

# Quality Assurance Program



## Field Data Collection & Entry Manual

Maintenance and Operations Division

April 2013

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## 1 INTRODUCTION

The purpose of the Quality Assurance Program is to enhance asset management and fulfill the DOT &PF mission statement: Our mission is to provide for the safe movement of people and goods and the delivery of State services. This mission statement can only be fulfilled through proactive transportation asset management.

An important part of the department's proactive asset management is the Quality Assurance Program with annual field condition inspections conducted all across the highway system. The inspections assess the level of service DOT&PF staff provides to the highway system users through regular preventive maintenance and construction activities. The purpose of this manual is to document the procedures for consistent data collection on road and roadside features and the elements of accurate data entry in the QA module.

Beginning with the QA Pilot Program in the spring of 2005, the number of QA segments inspected statewide was 125. During the pilot program DOT collected the data with existing staff. In 2006 the number of segments surveyed was increased to 500 and a contractor was hired to perform data collection. In 2010 the department increased the number of inspected segments to 1,000 in an effort to provide a data set that is statistically more reliable and representative of the data population.

The higher the number of total segments inspected, the higher the confidence level is for the inventory results. It appears that inspecting 1,000 segments, even though this places a burden on the DOT staff, has decreased the volatility between comparison years. The payback for the time and money invested to inspect 1,000 segments may be at or near the crossing point for a desirable cost to benefit comparison. As more data is collected, a new cost to benefit evaluation will be necessary to determine where improvements are needed.

In states where the entire highway system is inter-connected, the number of segments which are to be inspected is easily changeable without dramatically increasing the cost. However in Alaska, the random selection system does dramatically increase the cost of data collection because of the number of roads present at rural communities accessible only by air or ferry.

The bridge inspection program is excluded from the QA inspection process and is accomplished separately by the bridge inspectors from Design and Engineering Services. Bridge data is collected and stored in the Pontis Bridge Management System by Bridge Engineers. Bridge deficiencies are imported from Pontis into the MMS to allow maintenance crews to address and correct deficiencies in a timely manner.

Pavement Management evaluations are performed by a DOT specialist and the capture of the International Roughness Index (IRI) and Rutting is performed by contract. The IRI and Rutting data results are imported into the QA module and the module provides ratings for each on the QA report card (see Attachment 2).

The Quality Assurance Program Manual is maintained by the DOT&PF Commissioner's Office. If you have questions please contact the Commissioner's Office at (907) 465-3900.

## 2 Maintenance Management System Annual Preparation

Each year the Quality Assurance module randomly selects 1,000 one-tenth mile inventory segments. There are several procedures which must be performed before and after the random selection is made.

### Before

- The MMS must be, at minimum, setup for the next fiscal year.
  - Entering the Fiscal Year, Pay Periods and Holiday table data.
  - Exclude the road segments which are not representative of the rest of the highway system or are scheduled for construction so they do not appear in the inventory list.
  - Exclude an additional five-tenths of a mile (1/2 mile) either side of a construction zone to prevent inspection segment from falling in the traffic control (flagger) zone for the construction.

### After

- Once the QA module randomly selects the inventory list, evaluate the system chosen roads to assure there are no data anomalies.
- Negotiate with the QA inspection contractor and DOT staff to determine who will inspect which segments.
  - The majority (typically 75 – 80%) of the segments are inspected by the contractor, however most of the extremely remote segments are inspected by DOT staff to control the contract cost.

Note: The fiscal year setup is the State fiscal year which begins July 1<sup>st</sup> of each year and ends June 30<sup>th</sup>.

## 3 QA Data Collection Procedures

The Department's Maintenance Management System (MMS) Quality Assurance (QA) module identifies approximately 1,000 randomly selected data survey segments from the approximately 5,700 centerline miles of state highway inventory. The QA module also prints the inventory form (see Attachment 1) used to inspect the tenth- mile segments (528 feet). A QA inspection contractor (hereafter QA contractor) will inspect and collect the majority of the segments augmented by DOT staff for the more remote segments.

Each DOT region will have at least one dedicated QA inventory team with two persons per team. Each region will also identify two alternate inspectors to fill in if one or both regular members are unavailable. These teams are region wide teams, under regional direction rather than under the direction of a District or Station.

### SAFETY FIRST

Prior to conducting inspections, review this Pre-activity Safety Plan for QA inspections.

- Inspect the vehicle lights, flashers and rotating beacons before beginning operations each day.
- Ensure that all appropriate personal protective equipment and traffic control devices are available and used.
- Always wear required safety equipment, reflective vest, safety glasses, etc.

