker as required that have a mono-directional retro-reflective configuration;
 - c. One-way lane separation applications — white markers that have a bi-directional retro-reflective configuration.
3. Are suitable for use on concrete or asphalt surfaces.
4. Are made of high impact durable material that will not deflect or deform under tire impacts.
5. Have nominal 4 in outside dimension, with a minimum installed height of 0.75 in.
6. Have a reflective surface area that is at least one square inch and displays the same color both day and night.
7. Have a Specific Intensity (SI) (candlepower/foot-candle) for each white retro-reflective surface at 0.2° observation angle that is at least the following when the incident light is parallel to the base of the marker in accordance with ASTM D 4280 and Table 626.02-2.

Table 626.02-2 - Rigid Pavement Marker Criteria

Horizontal Entrance Angle	SI
0 degrees	3.0
20 degrees	1.5

8. Has an SI for each yellow marker surface that is 60% of the value for white.
9. Ensure markers are removable from asphalt and concrete pavements, either manually or by mechanical devices, without the use of heat, grinding or blasting.

F. Tubular Markers. Provide portable tubular markers that meet the following:

1. Are orange or fluorescent orange.
2. Made of plastic or other yielding materials.
3. Are at least 36 in high and have at least 3 in width when facing traffic.
4. Have retro-reflective bands that meets Class B sheeting as specified in 712.02.
5. Has a single base weight of at least 15 lb.

Provide incidental traffic control items that are Engineer approved.

626.03 Construction Requirements. Design, use, and maintain traffic control devices in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), as adopted by the State.

Provide and place traffic control devices that demonstrate acceptable field performance.

Do not use a device for purposes other than those for which it is Engineer approved.

Cover or remove traffic control devices not currently necessary for the safety of project personnel or traveling public.

Provide retroreflectometer measurements taken by using a properly calibrated retro-reflectometer and documented testing procedures to ensure that designated traffic control devices comply with the retroreflectivity requirements of Chapter 2 of the Manual on Uniform Traffic Control Devices (MUTCD) as adopted by the State, when Engineer requested. Repair or replace any traffic control device found defective or damaged at no additional cost to the Department.

Unless otherwise specified on the plans, be responsible for taking appropriate preventative measures and supplying and installing supplemental devices necessary to ensure that traffic control devices remain in place and serviceable during the time that their use is required. This requirement includes providing supplemental devices to ensure that portable sign stands, barricades, drums, tubular markers, and cones are not displaced from their intended use.

- A. Traffic Control Maintenance.** Traffic control maintenance is the man-hours of labor for relocating, cleaning, maintaining, moving between projects on multiple project contracts; and immediately repairing damaged, inoperative, or no longer useable traffic control devices as Engineer determined. Labor will also include installing and removing Department furnished guide and regulatory signs.

Record the number of man-hours for traffic control maintenance each day on report sheets furnished by the Engineer. Provide the report sheets at the close of every work week for the Engineer and the Contractor to review and agree on the number of weekly hours to be authorized.

- B. Temporary Pavement Marking Tape.** Provide and place temporary pavement marking tape to temporarily mark lane separation lines for traffic channelization. Install temporary pavement marking tape as soon as practical and before nightfall, on newly placed pavements, including leveling courses, scrub coats, asphalt treated bases, road mix pavements, and asphalt plant mix surface courses. Use sections of temporary pavement marking tape 4 in x 2 ft and install at the same cycle length as detailed on the permanent marking plan. Use half cycle lengths with at least 4 in x 2 ft strips on roadways with severe curvature, or as Engineer directed.

During use, maintain the tape in its proper location and in effective condition to serve the purpose that it is intended.

- C. Advance Warning Arrow Boards.** Provide and place Advance Warning Arrow Boards, which include operating costs and maintenance. Mount the boards on a vehicle, trailer or other suitable support, with the bottom of the board at least 6 ft above the roadway surface.

Use the dimmed mode for nighttime operation of arrow boards. Full brilliance should be used for daytime operation of arrow boards.

- D. Temporary Flexible Raised Pavement Markers (seal coat tabs).** Provide and place temporary flexible raised pavement markers to temporarily mark edge lines, lane separation lines, and turn bays on pavements used by traffic. Place markers on their own respective color of pavement markings. Use two markers placed side by side to mark double width lines. Do not use markers for periods exceeding 3 days. Provide and replace markers that get displaced at no additional cost to the Department. The Engineer may require additional markers placed at a reduced spacing.

For edge lines and lane separation lines, place a single marker at the skip cycle length of the permanent marking or a skip cycle length based on the posted

speed of that roadway segment. Reduce marker spacing to half cycle lengths on roadways with severe curvature.

For turn bays, place markers at angle points and on solid lines at a spacing of 25 ft or less.

Provide markers with transparent covers over the retro-reflective portion of the markers for seal coat operations as follows:

- a. A single transparent cover for seal coats without a fog coat.
- b. A double transparent cover for seal coats with a fog coat.

Place markers no more than 24 hr before being seal coated and replace the markers with permanent markings in no more than 14 days. Remove the marker cover after each seal coat and each fog coat. Before seal coating, provide and replace markers that get displaced at no additional cost to the Department.

- E. Temporary Rigid Raised Pavement Markers.** Provide and place non-snow-plowable, temporary rigid raised pavement markers placed in conjunction with tubular markers to temporarily mark lane separation lines between bi-directional traffic as shown on the plans or as Engineer directed. Fasten markers to the pavement by adhesion in accordance with the manufacturer's recommendations so they will remain firm. Do not use nails to fasten markers to the pavement. Protect markers from traffic until the adhesive has properly cured.

Visually inspect installed markers at least twice daily.

- F. Barricades.** Provide and place barricades as shown on the plans or Engineer directed.
- G. Incidental Traffic Control Items.** Provide and replace any incidental traffic control items as shown on the plans or Engineer required, but not covered by other items for which a bid quantity is established.
- H. Removal of Traffic Control Devices.** Do not remove signs, barricades, or other traffic control devices the Engineer approved for payment from the project until removal is approved in writing by the Engineer.

626.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Construction Signs will be by the square foot of sign face.
2. Barricades, Drums, Portable Tubular Markers, and Vertical Panels will be per each.

627.02

3. Temporary Pavement Marking Tape will be by the foot of 4 in tape placed on the roadway.
4. Incidental Traffic Control Items will be by the lump sum.
5. Advance Warning Arrow Boards will be by actual hours of operation as shown on the hour meter.
6. Traffic Control Maintenance will be by the actual man-hours authorized by the Engineer.
7. Temporary Flexible Raised Pavement Markers will be per each.
8. Temporary Rigid Raised Pavement Markers will be per each.

626.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Rent Construction Signs, Class ____	SF
Rent Construction Barricade, Class ____ Type ____	Each
Rent Drums, Class ____	Each
Rent Incidental Traffic Control Items	Lump Sum
Rent Vertical Panels, Class ____	Each
Rent Advance Warning Arrow Board, Type ____	Hour
Temporary Pavement Marking Tape (Yellow)	ft.
Temporary Pavement Marking Tape (White)	ft.
Traffic Control Maintenance	Man-Hour
Temporary Flexible Raised Pavement Markers	Each
Rent Portable Tubular Markers	Each
Temporary Rigid Raised Pavement Markers.....	Each

SECTION 627 - PAINTING

627.01 Description. Prepare surfaces and apply paint to specified surfaces. Provide protective devices so as not to damage the work, facilities, or traffic. Dispose of waste.

627.02 Materials. Provide materials as specified in 707 for selected paint systems.

Use the following structural steel paint systems:

System A - Application to newly fabricated girders and bearings.

System B – Application to newly fabricated railing, immersion service (2 coats of epoxy below water line and one coat of urethane above the waterline), and repair of System A.

System C & D – Spot, zone, or encapsulation of existing paint, including lead based paint. (Special Provisions required and existing paint system evaluated for painting).

System E - Selected immersion service based on environmental conditions of water quality.

Each system for structural steel paint is described in Table 627.02-1.

Table 627.02-1 - System Descriptions

System	Application	Layer - Formula	Composition	Dry Film Thickness
A	Shop only	Primer - 1 Intermediate - 5 Top Coat - 8	Inorganic Zinc Epoxy Polyurethane	3-5 mils 4-6 mils 2-4 mils
B	Shop or Field	Primer - 2 Intermediate - 5 Top Coat - 8	Organic Zinc Epoxy Polyurethane	3-5 mils 4-6 mils 2-4 mils
C	Shop or Field	Primer - 3 Intermediate - 6 Top Coat - 9	Moistures Cured Urethanes Moistures Cured Urethanes Moistures Cured Urethanes	3-5 mils 3-5 mils 3-5 mils
D	Shop or Field	Primer - 3 Intermediate - 6 Top Coat - 8	Moisture Cured Urethanes Moistures Cured Urethanes Polyurethane	3-5 mils 3-5 mils 3-5 mils
E	Shop or Field	Primer - 4 Intermediate - 5 Top Coat - 8	Epoxy Epoxy Polyurethane	4-6 mils 4-6 mils 3-5 mils

627.03 Construction Requirements.

- A. General.** Comply with applicable environmental protection and occupational safety and health standards, rules, regulations, and orders. Failure to comply is sufficient cause for suspension or disqualification.

Contain waste materials, such as used blasting material and old paint, classified as hazardous, and dispose of according to the applicable Federal, State, and local laws.

Provide protective devices such as tarps, screens, or covers as necessary to prevent damage to the work and to other property or persons from cleaning and painting operations.

Assume responsibility for damage to vehicles, persons, or property resulting from the painting operations.

Remove or obliterate paint or paint stains that result in an unsightly appearance on surfaces not designated to be painted.

Protect the prepared surface from weather and contamination before and during the application process. Protect the work against disfigurement by splatters, splashes, and smirches of paint materials. Protect painted surfaces from weather, contamination, and damage until the paint has dried.

Repair painted surfaces that are marred or damaged during the operation to a condition equal to that of the coating specified.

Sprinkle the adjacent roadbed and shoulders with water or dust abatement for a sufficient distance on each side when traffic causes an objectionable amount of dust.

After painting operations are complete, thoroughly clean the painted surfaces of other work that would cause dust, grease, or other foreign materials to be deposited on the painted surfaces.

Ensure the dry film thickness of each coat and total thickness of the finished product is as specified. Determine the thickness of previously applied coatings, or an existing coating that is to be top coated on steel, in accordance with Steel Structures Painting Council SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages, before applying the next coat.

Separately apply each coat of paint to ensure complete coverage. Hide the previous coat by a single coat of the next application.

Apply paint only on clean and dry surfaces and only during periods of favorable weather and as follows:

1. The atmospheric temperature, paint and surface to be painted are between 45 °F and 100 °F when metal surfaces are 5 °F above the dew point.
2. The humidity is less than 85 percent at the work site. Determine the dew point with the use of a psychrometer and psychrometric tables.
3. Do not paint when the temperature of the air, paint, or metal is below that described in the product technical data sheet; when the air is misty; or when conditions are otherwise unsatisfactory.
4. Do not paint damp or frosted surfaces or surfaces hot enough to cause the paint to blister, to produce a porous paint film, or to cause the vehicle to separate from the pigment.
5. Do not apply paint coat if the anticipated atmospheric temperature will not remain above 45 °F during the drying period.

Provide a suitable enclosure to allow painting during inclement weather. Control atmospheric conditions inside the enclosure throughout the painting operation. Remove the enclosure when the paint is dry or weather conditions allow open exposure.

Perform painting in a neat and skillful manner. Ensure the application is without runs, sags, skips and other defects. The Contractor may apply a subsequent coat only when the previous coat is dry and clean.

Provide rollers, when used, of a type that does not leave a stippled texture in the paint film.

If air spray is used, provide suitable traps or separators to exclude oil and water from the air. Keep the paint thoroughly mixed by continuous mechanical agitation. Keep paint thoroughly mixed so the pigments stay suspended during its application.

Thin the paint in accordance with the manufacturer's recommendations and product data sheets.

The same manufacturer shall furnish coatings for the complete system.

Store paint materials in the manufacturer's original containers, in a weather tight space, and where the temperature is maintained within the paint manufacturer's recommended storage temperature range, but in no case where the temperature is lower than 40 °F or greater than 100 °F. Monitor the paint

material storage facility with a high-low recording thermometer device. Ensure paint storage facility is separate from the storage facilities used for storing painting equipment, storing contaminated waste, or construction generated waste.

Warrant coatings for a period of one year after acceptance.

B. Painting of existing structural steel.

Apply coating systems on existing structural steel as specified in the Special Provisions.

C. Painting new structural steel

1. Surface Preparation. References, such as SSPC-SP 10 or SSPC-PA 1, refer to Volume 2, *Systems and Specifications*, of SSPC's *Steel Structures Painting Council Manual*. SSPC-Vis 1 refers to SSPC's *Visual Standards For Abrasive Blast Cleaned Steel*.

Blast clean all new steel structure surfaces to be coated as specified in SSPC-SP 10, "Near-White Blast." Use methods specified in SSPC-SP 1, "Solvent Cleaning," SSPC-SP 2 "Hand Tool Cleaning," and SSPC-SP 3, "Power Tool Cleaning," as necessary to supplement blast cleaning. The "Near-White Blast" surface is shown in the pictorial standards of SSPC-Vis 1. If a conflict between the pictorial standard and the written SSPC definition, follow the written definition.

Prepare contaminated surfaces to the Engineer's satisfaction before application of coating material. Ensure the surface covered with a coating is free of moisture, dust, grease, or other substance that prevents bonding.

Perform blast cleaning using an abrasive that will uniformly produce a surface profile of 1.5 mils to 3.5 mils deep, in a dense, uniform pattern of depressions and ridges but no greater than that recommended by the paint manufacturer. Verify the surface profile obtained on the prepared surface using ASTM D 4417 Standard Test Method of Surface Profile of Blast Cleaned Steel, Method A or C. Grind laminations raised by the blasting operation to a flush surface and reblast the ground area to obtain the specified anchor pattern. Make a written record of surface profile measurements for the Engineer.

Grind the edges of flame cut steel that will receive paint until the hardened edge accepts the abrasive blast imparted during the blasting process.

ture. Verify the surface profile obtained on this prepared surface using ASTM D 4417 Method A, Surface Comparator.

Prepare edges of plates of main stress carrying members, except bearing stiffeners and girder webs, in accordance with ANSI/AASHTO/AWS D1.5M, Section 3.2.9.

Meet the welding requirements of ANSI/AASHTO/AWS D1.5M, Bridge Welding Code, before painting.

2. Materials. Meet the materials requirements as specified, with an inorganic zinc primer, epoxy intermediate, and a polyurethane topcoat.

Paint the structural steel shown on the plans using paint System A (Table 627.02-1).

Ensure the coated steel final dry film thickness is 9 – 15 mils.

Submit a manufacturer's certification stating that the coating materials meet the specifications and that the coatings are compatible.

The Engineer will not allow application of coating materials until the product certifications have been provided and the materials have been tested and accepted by the Central Materials Laboratory in Boise, Idaho. Notify the Engineer at the pre-construction meeting which manufacturer's products will be used along with the paint supplier's name and telephone number. The Central Materials Laboratory will set up the inspection of the products at the manufacturer's plant or supplier's facility upon notification. The Department will inspect, sample, test and approve the products before being released for shipment to the fabricator or the field painter. Allow two weeks minimum for the testing of the paint samples in the Central Materials Laboratory after the products are received into the laboratory system.

Submit for Engineer approval the paint manufacturer's current product data sheets, mixing and thinning directions, recommended spray nozzle types and sizes, spray pressures, minimum drying times, temperature and humidity data for curing, and other pertinent product information that will be used on the project.

3. Coating of New Structural Steel. When not in conflict with these specifications perform coating application using trade best practices, coating manufacturer recommendations, and those applicable portions of SSPC-PA 1.

Prepare surface of the structural steel specified to receive the paint system; apply furnish, and protect both shop and field applied paint coatings; and complete other work specified.

Apply in the shop the prime, intermediate and topcoat coatings in accordance with the manufacturer's instructions and this subsection.

The steel fabricator applying the shop coats and the Contractor or subcontractor performing the field painting shall be certified in accordance with the Steel Structures Painting Council (SSPC) "Painting Contractor Certification Program", or approved equal. "approved equal" can be documentation that the Fabricator, the Painting Subcontractor or both have been successful in applying bridge paint systems for at least the past 5 years.

Clean the surfaces prepared for painting for the Engineer's approval. The Engineer will observe and inspect the first applications of the three paint coats. Ensure the first members painted with the three-coat system meet the satisfaction and approval of the Engineer. Once approved this application of coatings will be the standard that the Engineer will judge the remaining paintwork.

Only apply a prime coat in the shop to faying surfaces and the exposed bolted connection areas where bolt heads, washers, and nuts are exposed to the steel. The design of bolted faying surfaces for this project is for a Class B Slip Coefficient. Ensure that the faying surfaces are painted to the correct paint dry film thickness to provide a Class B Slip Coefficient. Mask other coats from the faying surface. Supply a Paint Manufacturer's Certification of Testing that the paint to be used will provide the required resistance at the proposed thickness, when tested in accordance with the requirements of the Research Council on Structural Bolting "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints."

Apply coatings in an enclosed shop with a controlled environment to match optimum conditions for application and curing as recommended by the paint manufacturer.

Apply the prime coat the same day as the steel is blasted. If the steel shows any flash rusting before being primed, blast clean the steel again to the specification requirements. If material, other than rust, contaminates the prepared surface, clean the surface to the requirements of these specifications and the Engineers approval before making the succeeding application.

Apply each coat in a uniform layer, completely covering the preceding coat. Tint the individual coats sufficiently different so skips and holidays can be easily detected. Correct runs, sags, skips, mud cracking, holidays, or other deficiencies before application of succeeding coats. The Engineer may require corrective work such as re-cleaning, application of additional coating, or other measures at no additional cost to the Department.

Precede each specified coat by a strip coat on edges, corners, seams, crevices, interior angles, joining members junctions, rivet or bolt heads, nuts and threads, weld lines, and similar surface irregularities. Ensure a sufficient thickness of strip coat completely hides the surface being covered; follow as soon as practical by the application of the full prime, intermediate, or finish coats to its specified thickness. Application of this strip coat may require special techniques in accordance with the manufacturer application specifications.

Prepare and coat the steel surfaces inaccessible to preparation and coating after erection with all coats before erection. Discuss inaccessible areas with the Engineer before painting.

Make and record coating thickness measurements and a visual inspection for complete coverage after the each coat application and before succeeding coat application. If dry film thickness measurements or visual inspections of coverage do not meet the specified minimum, make additional applications. Measure dry film thickness above the average magnetic surface profile of the anchor pattern in the steel substrate.

The Engineer will measure the dry film thickness for acceptance using ASTM D 1186, Method A or B (magnetic gauge or magnetic flux gauge). If a question arises about an individual coat thickness or coverage, the Engineer will verify using ASTM D 4138, Method A (Tooke Gauge). If the Tooke Gauge shows a prime coat thickness to be less than the specified minimum thickness or a missing intermediate coat, the Engineer will reject the total coating system on that member even if the thickness of the total system equals or exceeds total thickness specified. The Contractor or the fabricator shall reclean and recoat the steel at no additional cost to the Department. On areas where the Tooke Gauge is used to determine coating thickness and the prime coat is determined to be of the correct thickness, repair the destructive test area in accordance with the approved repair procedure. Repair the test area at no additional cost to the Department.

In areas where dry film thickness measurements are impractical, the Engineer will measure wet film thickness in accordance with ASTM D 1212 or ASTM D 4414.

4. Field Painting and Repair. Supply the Engineer approved steel fabricator field and repair procedures plan to the field personnel. Ensure field repairs include the application of the complete three-coat system (primer, intermediate coat, and finish coats) on all surfaces. Use Formula 2 – Organic Zinc Rich with a dry film thickness of 3 – 5 mils in the field for minor primer damage.

Clean the erected exposed bolted areas and areas with exposed primer with intermediate and topcoat application.

Make field painting and repairs in accordance with the coating manufacturer's recommendations and the field painting and repair plan. The Engineer will review the field painting areas for approval before final acceptance.

Prevent damage with temporary attachments or supports for scaffolding or forms to the coating system. Repair damage that may occur in accordance with the prescribed procedure at no additional cost to the Department.

5. Protection of the Work. Adequately Protect the work until final acceptance. Protect surfaces not to be coated under this contract from over spray and drippings. Repair painted surfaces that are marred or damaged with materials to a condition equal to that required for the finished surface.

Replace or repair damaged coatings at no additional cost to the Department.

6. Environmental Control. Apply coating materials as specified and the manufacturer's specifications. Adhere to the manufacturers specifications for uniform temperature and humidity for the curing of the inorganic zinc.

The Engineer will not allow application if conditions are not favorable for the proper application and performance of the coating.

7. Transportation and Erection. Exercise extreme care in handling the steel in the shop, during shipping, during erection, and during subsequent erection of the bridge. Insulate the steel from the binding chains by Engineer approved softeners. Pad hooks and slings used to hoist steel. Space the diaphragms and similar pieces so that no rubbing damage to the coating will occur during shipment. Store the steel on pallets at the job site, or

by other Engineer approved means so that it does not rest on the dirt or so that components do not fall or rest on each other. Before shipping the steel, present shipping and job site storage details to the Engineer for approval at the prefabrication meeting.

8. Sealing. Fill and seal crevices and gaps between structural shapes and plates, around bolt heads or nuts, and similar areas that would retain moisture with the following:
 - a. Coating materials where possible.
 - b. Sealant if the crevice or gap cannot be bridged with coating materials. Apply the sealant after complete application of topcoat.
 - c. Backing material and sealant to fill crevices and gaps that the sealant alone cannot bridge. Apply sealant over the backing material to form a watertight seal.
9. Stenciling. Stencil the month and year of application and the type of coating used in 2 inch high block letters at two locations on the structure being coated. The Engineer will determine the exact location of stenciling. Color the stenciling flat black unless otherwise Engineer directed.
10. Quality Control and Assurance Inspection. Be responsible for Quality Control (QC) of the surface preparation and painting. Submit a QC plan to the Engineer for approval before starting work. Perform inspection and testing as specified in the QC plan.

Ensure the QC plan includes at least the following information:

- a. Paint manufacturer brand and type of paint proposed for each coat.
- b. A copy of the manufacturer's certification per 707.03 that the paint meets the project requirements including the VOC limitations.
- c. Curing timetable with temperature and humidity requirements for the specified thickness of the applied Inorganic Zinc.
- d. Masking plans and diagram for both bolted and faying surface areas.
- e. Testing frequency and acceptance criteria for surface profile, and dry film thickness measurements of each coating. Include the type of measurement instrument and calibration standards by which the instrument will be calibrated.

- f. A copy of the QC sheet that will be used to maintain the written records of the date and time of blasting, measured surface profile of the steel, date and time of coating applications, cure times, dry film thickness of each coating, batch numbers of coatings, air temperature, relative humidity, and steel temperature at the time of coating.
 - g. Shop paint repair procedures for scratches, gouges, holidays, mud cracking, runs, sags, etc.
 - h. Field painting and repair procedures.
 - i. Equipment maintenance procedures (moisture traps, cleanliness check on recycled abrasive, paint nozzle tip replacements, etc.)
 - j. Designated Quality Control officer responsible for insuring the above procedures are maintained.
11. Quality Assurance. Quality Assurance (QA) is the prerogative of the Engineer. The Engineer will perform inspection and testing as necessary to verify that an acceptable product is provided as specified. The Engineer will perform quality assurance inspection on cleaning and painting for approval.

The Engineer reserves the right to inspect cleaned surfaces before coat application. Provide the necessary means to perform proper inspections upon request.

D. Painting Timber.

1. Preparing Surfaces. Remove cracked or peeled paint, loose chalky paint, dirt, and other foreign material by wire brushing, scraping, or other means immediately before painting. Ensure the moisture content of the timber is less than 20 percent at the time of the first application.
2. Paint. Paint Formula 11 and Formula 12. Use three applications to paint new timber requiring painting. Paint is intended for use in covering previously painted surfaces. Use white or tinted paint as specified in the plans.
3. Application. After the first application has dried and the timber is in place, putty cracks, checks, nail holes, or other depressions flush with the surface. Allow to dry before the second application of paint.

Apply paint by brush, air spray, or roller, spread evenly, and work thoroughly into seasoning cracks, corners, and recesses. Apply another coat when the full thickness of the previous coat has dried.

E. Painting Concrete.

1. Preparing the Surface. Remove laitance and curing compounds from the surface before painting the concrete surfaces. Use abrasive blast cleaning.

At the time the paint is to be applied, ensure the surface is thoroughly dry and dust free.

2. Paint. Use Formula 13 tinted as specified on the plans.
3. Application. Apply paint in two separate coats, at a minimum finished application rate of 100 ft²/gal to 150 ft²/gal. Apply the second coat in a direction perpendicular to the first coat. Allow first coat to dry thoroughly before applying the second coat. Ensure final appearance is even with uniform color acceptable to the Engineer.

Paint only when the ambient temperature is 50 °F or above for the application and drying of the paint.

627.04 Method of Measurement. Unless otherwise specified, the Engineer will not measure the work.

627.05 Basis of Payment. Unless otherwise specified, the Department will consider painting as incidental work and the cost included in the contract unit prices for contract pay items that require paint.

SECTION 628 - SNOW POLES

628.01 Description. Provide and install snow poles.

628.02 Materials. Provide materials as specified in:

Rigid Posts for Delineators, Snow Poles, and Mileposts	708.16
Reflector Unit for Delineators	712.04
Flexible Snow Poles.....	712.11

Submit for Engineer approval a list of materials proposed for installation. Provide snow poles that are the same manufacturer brand and style throughout the project unless otherwise specified and Engineer approved.

628.03 Construction Requirements. Install snow poles as specified. Erect snow poles plumb. The Department considers removed snow poles as property of the Contractor. Snow poles are shown on Standard Drawings G-3-B.

A. Rigid Snow Poles. Assemble rigid snow poles and delineator reflector unit(s) and attach the assembly to the rigid delineator post as shown on the plans.

B. Flexible Snow Poles. Install flexible snow pole in accordance with manufacturer's recommendations.

628.04 Method of Measurement. The Engineer will measure acceptably completed work per each.

628.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Snow Poles, Type _____	Each

The Department will not make separate payment for delineators where rigid snow poles are installed.

SECTION 629 - MOBILIZATION

629.01 Description. Mobilization consists of preparatory work and operations, including, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of offices, buildings and other facilities necessary for work on the project; for premiums on bond and insurance for the project; and for other work and operations which must be performed or costs incurred before beginning production work on the various contract items. The Department considers mobilization cost for subcontracted work to be included in the subcontract unit price.

629.02 Materials. Not Specified.

629.03 Construction Requirements. Not Specified.

629.04 Method of Measurement. The Engineer will measure accepted work by the lump sum.

629.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price and as follows:

Pay Item	Pay Unit
Mobilization	Lump Sum

The Department will pay 60 percent of the contract unit price or 6 percent of the total contract amount, whichever is less, on the first monthly progress estimate.

The Department will pay 40 percent of the contract unit price or 4 percent of the total contract amount, whichever is less, on the second monthly progress estimate providing that the Contractor has initiated productive work on the project.

Upon completion of work on the project, the Department will pay the amount bid for mobilization in excess of 10 percent of the total original contract amount.

The Department defines total contract amount as the original total of bid items plus the cost of items paid for at invoice estimated by the Department as shown on the original bid schedule.

SECTION 630 - FLAGGING AND PILOT CARS

630.01 Description. Provide certified flaggers and pilot or pace cars with operators.

630.02 Materials. Provide the following:

1. **Flagger.** An individual who has received a certificate of training from a Department approved flagging course and who carries the certificate of training on their person. Certificates of course completion are valid for 3 years from date of issue, and may be issued by Idaho, or by surrounding states having a reciprocity agreement with the Department. A flagger must wear high visibility clothing (vest, shirt or jacket) and a hard hat or soft cap. High visibility clothing may be yellow, strong yellow-green, orange, or fluorescent versions of these colors and the color of the hard hat or soft cap is the same as the vest, shirt or jacket color and is uniform throughout the Contractor's personnel.
2. **STOP/SLOW Paddle.** A paddle with an octagon shape on a rigid handle at least 18 in wide with letters at least 6 in high and is in accordance with 107.06.
3. **Pilot Cars.** Equipped with at least one roof-mounted high intensity rotating or strobe-type amber flasher that is readily visible from front and rear from 0.5 mi, and a G20-4 sign mounted so that it is visible from the rear of the pilot car and the bottom edge of the sign is at least 5 ft. above the ground.

630.03 Construction Requirements. Perform flagging using certified flaggers.

Ensure flaggers wear high visibility clothing (vest, shirt or jacket) and a hard hat or soft cap and use a STOP/SLOW paddle. The Department requires that a hard hat be worn when working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns.

Provide for mid-morning, mid-afternoon and lunch breaks for flaggers with a lunch break that is at least one-half hour.

Safely conduct traffic with pilot or pace cars over or around portions of the highway under construction. Identify the cars by at least one roof-mounted high intensity rotating or strobe-type amber flasher and is readily visible from front and rear from

632.01

0.5 mi. Supplement the amber flasher with orange flags appropriately placed on the vehicle. Equip pilot cars with the G20-4 sign designated in the Manual on Uniform Traffic Control Devices as adopted by the State. Mount the sign in a conspicuous position so that the bottom edge of the sign is at least 6 ft above the ground.

630.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Flagging will be by the hour of authorized paddle time.
2. Pilot car operation will be by the authorized hour of vehicle operation fully operated.

Document flagging hours and pilot car operation work daily on duplicate report sheets provided by the Engineer. These reports will be agreed upon weekly and signed by both parties.

630.05 Basis of Payment. The Department will pay for acceptable quantities at contract unit prices as follows:

Pay Item	Pay Unit
Flagging	Hour
Pilot Car Operation.....	Hour

The Department will only pay for authorized paddle time and considers show up time, stand by time, or relief personnel for flagging and pilot car operation, or provision of restroom facilities incidental and the cost included in the contract unit prices for flagging and pilot car operation.

The Engineer may disallow flagging for the sole convenience of the Contractor. If allowed, it will be at no additional cost to the Department.

SECTION 632 - REMOVAL OF BRIDGE DECK CONCRETE

632.01 Description. Remove defective or contaminated concrete or both from the upper portions of bridge decks to the limits shown on the plans or as Engineer directed. Removal does not include full depth deck removal unless required as Class B, or surface preparation beyond that which is incidental to the removal process. Upon completion of removal, the Engineer will inspect the deck to determine if further removal is required.

Temporarily plug bridge drains to prevent waste materials from entering the drainage systems. Protect expansion joints and barrier curbs from damage.

Class A removal is the removal of concrete from the deck top surface over the area

shown on plans to the mean depth limits shown on the plans. Use hydrodemolition or mechanical means after seal coat has been removed. If the hydrodemolition removal extends beyond the mean removal depth where unsound concrete is encountered, the Department will still consider the work Class A removal at no additional cost to the Department. Remove concrete not removed to specified limits during hydrodemolition by mechanical means. If less than an entire continuous slab is to undergo Class A removal, sawcut the line separating where it is required and the section where removal is not required, before removal of concrete, to a depth of approximately 75 percent of the planned removal depth.

Class B removal is the removal of concrete after completion of Class A removal and is as Engineer directed.

632.02 Materials. None specified.

632.03 Construction Requirements.

A. Class A Removal

1. Mechanical Removal. Perform mechanical removal using a power operated diamond grinding machinery, or by the use of jackhammers having a nominal rating of not more than 30 lb and held at an angle of 45° or less from the surface of the slab. If reinforcing steel is exposed in the course of this class of removal, immediately stop work and request instructions from the Engineer.
2. Hydrodemolition Removal:
 - a. Concrete Removal. The Engineer will designate a trial area for the Contractor to show that the equipment, personnel, and methods of operation are capable of producing satisfactory results. The Engineer will set parameters for the removal of the concrete. Begin work upon Engineer acceptance of the results of the trial area.
 - b. Completely clean exposed steel of rust, scale, and corrosion. Repair reinforcing steel that is damaged or broken with an approved procedure at no additional cost to the Department in accordance with 503.03.E.
 - c. Equipment. Use hydrodemolition equipment that is self-propelled with a high pressure water jet stream capable of removing concrete to the specified depth and capable of removing rust and concrete particles from reinforcing steel. Use hand held high-pressure wands or 30 lb maximum jackhammers operated a 45° angle or less from

horizontal in areas that are inaccessible to the self-propelled machine.

- d. Have available on the site during the start-up of hydrodemolition, a qualified full-time employee of the hydrodemolition equipment manufacturer until the removal operation is progressing satisfactorily. Ensure the representative remains available on the operation. Adhere to recommendations made by the manufacturer's representative, on or off the project, at no additional cost to the Department.
- e. Provide documentation that qualified personnel trained by the equipment manufacturer operate equipment. Provide sufficient spare parts and service to maintain the equipment operation.
- f. Provide shielding, as necessary, to ensure containment of dislodged material within the removal area. Protect the public from flying debris both on and under the work site.
- g. Runoff. Collect runoff water and residual material within existing roadway slopes then dispose by land application off site. Line temporary collection ponds with a separation geotextile. Do not allow runoff water or residual material to flow into the vehicular or pedestrian traffic areas or nearby waterways. Obtain any permit required and comply with applicable regulations concerning the water disposal.
- h. Cleaning. Perform cleaning, before debris and water dry on the surface, with a vacuum system or other method capable of removing wet debris and water in the same pass. Blow-dry the deck with air to remove excess debris and water. Adequately support exposed reinforcing steel that is left unsupported by the hydrodemolition process and protect the steel from construction operations.

B. Class B Removal

After the Class A removal has been completed, the Engineer will check for delamination in accordance with ASTM D 458, resound, or chain the deck to verify unsound material has been removed.

Perform additional removal, designated as Class B, with the hand held hydrowand, or 30 lb maximum jackhammer operated at an angle of 45° or less from horizontal, or by the use of hand tools. If the bond between concrete and rein-

forcing steel has been destroyed, remove the adjacent concrete to a depth that will provide a minimum $\frac{3}{4}$ in clearance around the steel.

Clean before debris and water dries on the surface. Adequately support exposed reinforcing steel that is left unsupported and protect the steel from construction operations.

As with Class A removal, exercise control of debris and wash residual. Protect areas below the bridge, and as Engineer directed.

632.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard.

632.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Concrete Bridge Deck Removal Class A.....	SY
Concrete Bridge Deck Removal Class B	SY

SECTION 634 - MAILBOX

634.01 Description. Remove the existing mailbox with stand, and provide and install mailbox and support/foundation.

634.02 Materials. Provide mailboxes that are Postmaster General approved.

Provide mailbox assemblies meeting NCHRP 350 criteria.

Submit for approval by the Engineer a list of materials proposed for installation.

Construct the one-piece mailbox platform adaptor plates for double mount and the mounting brackets from 16 gauge galvanized sheet steel. Fabricate the platform, adaptor plates, and brackets in accordance with ASTM A 568. Galvanize the supports, platform, locking wedges, anti-twist plates, adapter plate, bolts, bracket, nuts, screws, washers, and miscellaneous hardware as specified in ASTM A 153 Class C/D or ASTM B 695-Class 40.

Provide posts to be used as mailbox supports as shown on the plans and meeting the requirements of 708.16 and 710.02.

Mailbox Assemblies and Mounting Hardware are as shown on Standard Drawing H-5-A.

Provide mailbox snow shields as shown on Standard Drawing H-5-B.

634.03 Construction Requirements. Remove the existing mailbox assembly and snow shield and return it to the owner. Provide and install a new mailbox

635.04

assembly and mailbox snow shield as shown on the plans or as Engineer directed. Verify the number and size of mailbox, Mailbox Snow Shield, and type of support/foundation before ordering. See Standard Drawing Notes for additional construction requirements for each specific mailbox assembly type and snow shield.

Place the name and address as shown on the existing mailbox on the new mailbox or as Engineer directed.

Maintain continuous access to mailbox and do not interrupt mail service. The Engineer may approve an acceptable temporary mailbox assembly installed during construction operations before the installation of the new mailbox assembly.

634.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Mailbox will be per each, regardless of the type or size.
2. Mailbox Snow Shield will be per each.

634.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Mailbox.....	Each
Mailbox Snow Shield.....	Each

The Department considers support/foundations, platforms, adaptor plates, brackets, and other required hardware incidental and the cost included in the contract unit price for Mailbox.

SECTION 635 - ANTI-SKID

635.01 Description. Provide and stockpile anti-skid material at designated locations.

635.02 Materials. Provide materials as specified in 703.10. The Engineer will accept material at the point of delivery from Contractor furnished sources or the Engineer will accept the aggregate at the crushing plant from designated sources.

635.03 Construction Requirements. Prepare the stockpile site by clearing and smoothing the area as Engineer directed. Construct stockpiles neat and regular in form and occupy as small an area as possible.

635.04 Method of Measurement. The Engineer will measure acceptably completed work by the ton or cubic yard.

635.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Anti-skid Type _____	Ton or CY

SECTION 640 – CONSTRUCTION GEOTEXTILES

640.01 Description. Provide and install geotextile.

640.02 Materials. Provide materials as specified in 718.

640.03 Construction Requirements.

- A. Shipment and Storage.** Place the geotextile in a dry place off the ground and protected from damage and maintain in an opaque, heavy-duty protective covering during periods of shipment and storage.
- B. Placement.** Grade the area to be covered to a smooth, uniform condition without obstructions, depressions, and debris. Spread the geotextile immediately ahead of the covering operation. Do not drag the geotextile on the ground or mishandle it. Place the geotextile loosely and without wrinkles so that placement of the overlying material will not tear the geotextile. Hold the geotextile in place with pins, staples or small piles of fill or rock. Lap or sew the geotextile, as specified, at the ends and sides of adjoining sheets. Place the cover material on the geotextile so that at least 6 in to 18 in of material is between the vehicle or equipment tires or tracks and the geotextile at all times, depending on the survivability of the geotextile and the weight of the construction equipment.

Cover the geotextile with the specified cover material as soon as possible. Do not allow the geotextile to be exposed to the elements for more than 30 days for ultraviolet stabilized geotextiles and 7 days for geotextiles that have not been ultraviolet stabilized.

- C. Soft Ground.** Limit construction vehicles size and weight so that rutting in the initial lift above the geotextile is 3 in or less deep when geotextile is placed over soft ground. Do not turn vehicles on the first lift above the geotextile. Do not end-dump the cover material directly on the geotextile. Limit compaction of the first lift above the geotextile over soft ground to routing of placing and spreading equipment only. Do not allow sheep-foot type equipment on the first lift. Closely observe subsequent lifts during compaction and if any foundation failures occur during compaction operations, use lightweight compaction equipment. Use pegs, pins, or the manufacturer's recommended method as needed to hold the geotextile in place until the specified cover material is placed. Do

not drop cover material on unprotected geotextile from a height greater than 3 ft above the geotextile surface.

- D. Seams.** Use sewn seams when specified or shown on the plans that consist of two parallel rows of stitching. Ensure the two rows of stitching are $\frac{1}{2}$ in apart with a tolerance of $\frac{1}{4}$ in and do not cross, except for restitching. Provide a lock-type stitch. If a flat or prayer seam is used the minimum seam allowance, i.e., the minimum distance from the geotextile edge to the stitch line nearest to that edge, is $1\frac{1}{2}$ in. Ensure the minimum seam allowance for other seam types is 1 in. Obtain the Engineer's approval of the seam, stitch type, and the equipment used to perform the stitching before start of work. Use a "J" seam with two passes of a lock-type stitch with at least three stitches per 1 in unless otherwise specified. The Contractor may use the prayer seam (flat) for repair of damaged in-place geotextiles.

Sew the seams with high strength polyolefins, polyester, or kevlar thread that is as resistant to deterioration as the geotextile being sewn. Provide thread color that contrasts with the geotextile color. Do not use nylon threads. Ensure the strength of the seam is at least 90% of the minimum required tensile strength for the intended application as specified in 718.05 through 718.09. Obtain the Engineer's approval before production field stitching/seaming.

- E. Repairs.** If the geotextile is torn, punctured, or the overlaps or sewn joints disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or roadbed distortion, remove the backfill around the damaged or displaced area and repair or replace the damaged geotextile at no cost to the Department. Place a patch of the same type geotextile over the damaged area and overlap the existing geotextiles at least 2 ft from the edge of the damaged area, except for pavement overlay geotextiles. Patch overlay geotextiles as specified in 640.03.I. Where geotextile seams are required to be sewn, repair damaged sheets by sewing, unless otherwise specified. Sew seams as specified in 640.03.D.

- F. Underground Drainage.** Construct underdrains as shown on the plans. Place the geotextile to conform loosely to the shape of the trench.

Overlap the geotextile at least 12 in at longitudinal and transverse joints, or sew the geotextile joints. In trenches less than 12 in wide, overlap the width of the trench.

Type I installations refer to protected conditions and Type II installations refer to unprotected conditions as defined in 718.05.

When drainage geotextiles are placed under or over a horizontal or sloping surface, such as subgrade or in conjunction with drain blankets, use the geotextiles that meet the construction survivability requirements of subgrade separation geotextiles.

- G. Riprap/Erosion Control.** Construct geotextiles under riprap or rock buttresses as specified. Overlap the geotextile at least 2 ft at longitudinal and transverse joints, or sew the geotextile at joints at the time of manufacture to form geotextile widths as specified. If overlapped, place the geotextile so that the upstream strip of geotextile is on top of the next downstream strip. Where placed on slopes, lap each strip over the next downhill strip.

Key the geotextile at the top and the toe of the slope as shown on the plans. Secure the geotextile to the slope loose enough that the geotextile will not tear when the riprap is placed. Do not key the geotextile at the top of the slope until the riprap is in place to the top of the slope.

Start placement of aggregate, riprap or both on the geotextile at the toe of the slope and proceed upwards. Show that the combination of the rock-fill drop height and the thickness of any aggregate cushion, are adequate so as not to puncture or damage the geotextile when placing the riprap or rock-fill. Where an aggregate cushion is required, place it at least 6 in thick. In addition, the limits specified in Table 640.03-1 apply.

Table 640.03-1 - Riprap Drop Criteria

Size of Riprap Material	Maximum Drop Directly onto Geotextile	Maximum Drop Onto Aggregate Cushion Blanket
≤ 200 lb Rock	3 ft	5 ft
> 200 lb Rock	0	3 ft

NOTE: A rock weighing 200 lb will typically have a volume of approximately 1.3 ft³.

After placing the riprap, backfill voids in the riprap face so the geotextile is completely covered.

Do not grade slopes after placement of the riprap if grading results in stone movement directly on the geotextile. Do not allow stones weighing more than 110 lb to roll down slope. The Engineer may reduce drop heights if geotextile damage from the stones dropping is evident. When geotextile is placed on slopes steeper than 2H:1V, place the stones on the slope without free-fall.

Type I geotextiles are low to moderate survivability and Type II geotextiles are higher survivability as defined in 718.06.

- H. Subgrade Separation.** Prepare the subgrade as specified in 205 or as Engineer directed.

Overlap adjacent geotextiles at least 2 ft at longitudinal and transverse joints, or sew the geotextiles to form the widths specified.

Type I refers to moderate survivability conditions and Type II refers to high survivability conditions as defined in 718.07.

- I. Pavement Overlays.** Construct pavement overlays as follows:

1. **Weather Limitations.** Do not place sealant and geotextile when the roadway surface or weather conditions would prevent proper construction. Do not place paving grade asphalt sealant until the minimum air temperature is at least 50 °F.
2. **Initial Surface Preparation.** Prepare the pavement surface that the sealant is to be placed as specified in 401.03. In addition, clean cracks exceeding $\frac{1}{8}$ in width and fill with suitable bituminous crack filler. Allow the crack filling material to cure in accordance with the manufacturers' recommendation before placing the geotextile. Place leveling courses before placing the geotextile.
3. **Asphalt Sealant Application.** Provide asphalt sealant that is the type and grade specified. Spread the sealant material using a pressure distributor as specified in 406.03. Uniformly spray-apply the asphalt sealant to the prepared dry pavement surface at the rate recommended by the geotextile manufacturer and as Engineer approved. Do not allow the distributor tank temperature to exceed 320 °F for paving grade asphalt cements.

Spray the asphalt sealant 6 in wider than the paving geotextile. Apply the sealant only as far in front of the geotextile installation as is appropriate to ensure a tacky surface at the time of geotextile placement. Place the geotextile on the sealant while it is hot. Do not allow traffic on the sealant.

4. **Geotextile Placement.** Protect the geotextile from moisture at all times. Place the geotextile using mechanical or manual laydown equipment capable of providing a smooth installation with minimal wrinkling or folding. Slit wrinkles or folds larger than 1 in and lay flat. Shingle-lap transverse joints and slit folds or wrinkles in the direction of the paving operation. Provide overlap sufficient to ensure closure but no more than 6 in. Use

brooms or pneumatic rollers to maximize geotextile contact with the pavement surface. Apply additional hand-placed sealant material at laps if required. Limit traffic allowed on the placed geotextile to necessary construction equipment and emergency vehicles, unless otherwise Engineer directed. Avoid abrupt starts and stops. Remove and replace damaged geotextile with the same type of geotextile, and shingle lap the overlaps in the direction of paving at no cost to the Department.

5. Overlay Placement. Ensure overlay placement closely follows geotextile placement. Do not allow windrow asphalt on the geotextile ahead of the paving machine. Avoid abrupt starts or stops and keep turnings of paver and other equipments to minimum to avoid damages to geotextile.

640.04 Method of Measurement. The Engineer will measure acceptably completed work to the nearest square yard of surface area covered. No separate measurement will be made for construction of laps, seams, joints or patches, unless the Engineer orders more than the specified lap, in which case the added lap width will be measured.

The Engineer will compute the square yards of drainage geotextile in trench by multiplying the length of the trench where geotextile is used by the average perimeter of the constructed trench typical section.

640.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Drainage Geotextile	SY
Riprap/Erosion Control Geotextile.....	SY
Subgrade Separation Geotextile	SY
Pavement Overlay Geotextile	SY

If the Engineer directs geotextiles with properties more stringent than specified, the Department will allow price adjustments for difference in material cost only.

SECTION 656 – TRAFFIC SIGNAL INSTALLATION

656.01 Description. Provide and install fully functional permanent traffic signals as shown on the plans. Operate and maintain temporary signalization as required.

656.02 Materials. Provide materials as specified in:

Concrete	502
Non-Structural Concrete	509
Traffic Signal Materials.....	713

656.03

Use Class 40 B concrete for pole foundations.

Cabinet foundations, pads, electrical service pedestal foundations require non structural concrete specified in 509.

Provide materials that bear the seal of approval of the Underwriters Laboratories, Inc., or other Engineer approved testing organization, such as National Electrical Manufacturer's Association. Materials must also meet the requirements of the National Electrical Code and local codes and requirements of the connecting utility.

Submit a list of equipment and materials proposed for installation. For each item listed include manufacturer's name, size and catalog number.

Obtain the Engineer's approval of the submitted shop drawings before fabrication begins for the following items:

1. Steel signal poles (nonstandard poles only).
2. Concrete junction boxes.
3. Composite junction boxes.

Only use listed catalog numbers to identify material and equipment type and configuration required for use in the traffic signal installation.

656.03 Construction requirements. Construct in accordance with the plans, this section and 619. Provide workmanship that meets the National Electrical Code, local codes, and requirements of the connecting utility.

The Contractor may use existing signalization equipment to aid in the control of traffic during construction. Salvage existing signalization equipment and remove in a neat, skillful manner and deliver to the Department. The Department will not pay for removal and salvage of this equipment separately.

Submit the cabinet wiring schematic and the application programming for the control equipment for Engineer approval before fabrication begins.

Submit the specified or pre-approved controller, cabinet and auxiliary equipment to be installed in the cabinet assembly to the Department for inspection, compliance with specifications, and operational testing before installation. Make the cabinet assembly submittals or re-submittals available to the Department for at least 30 working days. When there are multiple cabinet assemblies per contract, add an additional 5 working days per assembly.

If the Contractor proposes to furnish cabinet assembly equipment other than the makes and models specified or pre-approved by the Department, provide or submit the complete control equipment and cabinet assembly to the Department for

evaluation and testing for 45 working days. The Department may accept or reject such alternates depending on the evaluation to determine if the proposed alternate equipment is equal to or better than that specified. Re-submittals of non-specified or non-pre-approved equipment requires 45 working days for testing and evaluation. When there are multiple cabinet assemblies per contract, add an additional 5 working days per assembly.

When components do not comply with the specifications or fail during testing, the Engineer will reject the components, notify the Contractor of the rejection, and provide the date the components are available for pickup. The Department is not responsible for costs and contract delays associated with rejected components and resubmitted components.

Deliver the equipment submitted for inspection and testing to:

Idaho Transportation Department
Signal Shop
8150 Chinden Boulevard
Boise, Idaho 83714

After the Department's evaluation and testing is complete, the Department will ship the approved equipment to the appropriate district office on the Department's regular delivery schedule. Submit requests for alternative shipping methods, locations, or delivery schedules in writing to the Engineer for approval. If approved, the Department will deduct expenses incurred by the Department from the next progress estimate.

Ensure that vehicle and pedestrian signal heads are installed with faces completely covered. Securely attach covers to prevent accidental removal or from being dislodged. Ensure covers remain in place and can only be removed during testing or temporary operation until the intersection has been permanently opened and the signal is operational. The Contractor may use opaque covers with a transparent center section or port for viewing of individual lens indications for testing that remain in place until such time that the signal is placed in full operation.

The Department will not allow covers with a transparent section or viewing port on a signal head that is in operational display. The Department requires full opaque covers for blanking out or restricting the visibility of an unwanted signal display.

Non-approved signal covers and attachment methods include cardboard, trash bags, burlap sacks, plywood, electrical tape, and duct tape.

Ensure that neutral wires are white and that wires are identified by attaching wire markers at terminal points. Mark the wires according to the number shown in the

field signal wiring diagram as shown on the plans. Attach wire identification that is a one-piece marker and is the required size for the size of conductors installed.

Use powdered soapstone, talc, or other Engineer approved lubricants when inserting conductors in conduit. Before proceeding to pull cable in the underground conduit runs, clean dirt or accumulations of moisture from conduit runs.

Do not use winches or other power-actuated equipment not specifically designed for pulling wire.

Ensure cable runs are continuous between the terminal blocks, as shown on the Field Signal Wiring Diagram. Do not splice between terminal blocks except at locations that may be shown on the plans.

Neatly arrange wiring within controller cabinets in bundles in a squared corner pattern, and lace or tie wrap. Provide at least 4 ft of slack cable in the cabinet base for each cable. Ensure cable shielding or jacket remains in place except the last 4 in measured from the termination of the shortest wire in each cable.

Use approved connectors on conductors at the terminal points.

The Contractor may use cable with more conductors than called for in the wiring diagram. When this is done, tape off the extra conductors and label as spares.

Install, direct, and veil optical programmed signals in accordance with published instructions of the manufacturer. Mask each section of the signal with specified materials in an acceptable and skillful manner. The Engineer may require the assistance of the equipment manufacturer company representative on site for directing and veiling in accordance with the visibility requirements.

Install detector loops as specified. Cut the slot approximately 1/16 in wider than the loop cable and of sufficient depth to provide at least 1 in of cover over the top wire if located in the top pavement course, and ½ in of cover if located in the bottom course.

Cut the slot corner on a diagonal or chamfered to prevent sharp cable bends. Remove sharp edges that might damage the loop cable jacket. Hydro clean and dry the slot with pressurized air to remove loose material before inserting the loop wire.

Provide one continuous length of cable from the junction box around the loop area and back to the junction box. Splice loop conductors in the junction box.

One turn is once around the saw slot with the same cable. Two turns are twice around the slot with the same cable, etc.

Place the loop cable in the sawed slot in the same direction (either clockwise or counter-clockwise) for loops on the same lane.

Use a blunt instrument to seat the loop cable at the bottom of the sawed slot. In no case use a screwdriver or similar sharp tool that could damage the cable jacket.

A loop system is defined as two, three, or four loops in one lane that is connected to a detector loop amplifier as shown on the plans.