- Wear proper clothing and footwear for the conditions.
- Do not attempt to conduct inspections in metropolitan areas during rush hour traffic.
- Activate the rotating beacon, flashing lights on vehicle, survey signs and place cones for safety and use appropriate traffic control measures where necessary.
- Determine what the individual segment may require before beginning each inspection.
- When performing data collection always try to walk facing traffic and have the second inspector on the team serve as a spotter.
- On divided highways and highways with heavy traffic it may be necessary to measure longitudinal and estimate horizontal cracks along or from the shoulder of the road as accurately as possible without entering the traffic lane.

### **Conducting the Inventory**

The following guidelines are intended to aid the field personnel with locating the QA inventory segment.

- Check the tire pressure and calibrate the DMI at the beginning of each day and any time the ambient air temperature changes more than 20 degrees or the drive distance between or to the inspection segment is more than 100 miles.
- Using easily identifiable reference points with a mile point cited in the Coordinated Data System (CDS) route log; such as a bridge, road intersection or mile marker (and with the vehicle's DMI when available) measure, locate and mark the beginning and end points for each inspection segment .
- The vehicle odometer may be used in locations where the vehicle does not have a DMI.
- Mark the start and end points with paint across the fog line at the edge of the shoulder or a pin flag when necessary so that they can be located again for Quality Control.
- Segments are always in the increasing direction from the starting mile point. For example: If segment location is 43.2 of the Parks Highway. Inspection segment is from Mile Point 43.2 to 43.3.
- If any portion of the segment falls on a bridge structure, the segment is to be moved forward or backward to the next tenth-mile as necessary to avoid including the bridge structure.
- If any portion of the segment falls in a construction zones or closed section of highway, relocate the segment outside of the construction zone/closed section, but as close to the original segment as possible, using a full tenth-mile road segment.
- Indicate the segment as an alternate segment in the inventory form.
- Do not assign the alternate segment location to a different, nearby highway unless absolutely necessary.
- If it is necessary to select a different road for an alternate segment the road selected should be similar to the original segment and the inspector should enter the road name of the new location on the inventory form.
- Segments located in areas that are not the maintenance responsibility of Alaska DOT shall not be evaluated and reassigned as an alternate segment, appropriately.
- Should a segment or a portion there of fall inside city limits, measure only activities funded by Alaska DOT or move the segment.

- Measure the tenth-mile length for highway on and off ramps starting from where the center of the ramp lane would intersect the Fog Line of the highway (if the fog line were continuous).
- Conduct field measurements and observations at the segment and record the data.

## 4 QA Inventory Process

The following highway features are at the heart of the MMS QA inventory process. The recorded results of the segment inspections are used by the QA module to evaluate the level of service currently being provided to the traveling public and commercial vehicle operations. The QA Inventory Form (see Attachment 1) contains two broad categories: Road Surface ratings and Road Side ratings. As each of these features is inspected the results are entered onto the QA form and then loaded to the QA module which extrapolates the probable feature condition statewide and identifies an overall level of service. This level of service is presented in a Report Card rating the current level of service for each feature, in scores labeled from A to F (see Attachment 2).

Pavement deficiencies are cumulative. Where one type of deficiency is found within the area of a second type of deficiency, the deficiencies are counted independently. For example, a 1,000 sq. ft. area of alligator cracking contains a 12 inch diameter pothole. For counting purposes count both, but do not subtract the pothole from the alligator cracking area measurement.

Mark the survey segment with a painted strip across the fog line (color choice determined each year at the annual training meeting) for the beginning and end of the segment. For gravel roads or where paint cannot be used a survey pin flag or stake is used. A Quality Control Team will visit and re-evaluate 5% of the segments inspected by the QA Teams each year.

### QA Inventory Form

The inventory form header information is self explanatory, with the following exceptions.

- The original segment number is entered in the alternate segment number block to indicate that an alternate segment was chosen. Enter a comment in the comment block at the bottom or on the reverse side of the form to indicate why an alternate segment was chosen.
- If the inspection segment is inspected as a QC segment enter a “yes” or check mark in the block.
- Enter the original/alternate CDS Rte. (road) Name in this block.
- Enter the name of the Station which has maintenance responsibility for the segment.
- Enter the name of the inspection Team members in this block or indicate “see reverse” if more space is required.

The form can be filled out prior to starting the inventory except for the date, alternate segment number and the begin mile point. If the segment is moved to a different mile point,

the segment number is written in the alternate segment number block and the new Begin MP is entered. Always carry spare blank forms in case a form is damaged or lost.