Test each loop after installation in the roadway and again after the slot has been sealed.

After the loop cable is installed in the cut slots and tested, fill the slot with a polyurethane resin sealant pre-approved by the Department.

Test the loop cables in the junction box with a permanent type wire marker indicating approach, loop number, and input or output (i.e., Loop No. 1, Lane a, the north approach, input = Na1+ and output = Na1-).

Connect the lead-in cable to the loop wire only in a junction box with a soldered, waterproof splice. Make the splice insulating package so that it includes loop leads and loop lead-in cable as one unit and extends at least 1 in onto the outside jacket of the lead-in cable.

Ground the lead-in cable shield at the cabinet end to the system ground. Solder the cable shield at the junction box so that it is continuous throughout the intermediate junction boxes included in the insulated splice to prevent grounding at any junction box.

Run the test conductor continuous from the farthest junction box in each loop system to the controller cabinet. Do not splice in the test conductor.

Do not install electrical conductors carrying over 50 volts in the loop detection conduits or junction boxes.

Comparative inductance test each loop system. Test each loop, as well as the system that the loop is associated with, as follows:

Ground Fault Test:

Before splicing to the lead-in cable, test individual loops between the loop conductor and an approved ground point with a 500 volt hand-charged megohm meter. Biddle Model 212159CL, AEMC Corporation Model 1250 or equal.

Test loop systems, with their leads un-terminated, at the control cabinet between one of the two lead-in conductors and approved ground point with a 500 Volt hand-charged megohm meter. Biddle Model 212159CL, AEMC Corporation Model 1250 or equal.

Ensure the minimum reading for the loop system test is at least 100 megohms. For the individual loop test; ensure the minimum reading on the hand charged meter is infinity. Correct any discrepancy before signal turn on.

Comparative Inductance Test:

Check each loop system with a Loop Testing meter of a type accepted for use by the Department.

Record and certify the values for the above tests, using forms provided by the Department.

Field test the system for 14 consecutive days of normal operation without a failure. Give written notice to the Engineer when the signal system is complete before starting the operational test. Correct any part or component of the signal equipment furnished by the Contractor that fails during the test period or before final project acceptance at no additional cost to the Department.

Signal equipment items provided by the Department and installed by the Contractor that fail due to no fault of the Contractor before final project acceptance will be corrected by the Department at no expense to the Contractor.

Submit manufacturer's warranties, guarantees, instruction sheets and parts lists for materials used in the signal installation to the Engineer upon completion of the project.

656.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

656.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Traffic Signal Installation	Lump Sum

The Department considers excavation, backfilling, surfacing, and materials incidental work and the cost included in the contract unit price.

SECTION 700 - MATERIALS

SECTION 701 - PORTLAND CEMENT

- 701.01 General Requirements.** Provide Portland cement as specified
- | | |
|--------------------------------|--|
| Portland Cement | AASHTO M 85 Type I, II, or III |
| Blended Hydraulic Cement | AASHTO M 240 Type IP, P, I (PM), or IS(20) |

Do not use Portland cement containing more than 0.6 percent total alkali. Obtain Engineers approval before using Type III cement other than pre-cast stringers.

Use the product of only one mill or other brand and type of Portland cement in a single structure component, (i.e., abutments, columns, stringers, deck, etc. unless otherwise Engineer approved.)

The Contractor may use limestone additions of up to 5.0% by mass of the cement providing that the chemical and physical requirements of the finished cement meet AASHTO M85. Use naturally occurring limestone, consisting of at least 70% by mass of one or more of the mineral forms of calcium carbonate. Include the CaCO₃ content of the limestone; the CO₂ content and calculated limestone content of the cement in manufacturers mill test report. Derive the limestone content in Portland cement as specified in ASTM C150 and tested by ASTM C114.

701.02 Acceptance Requirements. The Engineer will accept Portland cement materials for use based on the manufacturer's certification as specified in 106.04 and 106.05.

SECTION 702 - ASPHALT

702.01 Asphalt. Provide Asphalt Binder that meets AASHTO M 320 *Standard Specification for Performance-Graded Asphalt Binder*, except as follows:

1. When polymer modification is specified or when the sum of the grade designation values exceed 90, perform the AASHTO T-301, Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer test at 25 °C on residue from the Rolling Thin Film Oven Test (RTFOT). The binder must have at least 50% Elastic Recovery .

Provide asphalt for a specified use from one supplier unless otherwise Engineer approved. If a change of supplier for asphalt binder is proposed, or if blending of asphalt binder from more than one supplier is proposed, the Engineer will require mix design testing and verification as conditions of approval.

702.03 Emulsified Asphalts. Meet the following:

702.03

1. AASHTO M 140, *Standard Specifications for Anionic Emulsified Asphalt.*
2. AASHTO M 208, *Standard Specifications for Cationic Emulsified Asphalt.*
3. Ensure Rapid Setting Emulsion grades are homogenous after thorough mixing within 15 days after delivery.
4. Polymer Modified Cationic Emulsified Asphalts (CRS-2R and CRS-2L) are an emulsified blend of asphalt, polymer, water, and emulsifiers.
5. CRS-2L emulsified asphalt meets AASHTO M 316, *Standard Specifications for Polymer-modified Cationic Emulsified Asphalt.*
6. CRS-2R emulsified asphalt that includes asphalt cement thoroughly blended with at least 1.5 percent total rubber solids meeting the requirements of Table 702.03-1.
7. CRS-2P polymerized cationic emulsified asphalt. Mill the polymer into the asphalt or emulsion during the manufacturing of the emulsion and meeting the requirements of Table 702.03-2.
8. STE - 1 Special Tack Emulsion meeting the requirements of Table 702.03-3.

Table 702.03-1 - CRS-2R Requirements

SPECIFICATIONS

AASHTO TEST

PROPERTY	MINIMUM	MAXIMUM	NUMBER
Tests on Emulsion:			
Viscosity, Saybolt Furol at, 122 °F, seconds	150	400	T 59
Storage stability test, 24 hours, percent		1.0	T 59
Demulsibility 35ml., 0.8% Dioctyl Sodium Sulfosuccinate, percent	40		T 59
Particle charge test		Positive	T 59
Sieve test, percent		0.10	T 59
Distillation:			

Oil distillate by distillation: Oil distillate by volume of emulsion, percent		3.0	T 59
Residue by evaporation, percent	65		T 59 (Method B)
Test on residue from Distillation:			
Penetration, 25 °C, 100 g, 5 sec	80	150	T 59, T 49

Table 702.03-2 - CRS-2P Requirements

	SPECIFICATIONS		AASHTO TEST
PROPERTY	MINIMUM	MAXIMUM	NUMBER
Tests on Emulsion:			
Viscosity, Saybolt Furol at 122 °F, seconds	100	400	T 59
Storage stability test, 24 hours, percent		1.0	T 59
Demulsibility 35ml., 0.8% Dioctyl Sodium Sulfosuccinate, percent	40		T59
Particle charge test		Positive	T 59
Sieve test, percent		0.30	T 59
Distillation:			
Oil distillate by volume of emulsion, percent	0	3.0	T59(1)
Residue by evaporation, percent	65		T 59 (Method B)
Test on residue from Distillation:			

Penetration, 77 °F, 3.5 oz., 5 sec.	100	250	T 59, T 49
Torsional Recovery, (%)	18(A)		---
or			
Elastic Recovery (%), at 25 °C	45		T 301

(1) Distillation modified to use 300g of an emulsion heated to 350 °F ± 9 °F and maintained for 20 minutes.

(2) The Torsional Recovery test shall be conducted according to the California Department of Transportation Test Method No. 332.

The Torsional Recovery test may be used in lieu of Elastic Recovery based on type of modifier used, at the option of the Supplier. If the Torsional Recovery method is used for acceptance, the Supplier must supply all test data verifying specification conformance.

**Table 702.03-3 - STE-1 Requirements
SPECIFICATIONS**

AASHTO TEST

Tests on Emulsion:	MINIMUM	MAXIMUM	METHOD
Viscosity @ 77 °F SFS	----	30	T59
Storage Stability, 1 day, %	----	1	T59
Demulsibility 35 ml. 0.8% dioctyl sodium sulfosuc- cinate, percent 1	25	----	T59
Particle Charge	Positive	----	T59
Sieve Test, %	----	0.10	T59
Distillation: Oil distillate by volume of emulsion, %	----	5	T59
Test on Residue, %	45	----	T59
Test on the residue from distillation: Penetration 77 °F	100	200	T59

Ductility, 77 °F	40	----	T59
5 cm/min., cm			T59
Solubility in Trichloroethylene, %	97.5	----	T59

¹ Perform the demulsibility test within 30 days from date of shipment

702.04 Anti-Stripping Additive. Use liquid anti-strip additive or hydrated lime as follows:

- A. Treat PG binder products with a heat-stable anti-stripping additive. Use either 0.5 percent or 1.0 percent of anti-stripping additive per ton of asphalt. Test samples of the treated asphalt in accordance with Idaho T-99. Remove material that fails to indicate the presence of anti-strip additive.

Submit samples of the proposed liquid anti-strip additive and asphalt for Engineer approval before use. The Engineer will test the material as specified in Idaho T-137 for acceptance.

- B. Use hydrated lime for plant mix additive that meets 720.06.

702.05 Loading Certificate. Accompany each shipment of asphalt with a copy of the loading certificate providing the following information:

1. Contractor and project number.
2. Refinery.
3. Supplier, if other than refinery.
4. Car or delivery ticket number.
5. Type and grade of asphalt.
6. Specific gravity.
7. Temperature when loaded.
8. Shipment:
 - a. Truck. Individual certified weights of each loaded truck and trailer and the tare weight of each vehicle. Individual compartment asphalt weight must be certified for multiple compartment hauling units.
 - b. Railroad Car. Certified volume of asphalt load. Compute the weight from the volume corrected in accordance with 109.01.A.7.
9. Consistency of material:

702.08

- a. Saybolt viscosity of emulsified asphalt.
 - b. Performance Graded Binder: With each lot change, attach a copy of the ITD-966, (PG Binder Supplier's Certification), as required by 702.08.
10. The signature of authorized refinery or supplier representative.
 11. When an anti-stripping additive is specified, the percentage of additive by weight of asphalt and the brand, grade, or type of additive must be shown on the loading certificate.
 12. Lot number for PG binders.

702.06 Sampling and Testing. Sample asphalt in accordance with AASHTO T 40. Test asphalt in accordance with appropriate AASHTO and ASTM test methods for the type of asphalt. Check the presence of anti-stripping additive in accordance with Idaho T-99.

702.07 Temperature Viscosity Curve. Accompany each shipment of asphalt with a copy of temperature viscosity curve representing the material.

702.08 Asphalt Certification. The Department will require that the Contractor's supplier to:

1. Annually submit a Process Control Plan (Quality Control Plan) to the Department's Central Materials Laboratory for review.
2. Certify that Performance Graded (PG) binder supplied to the project meets the specified grade when tested in accordance with AASHTO M 320 and 702.01, and that emulsified asphalts supplied to the project meet 702.03.
3. Perform QC testing for large bulk tanks of PG 58-28 no less than once monthly.
4. Perform at least one complete set of quality control tests for each storage tank of polymerized PG binder produced.
5. For polymerized PG binder produced by in-line blending, outline consistency and specification compliance testing frequency in the Supplier's Quality Control Plan for approval by the Central Materials Laboratory.
6. Perform complete specification testing for PG binder no less than once monthly and furnish a copy of each test report to the Central Materials Laboratory.

Base the testing frequencies on consistent raw materials and production processes. Should a change occur to either the raw materials or the production process, the Department requires a new set of complete specification testing.

Use only supplier blended polymerized PG binders. Do not introduce modifiers/

polymers at the asphalt mix plant unless a QC/QA program has been submitted by the supplier and approved by the Central Materials Laboratory.

SECTION 703 - AGGREGATES

703.01 General Requirements. Provide aggregates that are reasonably free from wood, roots, bark, soft or disintegrated pieces, or other detrimental matter. Aggregate sources must meet the requirements of 106.09. Round the percent passing gradations to the nearest whole number except report the percent passing the No. 200 sieve to the nearest tenth of a percent.

703.02 Concrete Aggregate. Meet the following requirements for concrete aggregate:

- A. General.** Use a fine and coarse concrete aggregate that meet the requirements of Table 703.02-1.

Table 703.02-1 - General Concrete Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	5.0% Maximum loss
Ethylene Glycol	Idaho T-116	90% minimum retained
Sodium Sulfate Soundness(1)	AASHTO T 104	Maximum 10% loss for fine aggregate and 12% loss for coarse aggregate after 5 cycles

(1) Perform sodium sulfate soundness testing when requested by the Engineer.

Do not use limestone fine or coarse aggregate in concrete wearing surfaces.

Perform AASHTO T 303, ASTM C1293 or ASTM C295 testing to determine the potential Alkali Silica Reactivity of the aggregates. The Department will require mitigating measures for aggregates found to be potentially reactive per AASHTO T 303, ASTM C1293, or ASTM C295. Potentially reactive aggregates are those with expansion greater than 0.10 percent as determined by AASHTO T 303, or greater than 0.04 percent as determined by ASTM C1293. If ASTM C295 indicates an aggregate composition containing a percentage for any of the following materials greater than that shown in Table 703.02-2, the Engineer will consider the aggregate potentially reactive.

Table 703.02-2 - Aggregate Reactivity

Mineral	Limit
Optically strained, microfractured, or microcrystalline quartz	5.0% (max)
Chert or chalcedony	3.0% (max)
Tridymite or cristobalite	1.0% (max)
Opal	0.5% (max)
Natural volcanic glass	3.0% (max)

Include mitigation measures such as fly ash, lithium admixtures, or other material for Engineer approval. Submit test results from ASTM C1567 or IT 145 that demonstrate the proposed mitigation used with the cement and aggregates will control the potential expansion. Do not use an aggregate source for concrete before Engineer approval.

The Contractor's mitigation measures may include the use of fly ash, lithium admixtures, or other Engineer approved material. Do not use an aggregate source for concrete before Engineer approval.

- B. Fine Aggregate for Concrete.** Meet the fine aggregate gradation requirements shown in Table 703.02-3.

Table 703.02-3 - Fine Aggregate Gradation

Sieve Size	Percent Passing
3/8 in.	100
No.4	95-100
No.16	45-80
No.50	10-30
No.100	3-10
No.200	*0-4.0

*0-2.0 for concrete wearing surfaces (pavements, approach slabs, and bridge decks) except when the sand equivalent is at least 80, then 0 to 3.0 is acceptable.

Use fine concrete aggregate that meets the requirements shown in Table 703.02-4.

Table 703.02-4 - Fine Concrete Aggregate Criteria

Characteristic	Test Method	Requirements
Sand Equivalent	AASHTO T 176 Modified Alternate Method No. 2 Pre-Wet	70 minimum
Organic Impurities	AASHTO T 21	Reject a color darker than the standard
Deleterious Substances. (Percent by mass)	AASHTO M 6	Clay Lumps.....1.0 max Coal & Lignite...1.0 max All others (Shale, Alkali, Mica, Coated Grains, Soft and Flaky Particles).....5.0 max

Do not use recycled concrete in fine concrete aggregate.

Perform Idaho T- 13, Measuring Mortar-Making Properties of Fine Aggregate tests only when the samples meet all other specification requirements for fine aggregate for concrete. When Aggregates are tested for mortar making properties, apply the criteria shown in Table 703.02-5.

Table 703.02-5 - Mortar Properties

Cement	Type I and II	Type III
Age at Testing	7 days and 28 days	3 days and 7 days
Comparative Strength, Min.	90 percent	90 percent

- C. Coarse Aggregate for Concrete.** Meet the following gradation requirements for coarse aggregate for concrete shown in Table 703.02-6.

Table 703.02-6 - Coarse Aggregate Size No. and Gradation

	1	2a	2b	3	4	5
Sieve Size	Percent Passing					
2 1/2 in.						100
2 in					100	95-100
1 1/2 in				100	95-100	

1 in		100	100	95-100		35-70
3/4 in	100	90-100	80-100		35-70	
1/2 in	90-100			25-60		10-30
3/8 in	40-70	20-55	10-40		10-30	
No. 4	0-15	0-10	0-4	0-10	0-5	0-5
No. 8	0-5	0-5		0-5		

Use either size No. 2a or 2b when coarse aggregate size No. 2 is required.

Combine two or more coarse aggregates for Sizes 4 and 5.

Provide a coarse concrete aggregate that meets the requirements shown in Table 703.02-7.

Table 703.02-7 - Coarse Concrete Aggregate Criteria

Characteristic	Test Method	Requirements
Los Angeles Abrasion	AASHTO T 96	35% maximum
Deleterious Substances	AASHTO M 80	
	Coal & Lignite	1.0 max Percent by mass
	Clay Lumps	0.5 max Percent by mass
	Clay Lumps & Friable Particles	2.0 max Percent by mass
	Material Passing No. 200 Sieve	1.0 max Percent by mass
	Flat and Elongated Aggregate Particles (Length to Thickness Ratio Greater Than 5)	15.0% maximum

- D. Combined aggregate gradation for concrete.** As an option to using coarse and fine graded aggregates for concrete, aggregate gradation may consist of a combined gradation. Meet the requirements for coarse and fine aggregates for concrete with the following exceptions shown in Table 703.02-8.

Table 703.02-8 - Combined Aggregate Size No. & Gradation

	1C	2C	3C	4C	5C
Sieve size	PERCENT RETAINED				
2 1/2in				0	
2 in				0	0-5
1 1/2 in		0	0-5	5-15	
1 in		0	0-5	5-15	8-18
3/4 in	0	0-5	5-15	8-18	8-18
1/2 in	0-5	5-15	8-18	8-18	8-18
3/8 in	5-18	8-18	8-18	8-18	8-18
No. 4	8-20	8-18	8-18	8-18	8-18
No. 8	8-20	8-18	8-18	8-18	8-18
No. 16	8-20	8-18	8-18	8-18	8-18
No 30	8-20	8-18	8-18	8-18	8-18
No. 50	8-20	8-18	8-18	8-18	8-18
No. 100	5-18	5-15	5-15	5-15	5-15
No. 200	0-4.0	0-4.0	0-4.0	0-4.0	0-4.0
pan	0-3.0	0-2.0	0-2.0	0-2.0	0-2.0

The Engineer will not accept material with more than 3 sieve sizes outside the above gradations or with adjacent failing sieves.

Provide minimum of 70 for sand equivalent in stockpile with 5 percent or more passing the number 4 sieve.

For concrete wearing surfaces (pavements, approach slabs, and bridge decks) the percent retained in the pan shall be 0-1.5%. Provide a minimum of 80 for sand equivalent in stockpile with 5 percent passing the number 4 sieve.

The Fineness Modulus as calculated by the FOP for AASHTO T27 on the combine gradation shall be within 0.20 of the gradation proposed in the concrete mix design.

703.03 Not Used

703.04 Aggregate for Untreated Base, Treated Base and Road Mix. Meet the following aggregate gradation requirements shown in Table 703.04-1 **465**

Table 703.04-1 - Nominal Maximum Size

SIEVE SIZE	3/8 in	1/2 in	3/4 in A PERCENT	3/4 in B PASSING	1 in A	1 in B	2 in
2½ in							100
2 in						100	90-100
1½ in					100		
1 in			100	100	90-100	90-100	55-83
¾ in		100	90-100	90-100			
½ in	100	90-100			60-80	65-100	
⅜ in	85-100						
No. 4	55-75	50-70	30-60	40-65	35-60	40-80	30-60
No. 8	40-60	35-55		30-50	25-50	30-60	
No. 30	20-40	12-30	8-30		10-30	15-35	10-25
No. 200	3.0-9.0	3.0-9.0	0-7.0	3.0-9.0	2.0-9.0	6.0-18.0	0.0-8.0

Use the "B" gradation unless otherwise specified.

Use aggregate that meets the requirements of Table 703.04-2.

Aggregate Criteria - Table 703.04-2

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	8.0% maximum loss
Ethylene Glycol	Idaho T-116	90% minimum retained
Sand Equivalent	AASHTO T 176 Modified Alternate Method No. 2 Pre- Wet	30 minimum If 5.0% or more of the material passes the No. 200 sieve. Sand equivalent is not required if less than 5.0% passes the No. 200 sieve, or for aggregate to be used for lime or cement treated base.
Los Angeles Abrasion	AASHTO T96	35% maximum
R-Value	Idaho T-8	75 or more

Retained Asphalt Film	AASHTO T 182	above 95 % for road mix aggregate
Fractured Face	AASHTO T 335, Method 1	Untreated base – at least 60% of the material retained on the No. 4 sieve has at least one fractured face. Treated base and road mix – at least 75% of the material retained on the No. 4 sieve has at least one fractured face.

703.05 Aggregate for Superpave HMA Pavement.

Provide aggregate for mixes, except SP 2, in a minimum of two separate stockpiles. Use aggregate consisting of crushed stone or crushed gravel. Combine with other required aggregate fractions and fillers, in proper proportion so the resulting mixture meets the gradation required for the specific class under contract.

Screen the aggregate used for Superpave HMA so that not more than 10 percent of the naturally occurring minus $\frac{1}{2}$ in material remains in the material used to produce the stockpile(s). Crush the plus $\frac{1}{2}$ in material thus produced to produce the required gradation. This requirement does not apply to SP 2 mixes or mixtures designated as non-structural or temporary mixtures.

Size, grade, and combine the fractions for the mixture in proportions so the resulting blend conforms to the grading requirements as defined in the Table 703.05-2.

Use aggregate that meets the requirements of Table 703.05-1.

Table 703.05-1 - Superpave Mixture Requirements

Mixture Type	SP2	SP3	SP5	SP6
Design ESALs a (millions)	≤ 1	$1 \leq 10$	$10 \leq 30$	≥ 30
Idaho Degradation, maximum loss, %	5.0			
Ethylene Glycol, minimum retained, %	90			
R-Value	80 or more			
LA Wear, Max % loss	35	30	30	30
Sodium Sulfate Soundness b Max loss after 5 cycles, %	12			
Fractured Face, Coarse Aggregate c % Minimum,	65/-	75/60	95/90	98/98
Uncompacted Void Content of Fine Aggregate, % Min.	40	40	45	45
Sand Equivalent, Minimum	35	40	45	50
Flat and Elongated d, % Max.	10	10	10	10

^a The anticipated project traffic level expected on the design lane over a 20-year period. Regardless of the actual design life of the roadway, determine the design ESALs for 20 years.

^b Perform sodium sulfate soundness testing when requested by the Engineer.

^c 95/90 denotes that 95 percent of the coarse aggregate has one fractured face and 90 percent has two or more fractured faces.

^d This criterion does not apply to No. 4 nominal maximum size mixtures.

Table 703.05-2
Nominal Maximum Aggregate Size – Control points (Percent Passing)
and VMA Requirements

Sieve Size	1-1/2 in.		1 in.		3/4 in.		1/2 in.		3/8 in.		#4	
	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points
2 in.				—		—		—		—		—
1-1/2 in.		90-100		100		—		—		—		—
1 in.		90 max		* 90-100		100		—		—		—
3/4 in.		—		90 max		* 90-100		100		—		—
1/2 in.		* 40-70		—		90 max		* 90-100		100		100
3/8 in.		—		* 42-70		* 52-80		90 max		* 90-100		* 95-100
No. 4	34.7	—		39.5		—		—		90 max		90-100
No. 8	23.3	* 15-41		26.8		* 23-49		* 28-58		47.2		* 32-67
No. 16	15.5	—		18.1		23.3		25.6		31.6		—
No. 30	11.7	—		13.6		16.7		19.1		23.5		—
No. 50	10	—		11.4		13.7		15.5		18.7		—
No. 100		—		—		—		—		—		—
No. 200		* 0.0-6.0		* 1.0-7.0		* 2.0-8.0		* 2.0-10.0		* 2.0-10.0		* 6.0
VMA, % minimum	11		12		13		14		15		16	

Table 703.05-2 continued
PCS Control points for Mixture Nominal Maximum Aggregate Size**

Nominal Maximum Aggregate Size	1-1/2"	1"	¾"	½"	3/8"	No. 4
Primary Control Sieve	3/8"	No. 4	No. 4	No. 8	No. 8	No. 16
PCS Control Point (% passing)	47	40	47	39	47	42

Note: (*) denotes the sieves that will be used for mix design control points and quality analysis sieves for a Class SP 2 mix.

** The combined aggregate gradation shall be classified as coarse graded when it passes below the Primary Control Sieve (PCS) control point as defined in Table 703.05-2. All other gradations shall be classified as fine graded. (This classification is based on the Contractor Job Mix Formula and not individual gradation tests.)

Coarse graded mixtures shall not pass through the restricted zone.

703.06 Aggregate for Cover Coat Material. Meet the following aggregate gradation for class specified in Table 703.06-1.

Table 703.06-1 - Gradation Table
Percent Passing

Sieve Size	Class A-Urban	Class B-Rural
½ in	100	100
¾ in	95 - 100	40 - 70
No. 4	0 - 6	0 - 6
No. 8	0 - 3	0 - 3
No. 200	0 - 2.0	0 - 2.0

Use aggregate that meets the requirements of Table 703.06-2.

Table 703.06-2 - Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	5.0% maximum loss
Ethylene Glycol	Idaho T-116	90% minimum retained
Cleanness Value	Idaho T-72	80 or more
Los Angeles Abrasion	AASHTO T 96, Grading C	30% maximum (unless otherwise specified)
Retained Asphalt Film	AASHTO T 182	above 95 percent
Fractured Face	AASHTO T 335, Method 1	At least 70 percent of the material retained on the No. 4 sieve has at least one fractured face.

703.07 Aggregate for Blotter and Aggregate for Choke Sand. Use secondary rejects that meet the aggregate gradations specified in Table 703.07-1.

Table 703.07-1 - Aggregate Gradation

Sieve Size	Percent Passing	
	Blotter	Choke Sand
¾ in	100	100
No. 4	40 - 100	
No. 200	0 - 16.0	0 - 5.0

Use aggregate that meet the requirements of Table 703.07-2.

Table 703.07-2 - Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	Not Required
Ethylene Glycol	Idaho T-116	90% minimum retained

703.08 Aggregate for Open Graded Rock Base (Rock Cap). Meet aggregate gradation requirements specified in Table 703.08-1 in accordance with AASHTO T 27, excluding washing. Provide clean, angular, crushed quarry rock, free of clay coatings, lumps and soft or flaky particles material for Rock Cap.

Table 703.08-1 - Aggregate Gradation Requirements
 %Passing (by weight)

Screen/Sieve Size	Class I (Rock Cap)	Class II	Class III
3 in	100		
2 in		100	
1½ in	55-85	90 – 100	
1 in			100
* ¾ in	10-35	40 – 75	80 - 98
½ in	5-15	20 – 40	60 – 85
⅜ in			30 – 65
* No. 4	0-5	0 – 10	
No. 8		0 – 5.0	0 – 10
* No. 200			0 – 5.0

Note: (*) denotes the sieves that will be used for quality acceptance.

Use aggregate that meet the requirements of Table 703.08-2.

Table 703.08-2 - Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	8.0% maximum loss
Ethylene Glycol	Idaho T-116	90% minimum retained
R-Value	Idaho T-8	80 or more
Los Angeles Abrasion	AASHTO T 96	40% maximum loss for CI I 35% maximum loss for CI II & III
Flat & Elongated	FOP for ASTM 4791	15% for CI II & III
Fracture Face, % fractured faces	AASHTO T 335	90% retained on #4 with 2 FF for CI II
		90% retained on #4 with 2 FF and 75% retained on #8 with 1FF for CI and III

703.09 Aggregate for Extrusions. Meet the applicable aggregate gradation for asphalt or Portland cement extrusions specified in Table 703.09-1. Use aggregate with the characteristics of 703.05 SP 2, or 3 for asphalt extrusions and 703.02 for concrete extrusions.

Table 703.09-1 - Gradation Table

Sieve Size	Percent Passing		
	Asphalt	Concrete	
		NO. 1	NO. 2
¾ in	100		100
½ in	95-100	100	90-100
⅜ in	85-100	75-100	70-100
No. 4	60-80	50-75	50-75
No. 8	40-60	30-55	30-55
No. 16		20-40	20-40
No. 30		12-25	15-32
No. 50	12-25	5-15	10-25
No. 100		0-15	0-10
No. 200	3.0-10.0	0-2.0	0-2.0

703.10 Aggregate for Anti – Skid. Meet the applicable aggregate gradation specified in Table 703.10-1.

Table 703.10-1 - Gradation Table

SIEVE SIZE	Percent Passing				
	TYPE				
	1	2	3	4	5
¾ in	100	100	100	100	100
No. 4	0-40			0-70	
No. 8	0-10	0-40			
No. 30			0-25	0-30	
No. 100		0-2			
No. 200	0-5.0		0-5.0	0-10.0	

Use aggregate with the characteristics specified in Table 703.10-2.

Table 703.10-2 - Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	5.0% maximum loss for Type 2
		Not required for all others.
Ethylene Glycol	Idaho T-116	90% minimum retained
Los Angeles Abrasion	AASHTO T 96	45% maximum loss for Type 2
		Not required for all others.

703.11 Aggregate for Granular Subbase. Meet the aggregate gradation specified in Table 703.11-1 in accordance with AASHTO T 27, excluding washing.

Table 703.11-1 - Gradation Table

Sieve Size	Percent Passing
4 in. (100 mm)	100
3 in. (75 mm)	90-100
No. 4 (4.75 mm)	30-75
No. 200 (0.075 mm)	0-15.0

Use aggregate with the aggregate criteria specified in Table 703.11-2.

Table 703.11-2 - Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho T-15	8.0% maximum loss
Ethylene Glycol	Idaho T-116	90% minimum retained
R-Value	Idaho T-8	60 or more
Los Angeles Abrasion	AASHTO T 96	40% maximum loss
Sand Equivalent	AASHTO T 176 Modified Alternate Method No. 2 Pre-Wet	30 minimum If 5.0 percent or more of the material passes the No. 200 sieve. Sand equivalent is not required if less than 5.0 percent passes the No. 200 sieve.

703.12 Sampling and Testing. Sample and test aggregates in accordance with the following applicable standard methods:

- Sampling of Aggregates AASHTO T 2
- Sieve Analysis of Fine and Coarse Aggregates AASHTO T 27
with
- Amount of Material Finer than No. 20 (0.075 mm) Sieve AASHTO T 11
Method A or B
- Organic Impurities in Sands for Concrete AASHTO T 21
- Dry Preparation of Disturbed Soil and Soil-Aggregate
Samples for Test..... AASHTO R 58
- Effect of Organic Impurities in Fine Aggregate
on Strength of Mortar AASHTO T 71
- Determining the Percentage of Fracture
in Coarse Aggregate AASHTO T 335
Method 1
- Evaluating Cleanness of Cover Coat Material Idaho IT-72
- Resistance to Degradation of Small-size Coarse Aggregate
by Abrasion and Impact in the Los Angeles Machine..... AASHTO T 96
- Clay Lumps and Friable Particles in Aggregate AASHTO T 112
- Lightweight Pieces in Aggregate AASHTO T 113
- Plastic Fines in Graded Aggregates and Soils by Use of the
Sand Equivalent Test..... AASHTO T 176 Modified
Alternate Method No. 2-Pre-Wet
- Methods of Chemical Analysis of Limestone, Quicklime,
and Hydrated Lime ASTM C 25
- Uncompacted Void Content of Fine Aggregate AASHTO T304
Method A
- Standard Test Method for Flat Particles Elongated Particles, or Flat and
Elongated Particles in Coarse Aggregate ASTM D 4791
Idaho Field Operating Procedures (FOP)
of the Quality Assurance Manual.
- Accelerated Detection of Potentially Deleterious Expansion
of Mortar Bars due to Alkali-Silica Reaction AASHTO T 303
Low alkali cement may be used. Modified AASHTO T303
procedures are required for expansion mitigation testing
using fly ash, lithium, or other additives.

703.13 Aggregate Source Material Quality. Investigate sources in accordance with Idaho IT-142. Perform IT-15 on all sources. Perform Idaho IT-15 and IT-116 on basalt sources. Perform the remaining applicable tests specified in this subsection and the cited tests for specific products on samples resulting from the investigation. Prepare a materials source plan for aggregate sources.

Submit the materials source plan to the Engineer and include data from the testing for use by the Department in determining the acceptability of aggregate sources and borrow sources when applicable.

For aggregate source approval purposes, sample and test the material at the frequency indicated in Idaho IT-142. The testing below may be required by the Contractor to maintain and verify the quality of the material during the project and to ensure the material meets the contract quality and design requirements.

Idaho Degradation.....	Idaho IT-15
Method of Test for Disintegration of Quarry Aggregates (Ethylene Glycol).....	Idaho IT-116
Investigation of Aggregate and Borrow Deposits	Idaho IT-142
Specific Gravity and Absorption of Fine Aggregate	AASHTO T 84 or
Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) method	Idaho IT-144
Specific Gravity and Absorption of Coarse Aggregate.....	AASHTO T 85
Specific Gravity of Soils	AASHTO T 100
Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate	AASHTO T 104 (Use Sodium Sulfate)

Perform the tests below on the following categories of material:

1. Base Course and Granular Subbase Material

Compaction of Soils and Soil Mixtures for the Expansion
Pressure and Hveem Stabilometer Tests (R-value) Idaho IT-8

2. Asphalt Treated Material

Preparing and Determining the Density of Hot-Mix-Asphalt (HMA)
Specimens by Means of the Superpave Gyratory Compactor. ...AASHTO T312
Superpave Volumetric Design for Hot-Mix Asphalt (HMA) AASHTO R 35

- Coating and Stripping of Bitumen-Aggregate MixturesAASHTO T 182
- Percent Air Voids in Compacted Dense
and Open Bituminous Paving MixturesAASHTO T 269
- Maximum Specific Gravity of
Bituminous Paving MixturesAASHTO T 209
- Bulk Specific Gravity of Compacted
Bituminous MixturesAASHTO T 166
- Bulk Specific Gravity and Density of Compacted Asphalt Mixtures
Using Automatic Vacuum Sealing MethodAASHTO T 331
- Resistance of Compacted Hot Mix Asphalt (HMA)
to Moisture-Induced DamageASTM D1075
(Replace D1074 and D2726 with AASHTO T 167 and AASHTO T 166)
- Compressive Strength of Hot Mix Asphalt.....AASHTO T 167
- 3. Borrow and Granular Borrow**
- Compaction of Soils and Soil Mixtures for the Expansion Pressure
and Hveem Stabilometer Tests (Idaho R-value)..... Idaho IT-8
- 4. Fine Aggregate for Concrete**
- Fine Aggregate for Hydraulic Cement ConcreteAASHTO M 6
- Measuring Mortar-Making Properties of Fine Aggregate Idaho IT-13
- Accelerated Detection of Potentially Deleterious Expansion
Of Mortar Bars Due to Alkali-Silica Reaction.....AASHTO T 303
Low alkali cement may be used. Baseline testing,
with cement and aggregate only, is required.
- 5. Coarse Aggregate for Concrete**
- Coarse Aggregate for Hydraulic Cement ConcreteAASHTO M 80
- Accelerated Detection of Potentially Deleterious
Expansion of Mortar Bars Due to Alkali-Silica Reaction.....AASHTO T-303
Low alkali cement may be used. Baseline testing,
with cement and aggregate only, is required.

SECTION 704 - JOINT FILLERS AND SEALERS

704.01 Pre-formed Expansion Joint Filler. Meet AASHTO M 33, AASHTO M 153 or AASHTO M 213.

704.02 Joint Sealer for Asphalt and Concrete Pavements. Meet ASTM D6690 Type II.

704.05

704.03 Hot Poured Elastomeric Type Concrete Joint Sealer. Meet ASTM D3406.

704.04 Neoprene Compression Seal. Meet AASHTO M 220 for Concrete Pavement and AASHTO M297 for Bridges. Provide adhesive lubricant that meets ASTM D4070 for bridges and ASTM D2835 for Concrete Pavement.

Provide a manufacturer's certification stating that all material meet the contract requirements and the requirements of the manufacturer.

Submit shop drawings and installation procedures to the Engineer for review in accordance with 105.02.

Install the compression seal in accordance with the manufacturer's recommendations, using the proper size of installation tool as recommended by the manufacturer. Clean metal surfaces that will contact the seal in accordance with SSPC-SP6.

704.05 Silicone Sealant. Meet ASTM D 5893.

Sample and test each lot of silicone sealant before use. The Department requires an independent laboratory perform sampling and testing. Do not place material from a given lot until test results have been received by the Engineer, evaluated for compliance with typical properties listed in the manufacturer's design information bulletins, and approved for placement. Allow at least 30 calendar days for testing.

Perform the following specific tests:

1. Tensile stress at 150 percent Elongation(a).
2. Total Elongation(a); and Tack Free Time(b).
 - (a) ASTM D 412, Method A, Die C, 7-day cure at $77\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ and 45 percent to 55 percent relative humidity.
 - (b) ASTM C 679.

Testing is incidental and the cost included in the contract unit price.

Deliver silicone sealant in the manufacturer's original sealed container. Each container must have an intact, original manufacturer's label with the following:

1. Legibly marked manufacturer's name.
2. Trade name of the sealer.
3. Production lot number.
4. Expiration date of the manufacturer's shelf life warranty.

Retest sealant that has exceeded the expiration date at no additional cost to the Department and obtain Engineer approval before use. Do not use sealant if more than six months has elapsed since such re-testing.

704.06 Elastomeric Sheet. Fabricate the elastomeric sheet with nylon fabric embedded in a high quality vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer. Use a smooth elastomeric sheet that is free from pinholes and surface blemishes, shows no evidence of ply delamination, and meets the physical requirements shown in the Table 704.06-1. Provide methods and materials to install a leak-proof sheet to the required length.

Accompany elastomeric sheet with a manufacturer's certificate attesting compliance with the contract.

Table 704.06-1 - Elastomeric Requirements

Physical Property	Test Method	Performance Requirements
Hardness, Durometer A	ASTM D 2240	60±10 points
Tensile strength	ASTM D 412	2000 psi, min.
Elongation at break	ASTM D 412	300 percent, min.
Brittleness temperature	ASTM D 746	-40 °F(-40 °C)
Tear resistance	ASTM D 624 (Die C)	150 lb./in. (26.3 kN/m), min.
Flame resistance	ASTM C 542	must not propagate flame
Resistance to heat aging change in original properties after 70 hrs. at 212 °F (100 °C) Hardness Elongation Tensile strength	ASTM D 573	+10 points, max. -40 percent, max. -15 percent, max.
Resistance to oil aging change in volume after 70 hrs. immersion in ASTM oil no. 3 at 212 °F (100 °C)	ASTM D 471	+80 percent, max.

Resistance to ozone condition after exposure to 100 pphm ozone in air for 100 hrs at 100 °F (sample under 20 percent strain.)	ASTM D 1149	No cracks
Resistance to permanent set compression set after 22 hours at 158 °F (70 °C) Resistance to water change in weight after 7 days immersion at 158 °F (70 °C)	ASTM D 395 (Method B) ASTM D 471	30 percent, max. +5 percent, max.

704.07 Bridge Deck Joint Seals, General. Unless otherwise shown on the plans or in the Special Provisions, fabricate the elastomeric portion of each bridge deck joint seal in a single piece, or have the individual pieces factory-vulcanized and the entire elastomeric element shipped as a single unit.

SECTION 705 – GROUT AND MORTAR

705.01 Grout, Type “A.” Type A grout is Portland cement and water, containing an Engineer approved expansion admixture or compound.

The Department requires the 28-day compressive strength of grout cubes be at least 4,000 psi when cured and tested in accordance with AASHTO T-106, except confining cover plates are to be clamped on the molds immediately after filling, and left on the molds for at least 20 hours.

- A. Portland Cement.** Provide Portland cement as specified in 701. Ensure cement used for grouting does not contain lumps or other indication of hydration or “pack set.”
- B. Water.** Use water that is potable, clean and without injurious quantities of substances known to be harmful to Portland cement, aggregate or pre-stressing steel in accordance with 720.01.
- C. Admixtures.** Use admixtures that impart the properties of low water content, good flowability, and minimum of bleed and expansion properties. The grout must expand at least 5 percent but less than 10 percent as determined by extension of grout above the mold during cure as measured at the center of the specimen. Make a separate, unconfined specimen for this purpose. Use formulations that contain no chemical in quantities that may have harmful

effects on the pre-stressing steel or cement. Do not use admixtures containing chlorides, fluorides, sulphites and nitrates.

- D. Mixing of Type “A” Grout.** Add water to the mixer first, followed by Portland cement.

Mix the grout until a uniform, thoroughly blended grout is obtained without excessive temperature increase or loss of expansive properties of the admixture, if used. Continuously agitate the grout until it is pumped.

Do not add water to the grout to increase the flowability, which has been decreased by delayed use of the grout.

Base proportions of materials on tests made on the grout before grouting is begun. The Department requires the water content to produce a flow time of at least eleven seconds, as determined by ASTM C939. Provide test reports from a commercial laboratory confirming properties of grout made with materials supplied for the project.

705.02 Grout, Type “B.” Provide Class shown on the plans.

- A. Class I, Non-metallic, Non-shrink.** Meet the following criteria:

1. Pre-blended, commercial product with a 28-day compressive strength of at least 5,800 psi.
2. Nonmetallic, non-shrink, water mixing compound containing Portland cement, silica sand or other agents such as water reducers, plasticizers, fillers, etc.
3. Does not use chlorides, fluorides, sulphites or nitrates.
4. Meet ASTM C1107 grade B or C and the following:
 - a. When dried in air at 50% relative humidity for 28 days after standard 28 day moist cure, present 0.3 percent or less expansion from beginning of cure.
 - b. Shrinkage 0.0 percent.
 - c. Provide test data report to verifying compliance.

Strictly observe the manufacturer’s recommendations regarding mixing, maximum water content, application, curing temperatures, and curing conditions.

Sandblast areas being grouted.

Obtain the Engineer’s approval of the grout material before use.

706.03

B. Class II, Metallic, Non-shrink. Meet the requirements of Type B, Class I, except that the Engineer will allow metallic aggregates.

Do not use for any pumping application or where discoloration would be objectionable. Do not vibrate metallic aggregate grouts.

Obtain the Engineer's approval before use.

705.03 Grout, Type "C." Type C grout is two-component, 100 percent reactive epoxy system that is volumetrically stable.

Minimum required compressive strength in 24 hours is 5,800 psi.

Strictly observe the manufacturer's recommendations as to mixing and blending, aggregate gradation and dryness, application and curing temperatures.

Sandblast grout areas.

Obtain the Engineer's approval before use.

705.04 Grout, Type "D." Type D grout is one part Portland cement and two parts fine concrete sand by volume containing only enough water to permit placing and packing.

Provide materials that meet 701 and 703. The Engineer may waive the gradation requirements of 703.02.B to allow a finer-textured grout.

Clean grout surfaces of loose or foreign material that would prevent a bond between the grout and the base concrete. Flush grout areas with water and dry surface before placing the mixture. Cure using water or other Engineer approved method as specified in 502.03. Remove defective grout and replace at no additional cost to the Department.

SECTION 706 - PIPE

706.01 General Requirements for Concrete Pipe. Provide test results for strength, absorption, and hydrostatic pressure for concrete pipe from the manufacturer.

Only use manufacturers of precast concrete products that hold current certification under the NPCA Plant Certification Program, the ACPA Q-Cast Plant Certification Program, or PCI Plant Certification Program.

706.02 Concrete Sewer Pipe. Meet AASHTO M 86 for the specified strength classes.

706.03 Concrete Pipe for Irrigation or Drainage. Meet ASTM C 118.

706.04 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe. Meet AASHTO M 170 for the strength classes specified. If centrifugally cast concrete pipe is supplied, the Engineer may waive the AASHTO requirements for minimum wall thickness and area of steel reinforcements, provided that the pipe meets strength and other requirements.

Add to Table 4 (Wall A) of AASHTO M 170:

Internal Diameter in	Wall Thickness A in	Area Steel* in ² /ft	Type Reinforcement
33	2 ⁷ / ₈	0.38	Elliptical
36	3 ¹ / ₈	0.42	Elliptical
42	3 ³ / ₄	0.49	Elliptical
48	4 ¹ / ₈	0.60	Elliptical

*Per unit length of pipe wall

Add to Table 5 (Wall A) of AASHTO M 170:

Minimum Concrete Strength, 6,000 psi.

Internal Diameter in	Wall Thickness A in	Area Steel* in ² /ft	Type Reinforcement
12 (300)	2 (50)	0.11 (2.3)	Circular
15 (375)	2 (50)	0.21 (4.4)	Circular
18 (450)	2 1/4 (57)	0.30 (6.3)	Circular
21 (525)	2 3/8 (60)	0.39 (8.2)	Circular
24 (600)	2 1/2 (63)	0.54 (11.4)	Circular
27 (675)	2 5/8 (66)	0.50 (10.5)	Elliptical
30 (750)	2 3/4 (69)	0.55 (11.6)	Elliptical
33 (825)	2 7/8 (73)	0.63 (13.3)	Elliptical
36 (900)	3 1/8 (79)	0.70 (14.8)	Elliptical
42 (1050)	3 3/4 (95)	0.80 (16.9)	Elliptical
48 (1200)	4 1/8(104)	0.98 (20.7)	Elliptical

*Per unit length of pipe wall

706.06 Corrugated Metal Pipe and Pipe Arches. Meet AASHTO M 36 or M 196 with the following additions:

706.11

1. Provide special sections that are the same thickness as the conduit they are joined to and that meets AASHTO M 36 or M 196.
2. Repair the damaged spelter coating on pipe with approved asphalt cement that meets AASHTO M 36.
3. Provide close riveted pipe with the rivets on circumferential seams placed on approximate 2.5 in centers with a maximum spacing of 3 in.
4. Provide asphalt coated pipe that meets AASHTO M 190, type A. Do not coat coupling bands unless otherwise specified.
5. Provide polymer coated pipe with one of the following:
 - a. Meet AASHTO M 245, except coating thickness shall be 10 mils minimum on each side.
 - b. Meet AASHTO M 36, which has additionally been coated with material meeting polymer coating requirements of AASHTO M 246.
6. The Engineer will waive the provisions of AASHTO M 36, section No. 13.1 requiring testing of helical welded seam corrugated metal pipe by AASHTO T 241 for pipe that has had the ends successfully re-rolled into annular corrugations.
7. Provide spiral rib corrugated steel pipe that meets AASHTO M 36, Type IR, with the following exceptions:

Fabricate each pipe end with at least two annular corrugations for joining pipe sections with coupling bands. Provide coupling bands at least 12 in wide having two corrugations, spaced to seat in the second corrugation of each pipe without creating a gap greater than $\frac{1}{2}$ in between pipe ends. Provide gaskets that meet ASTM C-361, section 6.9 or AASHTO M 198, section 4.1.
8. The Engineer may approve coupling devices other than the standard configurations provided the Contractor's supplier submits test data confirming that the device complies with joint performance criteria of AASHTO Standard Specifications for Highway Bridges, Division II Section No. 23. Obtain the Engineer's review and approval before use.

706.07 Metallic (Zinc or Aluminum) Coated Corrugated Steel Underdrains. Meet AASHTO M 36.

706.08 Corrugated Aluminum Pipe for Underdrains. Meet AASHTO M 196.

706.10 Corrugated Polyethylene Drainage Tubing. Meet AASHTO M 252.

706.11 Gaskets for Concrete Pipe. Meet AASHTO M 198, type A or B.

706.12 Rubber Gaskets for Corrugated Metal Pipe. Meet ASTM D1056, Grade 2C3.

706.13 Acrylonitrile-Butadiene-Styrene (ABS) or Polyvinyl Chloride (PVC) Composite Sewer Pipe. Meet ASTM D2680.

706.14 Class PS 46 Polyvinyl Chloride (PVC) Pipe. Meet AASHTO M 278.

706.15 Ribbed Polyvinyl Chloride (PVC) Pipe. Meet ASTM F949 or ASTM F794.

706.16 Corrugated Polyethylene (PE) Pipe. Meet AASHTO M 294 for corrugated PE pipe nominal size of 12 in to 60 in diameter, inclusive, and meet AASHTO MP7 for corrugated PE pipe nominal size of 54 in and 60 in diameter.

706.17 Ribbed PE Pipe. Meet ASTM F894.

706.18 Steel Reinforced Ribbed PE Pipe. Meet AASHTO MP 20 or ASTM F2562.

706.19 Polypropylene pipe. Supply Polypropylene pipe meeting ASTM F2736 and ASTM F2764 per ASTM F2736 and ASTM F2764.

SECTION 707 - PAINT

707.01 General. Provide homogenous paint, without contaminant and of a consistency suitable for use. Do not allow pigment to settle excessively, cake or thicken in the container, and become granular or curdled during the pigment dispersion in vehicle.

707.02 Paint Formula. Unless otherwise specified or approved, follow formulations in accordance with Federal Paint Specifications (TT), or Steel Structures Painting Council (SSPC).

Tint coatings sufficiently different to provide a contrast between coats. Match the topcoat colors as designated on the plans or specifications to color chip numbers in Federal Standard No. 595. The Engineer will not allow field tinting.

Provide technical data sheets, material safety data sheets, and specific application instructions for coatings. Provide the manufacturers quality control test results for each paint batch component used on the project. Provide weight per gallon, viscosity, percent solids by weight, and finish coat color chips for the selected color. Provide percent of metallic zinc by weight in the cured zinc primer coat and percent of metallic zinc by weight in the zinc pigment component for zinc rich primers.

The Engineer will accept the applicable National Transportation Product Evaluation

Program (NTPEP) and the North East Protective Coating Committee (NEPCOAT) QPL paint formulations for products applied to structural steel specified formulations and paint systems. The Engineer will still test QPL paints from these programs based on this Standard Specifications, the manufacturer's specification or both for acceptance as per the quantities listed in the ITD Quality Assurance Manual.

Paints with a Volatile Organic Compounds (VOC) of 3.5 lb/gal maximum are acceptable.

FORMULA No. 1, Specification:	Primer, Inorganic Zinc Rich AASHTO M 300 Type I, or SSPC Paint 20 Type 1-C, Zinc Dust - ASTM D 520 Type II. Meet Class B requirements for Slip Coefficient and Creep Resistance.
FORMULA No. 2, Specification:	Primer, Organic Zinc Rich SSPC Paint 20 Type II, Zinc Dust – ASTM D 520. Meet Class B requirements for Slip Coefficient and Creep Resistance when specified.
FORMULA No. 3, Specification:	Primer, Zinc Rich Moisture-Cure Polyurethane SSPC Paint 40, Zinc Dust – ASTM D 520 Type II. Meet Class B requirements for Slip Coefficient and Creep Resistance when specified.
FORMULA No. 4, Specification:	Primer, High Solids Polyamide Epoxy SSPC Paint 22
FORMULA No. 5, Specification:	Intermediate, High Solids Polyamide Epoxy SSPC Paint 22
FORMULA No. 6, Specification:	Intermediate, Moisture-Cured Polyurethane, Micaceous Iron Oxide Reinforced, Performance-Based SSPC Paint 41
FORMULA No. 7, Specification:	Topcoat, High Solids Polyamide Epoxy SSPC Paint 22
FORMULA No. 8, Specification:	Topcoat, High Solids Aliphatic Polyurethane SSPC Paint 36
FORMULA No. 9, Specification:	Topcoat, Aliphatic Moisture-Cured Polyurethane SSPC Paint 38

- FORMULA No. 10, Micaceous Iron Oxide - Aluminum, Moisture-Cured Polyurethane**
 Specification: Volume Solids – 60% Minimum
 Weight Solids – 70% Minimum
 Pounds/Gallon – 10.0 Minimum
 Gloss – Flat
- FORMULA No. 11, Primer, Latex, Exterior,**
 Specification: TT-P-1984, The Engineer will not accept paint containing lead, chromium or cadmium pigments, or lead driers.
- FORMULA No. 12, Paint, Latex, Exterior, Semi-Gloss**
 Specification: TT-P-19, The Engineer will not accept paint containing lead, chromium or cadmium pigments; lead driers; or mercurial compounds for fungicide.
- FORMULA No. 13, Concrete Stain, Flat**
 Specification: Provide pigmented sealer that is semi-opaque colored toner containing methyl methacrylate-ethyl acrylate copolymer resins, toning pigments, and solvent. Suspend toning pigments in solution with a chemical suspension agent. Provide toning pigments that consist of laminar silicates, titanium dioxide and inorganic oxides. The Engineer will not allow lead or chromium compounds, settling, or color variation. Do not use vegetable or marine oils, paraffin materials, stearates or organic pigments in any part of coating formulation.
 Volume Solids – 20% Minimum
 Weight Solids – 25% Minimum
 Pounds/Gallon – 9.0 Minimum
 Gloss – Flat
- FORMULA No. 14, Highway Traffic Line Paint, Latex**
 Specification: QPL for ITD Waterborne Traffic Line Paint Formulations

707.03 Certification. Provide a manufacturer's certificate and Quality Control Test Data of each batch or lot as specified in 106.04 for any submitted formulation.