### **Segment Pictures**

Follow the camera Setup procedures, then with the GPS turned on, the Compass on/calibrated (if equipped) and the segment number software set for the segment number, i.e. segment 234A. Take the “234A” wide area pictures at the Begin MP looking up-station showing the segment beginning paint marking in the lower right 1/3 of the photo which should also show the right of way. Take a second “234B” wide area picture in the same manner at the End MP looking down-station showing the end of segment paint marking. Additional photos include a “234C” photo for any unusual maintenance issues observed. The “234P” would be taken if a culvert is found with 50% or greater blockage. The “234V” photo is taken to depict vegetation with an object like a survey stake or the measuring wheel near the vegetation for height scale.

## **5 Paved Road**

### **Paved Driving Surface**

The paved roadway driving surface (from inner edge of fog line to inner edge of fog line) at both of the segment end points are measured, then the average surface width in feet is calculated by adding both together and dividing by 2 for the segment, and the result is entered in this block.

### **Paved Shoulder**

The average **paved** shoulder width, which is the sum of width for both shoulders in whole feet, is entered in this block. Turnouts, paved bike paths/lanes and sidewalks are counted as paved shoulders and are added to the roadway shoulder width, even if the bike path is separated from the shoulder. Gravel shoulders are never entered for a paved road.

## **6 Gravel Road**

### **Gravel Driving Surface**

The average roadway driving surface width, from “apparent” shoulder to “apparent” shoulder, in whole feet for the segment is entered in this block. The “apparent” shoulder is identified by sighting up and down the road segment to see where the edge of commonly used road surface is, by observing tire tracks, the shoulder break from road grading, etc. The standard gravel road driving surface width is considered to be 24 feet wide.

### **Gravel Shoulder**

The average shoulder surface width, for both shoulders in whole feet, is entered in this block. Each side’s shoulder width is the distance from the edge of the driving surface to the shoulder break. Gravel bike paths are counted as gravel shoulders and added to the shoulder width, even if separated from the shoulder.

## 7 Road Surface Ratings

### Gravel Surface Material

The amount and type of gravel along with the presence of a crowned centerline determines whether the road surface is acceptable or requires maintenance activities to restore it to the as-built condition. The road surface should be comprised of D-1 (crushed gravel surfacing), and average at least 1 inch in depth. The road shall be graded relatively smooth, with a crown at centerline to facilitate proper drainage and prevent pooling of water on the road surface. If the gravel road does not meet these criteria it fails (Many rural roads do fail).

### Paved Surface

#### Cracks

Any opening in the pavement greater than (>) 1/8 inch wide is considered a crack in the paved surface or shoulder. Measure the length of all cracks along the entire 1/10<sup>th</sup> mile segment, and record the total on the QA inventory form as whole feet number. The writing tip of a standard retractable ballpoint pen makes a good gauge for a crack greater than 1/8" wide.

#### Alligator Cracking

This type of cracking (see Attachment 3) is symptomatic of a subsurface failure and is calculated as a percentage of the segment's surface area as follows. First note the length of the alligatored zone, then multiply that length by the width to calculate the total square feet of alligator cracking (both paved driving surface and shoulders). Divide that square footage by the square footage of the entire segment (528') times the width of the roadway, both driving surface plus shoulders, and enter the % result on the QA inventory form. (2%, and 3%, up to 10% are common values for roads plagued with alligator cracking)

#### Potholes

Pot holes are entered on the QA inventory form as a unit count for each of two categories; those which are 4 to 12 inches in diameter and those which are greater than (>) 12 inches in diameter.

#### Pavement Striping

Painted striping is a count of the number of lines painted along the segment, which includes lane dividers, centerlines and fog lines. Each solid stripe or dashed lane line is counted and entered on the QA inventory form as a whole number. The pavement striping quality decision to be made at the segment is to inspect and determine what is the number of striped lines where greater than (>) 1/3 of the line is worn, missing or obliterated. Write that number into the block to the right of the stripe inventory count.

#### Pavement Markings

Painted markings are counted as the number of diagonal lines on a medium/divider, horizontal lines at a cross walk, hold/stop lines, lettering or turn arrows. The evaluation block on the QA inventory form records the number of markings where greater than (>) 1/3 of the painted symbol or line is worn, missing or obliterated.

#### Pavement Rutting



This data is a download from the Pavement Management System in a flat file which is imported into the QA database and is not an inventory inspection item for QA or QC inspectors.

### **International Roughness Index**

This data is a download from the Pavement Management System in a flat file which is imported into the QA database and is not an inventory inspection item for QA or QC inspectors.