708.05

707.04 Identification and Marking. Plainly mark each container with the following information:

1. Color.
2. Product or Formula Number.
3. Quantity.
4. Batch or Lot number.
5. Date of Manufacturing.

SECTION 708 - METALS

708.01 General. When metal is placed in the work, ensure it is free from dirt, detrimental scale, paint, oil, or other foreign substance. Thin powdery rust and tight rust is not detrimental except in the case of pre-stressing reinforcement.

708.02 Reinforcing Steel. Provide welded wire-fabric for reinforcement that meets the requirements of AASHTO M 55. Unless otherwise specified, provide other reinforcing steel meeting AASHTO M 31, Grade 40 or 60. The Contractor may substitute deformed steel welded wire reinforcement that meets AASHTO M 221 for AASHTO M 31 reinforcing steel or AASHTO M 55 welded wire fabric with Engineer approval.

Provide epoxy coated metal reinforcement in accordance with AASHTO M 284. Do not use colors in shades of brown that inhibit visual detection of rust spots and damage.

Coat reinforcing steel, which is required to be epoxy coated, in a plant certified by the Concrete Reinforcing Steel Institute (CRSI) as a fusion bonded epoxy applicator.

708.03 Dowel Bars. Provide smooth dowel bars meeting AASHTO M 254 except the steel material meeting AASHTO M 31 as an alternative may be provided by the Contractor.

Coat epoxy coated dowel bars in a plant certified by the Concrete Reinforcing Steel Institute (CRSI) as a fusion bonded epoxy applicator.

708.04 Tie Bars. Meet AASHTO M 31, Grade 40 or 60. Ensure tie bars are deformed and epoxy coated.

708.05 Pre-stressing Steel. Use high-tensile wire strand for pre-stressing steel meeting with ASTM A416, or uncoated high-strength steel bars meeting with ASTM A722.

The Department requires pre-stressing steel in the same direction in individual member be of the same type, unless otherwise Engineer approved.

Ensure the assembled units have a tensile strength of at least the manufacturer's minimum guaranteed ultimate tensile strength if bars are to be extended by the use of couplers. Failure of sample to meet this requirement is cause for rejection of that heat of bars, lot of couplers or both, depending on the nature of failure. Obtain Engineer approval for the location of couplers in the member.

Whenever threaded studs, bolts, nuts and washers are specified with ASTM A307, ASTM A325, ASTM A449 or ASTM A563, and when galvanizing is required, use hot-dip zinc coated or mechanically zinc coated requirements.

708.06 Structural Steel and Related Materials

1. Structural Steel.

Provide structural carbon steel in accordance with AASHTO M 270, Grade 36

Provide structural low alloy steel in accordance with, AASHTO M 270, Grade 50

Provide structural low alloy weathering steel in accordance with, AASHTO M 270, Grade 50W

Provide structural high strength steel in accordance with, AASHTO M 270, Grade 100

Provide structural high strength weathering steel, AASHTO M 270, Grade 100W

Unless otherwise specified, fabricate structural steel rolled shapes and plates of structural carbon steel.

Do not use rimmed or capped steel for structural carbon steel, structural low alloy steel, or structural low alloy weathering steel.

Provide the Engineer with proof of weldability before fabrication when steel manufactured in accordance with AASHTO M 270, Grade 50W is used.

Cut plates so that the rolling direction is approximately parallel with the direction of tensile or compression stress. Show the rolling direction on the shop drawings.

Provide base materials for Fracture Critical Members (FCMs) in accordance with, AASHTO M 160, article 9 with the following modifications: Delete Paragraphs 9.2.1, 9.2.2, 9.2.2.1, 9.2.2.2 and 9.2.3 and replaced with the following:

9.2.1 Do not use welding to correct plate surface defects. The Contractor may condition plates by complete removal of imperfections or

depressions on the top and bottom surfaces by grinding. Condition by grinding as follows:

- a. Flare 1:5 without abrupt change in contour.
- b. Ensure the depth of the depression after grinding does not exceed 10 percent of nominal plate thickness or $\frac{1}{8}$ in, whichever is greater.
- c. Ensure areas removed by grinding do not exceed 2 percent of the surface area of the face of the plate where the imperfections are found.
- d. After grinding the net plate, ensure cross-sectional area is 90 percent or more of the nominal cross-sectional area of the plate.

9.2.2 The Contractor may condition the edges of plates to remove injurious imperfections in accordance with the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code, paragraph 3.2.3.

The Department considers longitudinal Charpy V-Notch (CVN) tests mandatory for acceptance on plates and shapes used for flanges and webs of main girders, including their splice plates, transverse and longitudinal stiffeners, floor-beams and plate or shape identified as fracture critical.

Provide sampling procedures in accordance with AASHTO T 243. Use the H (Heat) Frequency of testing for structural steels in accordance with AASHTO M 270, Grades 36, 50 and 50W. Use the P (Piece) Frequency for steels in accordance with AASHTO M 270, Grade 100/100W, and any plate or shape identified as fracture critical. Test in accordance with AASHTO T 244. The testing cost is incidental to the cost of the structural steel and included in the contract unit prices for structural steel.

Provide CVN impact values in accordance with the zone requirements specified on the plans.

2. Bolts.

- A. *General.* Provide unfinished bolts (ordinary machine bolts) in accordance with ASTM A307. Use grade A, unless otherwise specified.

Use turned bolts or other special bolts made from structural carbon steel or as specified.

Provide high strength bolts in accordance with ASTM A325 or ASTM A490. Do not galvanize ASTM A325, Type 2, and ASTM A490 bolts.

Provide anchor bolts in accordance with ASTM F1554 Grade 36, 55 or 105. If the grade is not specified, use Grade 36.

Ensure the maximum tensile strength is 150 ksi for bolts 1 in or less in diameter and 120 ksi for larger bolts.

Provide type 3 bolts when ASTM A325 bolts are used unpainted and non-galvanized. Ensure nuts and washers used with Type 3 bolts have comparable atmospheric corrosion resistance and weathering characteristics.

When ASTM A325 bolts are to be galvanized, ensure the steel is in accordance with the AISI 10XX series with a maximum yield strength of 105 ksi. Do not galvanize ASTM A325 anchor bolts which are 1 in in diameter or smaller and have a yield stress greater than 105 ksi however, they may be used if they are painted with two coats of zinc rich paint, with the specified Formula, consisting of 2 mils minimum dry thickness per coat. For galvanized fasteners, overlap the nuts to the minimum amount required for the fastener assembly. Provide the amount of overlap in the nut that will allow free assembly on the bolt in the coated condition and meet the mechanical requirements of AASHTO M291. The Department considers the rotational-capacity test for overlapping requirements in AASHTO M291, paragraph 7.4, maximum values instead of minimum.

Mark bolts, nuts and washers with a symbol identifying the manufacturer as required in ASTM A325, section 16; ASTM A490, section 18; ASTM A194, section 12; and ASTM F436, section 14. The Contractor's supplier must provide the symbol and address of each manufacturer for the bolts, nuts and washers supplied to the project.

B. *Testing*

- (1) Bolts. Test proof load in accordance with ASTM F606, Method 1. Test minimum frequency in accordance with ASTM A325, paragraph 9.2.4.

Wedge tests full size bolts in accordance with ASTM F606, paragraph 3.5. If bolts are to be galvanized, perform tests after galvanizing. The minimum test frequency is in accordance with ASTM A325, paragraph 9.2.4.

If galvanized bolts are supplied, measure the thickness of the zinc coating. Take measurements on the wrench flats or top of bolt head.

- (2) Nuts. Proof load tests in accordance with ASTM F606, paragraph 4.2. The minimum test frequency is in accordance with AASHTO M291, paragraph 9.3, or AASHTO M292, paragraph 7.1.2.1. If nuts are to be galvanized, perform tests after galvanizing, overtapping and lubricating.

If galvanized nuts are supplied, measure the thickness of the zinc coating. Take measurements on the wrench flats.

- (3) Washers. If galvanized washers are supplied, perform hardness tests after galvanizing. Remove coating before taking hardness measurements. Measure the thickness of the zinc coating.
- (4) Assemblies. Perform rotational-capacity tests on black or galvanized (after galvanizing) bolts, nut, and washer assemblies by the manufacturer or distributor before shipping. The Department requires washers as part of the test even though they may not be required as part of the installation procedure.

Apply the following:

- a) Except as modified, perform the rotational-capacity test in accordance with ASTM A325.
- b) Test each combination of bolt production lot, nut lot and washer lot as an assembly. Where washers are not required by the installation procedures, do not include in the lot identification.
- c) Assign a rotational-capacity lot number to each combination of lots tested.
- d) The minimum frequency of testing is two assemblies per rotational-capacity lot.
- e) Construct the bolt, nut and washer assembly in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device. This requirement supersedes the current AASHTO M164 requirement that the test be performed in a steel joint. For bolts too short to be assembled in the Skidmore-Wilhelm Calibrator, see 708.06.2.B.(4).i.
- f) Use the minimum rotation value in Table 708.06-1 from a snug tight condition (10 percent of the specified proof load).

Table 708.06-1 - Rotational Value

Bolt Length	Nut Rotation
<4D	240° or 2/3 turn
>4D and <8D	360° or 1 turn
>8D	480° or 1 1/3 turn
D is nominal bolt diameter	

(Note: These values differ from ASTM A325 Section 6.3 values.)

- g) Ensure the tension reached at the above rotation is 1.15 times or more of the required installation tension. The installation tension and the tension for the turn test are shown in Table 708.06-2.

Table 708.06-2 - Installation Tension

Diameter (in)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Req. Installation Tension (kips)	12	19	28	39	51	56	71	85	103
Turn Test Tension (kips)	14	22	32	45	59	64	82	98	118

- h) After the required installation tension listed has been exceeded, take one reading of tension and torque and record. Ensure the torque value meets the following :

$$\text{Torque} \leq 0.25 \text{ PD}$$

Where:

Torque = measured torque ft-lb

P = measured bolt tension lb

D = bolt diameter ft

- i) The Contractor may test bolts in a steel joint when they are too short to test in a Skidmore-Wilhelm Calibrator. Do not apply the tension requirement of paragraph 4.g. Compute the maximum torque requirement of paragraph 4.h using a value of P equal to the turn test tension shown in Table 708.06-2.

- (5) Reporting

- a) Record the results of tests (including zinc coating thickness) and in the appropriate AASHTO specifications on the appropriate document, and provide six copies to the Engineer.
 - b) Report location where tests are performed and date of tests on the appropriate document.
- (6) *Witnessing*

The Department does not require the tests to be witnessed by an inspection agency. However, the manufacturer or distributor that performs the tests must certify that the results recorded are accurate.

Supply three complete bolt, nut and washer assemblies from each lot and size to the Engineer for quality assurance testing.

C. *Documentation*

- (1) Mill Test Report (MTR). Provide Mill Test Reports for all mill steel used in the manufacture of the bolts, nuts or washers and where the material was melted and manufactured.
- (2) Manufacturer Certified Test Report(s) (MCTR). The manufacturer of the bolts, nuts and washers must provide MCTR for the item provided.

Report the relevant information on each MCTR in accordance with this subsection.

Include the following with the MCTR rotational-capacity test:

- a) The lot number of each item tested.
 - b) The rotational-capacity lot number.
 - c) The results of the tests required in 708.06.2.B.(4).
 - d) Pertinent information required in accordance with this specification.
 - e) A statement that MCTR for the items are in compliance to this specification and the appropriate AASHTO specifications.
 - f) The location where the bolt assembly components were manufactured.
- (3) Distributor Certified Test Report(s) (DCTR). Include the MCTR in the DCTR for the various bolt assembly components.

Report the rotational-capacity test performed by a distributor or a manufacturer on the DCTR.

Show the results of the tests required in 708.06.2.B.(4).

Show the pertinent information required in 708.06.2.B.(5).

Show the rotational-capacity lot number.

Certify that the MCTR complies with this specification and the appropriate AASHTO specifications.

D. *Shipping*

- (1) Ship bolts, nuts and washers (where required) from each rotational-capacity lot in the same container. If there is only one production lot number for each size of nut and washer, the nuts and washers may be shipped in separate containers.

Permanently mark each container with the rotational-capacity lot number that can be identified at any stage before installation.

- (2) The appropriate MTR, MCTR, or DCTR must be applied to the Contractor or owner as specified.

E. *Lubrication*

Check galvanized nuts to verify that a lubricant is visible on the threads.

Ensure black bolts are “oily” to the touch when delivered and installed.

Clean and lubricate weathered or rusted bolts or nuts before installation. Retest recleaned or relubricated bolt, nut and washer assemblies in accordance with 708.06.2.B.(4) before installation.

3. **Direct Tension Indicators.** Fabricate Direct Tension Indicators (DTI) in accordance with ASTM F959 and the following:

Mechanically galvanize DTI's for unpainted structures in accordance with ASTM B695, Class 50. After galvanizing, coat the DTI with a PPG Power Prime 500 °F epoxy. Electrodeposit the DTI with the epoxy, rinsed, and baked at 350° to 500 °F for 20 minutes. Ensure the final thickness of epoxy is 1 mil and black in color.

Galvanize and epoxy coat the DTI by the manufacturer or under their direct supervision.

The Contractor may use Type-3 DTIs that meet ASTM F959 for weathering steel structures. In addition, manufacture these DTIs from steel in accordance with the chemical requirements of ASTM F436 for Type-3.

4. **Stud Connectors.** Provide stud connectors made by cold heading, cold rolling, or cold machining. Ensure finished stud connectors are of uniform quality and without injurious laps, fins, seams, cracks, twists, bends, or other defects. Ensure studs do not have cracks or bursts deeper than one-half the thickness from the periphery of the head of the shaft. Determine tensile strength of stud connectors by test of bar stock after drawing or of full diameter finished studs. Comply with the following strength requirements as specified in Table 708.06-3.

Table 708.06-3 - Strength Requirements

Tensile Strength	Elongation	Reduction of Area
Min. = 60,000 psi	Min.= 20 percent in 2 in.	Min.= 50 Percent

Provide stud connectors with arc shields (ferrules) of resistant ceramic or other suitable material for welding.

Comply with qualifications, welding, and test procedures specified in ANSI/AASHTO/AWS D1.5 *Bridge Welding Code*.

5. **Steel Castings.** Provide steel castings in accordance with AASHTO M103, Grade 70-36. Heat-treat castings by normalizing and tempering after the castings have been allowed to cool from the pouring temperature to below the transformation range.

Determine Charpy impact properties on each heat from a set of three Charpy V-notch specimens made from a test coupon in accordance with ASTM A370 Methods and Definitions and tested at 70 °F and have a minimum of 25 ft-lb of energy.

An independent testing laboratory must inspect the entire base plates, webs, and pin sockets by both radiographic and magnetic particle examinations. Perform magnetic particle examination in accordance with ASTM E709. Judge radiographic examination in accordance with ASTM E94 and judge types and degrees of discontinuities in accordance with ASTM E186. Supply copies of radiographic negatives to the Engineer.

Ensure the acceptable surface discontinuities and finish is in accordance with ASTM A802 unless otherwise specified. Remove unacceptable visual discontinuities and verify the resultant cavities by visual examination.

Defects that, in the Engineer's opinion, cannot be removed without adversely affecting the casting will be cause for the Engineer to reject the entire casting. The Contractor may repair defects that can be removed without injury to the casting by welding in accordance with ASTM A488. Submit a complete weld procedure for Engineer review and approval before starting any repair work. Include the weld procedure for base metal preparations, pre-heat, electrode, postheat and procedure qualifications. The Engineer may perform radiographic and magnetic particle examination on repair welding.

6. **Steel Forgings.** Use steel forgings for pins, rollers, trunnions, or other forged parts. Accurately turn forgings to the detailed dimensions, smooth, straight, and flawless. Produce the final surface by a finishing cut. Machine final surfaces to a finish of ASA 3 micrometers (125 micro in.) or better unless otherwise specified.

708.07 Steel Guardrail Posts. Manufacture steel W-beam and three-beam guardrail posts in accordance with AASHTO M270M (ASTM A709B), Grade 250. If corrosion resistant steel is required, manufacture in accordance with AASHTO M270M (ASTM A709B) Grade 50W steel. Match the cross-section dimensions of a W6x9 post in accordance with AASHTO M160M (ASTM A6m). W6x8.5 wide flange posts are an acceptable alternative.

After the section is cut and holes are drilled or punched zinc-coat the component in accordance with AASHTO M111 (ASTM A123). If corrosion resistant steel is used zinc-coat the portion of the post to be embedded in soil in accordance with AASHTO M111 (ASTM A123) and do not zinc-coat, paint or otherwise treat the portion above the soil.

708.08 H-Beam Piles. Provide H-beam piles of structural steel in accordance with ASTM A 36. Furnish the Engineer with two certified copies of ladle analysis and physical test records.

708.09 Barbed Wire. Provide barbed wire in accordance with AASHTO M 280.

708.10 Woven Wire. Provide woven wire in accordance with ASTM A116, except wire size and strength options are limited to the following subsections of Table 1 of ASTM A116:

1. No. 12 1/2 Grade 60, No. 12 1/2 Grade 125, or No. 14 1/2 Grade 125. Ensure fence height, wire spacing, and stay spacing are as specified.

708.11 Hardware for Barbed or Woven Wire Fence. Provide 9 gage staples with a minimum length of 1.5 in, except that 1 in staples may be used in locust posts.

708.13

Provide 9.5 gage stay wire, 9 gage brace wire, and 12.5 gage tie wire and wire clamps. Provide stay wire, brace wire, tie wire and wire clamps in accordance with ASTM A 116. Galvanize the wire if no coating class is specified.

708.12 Metal Posts for Barbed or Woven Wire Fences. Provide painted or galvanized metal fence posts in accordance with AASHTO M 281 or ASTM A702. The Engineer will not accept punched lug-type posts.

708.13 Chain Link Fence. Provide 2 in diamond mesh woven chain link fabric from 11 gage (3.05 mm) coated wire. Ensure the weight of coating for galvanized fabric is 1.2 oz/ft². Provide posts, braces, tension wire, fittings and other hardware in accordance with Table 708.13-1.

Table 708.13-1 - Chain Link Posts and Braces

Fence Height		Pipe Section	C-Section (Class does not apply)		
		Min Size in-od	Min Weight lb/ft	Min Size in	Min Weight lb/ft
Line Posts					
≤6 ft	Class 1	1.9	2.72	1.875 x 1.625	1.85
	Class 2	1.9	2.28		
≤8 ft but > 6 ft	Class 1	2.375	3.65	1.875 x 1.625	2.28
	Class 2	2.375	3.09		
Corner and End Posts					
≤6 ft	Class 1	2.375 3.65			
	Class 2	2.375	3.09		
≤8 ft but > 6 ft	Class 1	2.875	5.79		
	Class 2	2.875	4.64		
Braces					
All Heights	Class 1	1.625	2.27	1.625 x 1.25	1.35
	Class 2	16.25	1.82		

Class 1 pipe lengths longer than those shown must comply with the weights relative to min O.D. shown in ASTM F1083, Schedule 40. The Engineer will allow interpolation of the weights shown in ASTM F1083.

Provide Class 2 pipe lengths longer than those shown that complies with the requirements for Class 1 adjusted per the formula below:

$$WtC2(\text{lb/ft}) = 0.7574 \times WtC1(\text{lb/ft}) + 0.2814 (\text{lb/ft})$$

where $WtC2$ =Weight (lb/ft) required for Class 2 posts and $WtC1$ =Weight (lb/ft) required for Class 1 posts.

Class 1 Pipe sections: Meet ASTM F1083, Schedule 40.

Class 2 Pipe sections: Meet outside dimension requirements of Schedule 40 and have minimum yield strength of 50,000 psi. Hot dip zinc coat class 2 pipe with at least 0.9 oz/ft² of exterior surface, over-coated with clear acrylic. Coat pipe interior surface with hot dip zinc or zinc rich paint to a minimum thickness of 0.3 mils.

Use either Class 1 or Class 2 posts and braces within the limits of the project.

Ensure C-Sections have a minimum yield strength of 45,000 psi. Ensure coating of C-Sections are the same as Class 1 or Class 2 pipe.

The Engineer may review and approve other post and brace types proposed, that meet Federal Specification RR-F-191/3C.

Provide tension wire 3/16 in diameter and 1.2 oz/ft² zinc coating. For fencing, fittings, and hardware meet AASHTO M 181.

708.14 Steel Guardrails and Fittings. Provide galvanized beam rail elements and terminal sections that meet AASHTO M-180, Class A, Type 2, except that galvanizing the rail occurs after fabrication, with fabrication to include forming, cutting, shearing, punching, drilling, bending, welding, and riveting. In addition, ensure the minimum average mass of zinc coating is 2 ounces per square foot of surface (not sheet). Galvanize channel rails, splice plates, WF steel posts in accordance with ASTM A 123. Galvanize anchor cables in accordance with AASHTO M30.

Provide bolts, nuts and washers used with steel beam guardrail in accordance with ASTM A 307 or A 325, except that rail splice bolts must be button headed. Provide galvanized bolts, nuts, washers and other fittings used with steel beam guardrail in accordance with ASTM A 153.

708.15 Milepost Plates. Fabricate plates from 0.08 in finished flat aluminum sheet in accordance with ASTM B 209 M, Alloy 6061-T6, with an alodine 1200 finish.

708.17

Provide milepost plates with a green reflectorized background and white reflective legends and borders.

The Contractor may fabricate milepost plates with green silk screen paste or cutout direct applied white reflective sheeting legends and borders.

Ensure milepost plates visually match the limits of the current Color Tolerance Chart - highway green, prepared by the U.S. Department of Transportation, Federal Highway Administration.

708.16 Rigid Posts for Delineators, Snow Poles, and Milepost.

1. Provide finished steel posts for delineators and snow poles weighing a minimum of 1.12 lb/ft and that meet ASTM A 702, Steel B. Coat with a deep green, baked-on enamel finish.
2. Provide steel posts for mile posts, Type E1, that meet ASTM A 1011 Grade 45 minimum, ASTM A 653, G 90, and ASTM with 12 gage thickness.

708.17 Steel and Aluminum Sign Supports.

A. General

Galvanize structural steel in accordance with ASTM A 123. Zinc coat miscellaneous steel hardware in accordance with ASTM B 633, Class No. Fe/Zn 25, Type III coating. Galvanize steel square tubes (type E Signposts) in accordance with ASTM A653 G 90.

Provide anchor bolts with three nuts and two washers. Galvanizing the nuts, washers and no less than 10 in of the threaded end of the anchor bolts in accordance with ASTM A153. Ensure the anchor bolt threads accept galvanized nuts without tools or causing removal of the protective coating after galvanizing.

B. Ground-Mounted Sign Supports. Provide Ground-Mounted Sign Supports as follows:

1. Steel for type A sign posts: meet ASTM A709 Grade 50.
2. Steel for type B sign posts: meet ASTM A500 Grade B.
3. Steel posts for Type E sign posts: meet ASTM A1011, Grade 45 minimum, ASTM A653M G 90, and ASTM A513. E1 posts are 12 gage. E2 posts are 10 gage.
4. Structural steel for brace angles and brackets: meet ASTM A 36.
5. High strength bolts, nuts and washers for sign posts: meet ASTM A 325.

6. Anchor bolts, nuts, and washers: meet ASTM F 1554.

Finish shop fabrication of steel supports, brace angles, and brackets with galvanizing. The Engineer will not allow field modification that damages the galvanization.

- C. **Overhead Sign Structures.** Provide Overhead Sign Structures as follows:

Fabricate sign structure components from material meeting the specifications in the Table 708.17-1.

Table 708.17-1 - Overhead Sign Structure Components

Steel Structure	Aluminum Structure
ASTM A 36 (Except ASTM A 283)	ASTM B 308, Alloy 6061-T6
ASTM A 53, Types E & S, Grade B	ASTM B 429, Alloy 6063-T6
ASTM A325	ASTM B 209, Alloy 2024-T4
ASTM F 1554 (anchor bolts)	

Provide end poles, mastarms, or truss assemblies formed into a continuous shaft. Provide pole shafts uniformly straight, with a permissive variation not to exceed 3/4 in, measured at the midpoint of the pole in place and unloaded.

Provide aluminum bolts with an anodic coating 0.0002 in minimum thickness with a dichromate or boiling water seal, coated with a suitable lubricant.

Provide overhead sign structures fabricated entirely from steel, or aluminum, providing only one type on the project. Manufacture structures alike.

The Engineer will only approve splices for the overhead steel sign structure.

Finish shop fabrication of overhead steel sign structures, posts and brackets before galvanizing. Repair damaged galvanized surface as follows:

1. Thoroughly clean the damaged area and remove traces of welding flux and loose or cracked spelter.
2. Paint the cleaned area with two coats of zinc dust-zinc oxide paint.