## **8 Road Side Ratings**

### **Culverts**

The culvert item on the QA inventory form is a count of the total culverts found within the segment. This includes any driveway culverts that are maintained by the State. The evaluation block on the form is a count of the culverts which are 50% or greater (>) blocked.

### **Ditches**

The quantity of ditching to be noted on the inspection form is the linear feet (not to exceed 528') of drainage ditches which are at least 1 foot (or greater) in depth and have a back slope. (thus without proper drainage the feature would fill with water; it needs maintenance to perform properly) The evaluation block is used to record the number of linear feet (not to exceed 528') of ditch which are 50% or greater (>) blocked. Special Note: Due to the QA module design no more than 528 linear feet of ditches can be entered for either segment measurement or the 50% blocked measurement. Example: if there are 100 feet on one side of the road and 528 feet on the other, the total 628 is divided by 2 for a whole number answer of 314.

### **Guardrail Panels**

The first Quantity block is a count of the total number of panels found within the segment. The evaluation Quantity block is the number of panels which are functionally impaired to the point that they may not serve their intended purpose (i.e. the panel or post are compromised to the point that they may not prevent a vehicle leaving the highway). Or, for example if the panel is torn or cut or there are three or more consecutive posts broken, rotten or missing. Up to three posts may be omitted during installation if additional overlapping panels are added to stiffen the rail.

### **Guardrail Ends**

The first Quantity block is a count of the total number of guardrail ends in the segment. The evaluation Quantity block is the number of ends which are functionally impaired to the point that they may not serve their intended purpose (i.e. the ends or deceleration system are compromised to the point that they may increase the probability of death or injury). Indications of impaired ends: If the end is partially activated, there are broken posts, stiffener bars are bent or broken, or tension cables are broken or slack, there is a stub post greater than 4 inches exposed above the surface, or the grade is greater than 10:1 due to erosion.

**Guardrail Height**

The height is measured from the top edge panel to the finish grade and has a tolerance of + or – 3 inches (see Attachment 4). Enter the total number of guardrail panels which are out of tolerance and may not serve their intended purpose (i.e. having the panel(s) at a wrong height may increase the probability of a vehicle going under or over the guardrail).

**Traffic Signs**

The first Quantity block is a count of the total number of signs within the segment (only signs maintained by DOT are to be counted). The second Quantity block is a count of the total number of signs where 1/3 or more of the legend or symbol or background is illegible, missing, obliterated or the reflectivity of the sign is visibly compromised.

**Vegetation Hydro Axe**

For this feature the length (which is the inventory) of the area which **normally would be cut** with a hydro axe is measured and entered in the QA inventory form. If the area needs to be cut the width which would be cut by Hydro Axe is entered, otherwise the width is 0.

**Vegetation Side Arm Mower**

For this feature the length (which is the inventory) of the area which **normally would be cut** with a side arm mower is measured and entered in the QA inventory form. If the area needs to be cut the width which would be cut by side arm mower is entered, otherwise the width is 0.

**Vegetation Standard Mowing**

For this feature the length (which is the inventory) of the area which **normally would be cut** with a standard mower is measured and entered in the QA inventory form. If the area needs to be cut the width which would be cut by standard mower is entered, otherwise the width is 0.

## 9 MMS Data Loading Procedures

The loading of data from the inventory form into the QA module is a straight copy of values and notations from the QA inventory form, with the following exceptions:

**Alternate Segment**

If it is necessary to select a different road for an alternate segment, the road selected should be similar to the original segment. Enter the road name of the new location in the inventory form, however, only the original, randomly selected road name and the adjusted mile point are displayed in the QA module.

**Paved Road**

For paved roads there is never an entry for gravel shoulders in the QA module.

**Paved Shoulder**

Paved bike paths are counted as paved shoulders and added to the paved shoulder width, even if separated from the shoulder.

**Alligator Cracking**

The data entered in the MMS requires the calculation of the percentage of segment. First note the total square footage of alligator cracking from the QA inventory form. Then calculate the total square feet of the segment or segment. The shoulders widths are added to the driving area width, multiply that by 528 to determine the total square feet of the segment. Then the result is divided into the square feet of alligator cracking to determine the percent of segment or segment impacted by alligator cracking. Example:  $700 \text{ SF} / ((24 + 4 + 5) * 528 \text{ LF}) = 4\%$ . In this example 700 sq. ft. is the alligator cracking, 24 ft. is the average driving surface wide (between fog lines) and the shoulders are an average of 4 ft. and 5 ft. wide. The 528 ft. is the length of the segment (tenth-mile). The 4% is entered in the MMS QA module as a rounded whole number.

**Vegetation Management**

There are two entry blocks for vegetation management, the average width of vegetation clearing being performed periodically at the segment and the entry for the length of cleared area at the segment. When entering the length in the QA module the number is a whole number in linear feet and cannot be larger than 528. If there is a total of 1056 linear feet of vegetation which needs to be cut (both sides of the road, along the whole segment) the total is divided by 2 and then enter the resulting 528. If there were 528 feet on one side and 300 on the other for a total of 828, you divide by 2 then enter the answer of 414 in the QA module.

**Ditches**

As with Vegetation Management the maximum linear feet of ditch you can enter in the QA module are 528. Again you will need to do the math, adding both sides together and dividing by 2. Enter the answer in the appropriate block.

**10 Definition of Terms and Acronyms****Cumulative Deficiencies**

Pavement deficiencies are cumulative. Where one type of deficiency is found within the area of a second type of deficiency, the deficiencies are counted independently. For example, a 1,000 sq. ft. area of alligator cracking may contain a 12 inch diameter pothole. For counting purposes count both, but do not subtract the pothole from the alligator cracking area measurement.

### **Fog Lines and Pavement Width Measurements**

For the purposes of QA field data collection, **the fog line is considered part of the paved shoulder**. Thus the shoulder area is measured from the inside of the fog line nearest the driving surface to the outside of the paved shoulder. On roads without a fog line the seam between the shoulder and driving surface can be used as the boundary.

**Level of Service** – The purpose of QA is to measure the level of service provided by Alaska DOT personnel to the traveling public using funding approved by the Alaska State Legislature. The QA module also provides tools to predict the level of service if funding is increased or decreased. The QA Level of Service goals are outlined in Attachment 5. **Beginning in 2010, the number of segments collected was doubled to 1,000 segments. The program has been improved and updated for 2010 to better depict the level of service.** The program information can be downloaded from the M&O Statewide Home Page. Look for the Maintenance Management System and Quality Assurance Program data presentation pages at: <http://www.dot.state.ak.us/stwdmno/index.shtml>

**MMS** – The Maintenance Management System is a comprehensive software application used to record and report maintenance work activities. The system was developed to provide an electronic timesheet, stockpile usage inventor and as a methodology provides for asset management through the Quality Assurance module.

**QA** – The Quality Assurance module of the MMS is used in conjunction with inspections of highway features to predict the statewide highway system condition and the level of service provided to the traveling public and commercial vehicle operations. The QA module allows the department to evaluate the level of service for each feature listed in the QA inventory form. The ability to predict how the level of service is changed if the maintenance budget is increased or decreased based on a standard rate of change per year is a valuable tool. The QA module is a key element of our proactive asset management program.

**MP** – Mile Points are used in the state GIS linear referencing system and when measuring to find a particular location on a highway or other CDS route.

**Mile Post** – A historical mile marker is a highway feature and is identified in the right of way by a small green sign with a number. Note: A mile post and a mile point are not always at the same location on the highway.

**CDS Route Number** – Alaska DOT&PF identifies each road in the Highway Analysis System (HAS) with a Coordinated Data System (CDS) Route Number. Each road has a route name (the CDS Route Number) and a route description (the posted road name).

### 11 Attachment 1 - MMS QA Inventory Form

The numbers in the form indicate the section in the manual where instructions are located.

#### AKDOT&PF Quality Assurance Inventory Form

Date		Site #		Alt. Site #	5	Q.C.		
Station		Rte. Name				Begin MP		
Team	5							
AVERAGE ROADWAY SURFACE WIDTH (Feet)	Paved Road		Paved Driving Surface		6			
			Paved Shoulder		6			
	Gravel Road		Gravel Driving Surface		7			
			Gravel Shoulder		7			
Feature			Threshold Condition		Site Assessment			
GRAVEL SURFACING MATERIAL (3/4", Fractured)			1" of Material Or Less		Pass	8		
					Fail	8		
CRACKS			> 1/8" (Linear Feet)			8		
ALLIGATOR CRACKING			Square Footage			8		
POTHoles (Total Number, Paved Roads Only)			Diameter 4" to 12"			8		
			Diameter > 12"			8		
VEGETATION MNGT. (Average Width at site in Feet)			Hydro Axe		Length	9		
					Width			
Side Arm Mowing	Length	9		Standard Mowing		Length	9	
	Width					Width		
		Quantity	UOM			Quantity	UOM	
CULVERTS		9	Each	50% or > Blocked			Each	
DITCHES		9	Ditch Feet	50% or > Blocked			Ditch Feet	
GUARDRAIL PANELS (Total Length Divided by 12.5)		9	Each	Functionality Impaired			Each	
GUARDRAIL ENDS		9	Each	Functionality Impaired			Each	
GUARDRAIL HEIGHT (At Mid-Point of Panel, Note Cable vs Panel)			Same as # of panels	Out of Tolerance (when > +/- 3")		9	Each	
TRAFFIC SIGNS		9	Each	> 1/3 Illegible, Missing or Obliterated			Each	
PAVEMENT STRIPING		8	# Stripes	> 1/3 Worn, Missing or Obliterated			# Stripes	
PAVEMENT MARKINGS		8	Each	> 1/3 Worn, Missing or Obliterated			Each	