- 708.18 Hardware for Signs.** Provide zinc coated steel, or aluminum bolts, nuts, washers and other hardware items used for fabrication and mounting of signs in accordance with applicable specifications as follows:

Electrodeposited Coatings of Zinc on Iron and Steel ASTM B 633
Class No. Fe/Zn 25, Type III Coating

Low or Medium Carbon Steel Externally or Internally Threaded Standard Fasteners.....	SAE J429 or SAE J995
both Grade 2	
Alloy-Steel Bolting Materials for Low-Temperature Service	ASTM A 320
Aluminum-Alloy Sheet and Plate.....	ASTM B 209
Flat washers.....	ASTM B221, Alloy Alclad 2024-T4
Aluminum-Alloy Bars, Rods, and Wires	ASTM B 211
Lock nuts.....	Alloy 2017-T4
Bolts and screws	Alloy 2024-T4 or 6061-T6
Nuts 1/4 in tap and under.....	Alloy 2024-T4
Nuts 5/8 in tap and over	Alloy 6061-T6 or 6262-T9
Spring lock washers	Alloy 7075-T6
Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.....	ASTM B 316
Blind rivets.....	Alloy 2017-F, 2117-F or 5056-F

708.19 Illumination Poles and Bases. Manufacture furnished lighting poles alike. Submit shop drawing for Engineer approval before fabrication begins. Use materials for fabricating poles in accordance with applicable specifications as follows:

High Strength Bolts and Nuts.....	ASTM A 325
Anchor Bolts.....	ASTM F 1554
Mild To Medium-Strength Carbon-Steel Castings for General Application.....	ASTM A-27
Cast steel parts	Grade 65-35
Structural Steel Sheet	ASTM A 659, ASTM A 572, and ASTM A 1011
Sheet Steel for fabricating shafts, anchor bars and nuts	
Welded and Seamless Steel Pipe	ASTM A 53
Steel pipe for lighting bracket arms	
Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.....	ASTM A 123

Galvanizing steel poles	
Gray Iron Castings for Valves, Flanges, and Pipe Fittings	ASTM A 126
Cast iron parts	
Zinc (Hot-Dip) on Iron and Steel Hardware	ASTM A 153
Galvanizing anchor bolts and bracket arms	
Aluminum-Alloy Sand Castings or	
Permanent Mold Castings	ASTM B 26 M or B 108
Aluminum base flanges and transformer bases Alloy A 357.0-T6	
Aluminum Die Castings	ASTM B 85
Alloy 380	
Aluminum-Alloy Bars, Rod and Wire	ASTM B211
Aluminum pole shafts and aluminum lighting bracket arms Alloy 6063-T6	

Catalog numbers listed on the plans are provided only for the purpose of showing general dimensions and configurations. Poles and appurtenances must be capable of supporting design loads within allowable stress ranges as set forth in the AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*. Weld in accordance with AASHTO Specifications.

Form the pole into a continuously tapered shaft having uniform taper of approximately 0.14 in/ft. Provide pole shafts straight with an allowable variation of 1 in or less measured at the midpoint, in place, and unloaded. Cover the top of the pole shaft with a removable waterproof pole cap. The maximum pole deflection allowed after loading (excluding wind load) is equal to 1 percent of the shaft length.

Secure a removable anchor bolt cover or covers to the base plate.

Provide a hand hole in the pole shaft with a reinforcing frame and cover. Locate the hand hole 90° to 270° from the bracket arm. Provide a bonding device in the lower half of the hand hole reinforcing frame for grounding purposes.

Ensure materials, components and hardware for each pole assembly is compatible with the type of pole used.

Fabricate steel pole shafts from sheet steel. Permanently show the pole wall thickness on each pole near the base.

Galvanize poles after welding is complete.

Provide aluminum poles with a natural finish and without defects. Form anchor bases for aluminum poles from aluminum alloy secured to the bottom of the shaft so the full strength of the shaft is developed.

708.21

Galvanize at least 10 in of the threaded end of the anchor bolts, and the nuts and washers. Ensure the anchor bolt threads accept galvanized nuts without requiring tools or causing the removal of the protective coating after galvanizing.

Provide threaded hubs for steel poles made of forged steel in accordance with ASTM A 105. Ensure the end of the hub inserted into the pole shaft has a minimum 1/4 in round beveled end or edge to prevent insulation stripping during wire pulling operations. Do not use half pipe coupling, tank spud, etc.

Provide four-bolt configuration safety slip bases. Design the base to meet necessary design loading requirements and as a minimum meet the current breakaway requirements of the AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*.

Design breakaway support couplings to meet necessary design loading requirements and as a minimum meet the current breakaway requirements of the AASHTO *Standard Specifications for Highway Signs, Luminaires and Traffic Signals*. Limit use of the couplings to pole assemblies weighing less than 900 lb and poles providing 40 ft or less nominal luminaire mounting heights unless higher mounting heights are specified.

Surround the support coupling with a 1/16 in aluminum skirt fastened with No. 10 x 5/8 in stainless steel sheet metal screws.

708.20 Structural Plate Pipe, Pipe Arches and Arches. Provide material for structural pipe and pipe arches that meets AASHTO M 167 or M 219.

The Engineer will accept hot dipped or mechanically galvanized bolts and nuts provided they meet ASTM A 449 and ASTM A 563.

Provide polymer coated pipe that meets AASHTO M 246; except the coating may be shop or field applied after corrugation, and coating thickness must be a minimum of 0.01 in on each side of the sheet. After tightening, coat exposed portions of bolts and nuts (both on soil side and water side of pipe) with the same material used on the pipe.

The Contractor may substitute polymer coated pipe for bituminous coated pipe.

When yielding seam (keyhole slotted) pipe is specified to be bituminous coated, or polymer coated, do not coat mating surfaces in the overlap portion of the joint unless authorized in writing by the pipe manufacturer.

708.21 Metal Aprons. Meet AASHTO M 36 or M 196.

708.22 Manhole Covers and Rings, Grates, Catch Basins, Inlets, Etc. Meet AASHTO M306, Class 35 for Gray Iron.

708.25 Aluminum Rail and Fittings. Meet the following:

Aluminum-Alloy Sheet and Plate.....	ASTM B 209
Guardrail Plate and Terminal Plate.....	ASTM B 221 Alloy-Alclad 2024-T3
Washers	ASTM B 221 Alloy-Alclad 2024-T4 not anodized
Aluminum-Alloy Bars, Rods, and Wire	ASTM B 211
Bolts	Alloy 2024-T4, 30 min. anodized and 30 min. seal
Nuts.....	Alloy 6061-T6, not anodized

Ensure rail element joints tensile strength is 80,000 lb or more. Ensure the rail element does not deflect more than 5.5 in when tested as a simple beam with the traffic face up and with a 2,000 lb load applied at the center of a 12 ft clear span, through a 3 in wide, flat bearing.

708.26 Extruded Aluminum. Meet ASTM B 221, Alloy 6063-T6 for reflective sheeting backgrounds. Ensure extrusions are flat and true within a tolerance of 1/4 in per 8 ft of panel length. Prevent deviation from flat surface across the width of the panel before coating from exceeding 0.005 in/in of width. Provide continuous extruded sections for the length of the signs.

708.27 Sheet Aluminum. Meet ASTM B 209, Alloy 6061-T6 or 5052-H38 with an alodine 1200 finish. Provide sheet aluminum used for flat aluminum signs with the following minimum thickness:

Type B Signs – 0.063 in	May be used for panel-applied signs only required for stand-alone signs.
	May be used for panel-applied signs.
Type B Signs	0.08 in

708.28 Caps for Right-of-way and Street Markers. Cast caps from brass or bronze.

Ensure the top of the finished casting is free from blowholes, pits, cracks, corrugations, or other surface roughness to render completely legible the standard identification and other letters or numerals which may be subsequently stamped.

Stamp each cap or cast as specified.

708.29 Self-Lubricating Bronze Bearing Plates. Provide self-lubricating bronze bearing plates with circular recesses filled with an approved lubricating compound of graphite and metallic substances with a lubricating binder. Press the

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compound into the recesses so as to form dense, nonplastic lubricating inserts. Cover 25 percent or more of the total area of the plate with the lubricating material.

708.30 Steel Shell Piles. Provide cylindrical, cylindrical with a taper, or step-tapered steel shell piles. Provide cylindrical shell piles with an outside diameter as specified. Provide tapered piles with outside tip diameter a minimum of 8 in and the outside butt diameter not less than shown on the plans.

Provide steel shell piles driven without a mandrel of sufficient strength and rigidity to permit driving to the specified resistance without distortion. Ensure the steel minimum yield strength is 30,000 psi. Furnish four copies of a certified test report showing compliance with yield strength requirements. Ensure the minimum wall thickness is 1/4 in. Ensure steel shell piles in exposed pile bents in water have a minimum wall thickness of 5/16 in. Unless otherwise specified equip shells driven without a mandrel with driving points, flat plates, or other suitable end closures, adequately fixed, and of sufficient thickness and strength to permit driving without distortion and remain water tight.

Provide steel shell piles that when driven with a mandrel of sufficient thickness the pile will hold its original shape after the mandrel is withdrawn and shows no harmful distortion after it and the adjacent piles have been driven.

708.31 Permanent Metal Concrete Forms. Meet ASTM A 653 M SS designation with coating Designation Z500, and meet requirements relevant to steel permanent metal forms and the placing of concrete as specified.

SECTION 709 - CONCRETE CURING MATERIALS AND ADMIXTURES

709.01 Membrane-Forming Curing Compound. Meet:

System 1. AASHTO M 148, Type 1-D, Class B with Fugitive Dye

System 2. AASHTO M 148, Type 2, Class B, White Pigmented

709.02 Concrete Admixtures - General. If more than one admixture is used, use the same brand from the same manufacturer, and ensure it is compatible, and can be dispersed in accordance with the manufacturer's recommendations. Do not use admixtures containing chlorides, flourides, sulphites, and nitrates unless otherwise specified.

709.03 Air Entraining Admixtures. Meet AASHTO M 154.

709.04 Set Retarding Admixtures. Meet ASTM C 494.

709.05 Water Reducing Admixtures. Meet ASTM C 494.

709.06 Lithium Nitrate Admixtures. Provide lithium nitrate admixture consisting of a 30% aqueous lithium nitrate solution. Use the same brand and from the same manufacturer as that reported in the mix design and used in the concrete alkali-silica reaction mitigation testing for the lithium nitrate admixture used in the concrete. Follow manufacturer's recommendations.

SECTION 710 - TIMBER AND PRESERVATIVES

710.01 Structural Timber and Lumber. Provide Douglas Fir or Larch structural timber and lumber of the grade specified. Ensure grade of structural timber and lumber is determined using the current version of the Western Wood Products Association (WWPA) standard grading rules of western lumber. Ensure wood is incised and treated to meet AWPA Standard C-14.

710.02 Wood Sign Posts. Provide sign posts surfaced four sides, (S4S), and free of wane and decay. Ensure ends are cut square and the post incised on all four sides before treating. No checks shall be more than 1/4 in in width. The Engineer will not accept twisted pieces. Ensure sweep is limited to 1 in per 10 ft. Incise in accordance with AWPA Standard C2 and treat as specified in 710.09.

Provide treated and graded Douglas Fir or Hem-Fir sign posts. Use the current version of the West Coast Lumber Inspection Bureau (WCLIB) or WWPA to meet the following grades and requirements:

Douglas Fir:

4" x 4" 85% of the sign posts free of heartcenter. Structural Light Framing, No. 2 grade per paragraph 124c WCLIB or paragraph 42.12 WWPA.

4" x 6" 85% of the sign posts free of heartcenter. Structural Joists and Planks, No. 2 grade per paragraph 123c WCLIB or paragraph 62.12 WWPA.

6" x 6" or
6" x 8" Posts and Timbers, No. 1 grade per paragraph 131b WCLIB or paragraph 80.11 WWPA.

Hem-Fir:

6" x 6" or
6" x 8" Posts and Timbers, Select Structural per paragraph 131a WCLIB or paragraph 80.10 WWPA.

Provide posts inspected and certified in accordance with the designated current

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grading and dressing rules of the WCLIB or WWPA. Provide a certificate of inspection executed by the WCLIB, the WWPA, or the Pacific Lumber Inspection Bureau (PLIB), at the time of delivery. Ensure certificates of inspection identify the destination or F.O.B. for which the material is intended and each piece is inspected, certified, and stamped with a mark to indicate inspection. Such certification or grade marking, however, does not constitute final acceptance of the material by the Engineer, and the Engineer may reject lumber or timber that does not comply with the specifications upon delivery.

710.03 Wood Guardrail Posts and Wood Spacer Blocks. Provide rough surfaced two sides, (S2S), or S4S wood guardrail posts and wood spacer blocks. Do not exceed the size tolerance of $\pm 1/4$ in for rough sawn blocks. Provide incising that meets AWWPA Standard C2 and treat as specified in 710.09.

Grade guardrail post and blocks using WWPA standard grading rules for western lumber and the following:

Douglas Fir or Larch.....	No. 1 Grade
Hem-Fir	No. 1 Grade
Pine (Lodge pole, Ponderosa, Idaho White, & Southern)	No. 1 Grade
Western Red Cedar.....	No. 1 Grade

The Engineer will reject an otherwise acceptable guardrail post with a through check, shake, or end split in the same plane, or parallel plane as the bolt hole and extending from the top of the post to within 3 in of the bolt hole, unless it is provided with a tight fastening across the separation centered 2 in below the top of the post. Use a galvanized bolt fastener 1/2 in diameter with a galvanized washer under the bolt head and the nut. Treat holes for fastening with preservative.

710.04 Service Poles for Power. Meet ANSI No. 05.1. The Contractor may use Douglas Fir, Larch, Hemlock and Pine (all species). Treat poles as specified in 710.09.

710.05 Timber Piles.

1. Provide first quality timber piles Douglas Fir or Western Larch that meet ASTM D 25 unless otherwise specified.
2. Treated Piles. Treat as specified in 710.09.
3. Untreated Piles. Provide untreated piles with a high heartwood content and a diameter of heartwood at least eight-tenths of the diameter at the butt.
4. Dimensions. Provide piles with a diameter at a section 3 ft from the butt and at the tip as shown in Table 710.05-1 unless otherwise specified.

Table 710.05-1 - Pile Diameter

Length of Piles – ft.	Butt Diameter - in	Tip Diameter – in., minimum
Under 40	12-18	8
40-60	13-18	7
Over 60	14-20	6

The Engineer will measure the diameter of the piles after peeling. When the pile is not exactly round, the Engineer will use the average diameters, or the circumference divided by $PI = 3.14159$ to determine the diameter. For any structure, provide pile with the butt diameters and length as uniform as practical.

710.06 Service Poles for Illumination. Provide poles thoroughly seasoned and treated, 35 ft long, rated class 4; machine peeled; and that meets ANSI 05.1, except that the number and size of knots and the sweep of the pole can be two-thirds that allowed by the ANSI specification. Provide treated poles as specified in 710.09.

710.07 Pole Keys. Provide thoroughly seasoned and treated pole keys, 5 ft long, have a 4 in minimum dimension and a minimum cross-sectional area of 25 in².

Treat pole keys as specified in 710.09.

710.08 Posts for Barbed or Woven Wire Fence. Provide line posts with a minimum post circumference of 10 in and install a minimum distance between opposite faces or between any face and an opposite corner of 3 in. Provide posts for corner, terminal, or braces with a minimum circumference of 17 1/2 in and install a minimum distance between opposite faces or between any face and an opposite corner of 4 in.

Pressure treat wood posts as specified in 710.09. The contractor may use Douglas Fir, Western Larch, Cedar, or Pine of any species.

710.09 Preservative Treatment. Provide treated timber and lumber requiring preservative treatment that meets AWPA standards and specifications. These specifications include the following:

1. Storing and curing the timber and lumber.
2. Wood preservatives.
3. Preservative treatment process.
4. Documenting the results of the treatment.

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5. Inspection.
6. Testing.
7. Identification of properly treated timber.

Unless otherwise specified, treat timber and lumber in accordance with AWPA Section C-14 standards.

Perform cutting, boring, chamfering, routing, surfacing, and trimming before treating. Treat with two liberal applications of a compatible preservative after field drilling or cutoff, in accordance with AWPA Standard M-4.

Charges must consist of pieces of the same species that are similar in form, size, moisture content, and receptivity of treatment. The pieces in the charge must be separated to ensure contact of treating medium with surfaces. Use assay for determining the retention of the preservatives.

Include the following information in the Certificate of Treatment:

Name and location of the wood preserving company.

1. Customer identification.
2. Date of treatment and charge number.
3. Type of chemical used and the amount of retention by assay.
4. Treating process and identification of the specifications used.
5. Description of material that was treated.
6. Signature of a responsible plant official.

Chemically treat timber and lumber to be used in aquatic environments using Best Management Practices (BMPs), unless specified otherwise. The producer of the chemically treated products must supply a written certification that the BMPs were used, including a description and appropriate documentation of the BMPs used. Include this information with or on the Certificate of Treatment record.

Pressure treat sign posts and fence posts with Ammoniacal Copper Zinc Arsenate (ACZA), Chromated Copper Arsenate (CCA), Copper Naphthenate or Pentachlorophenol in accordance with AWPA P5, P-8, P-9 and C-14, except:

Ensure the minimum preservative retention in the wood as determined by assay meet criteria of Table 710.09-1.

Table 710.09-1 - Preservative Exception for Sign Post & Fence

Preservative	Lbs/ft3
Ammoniacal Copper Zinc Arsenate (ACZA)	0.40
Chromated Copper Arsenate (CCA)	0.40
Copper Naphthenate	0.060
Pentachlorophenol	0.50

Provide pressure treated guardrail post and block spacers with Ammoniacal Copper Zinc Arsenate (ACZA), Chromated Copper Arsenate (CCA), Copper Naphthenate or Pentachlorophenol in accordance with (AWPA) P5, P-8, P-9 and C-14, except:

Ensure the minimum preservative retention in the wood as determined by assay meet criteria in Table 710.09-2.

Table 710.09-2 - Guardrail Posts and Block Spacers

Preservative	Lbs/ft3
Ammoniacal Copper Zinc Arsenate (ACZA)	0.50
Chromated Copper Arsenate	0.50
Copper Naphthenate	0.075
Pentachlorophenol	0.60

The Engineer may inspect treated posts after arrival at the site and reject regardless of previous inspections at the plant.

Provide certified treating reports for treated timber products to be shipped. Provide assay reports for a minimum of one out of four charges shipped. Ship one copy of each treating report and assay report with the posts, and send a second copy of each report to:

ITD Design/Materials/Construction Engineer
 PO Box 7129
 Boise, ID 83707

Ensure the treating plant imprints legible symbols in the end of timber products treated showing the name of the treating company and the type and year of treatment in accordance with AWPA Standard M1 and M6.

710.10 Preservative Treatment by the Hot-Cold Soaking Method. Lumber and timber to be treated by the hot-cold soaking method consists of reasonably well

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seasoned and without outer and inner bark, dirt, grease, or other objectionable matter that will hinder the free penetration of the preservative. Incise lumber and timber of 2 in dimensional stock or larger and do the framing before treatment.

Use a 5 percent concentration of pentachlorophenol for preservative.

Use tanks of sufficient size to permit complete submergence of the largest timber in any operation and allow free circulation of the liquid around the timber being treated. Maintain sufficient liquid in the tank to completely submerge the timber to a minimum depth of 6 in. When a number of pieces are being treated at one time, separate each piece from the others on all sides by spacers 1/4 in in least dimension. Provide suitable weights or cross bracing to keep the material submerged.

Submerge the timber or lumber in the cold solution as previously described. Slowly increase the temperature for a period of at least 5 hours to a minimum temperature of 180 °F, and not exceeding 210 °F. After 5 hours and attaining the minimum specified temperature, allow the timber or lumber to cool in the solution until such time as the minimum specified quantity of preservative is absorbed by the wood.

Provide No. 1 common grade timber for minor irrigation structures, of the species listed, and treat in accordance with the Hot-Cold Soak Process. The species allowed and the minimum retention in pounds per cubic foot required are as follows:

Douglas Fir (Rocky Mountain, Inland, or Coast)	2.0 lb
Pine, Yellow (Pinus Ponderosa)	4.0 lb
Pine, Lodge Pole (Pinus Contorta).....	4.0 lb
Cottonwood, Northern Black (Populus Trichocarpa Hastata).....	4.0 lb

SECTION 711 – ROADSIDE IMPROVEMENT MATERIAL

711.04 Riprap. Material for riprap consists of durable, angular field or quarry stones meeting quality requirements, sound, hard, free from seams and other structural defects and from an approved source. Provide material resistant to weathering and water action that meets the criteria in Table 711.04-1.

Table 711.04-1 - Rip Rap Criteria

Property	Test Method	Requirement
Apparent Specific Gravity	AASHTO T 85	2.5 minimum
Absorption	AASHTO T 85	4 % maximum
Coarse Durability Index	AASHTO T 210	52 minimum

Determine the riprap grading by visual inspection of each load as follows:

1. Loose Riprap. Nearly rectangular stone with approximately 50 percent having a volume greater than 1 ft³. Do not exceed the minimum specified depth of riprap with the maximum size rock.
2. Hand Placed Riprap. Nearly rectangular stone with, approximately 40 percent having a volume greater than 1 ft³. Use stone 6 in or more thick.

711.05 Seed. Provide seed as Pure Live Seed (PLS); true of genus and species and that meets purity, germination specifications, and standards of the Federal Seed Act and Idaho Pure Seed Laws. Obtain Engineer approval sixty days before substituting seed not available for purchase. Provide seed certified in the State of Idaho by an authorized (or approved) state agency and declared “noxious weed free.” Provide a seed analysis report for each species issued from the Idaho Department of Agriculture, Bureau of Seed Analysis & Control, or Association of Official Seed Certifying Agency (AOSCA) verifying the pure live seed percentage statements of the seed label including the name of the certifying state issuing the report. Label and attach an analysis (certification) to seed bags. Ensure seed contains less than 1% by weight restricted noxious-weed seed, less than 3% of cheat or downy brome, and less than 3% other weed and crop seed. Seed containing prohibited noxious-weed seed is not acceptable.

711.06 Plants. Provide plants that meet the applicable requirements of the American Standard for Nursery Stock. Ensure plants are true to type and name in accordance with Standardized Plant Names prepared by the American Joint Committee on Horticultural Nomenclature. Provide plants that are sound, healthy, vigorous, well branched, and densely foliated when leaves are present, and without disease or insects including adult eggs, pupae, or larvae. Provide plants without disfiguring limbs, knots, limb scars, sun scald, abrasions of the bark, wind or freezing damage, or other disfigurements. Do not cut back plants from larger sizes to meet specified sizes. The Engineer will reject plants with the presence of noxious weeds in the containers or at the source.

Provide nursery grown plants unless collected plants are specified. Grow or condition plants to an environment similar to the project site including elevation, site and soil conditions, and climate.

The term “nursery grown” consists of plants collected in the forest or natural seedling trees and shrubs, provided such trees and shrubs have been growing continuously in one nursery for the minimum periods of time specified in Table 711.06-1.

Table 711.06-1 - Plant Age

Plant Material	Time in Nursery
Trees	2 Growing Seasons
Shrubs, Evergreens	2 Growing Seasons
Shrubs, Deciduous	1 Growing Season
Wetland Plants	2 Growing Seasons
Vines	1 Growing Season

Provide trees with straight trunks, well branched with symmetrical tops and no unhealed scars more than $\frac{3}{4}$ in diameter.

Provide well established containerized plants with a root system sufficiently developed to retain its shape and hold together when removed from the container. The Engineer may reject plants that are pot bound, or have kinked, circling, or bent roots. Provide plants in pots or containers of a size shown on the plans.

Deciduous plants may be supplied bareroot (B.R.) unless specified otherwise. Provide B.R. plants that are one size group larger than the sizes specified before pruning and are packed in moisture retaining material.

Provide broadleaf evergreen plants and conifers Balled and Burlapped (B&B) or in suitable containers. Pack B&B plants, except seedlings, with a firm ball of earth surrounded with burlap firmly held in place by a cord or wire wrapping. Provide B&B plants with firm, natural earth balls of standard size in accordance with the American Standard for Nursery Stock and the root collar located within the top two inches of the soil ball. Handle B&B plants by the earth ball only and protect against drying and freezing. The Engineer will reject broken or loose balls or plants without an adequate root system.

Do not dig collected plants until they have been inspected. Dig collected plants with a greater ball or root spread for the applicable plant type as stated in the American Standard for Nursery Stock.

Pack and ship the plants in accordance with the American Standard for Nursery Stock.

File required state and federal inspection certificates for plant shipments with the Engineer.

Do not substitute plant materials unless authorized in writing and Engineer approved.

If proof is submitted, substantiated in writing, that a plant specified is not obtainable, the Engineer will consider allowing the nearest available size or similar variety, with corresponding adjustment to the contract unit price.

Label plants according to size and scientific plant name with durable and legible tags. Deliver plants with labels securely attached to plants, bundles, and containers of plant materials. Provide actual certificate of inspection, or a copy, for injurious insects, plant diseases, and other plant pests for each shipment or delivery of plant materials. Indicate the name, address and the source of the stock on the certificate.

Leave the labels on at least one plant of a group of the same species and on each plant for individual planting during and after planting operations within the same area.

Anti transpirants accepted by the Department are polymer gels, wetting agents, spray on chemicals or natural products.

711.07 Commercial Fertilizer. Provide commercial fertilizer in containers marked with the weight, volume or both along with the manufacturer's guaranteed analysis of the contents. Ensure dry fertilizers are free from lumps or cakes.

711.08 Soil Conditioner. Provide soil conditioner that includes compost, peat moss, sedge peat, gypsum, lime, diatomaceous earth, clay, vermiculite, wetting agents, absorbent polymers, or other approved natural material that are reasonably free of wood substances and contain 50 percent organic matter by weight. Provide soil conditioner certified in the State of Idaho or by an authorized (or approved) state agency and declared "noxious weed free." Provide a product inspection certificate from approved commercial or state laboratory or manufacturer's certification. Ensure the source is approved before shipping to the project.

711.09 Select Topsoil. Obtain select topsoil from approved sources that consists of friable, loamy topsoil reasonably free of refuse, roots and seed of noxious weeds and other material detrimental to vegetative growth. Ensure the County Weed Authority has visually inspected approved sources for noxious weeds before delivery or placement on the project. Test sources if noxious weeds are located within or adjacent to the source site and certify as "noxious weed free" by the State of Idaho authorized (or approved) state agency and declared "noxious weed free."

Remove and dispose of vegetation on sources of select topsoil material before taking materials from the source.

Provide select topsoil in accordance with Tables 711.09-1 and 711.09-2.

Table 711.09-1 - Topsoil Gradation

Sieve Size	Percentage by Weight Required to Pass a Square Mesh Sieve
1 in.	98-100
No. 4	95-100
No. 8	80-100
No. 200	15-80

Table 711.09-2 - Topsoil Chemistry

Property	Minimum	Maximum
pHa	5.5	7.8
ESPb	-	10.0
ECc	-	8.0
Organic Material	0.5	15.0

a. pH - Negative logarithm of the hydrogen ion concentration

b. ESP – Exchangeable sodium percentage

c. EC - Electrical conductivity, milliohms per cm at 77 °F

711.10 Mulch. Ensure mulch is certified in the State of Idaho by authorized (or approved) state agency and declared “noxious weed free.” Ensure the mulch source is approved before shipping to the project.

1. Ensure bark mulch (granular and ornamental type) is reasonably free of strips and splinters.
2. Certify grain straw or grass hay is “noxious weed-free” and approximately 50 percent of the stems exceed 9% in length where it is to be anchored by mechanical crimping.
3. Provide shredded bark with a shredded or stringy texture.
4. Apply wood and paper fiber to form a blotter-like ground cover.

711.11 Erosion Blankets. Provide erosion blankets in pre-manufactured rolls. Ensure erosion blankets are certified “noxious weed free” in the State of Idaho by an authorized (or approved) state agency.

Ensure erosion blankets comply with the specifications for rolled erosion control products as outlined by the Erosion Control Technology Council (ECTC).

For other erosion blankets provide certification from the manufacturer that the materials are nontoxic to animals, soil microorganisms, aquatic and plant life, and will not interfere with or impede seed germination or vegetative growth and establishment.

711.12 Irrigation Water. Provide an approved source for irrigation water that is without oil, acid, salt, or other substances harmful to plants.

711.16 Mulch Tackifier. Mulch tackifier is a material that binds mulch together so that it will prohibit the mulch from washing or blowing away after application. Ensure the tackifier is not re-emulsifiable when cured. Provide tackifier mixable in water, non-toxic to animals, soil microorganisms, aquatic and plant life; and does not interfere with or impede seed germination, vegetative growth and establishment and nonstaining to concrete or painted surfaces.

711.17 Mulch plus Tackifier. Mulch plus tackifier is a premixed packaged of wood fiber mulch with tackifier or wood fiber mulch plus tackifier blended before application. Mix in accordance with manufacturer's written instruction. Provide mulch plus tackifier as specified in 711.10 and 711.16.

711.18 Soil Amendments. Soil amendments are organic soil applied compost or manufactured organic soil amendments.

Provide compost that is the result of the biological degradation and transformation of plant-derived materials under controlled conditions designed to promote aerobic decomposition.

Provide compost that is stable with regard to oxygen consumption and carbon dioxide generation. Ensure stability of 7 or below in accordance with Test Methods for Evaluation of Compost and Composting (TMECC) 05.08-B, *Carbon Dioxide Evolution Rate.*"

Provide compost that is mature with regard to its suitability for serving as a soil amendment or in erosion and sediment control applications. Ensure maturity is greater than 80 percent in accordance with TMECC 05.05-A, *In-Vitro Germination and Root Elongation.*

Provide compost that is certified in the State of Idaho by an authorized (or approved) state agency and declared "noxious weed free."

Provide compost with a moisture content that has no visible free water or dust produced when handling the material.

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Provide compost that has a pH of 6.0 to 8.2 when tested in accordance with TMECC 35 04.11-A, 1:5 *Slurry pH*.

Provide compost that has a manufactured inert material (e.g., plastic, concrete, ceramics, metal, etc.) of the compost less than 0.5 percent on a dry weight or volume basis, whichever provides for the least amount of foreign material.

Provide compost that has a minimum compost organic matter of 40 percent dry weight basis as determined by TMECC 05.07A, *Loss-On-Ignition Organic Matter Method*.

Provide compost that has a soluble compost salt content of less than 3.0 mmhos/cm tested in accordance with TMECC 04.10-A, 1:5 *Slurry Method, Mass Basis*.

Provide a compost product that is composed of at least 65 percent by volume from recycled plant waste. A maximum of 35 percent by volume of other approved organic waste, bio-solids, or both may be substituted for recycled plant waste.

Provide fine compost that has a score of 6 or greater on the Solvita Compost Maturity Test. Provide coarse compost that has a score of 5 or greater on the Solvita Compost Maturity Test. Submit test results to the Engineer for verification before application.

711.19 Mulch Mixture. Mulch mixture consists of mulch, soil amendments, soil biological stimulants, soil microorganism inoculants, bonding fibers, tackifiers, and other erosion control and plant nutrient ingredients as specified. Premix mulch mixture in tank to be hydro-applied in one operation using the specified products and rate.

711.20 Fiber Wattle. Provide fiber wattle that consists of certified “noxious weed free” material and is manufactured from natural straw, coir (coconut), composted material, wood fibers, or a combination of; and wrapped in approved degradable netting made of plastic, or natural fiber such as jute, sisal, cotton, hemp, or burlap. Ensure material including netting has a life expectancy of approximately one year.

Provide fiber wattle with a minimum diameter of 8 in. Ensure fiber wattles are 8 in to 11 in in diameter and have a minimum weight of one pound per linear foot. Ensure fiber wattles with a diameter greater than 11 in have a minimum weight of three pounds per linear foot. Secure ends tightly with degradable twine.

711.21 Compost Sock. Provide compost sock with a minimum 8 in diameter that is without preservative. Provide compost sock made of a mesh tube, oval to round in cross section and that is clean, evenly woven, and free of encrusted concrete or other contaminating materials. Ensure sock is free from cuts, tears, broken or missing yarns and does not have thin, open, or weak places. Provide

sock that has a minimum tensile strength of 44 psi. Provide sock that is composed of either degradable plastic or polyester netting, or is composed of biodegradable jute, sisal, burlap, or coir fabric. Ensure sock has at least a one year durability after installation.

Ensure compost products used in compost socks meet the compost requirements in 711.18.

711.22 Hydraulically Applied Erosion Control Products. Hydraulically applied erosion control mixtures consist of hydraulic mulch, stabilized mulch matrix, bonded fiber matrix, and fiber reinforced matrix.

Provide certification for hydraulically applied erosion control products from the manufacturer that the materials are nontoxic to animals, soil microorganisms, aquatic and plant life, and will not interfere with or impede seed germination or vegetative growth and establishment.

711.23 Inlet Protection. Use inlet protection that has been Engineer approved.

SECTION 712 – SIGNING MATERIALS

712.01 Plywood for Type E Signs. Meet U.S. Product Standard for Construction and Industrial Plywood, minimum ½ in thickness, exterior type grade, B-B high density overlay, 2 sides. Use the natural standard color. Seal the edges of the plywood.

712.02 Reflective Sheeting.

A. Materials. Meet ASTM D 4956 standards for classification, color and performance.

For retroreflective sheeting material meet ASTM D 4956 supplemental requirement S1 if specified. For reboundable retroreflective sheeting meet ASTM D 4956 including supplemental requirement S2.

B. Retroreflectivity Requirements.

1. Class B. Sheet Aluminum Signs, Plywood Signs and Other Traffic Control Devices. Meet ASTM D 4956, Type IV reflective sheeting used for cones, barricades, drums, tubular markers, vertical panels and the background, direct applied legend and borders on information signs, warning signs, guide signs and regulatory signs, except for sheeted aluminum delineator reflector units and flexible post delineators that require ASTM D 4956, Type IX direct applied reflective sheeting.

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2. Class C. Extruded Aluminum -- Meet ASTM D 4956, Type IV sheeting for background and ASTM D 4956, Type IX sheeting for direct applied legend, borders, and arrows for reflective sheeting.

C. Field Measurement. Take retroreflectivity readings following procedures specified in ASTM E 1709, Standard Test Method for Measurement of Retroreflective Signs Using a Portable Retroreflectometer. Compare retroreflectivity readings to the initial retroreflectivity values shown in ASTM D 4956 for retroreflective sheeting by classification, type, and color and used to determine a traffic control devices' compliance with 626.03.

D. Fabrication. Apply the reflective sheeting on aluminum or plywood sections in accordance with the manufacturer's recommendations and so that no background material will be visible when the sign is assembled.

Do not splice reflectorized sheeting on panels 24 in or less in width. On larger panels use only one splice per sign. Use horizontal splices or at 45 degrees from horizontal with the top sheet overlapping the bottom sheet 3/16 in or more except for signs screen processed with transparent color and extruded aluminum interstate overhead signs which have butt splices. Do not allow the sheeting pieces to touch each other at the splice and the gap to exceed 1/32 in. Wherever two or more pieces of sheeting are used side by side on a sign, match their orientation to assure uniform day color and night appearance. The Engineer will accept manufactured splices in the reflective sheeting in addition to the above limitations.

Carefully match sign faces composed of two or more pieces of panels or reflective sheeting for color at the time of sign fabrication. Do not allow non-uniform shading and undesirable contrast between adjacent widths of applied sheeting.

Do not allow cracks, discoloration, appearance of air pockets, or any other indication of non-adherence in the sheeting.

E. Finish. Seal sign edges and splices of the reflective sheeting in accordance with the methods specified by the reflective sheeting manufacturer.

Cut direct applied cutout reflective sheeting legends, borders, and symbols with a smooth regular outline, without ragged or torn edges. Cut letters, numerals, and symbols having interior or exterior rounded corners with a smooth 3/16 in \pm 1/16 in radius.

712.04 Reflector Unit for Delineators.

Types 1 thru 8. These are delineator reflector units composed of Type IX Reflective

Sheeting meeting the requirements of 712.02, direct applied on Sheet Aluminum of 0.063 in thickness and with suitable mounting holes as shown in Standard Drawing G-3-A.

Type 9. Barrier Mounted Delineators. These are delineator reflector units composed of a flexible or rigid substrate material with factory direct applied Type IX Reflective Sheeting meeting the requirements of 712.02, and a factory applied adhesive on the delineator base with release paper or an anchor mounting as shown.

712.07 Silk Screen Opaque Inks. Apply opaque silk screen inks in accordance with the manufacturer's recommendations; waterproof for outdoor use; and dry within 18 hours to a film without running, streaking, bubbling, or sagging.

Visually match opaque colored silk screen inks within the limits of the current color tolerance charts, prepared by the U.S. Department of Transportation, Federal Highway Administration.

712.08 Silk Screen Transparent Inks. Apply transparent silk screen inks of the desired color onto reflective sheeting background meeting the requirements of 712.02.

712.09 Direct Applied Non-reflective Sheeting and Direct Applied Transparent Films. Direct applied non-reflective sheeting consists of flexible, glossy sheeting. Direct applied transparent films consist of transparent, acrylic colored films. Use solvent resistant sheeting and films that are pre-coated with Class 1 pressure sensitive, tack free adhesive on the back side.

Ensure the sheeting and films are applied as directed by the manufacturer to form a durable bond with the background enabling it to withstand severe weather conditions without appreciable loss of bond.

712.10 Flexible Post Delineators. These are assemblies that consist of:

1. Post meeting the following:
 - a. White unless otherwise specified.
 - b. Driveable with a steel stub or sleeve.
 - c. Flexible, non-warping, non-metallic, durable composite material.
 - d. Resistant to damage due to impact, ultraviolet light, ozone, hydrocarbons and other effects of atmospheric weathering.
 - e. Resistant to overturning, twisting, displacement from wind and impact forces.

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- f. Retain flexibility for a designed minimum life equaling 60 months of outdoor service.
2. Reflective Sheeting meeting the following:
 - a. Type IX direct applied conforming to 712.02.
 - b. Provided in various colors as shown.
 - c. Placed at least 2 in but less than 2½ in from the top.
 - d. Centered horizontally on the post.
 - e. Measures either:
 - i. 3 in wide by 3 in long or,
 - ii. 3 in wide by 6 in long.

712.11 Flexible Snow Poles. Provide orange poles meeting the following:

1. 1¼ in wide by ¾ in thick and a length as specified.
2. Non-warping, non-metallic, durable fiber reinforced composite material.
3. Resistant to impacts as a result of snow plowing or twisting.
4. Resistant to displacement from wind, ultraviolet light, ozone, hydrocarbons and other effects of atmospheric weathering.
5. Retain flexibility for a designed minimum life equaling 60 months of outdoor service.

SECTION 713 – ILLUMINATION AND TRAFFIC SIGNAL MATERIALS

713.01 High Pressure Sodium Vapor Luminaires. Provide each street lighting luminaire except underpass luminaires with a 2 in slip-fitted type of mounting and designed for the horizontal operation of the sodium vapor lamp specified. Provide street lighting luminaire refractors with IES type light distribution as specified by means of refraction, reflection, adjustable sockets or any combination.

Provide sign lighting luminaires with High Pressure Sodium type approved for use by the Engineer before installation.

Individually ballast luminaires unless remote ballasts are specified.

713.02 High Pressure Sodium Vapor Ballasts. Provide the type of ballast specified. Pre-wire the ballast to the lamp socket and terminal board. Ensure the ballast has 86 percent minimum efficiency and is rated for operation to -20 °F.

Readily make connections to the ballasts by either splicing to existing leads or by screw type terminal blocks. Make leads or terminals easily identified.

713.03 Rigid Steel Conduit. Galvanize or sherardize conduit to protect against corrosion.

713.04 Plastic Conduit. Provide schedule 40 P.V.C. or H.D.P.E. smoothwall suitable for direct burial as a minimum for plastic conduit. The conduit can be rigid or coiled and have a solid wall. The manufacturer shall certify the conduit meets the minimum requirements of the applicable U.L., N.E.M.A., or ASTM specifications for direct burial electrical conduit.

713.05 Concrete Junction Boxes. Construct bottomless concrete junction boxes of vibrated concrete. Provide a steel diamond plate lid $\frac{3}{8}$ in minimum thickness, with a locking device to hold the lid securely in place and painted with corrosion preventive type paint, gray in color. Weld a $\frac{3}{8}$ in x 1 in plated bolt to the bottom of the steel lid. Place a 36 in section of #10 AWG Green THWN wire with ring connector on the bolt and attached with a $\frac{3}{8}$ in nut. Size junction boxes as follows:

1. Size "A" inside dimensions of 9 in x 5 in x 10 in deep and a nominal wall thickness of 2.5 in.
2. Size "B" inside dimensions 13 in x 9 in x 10 in deep and a nominal wall thickness of 2 in.
3. Size "C" inside dimensions of 18 in x 13 in x 15 in deep and a nominal wall thickness of 2 in.
4. Size "D" inside dimensions of 36 in x 32 in x 28 in deep with a nominal wall thickness of 3 in and shall be reinforced by a $\frac{3}{8}$ in round rebar hoop 2 in below the top of the box and No. 10 welded wire mesh continuously within the walls.

Provide "A", "B" and "C" junction boxes with metal tops and reinforced walls with continuously welded wire.

Submit detailed shop drawings for Engineer approval of a Size "D" junction box.

713.06 Composite Junction Boxes. Composite junction boxes are polymer concrete and reinforced by a heavy weave fiberglass and constructed bottomless. Provide a heavy duty traffic cover rated at 80 psi or more with a positive locking device to hold them securely in place. Color Junction boxes and covers concrete gray. Size junction boxes as follows:

Size "PGB" nominal inside dimensions of 10 in x 19 in x 12 in deep and wall thickness of $\frac{1}{2}$ in.

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Size "PGC" nominal inside dimensions of 13 in x 27 in x 18 in deep and wall thickness of ½ in.

713.07 Electrical Conductors and Cables. Provide electrical conductors and cables, U.L. listed and labeled, AWG or equivalent, stranded copper, meeting the requirements of the Insulated Power Cable Engineers Association Publications S-61-402 or National Electrical Manufacturers Association current Publication (IPCEA – NEMA) WC5, Section 7.4, type B and the following:

- A. Multiple Conductor Signal Cable:
 - 2. The number of conductors per cable as shown on the plans.
 - 3. Conductors are 600 volt, No.14 uncoated annealed stranded copper wire with polyethylene insulation.
 - 4. Cable labeled as meeting the requirements of International Municipal Signal Association Specifications No. 19-1 for polyvinyl chloride sheath, or No. 20-1 for polyethylene sheath.
- B. Multiple Conductor Loop Cable:
 - 1. No. 18 AWG stranded four conductor waterproof instrumentation cable.
 - 2. Provide color coding of the four conductors that is in accordance with the published IPCEA - NEMA standards.
 - 3. High density polyethylene jacket with a water blocking filler between conductors, suitable for direct burial, equal to Canoga Controls 20002, Clifford of Vermont 4C18B7NS-F, Independent PDS-078506, or Atlas Wire and Cable Corp. A953.
- C. Multiple Conductor Loop Lead-in Cable:
 - 1. No. 18 AWG shielded stranded four conductor wire with a polyethylene jacket.
 - 2. Provide color coding of the four conductors that is in accordance with the published IPCEA - NEMA standards.
 - 3. High density polyethylene jacket with a water blocking filler between conductors, is suitable for direct burial, equal to Clifford of Vermont 4C18 B7 OS-F or Canoga 30003.
- D. Video Detection Cable:
 - 1. U.L. listed and labeled.
 - 2. Meeting the requirements of the video equipment manufacturer.

713.08 Signal Poles. Provide signal poles that meet the requirements for Standard or Non-Standard Mastarm Traffic Signal poles, Pedestal Signal Poles, and Pedestrian Pushbutton Poles with materials as specified in 708.19 and the following additional requirements:

1. Permanently display the signal mastarm shaft (gauge) thickness in inches on each mastarm near the attachment plate (Non-Standard poles only).
 2. Provide poles that have a 4 in x 6.5 in frame and cover located 90° to the right of the mastarm location.
- A. Standard Mastarm Traffic Signal pole requirements:
1. Maximum nominal pole height (including luminaire extension) of 40 ft.
 2. Maximum luminaire mastarm length of 20 ft.
 3. Maximum signal mastarm length of 55 ft.
 4. Designed in accordance with the current AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*.
 - a. Design Life – 50 years.
 - b. Design Wind Speed – 90 mph.
 - c. Fatigue Category – II design criteria (includes natural wind gusts and truck induced wind gust loads based on a truck speed of 55 mph).
 4. Meet additional criteria of the Department's Standard Mastarm Signal Pole traffic detail drawings, TD14 and TD15.
 5. Provide four steel anchor bolts of the manufacturer's recommended size with each pole. Fit each bolt with three nuts and two washers. Include one extra anchor bolt per batch for destructive testing.
 6. Submit shop drawings and calculations for final approval before fabrication.
- B. Non-Standard Mastarm Traffic Signal pole requirements:
1. Designed in accordance with the current AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*.
 2. Design Life – 50 years.
 3. Design Wind Speed – 90 mph.

4. For signal mastarm length greater than 55 ft or luminaire mast arm length greater than 20 ft, use Fatigue Category – I design criteria (fatigue design shall include natural wind gust; periodic galloping forces; and truck-induced wind gust loads based on a truck speed of 65 mph.)
 5. Provide four steel anchor bolts of the manufacturer's recommended size with each pole. Fit each bolt with three nuts and two washers. Include one extra anchor bolt per batch for destructive testing.
 6. Submit shop drawings and calculations for final approval before fabrication.
- C. Pedestal Signal pole requirements:
1. A 4 inch rigid galvanized conduit with National Pipe Tapered (NPT) threads.
 2. A square, frangible cast aluminum base that is:
 - a. 15 in high.
 - b. Nominal dimension of 14 in X 14 in.
 - c. 4 slotted holes for anchor bolts.
 - d. Heat treated to industry standards.
 5. Four anchor bolts, washers, and nuts supplied by the base manufacturer.
 6. Meet additional criteria of standard drawing I-6-B.
- D. Pedestrian Pushbutton pole requirements:
1. A 4 inch rigid galvanized conduit with National Pipe Tapered (NPT) threads.
 2. A round cast iron pipe flange that is:
 - a. Nominal flange thickness of 1 in.
 - b. Nominal outside diameter of 9 in.
 - c. Bolt circle diameter of 7½ in.
 - d. Minimum of four, 5/8 in diameter holes for anchor bolts.
 - e. Cold zinc treated.
 3. Four anchor bolts, washers, and nuts.
 4. Galvanized pipe cap.
 5. Meet additional criteria of standard drawing I-6-B.

713.09 Illumination Poles. Provide Standard and Non-Standard poles that meet the requirements of 708.19 and:

A. Standard Illumination pole:

1. Nominal luminaire mounting heights of 30 ft, 40 ft, and 50 ft.
2. Maximum luminaire mastarm length of 15 ft.
3. Designed in accordance with the current AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*:
 - a. Design Life – 25 years.
 - b. Design Wind Speed – 90 mph.
 - c. Importance Factor – 0.87.
 - d. Fatigue Category – II design criteria (natural wind gust only).
4. Anchor base design to use steel necked breakaway couplers meeting NCHRP 350 requirements unless the lighting unit (pole, mastarm, and luminaire) exceeds 1000 lb.
5. Furnish four steel anchor bolts or four base breakaway devices, as shown on the plans, of the manufacturer's recommended size with each pole. Fit each bolt with three nuts and two washers. Include one extra anchor bolt per batch for destructive testing.
6. Meet additional criteria of the Details For Highway Lighting on traffic detail drawing, TD10.
7. Submit shop drawings and calculations for final approval before fabrication.

B. Non-Standard Illumination pole:

3. For luminaire mounting heights greater than 50 ft, or for luminaire mastarm lengths greater than 15 ft or multiple mastarms.
4. Designed in accordance with the current AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*:
 - a. Design Life – 50 years.
 - b. Design Wind Speed – 90 mph.
 - c. Importance Factor – 1.00.

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- d. Fatigue Category – I design criteria (Natural wind gust and vortex shedding only).
5. Anchor base design to use base breakaway device meeting NCHRP 350 requirements unless the lighting unit (pole, mastarm, and luminaire) exceeds 1000 lb.
6. Furnish steel anchor bolts or base breakaway device, as shown on the plans, and of the manufacturer's recommended size with each pole. When using anchor bolts, fit each bolt with three nuts and two washers. Include one extra anchor bolt per batch for destructive testing.
7. Submit shop drawings and calculations for final approval before fabrication.

713.10 Base Breakaway Device. Provide a base breakaway device with four steel necked couplers and female anchors, meeting NCHRP 350 requirements and certified for loads up to 1000 lb. Provide the base breakaway device with an aluminum skirt and associated hardware.

713.11 Signal Heads. Provide signal heads meeting the following requirements:

A. Vehicular Signal Heads:

1. Adjustable, one-way type with the number of sections as specified.
2. UV stabilized polycarbonate signal housing with top and bottom reinforcement plates.
3. Vehicular signal head assembly exteriors that are traffic signal green.
4. Terminal block in the center section of the signal head.
5. Lamp module wires with terminal connectors fastened to the terminal block.
6. Optically programmed signal heads allow the visibility zone of the indication to be determined optically and require no hoods or louvers. The projected indication may be selectively visible or veiled anywhere within 15° of the optical axis.
7. No indication can result from either external illumination or from one lamp module illuminating another.
8. Light Emitting Diode (L.E.D.) lamp modules that comply with the current Institute of Transportation Engineers (ITE) *Vehicle Traffic Control Signal Head* (VTCSH) requirements, except that green indications require a clear, polycarbonate lens.

9. Tunnel visors for each signal face that are:
 - a. One piece polycarbonate.
 - b. 8 in for 8 in lens, and 10 in to 12 in for 12 in lens.
 - c. Inside of visors that are flat black and exteriors that are traffic signal green.
 - d. Approved to be mounted on the provided signal head without field modifications.
 10. Signal backplates that are:
 - a. Five inch, one piece polycarbonate.
 - b. Flat black finish on the front and signal green on the back.
 - c. Conforming to the signal head outline.
 - d. Approved to be mounted on the provided signal head without field modifications.
- B. Pedestrian Signal Heads:
1. One-way illuminated L.E.D. lamps.
 2. Pedestrian signal housing that is:
 - a. Nominally 18 in high by 18 in wide.
 - b. One piece.
 - c. UV stabilized polycarbonate or powder-coated aluminum.
 - d. Traffic signal green exteriors.
 3. Flat black tunnel visors.
 4. Terminal block in the pedestrian signal head housing.
 5. Lamp module wires with terminal connectors and fastened to the terminal block.
 6. Countdown pedestrian timer.
 7. L.E.D. Lamp modules that comply with the current ITE *Pedestrian Traffic Control Signal Indications* (PTCSI) requirements.
 8. Filled Hand/Man symbols.

713.12 Signal Head Covers. Provide signal head covers that meet the following requirements:

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1. Opaque, light in color (i.e. Yellow or Tan):
 - a. With a transparent center section or port for partial viewing of individual lens indications for circuit testing.
 - b. Full opaque covers for blanking out or restricting the visibility of an unwanted signal display.
2. At least 50% contrast to the signal housing and signal back plate.
3. Sized to cover the appropriate signal head faces.
4. Weather and UV resistant material.
5. Method to securely attach to prevent accidental removal or being dislodged by winds up to 90 mph.

713.13 Electrical Service Pedestals. Provide underground service pedestal that is the type specified and shown on the plans and as follows:

1. 120/240 volt single phase.
2. Underground feed.
3. NEMA 3R enclosure.
4. 12 ga Galvanized steel construction.
5. White powder coated interior and exterior.
6. Meet additional criteria of the Underground Service Pedestal detail drawings, TD01-TD05.

713.14 Signal Controllers and Cabinet Assemblies. Provide traffic signal controller, cabinet and auxiliary equipment that is the type specified and shown on the plans or found under the publication Traffic Signal Controller and ITS Equipment Specifications in the References and Standards section of the Department website.

SECTION 714 – SECONDARY CEMENTITIOUS MATERIALS

714.01 General Requirements. Protect Secondary Cementitious Materials (SCMs) from exposure to moisture until used. Tightly seal and adequately separate containers used for transport or storage from other material containers to prevent seepage or mixing of materials. Provide equipment used for discharge with positive shut-off controls at the point of discharge.

SCMs used as a partial substitute for Portland Cement may cause a delay in strength gain and may require more curing time before the concrete is exposed to loadings.

The Engineer may accept SCMs for use on the basis of the manufacturer's certification as specified in 106.04 and 106.05. Submit the manufacturer's certification indicating material class and compliance to material specifications.