Photo A:	5	Comments or Questions:
B:		
C:		
P:		
V:		

(continue on reverse)

## 12 Attachment 2 – MMS QA Report Card

ALASKA DEPT. OF TRANSPORTATION & PUBLIC FACILITIES  
MAINTENANCE MANAGEMENT SYSTEM

Quality Assurance Report Card  
Fiscal Year: JULY10-JUNE11

	Condition A				Condition B				Condition C				Condition D				Condition F			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b>ROAD SURFACE</b>																				
GRAVEL SURFACE MATERIAL													N							
CRACKS									N											
ALLIGATOR CRACKING									N											
POTHoles									N											
PAVEMENT STRIPING													N							
PAVEMENT MARKINGS																	N			
PAVEMENT RUTTING																	A			
PAVEMENT IRI									A											
<b>ROAD SIDE</b>																				
CULVERTS													N							
DITCHES					N															
GUARDRAIL PANELS (12' 6")					N															
GUARDRAIL ENDS									N											
GUARDRAIL HEIGHT									N											
TRAFFIC SIGNS													N							
VEG - HYDRO AXE					N															
VEG - SIDE ARM MOW					N															
VEG - STD MOWING									N											

Key

- A = Actual
- P = Planned
- N = No Change (Planned and Actual the same)

### 13 Attachment 3 - Alligator Cracking Examples

Alligator Cracking





## 14 Attachment 4 – Guardrail Height Measurement

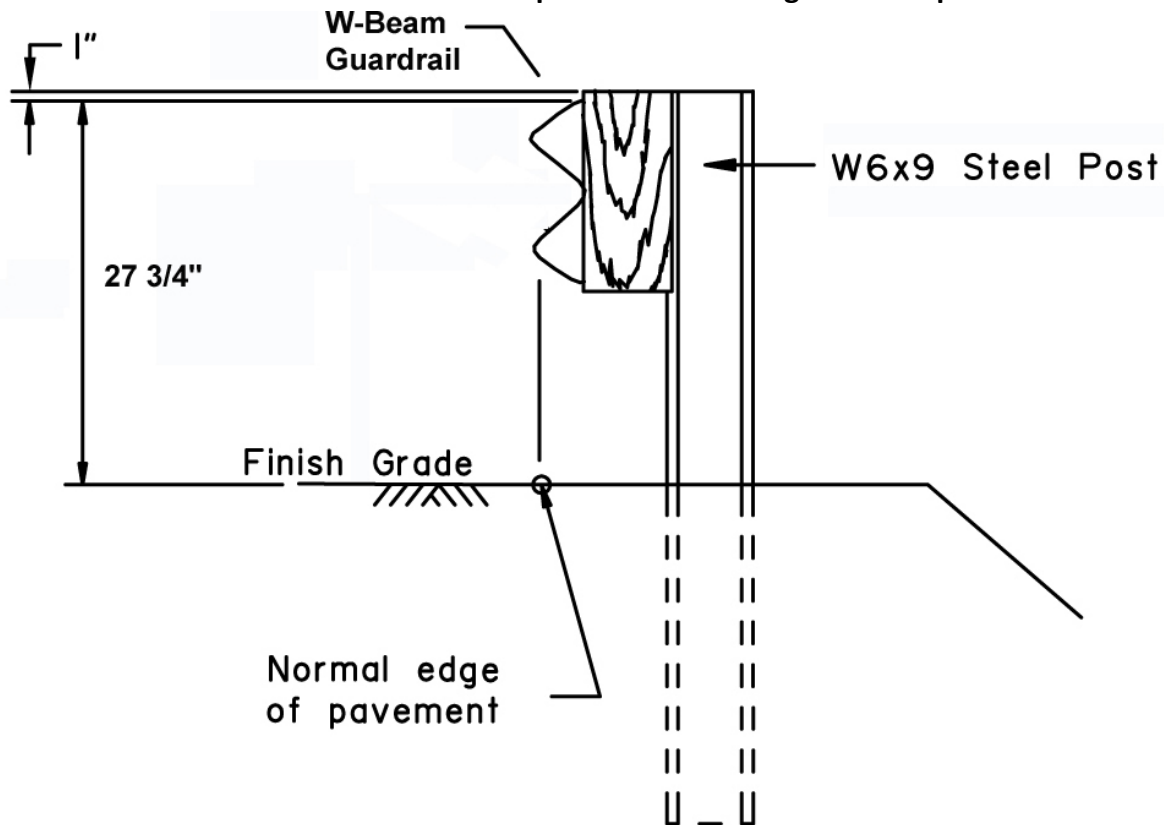
### Guardrail Panel Height Tolerance

The height of guardrail is determined from years of crash testing. Currently the top of a w-beam rail is tested at 27 ¾ inches. Crash testing has shown the height is important for the proper performance of the guardrail in vehicle impacts. An installation too low may allow a larger vehicle with a relatively high center of gravity to climb the barrier, while too high of an installation may let a smaller vehicle slip underneath. Nominal construction tolerance for a new installation is +/- one inch, and AASHTO recommends guardrail to be rebuilt if the height varies more than three inches from the standard height.

A change in height is typically caused by resurfacing projects, frost heave or the post being undermined by water. Excessive winter sand and gravel buildup is a maintenance issue and not a tolerance failure. Scrape away excess sand and gravel down to grade before measuring height.

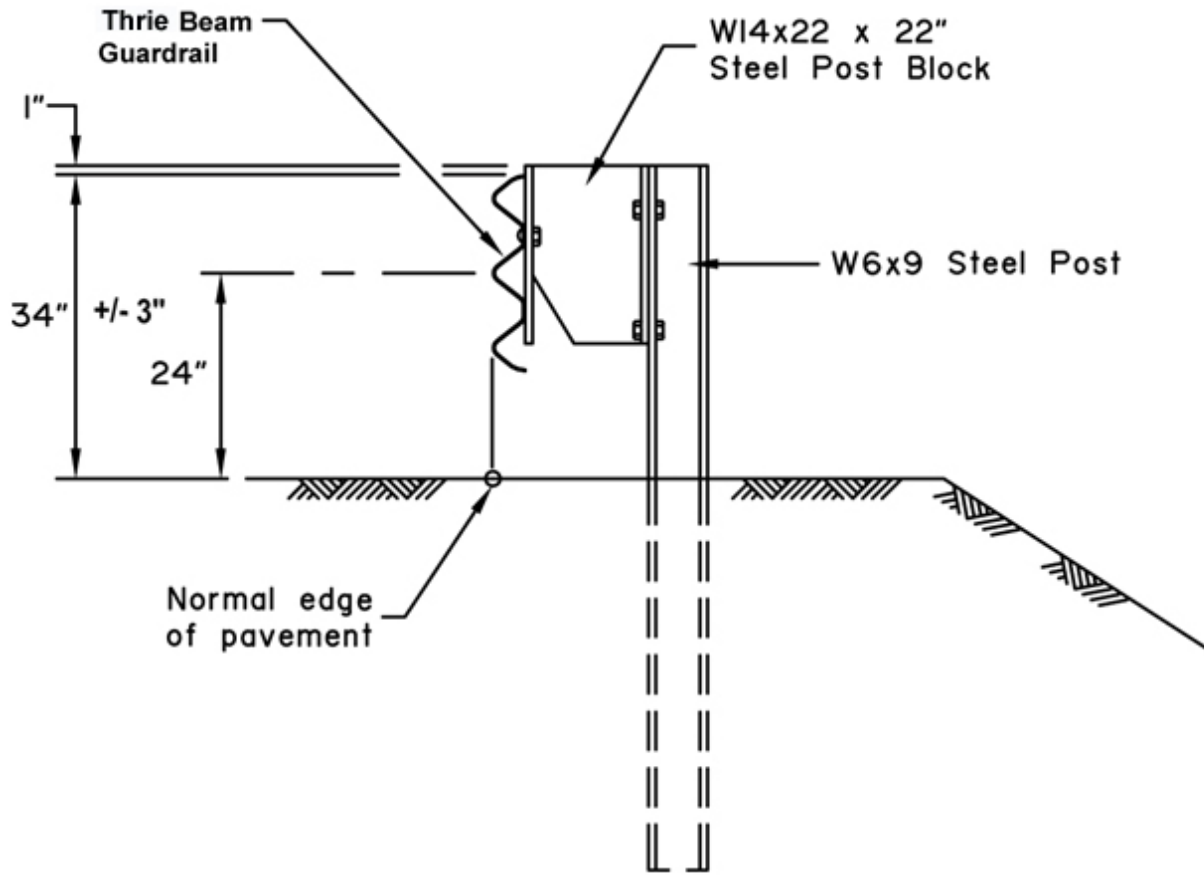
**W-Beam Guardrail is measured to top edge of panel 27 ¾ inches +/- 3 inches.**