714.02 Fly Ash. Provide natural pozzlans and fly ash that meets AASHTO M 295, Class F, except that Loss of Ignition (LOI) must not exceed 1.5 percent.

When fly ash is used for mitigation of Alkali Silica Reactivity (ASR) do not exceed 1.5 percent available alkalis (as Na₂O), and do not exceed 11 percent calcium oxide (CaO) content.

When fly ash is used as a mineral admixture, use fly ash meeting Class F requirements and the Engineer will then not apply the limits of the available alkalis and calcium oxide.

714.03 Ground Granulated Blast Furnace Slag. Provide ground granulated blast furnace slag that meets AASHTO M302 grade 100.

714.04 Silica Fume. Provide Silica Fume that meets AASHTO M307 with a maximum available alkali of 1.5 % and 10% or less retained when wet-sieved on the No. 325 screen.

SECTION 715 – GABION AND REVET MATTRESS

715.01 Mesh. Fabricate gabion panels for the base, ends, sides, diaphragms, and lids from either welded or twisted wire mesh. Use only one type of wire mesh within a structure. Meet the requirements of Table 715.01-1 for individual wires of either type wire mesh:

Table 715.01-1 - Wire Criteria

Characteristic	Test Designation	Requirements
Minimum Tensile Strength	ASTM A 370	60,000 psi
Wire Size	USA Steel Wire Gage	11
Wire Diameter	ASTM A 641, and ASTM	0.120 in
Minimum	A 90	0.116 in
Galvanizing		0.80 oz/ft ²
Wire Size	USSWG	9
Wire Diameter	ASTM A 641, and ASTM	0.148 in
Minimum	A 90	0.144 in
Galvanizing		0.90 oz/ft ²

Provide welded wire mesh that meets ASTM A 185 except that 600 pounds force for

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11-gage and 800 pounds force for 9-gage wires on the weld shears. Wire gages are United States Steel Wire Gage (USSWG) after galvanizing.

Manufacture gabion panels of the welded wire mesh from 11-gage or 9-gage wire. Provide mesh to form a nominal 3 in by 3 in square grid pattern made by resistance welding in accordance with ASTM A 185. Ensure the maximum diagonal dimension of any grid opening is 4.75 in.

Manufacture gabion panels of twisted wire mesh from 11-gage wire with 9-gage selvedge wires. Form a uniform hexagonal pattern and with a non-raveling twist. Do not exceed 4.75 in on the major axis (maximum line dimension) of any hexagonal opening.

715.02 Fabrication. Fabricate gabions so that the sides, ends, lids, and diaphragms can be assembled at the construction site into a rectangular or square basket of required sizes. Construct gabions as a single unit. Weave the base, ends, and sides into a single unit or one edge of these members connected to the base section of the gabion so that strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds its horizontal width, equally divide the gabion by diaphragms, of the same mesh and gage as the body of the gabion, into cells whose length does not exceed the horizontal width. Furnish the gabion with the necessary diaphragms secured in proper position on the base section so that no additional tying at this juncture will be necessary.

Securely selvedge or bound perimeter edges so that the joints formed by tying the selvedges have the same strength as the body of the mesh.

715.03 Packing and Marking. Ship gabions folded flat in bundles not to exceed 1200 lbs in weight. Ensure each bundle contains gabions of one size except that odd numbers necessary to complete an order may be made into a bundle of less than the uniform number. Clearly mark this bundle to distinguish it from others. Clearly mark each gabion by color code, or some other readily identifiable means to indicate size. Handle bundles without lifting on gabion mesh to avoid damage to wire or galvanizing.

715.04 Dimensions. Supply gabions in various lengths and heights as shown on the plans. Gabion dimensions are subject to a tolerance limit of $\pm 5\%$ of manufacturer's stated sizes.

715.05 Joints. Provide wires used to form joints in accordance with ASTM A 641 for "carbon steel," zinc-coated wire and that meet the requirements of Table 715.05-1.

Table 715.05-1 - Wire Criteria

Characteristic	Test Designation	Requirements
Minimum Tensile Strength	ASTM A 370	60000 psi
Wire Size	US Steel Wire Gage	13.5
Wire Diameter	ASTM A 641, and ASTM A 90	0.086 in
Minimum		0.083 in
Galvanizing		0.72 oz/ft ²
Wire Size	USSWG	9
Wire Diameter	ASTM A 641, and ASTM A 90	0.148 in
Minimum		0.144 in
Galvanizing		0.90 oz/ft ²

Ensure spiral binders have a 3 in separation between continuous, successive loops.

Provide internal connecting wires or preformed stiffeners with at least 13.5-gage. Meet the minimum specification requirements with each wire.

The Contractor may request Engineer acceptance of alternative fasteners. Alternative fasteners must form a closed loop with an overlap of at least 1 in when the ends are brought together and properly closed. Ensure the closed loop has an inside area that is large enough to enclose up to four selvaged wires.

Provide fasteners that meet ASTM A 764, with the same weight of coating as specified in ASTM A 641. Provide stainless steel that meets ASTM A 313 for applications involving PVC coated gabion baskets. Ensure the fastener resists a direct tension force across any axis, of at least 600 pounds force while remaining closed. Submit to the Engineer random samples of fasteners for testing at least 10 working days before construction of gabions. Submit 12 formed and 12 unformed fasteners. Assemble the 12 formed fasteners at the project site and witnessed by the Engineer. Space fasteners at intervals of 4 in to 6 in with at least one fastener per gabion mesh opening.

715.06 Gabion Fill Material. The fill material for the gabion baskets is rock ranging in size from a minimum of 4 in to a maximum of 8 in, both measured in the greatest dimension. Provide rock that is sound, durable, well graded, and does not disintegrate on exposure to water or weathering during the life of the structure. Obtain rock for gabions from an Engineer approved source. Ensure the minimum

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unit weight of a rock-filled gabion is 110 lbs/ft³. Verify the gabion unit weight when directed by the Engineer.

715.07 Geotextile. Meet the requirements of 718.06 if Geotextile is used.

715.08 Testing. When directed by the Engineer, test gabions which have not been previously tested and approved as follows:

1. Cubical-Celled Gabions – Test wire mesh of gabions with a 3 ft by 3 ft square cross section for sufficient strength and flexibility when assembled and filled with rock as follows:
 - a. Loading and Configuration: Place an approximate 4000-pound line load over the center of a 12 ft long gabion (perpendicular to the long axis), which is unsupported under the middle 6 ft and anchored at both ends. (A piece of concrete pipe 4 ft diameter or less, weight about 4000-pounds, can be used to impose the required line load on the gabion).
 - b. Requirements: Deflection at the unsupported mid span of 0.50 ft or less. No visible reduction of wire size in any panel, no loss of internal rock, and no unraveling of twisted-mesh or weld breaks in welded-mesh.
2. Mattress-Style Gabions – Test wire mesh of gabion mattresses, 1 ft or 1.5 ft high, for sufficient strength and flexibility when assembled and filled with rock as following:
 - a. Loading and configuration: Initially support the base of a 3 ft wide by 12 ft long gabion 2.5 ft above the ground. No load will be placed on the mattress. Remove about 3 ft of support from the end of the mattress.
 - b. Requirements: The cantilevered, unsupported end may sag and touch the ground. No visible reduction of the wire size in any panel, no loss of internal rock, and unraveling of twisted-mesh or weld breaks in welded-mesh.

The Engineer may accept those systems which have been previously tested and approved by the Department.

SECTION 718 – GEOTEXTILES

718.01 General Requirements. Use geotextile consisting of a long chain polymeric filaments or yarns oriented into a stable network that retains its relative structure, including selvages, during handling, placement, and design service life. Ensure that at least 85% by weight of the long chain polymers are polyolefins, polyesters, or polyamides. Ensure the geotextile has no defects or tears. The Engineer may reject geotextile if dimensional stability or resistance to ambient temperatures,

acid or alkaline conditions, and micro-organisms/insects are unsatisfactory for the intended purpose. Provide geotextile in accordance with the properties as indicated for each specified use. Provide the geotextile without treatment or coating which might adversely alter its physical properties after installation.

718.02 Certification. Submit to the Engineer the geotextile manufacturer's certification consisting of certified test results showing the geotextile and factory seams meet the specifications for the intended application. Ensure the certification includes the named product and that representative samples have been delivered and tested as specified.

Include the following information in the certification for each geotextile to be used:

1. Manufacturer's name and current address.
2. Full product name.
3. Geotextile roll number.
4. Proposed geotextile use(s).
5. Certified test results.

Provide the name and address of the testing agency, the test date, on the identification certification. Also, provide a means to identify the geotextile, including a lot number that can be used to ensure the product delivered is the product covered by the certification.

Provide a certified copy of the test results that include each test result, each mean roll value, the calculated standard deviation for each lot, and the manufacturer's coefficient of variation for test results.

Provide duplicate certification with one copy to be sent with the shipment of the covered product to the Engineer, and one copy sent to the Central Materials Laboratory.

718.03 Samples. The Engineer will sample geotextiles for quality assurance testing.

Cut the geotextile samples from the roll with scissors, sharp knife, or by another suitable method that produces a smooth edge and does not cause ripping or tearing. Do not take samples from the outer wrap of the geotextile roll or from the inner wrap of the core. The minimum dimension for each sample is 6 ft by the full roll width. Submit one sample for each lot.

Label the samples with the lot and batch number, date of sampling, project number, specifications, manufacturer, and product name. The Department defines a lot as

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geotextile rolls within the same consignment or shipment that a manufacturer produced with the same product name or designation.

Submit samples of sewn seams before installation to the Central Materials Laboratory. Sew the seam sampling using the same equipment and procedures as will be used to sew the production seams. If production seams sewn in both the machine and cross-machine directions, provide sewn seams for sampling oriented in both the machine and cross-machine directions and at least 6 ft long in each direction. If the seams are sewn in the factory, the Engineer will obtain samples of the factory seam at random from any of the rolls to be used.

718.04 Testing. The Department reserves the right to perform tests as necessary to determine that geotextile properties are in accordance with the values specified for the intended application(s).

Geotextile property requirements specified are minimum average roll values. Determine the tensile strengths in both machine and cross-machine directions.

718.05 Drainage Geotextile Property Requirements. Provide nonwoven or monofilament woven geotextiles. The Engineer will not accept slit film or slit tape geotextiles for drainage applications. Meet the requirement of Table 718.05-1.

Table 718.05-1 - Drainage Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)	
		Type I ⁽¹⁾	Type II ⁽²⁾
Grab Tensile Strength, lb	ASTM D 4632	80	180
Grab Elongation, (%)	ASTM D 4632	NA	
Puncture Strength, lb	ASTM D 6241	300	500
Apparent Opening Size (AOS) (Std. Sieve)	ASTM D 4751	#70 or Finer	
Permittivity, (sec-1)	ASTM D 4491	0.7	0.7

Note: Strength properties of drainage geotextiles placed on level or near level surfaces such as under drain blankets or on subgrade must meet those specified in 718.07.

(1) Type I refers to protected conditions. Protected conditions include trench depth < 10 ft, rounded aggregate or crushed aggregate less than 4 in size, and relatively smooth trench walls.

(2) Type II refers to unprotected conditions. All other conditions are unprotected.

718.06 Riprap/Erosion Control Geotextile Property Requirements. Provide nonwoven or monofilament woven geotextiles. The Engineer will not accept slit film or slit tape geotextiles for riprap/erosion control applications, including installation behind gabions. Meet the requirements of Table 718.06-1.

Table 718.06-1 - Riprap/Erosion Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)	
		Type I (1)	Type II (2)
Grab Tensile Strength, lb	ASTM D 4632	130	200
Grab Elongation, (%)	ASTM D 4632	15	15
Puncture Strength, lb	ASTM D 6241	400	600
Trapezoidal Tear, lb	ASTM D 4533	40	50
Apparent Opening Size (AOS) (Std. Sieve)	ASTM D 4751	#50 or Finer	
Permittivity, (sec-1)	ASTM D 4491	0.5	0.5
Ultraviolet (UV) Radiation Stability	ASTM 4355	70% Strength Retained @ 150 hours	

(1) Type I refers to low to moderate survivability geotextiles. The Contractor may use Type I behind gabions less than 10 ft high without an aggregate cushion.

(2) Type II refers to higher survivability geotextiles. Use a Type II geotextile in severe conditions, where stones will be larger than 250 lb or drop heights cannot be practically reduced.

718.07 Subgrade Separation Geotextile Property Requirements. Provide nonwoven or woven geotextiles, except that only non woven geotextile may be used for Type III. Meet the requirements of Table 718.07-1.

Table 718.07-1 - Subgrade Separation Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)		
		Type I ⁽¹⁾	Type II ⁽²⁾	Type III ^(2,3)
Grab Tensile Strength, lb ⁽⁴⁾	ASTM D 4632	180/115	270/180	270/180
Grab Elongation, (%) ⁽⁴⁾	ASTM D 4632	<50%/ ≥50%	<50%/≥50%	<50%/ ≥50%
Puncture Strength, lb ⁽⁴⁾	ASTM D6241	500/300	600/450	600/450
Trapezoidal Tear Strength, lb ⁽⁴⁾	ASTM D 4533	70/40	100/75	100/75
Apparent Opening Size (AOS) (Standard Sieve)	ASTM D 4751	#30 or Finer	#70 or finer	
Permittivity, (sec-1)	ASTM D 4491	0.02	0.02	0.7

(1) Type I refers to moderate survivability conditions. Moderate survivability is low to moderate ground pressure equipment, < 40 psi with 12 in to 18 in initial lift thickness or high ground pressure equipment, > 40 psi with more than 18 in initial lift thickness.

(2) Type II and Type III refers to high survivability conditions. High survivability is low to moderate ground pressure equipment with 6 in to 12 in initial lift thickness or high ground pressure equipment with 12 in to 18 in initial lift thickness. Subgrade condition is assumed cleared of rocks, stumps & large limbs, and graded reasonably smooth. If subgrade preparation or clearing is not as stated, or cover material is angular shot rock, even higher survivability geotextiles may be necessary.

(3) Type III is used when subgrade separation geotextile will also function in a drainage application.

(4) The dual values for strengths for each geotextile Type are related to the grab elongation. For geotextiles with elongation which is less than 50%, the first strength values are applied. For geotextiles with elongation which is equal or greater than 50%, the second strength values are applied. Higher strength is required for geotextiles with lower elongation.

The subgrade condition is assumed to be cleared of rocks, stumps & large limbs, and graded reasonably smooth. If subgrade preparation or clearing is not as stated, or cover material is angular shot rock, even higher survivability geotextiles may be necessary.

718.08 Pavement Overlay Geotextile Property Requirements. Provide only non woven geotextiles. Meet the requirements of Table 718.08-1.

Table 718.08-1 - Overlay Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)
Grab Tensile Strength, lb	ASTM D 4632	80
Grab Tensile Elongation, (%)	ASTM D 4632	50
Trapezoidal Tear Strength, lb	ASTM D 4533	40
Asphalt Retention, gal/yd ²	ASTM D 6140	0.20

718.09 Temporary Silt Fence Geotextile Property Requirements. Meet the requirements of Table 718.09-1.

Table 718.09-1 - Temporary Silt Fence Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)
Grab Tensile Strength, lb (N)	ASTM D 4632	90
Grab Tensile Elongation, (%) [At 50% of minimum Tensile Strength, 45 lb]	ASTM D 4632	50 max(1)
Permittivity, (sec-1)	ASTM D 4491	0.05
Apparent Opening Size (AOS)	ASTM D 4751	#20 or finer
Ultraviolet (UV) Radiation Stability Retained	ASTM D 4355	70% Strength Retained @ 150 hours

(1) For wire fence supported geotextile, elongation requirements are not applicable.

SECTION 720 – MISCELLANEOUS

720.01 Water for Concrete, Grout, and Mortar. The Contractor may use water from any municipal drinking water supply for concrete, grout, or mortar. The Contractor may use water from other sources, provided it is reasonably clear without oil, contains less than 1000 parts per million of chlorides and less than 1000 parts per million of sulfates, determined in accordance with AASHTO T26. If a water source other than a municipal drinking water supply is proposed provide independent laboratory test reports verifying compliance with these chemical requirements. Provide reports that are less than two years old before using a non-municipal drinking water supply.

720.02 Elastomeric Bearings.

720.04

1. **Description.** Elastomeric bearings include unreinforced pads (consisting of elastomer only) and reinforced bearings with steel laminates.

The Engineer will not allow stacking of individually laminated pads.

Provide bearings with the dimensions, material properties, elastomer grade and type of laminates specified. Show the design load specified and testing requirements. Unless otherwise specified, provide Grade 3 bearings with a shear modulus of 0.130 ksi, steel reinforced, and subjected to the load-testing requirements specified.

2. **Materials.** The raw elastomer consists of virgin Neoprene (polychloroprene) or virgin natural rubber (polyisoprene). Provide the elastomer compound classified as being of low-temperature Grade 0, 2, 3, 4, or 5. The grades and other material properties are defined in the AASHTO LRFD Bridge Design Specifications, Section 14 and AASHTO M 251. A higher grade of elastomer may be substituted for a lower one.
3. **Fabrication.** Fabricate bearings in accordance with AASHTO M 251.
4. **Testing.** Subject materials for elastomeric bearings and the finished bearings to the tests described in AASHTO M 251 including subsection 8.9.2.
5. **Installation.** The Contractor may place elastomeric bearings without external load plates directly on a concrete or steel surface provided that it is flat within a tolerance of 0.005 of the nominal dimension for steel reinforced bearings and 0.01 of the nominal dimension for others. Place bearings on surfaces that are horizontal to within 0.01 rad. Correct the lack of parallelism between the top of the bearing and the underside of the girder that exceeds 0.01 rad by grouting or as Engineer directed.

Do not weld exterior plates of the bearing unless at least 1.5 in of the steel exists between the weld and the elastomer. Do not allow the elastomer or the bond to be subjected to temperature higher than 400 °F.

720.03 Polytetrafluoroethylene(TFE/PTFE) Bridge Bearing Pads. Provide TFE/PTFE pads and stainless steel mating surface where specified that meets AASHTO Specifications for Highway Bridges. If filled TFE/PTFE sheet is used, only glass-fiber filler will be accepted by the Engineer.

720.04 Epoxy-Resin-Base Bonding Systems For Concrete. Meet ASTM C 881 with the classification (type and grade) of the system selected as specified. The Contractor and the Contractor's supplier with Engineer approval will determine the class after project conditions have been established. Provide materials and applica-

tion that meets applicable ACI Standards: 503.1, 503.2, 503.3 or 503.4. Submit the manufacturer's certification verifying compliance to material specifications.

720.05 Recycled Glass. Provide recycled glass, whole bottles or crushed glass, for use in roadway fills, and crushed glass for use in granular borrow, granular subbase, or aggregate base meeting the requirements of AASHTO M 318. Certify in writing to the Engineer that the glass is from a waste stream generated in Idaho.

720.06 Hydrated Lime. Provide hydrated lime as follows in accordance with the following requirements respective to use.

1. **QuickLime for Cold In Place Recycled Pavement.** Meet ASTM C-977.
2. **Hydrated Lime for Plant Mix Additive.** Meet AASHTO M 303 Type I.

720.07 Recycled Asphalt Pavement (RAP). RAP is salvaged, milled, pulverized, broken, or crushed bituminous material that may have minor coatings of dust or aggregate particles with no discernable seams, pockets, or amounts of base, soil, or deleterious material.

1. **RAP Categories.** Provide RAP that complies with one of the following categories:

Category 1: The Department defines this material as being from an agency project or is traceable to an agency project. The Engineer will accept Category 1 RAP for use provided the Contractor submits a letter of certification to the Engineer stating the RAP is from a specific pavement, including the route and mile post. Do not add material from other sources during stockpiling and provide certification of this from the producer on a stockpile by stockpile basis.

Category 1 RAP may consist of asphalt material removed from Interstates, United States Highways, Primary routes, Secondary routes, airfields, or local projects.

Category 2: The Department defines this material as not being from agency projects or is not traceable to an agency project. The Engineer will accept Category 2 RAP for use as Category 1 RAP if the Contractor performs all tests as described in "720.07.C. RAP Testing and Test Frequency, Category 2", and submits test results and materials to the Engineer that show the RAP meets the specifications and is verifiable by the Department. Submit

test results no less than 10 calendar days before mix design submittal.

Do not use Category 2 RAP that does not meet these requirements as Category 1 RAP.

Category 2 RAP is:

Production Returns – asphalt material generated from plant waste, i.e., start-up/shut down material; and

Random RAP – crushed and screened asphalt material removed from private paving projects, plant overruns, rejected loads, or any combination.

2. **RAP Processing.** The Contractor may use processed or unprocessed RAP as follows:

Processed RAP: RAP that is at least processed by crushing and screening to produce a uniform gradation from coarse to fine and a uniform binder content in the RAP before use in a recycled mix. The Engineer will accept millings as processed provided they have a reasonably uniform gradation, from coarse to fine, a reasonably uniform binder content, and do not contain oversize material as Engineer determined. Provide processed RAP that has 100 percent passing the $\frac{5}{8}$ in sieve upon entry into the mixing plant.

The Contractor may recycle processed RAP in Superpave HMA at the percentages shown below:

- Category 1 RAP is not limited when used in any lift.
- Category 2 RAP is allowed up to 10 percent when used in the top lift and is limited to 30 percent maximum when used in a lower lift.

Processed RAP stockpiles may contain RAP from sources as indicated by the category and *may be replenished* with RAP from sources of that same category.

Unprocessed RAP: RAP removed from the original location that has not been processed for gradation and binder content uniformity. The Contractor may stockpile different sources of unprocessed RAP together provided it is generally free of contamination from dirt, debris, clean stone, concrete, etc. Provide unprocessed RAP that has 100 percent passing the $\frac{5}{8}$ in sieve upon entry into the mixing plant.

The Contractor may recycle unprocessed RAP into any Superpave HMA at the percentages shown here:

- Category 1 RAP is limited to 17 percent maximum in the top lift and to 30 percent maximum in a lower lift.
- Category 2 RAP is not allowed in the top lift and is limited to 17 percent maximum when used in a lower lift.

Unprocessed RAP stockpiles may contain RAP from sources as indicated by the category and *cannot be replenished* once approved by the Engineer.

The Contractor may re-crush RAP particles retained on the 5/8 in screen provided the re-crushing does not result in further degradation of the aggregates.

Fractionation of RAP stockpiles may be necessary to meet specifications when high RAP percentages are used.

3. RAP Testing and Test Frequency. Perform the following tests at the specified testing frequencies for each Category:

Category 1: Establish an extraction correlation. Determine the asphalt binder content and aggregate gradation in accordance with the FOP for AASHTO T 308 and AASHTO T 30 at the minimum frequency of one test per 500 ton for the first 2,000 ton and one test per 1,000 ton thereafter. Then perform a minimum of six tests for stockpiles less than 4,000 ton.

Perform chemical binder extractions in accordance with AASHTO T 164 or AASHTO T 319 to reclaim the binder from the RAP when the RAP asphalt binder contribution to the mixture exceeds 30 percent of the total asphalt binder. Determine the PG binder grading of the reclaimed binder in accordance with 702 at the frequency of one test per 5000 ton with at least one test per stockpile.

Category 2: Asphalt binder content, aggregate gradation testing and binder grade testing requirements are the same as Category 1. In addition, test the aggregate recovered from the RAP by the extraction process AASHTO T 308 or AASHTO T 164 or AASHTO T 319 to determine the aggregate quality. Test RAP aggregate quality as follows:

AASHTO T 96 and Idaho IT-15 tested on extracted aggregate as specified at a frequency of one test per stockpile.

AASHTO T 335, AASHTO T 304, and ASTM D4791 at the minimum frequency of one test per 500 ton for the first

2,000 ton and one test per 1,000 ton thereafter. Perform at least six tests for stockpiles less than 4,000 ton.

Meet the applicable aggregate quality requirements of Table 405.02-1 and 703 for the combination of virgin and RAP aggregate.

Use the RAP as Category 2 RAP, Unprocessed, if it was not tested.

Asphalt Binder/Aggregate Correlation Factor: Perform at least six AASHTO T 164 or AASHTO T 319 chemical extraction tests and AASHTO T 30 gradation tests and six AASHTO T 308 burn tests and AASHTO T 30 gradation tests to establish a correlation factor for asphalt binder and aggregate gradation. Prepare six identical pairs of samples and test one sample of each pair by AASHTO T 164 or AASHTO T 319 and test the other sample by AASHTO T 308. The standard deviation of the correlation test results must be less than 0.07. If the standard deviation for the correlation test results exceeds 0.07, the Engineer will require additional AASHTO T 164 or AASHTO T 319 and AASHTO T 308 testing until the standard deviation for the correlation testing falls below 0.07.

For testing after stockpiling, submit a plan to sample and test the RAP pile, either in-situ or by re-stockpiling, to the Engineer for approval. Meet the minimum frequency required and detail the procedure used to obtain representative samples throughout the stockpile for testing.

4. RAP Stockpiles and Record Keeping. Place RAP stockpiles on a base with adequate drainage, and construct in layers to minimize RAP segregation and ensure a workable face. Construct separate stockpiles for each source of RAP based on the category of RAP, the quality of aggregate, type and quantity of asphalt binder, and size of processed material. Positively identify RAP stockpiles on a map of the stockpile areas and place signs in or near each stockpile. Maintain a record system at the plant site for RAP stockpiles that includes at a minimum, the following:

1. Stockpile identification and a sketch of stockpile areas at the plant site.
2. RAP category (project, state route, plant waste, rejected loads)
3. Origin or dates milled and approximate number of tons in the stockpile.
4. Chemical extraction and AASHTO T 308 burn test results.

Make the RAP stockpile records available to the Engineer at the plant site. The Engineer will reject, by visual inspection, stockpiles that are not kept clean and

free of foreign materials. The Engineer will reject RAP containing contaminants, such as earth, brick, sand, concrete, pavement fabric, joint sealants, etc. The Contractor may reprocess the rejected RAP stockpile to meet requirements or remove the stockpile from use in Department projects.

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Delivering Quality Transportation

A stylized graphic featuring a white mountain range silhouette above a perspective view of a road with dashed white lines receding into the distance.

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