**Measurement is taken at the face of the panel to the finish grade as depicted below.**



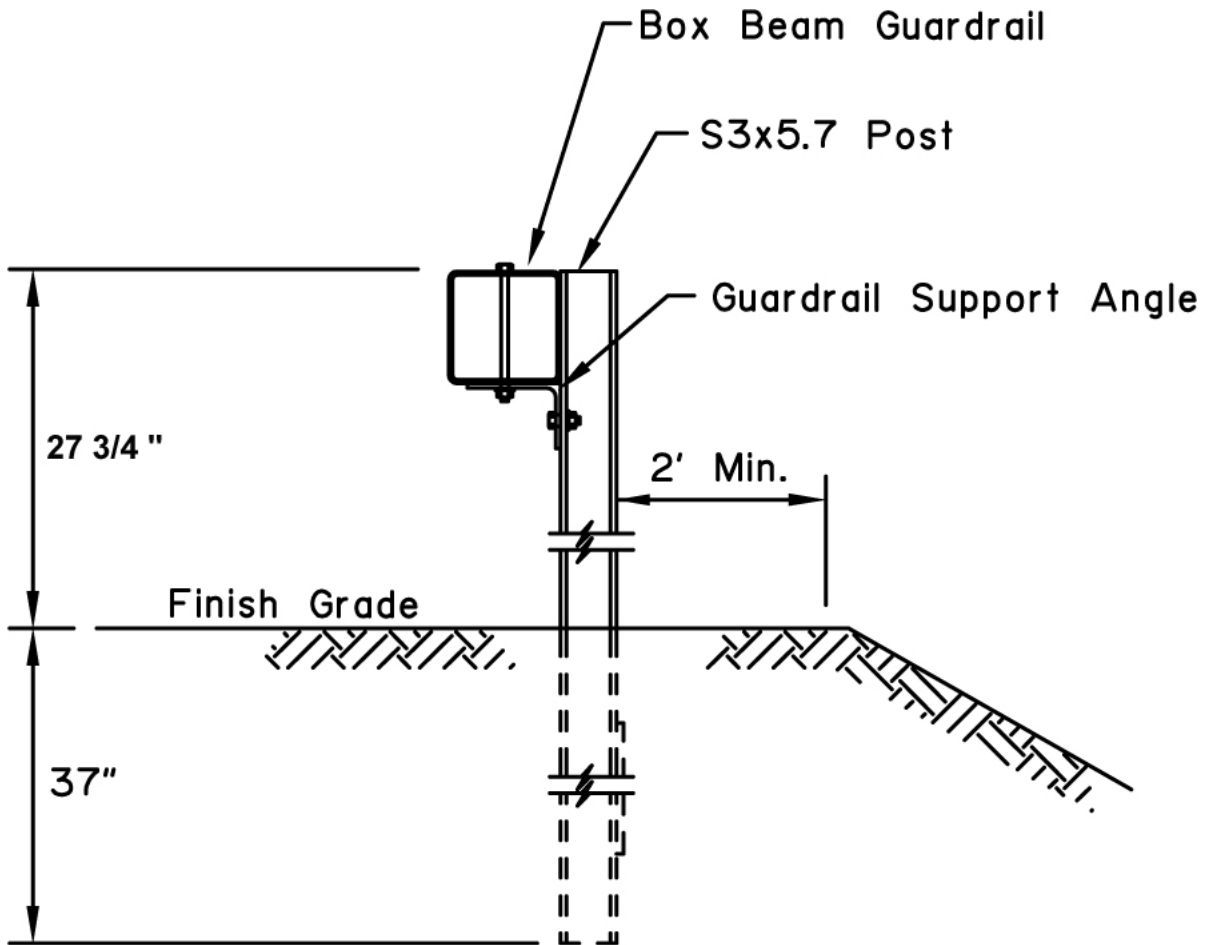
Attachment 4 (cont)

Thrie Beam Guardrail is measured to top edge of panel 34 inches +/- 3 inches. Measurement is taken at the face of the beam to the normal edge of pavement or the finish grade as depicted below.



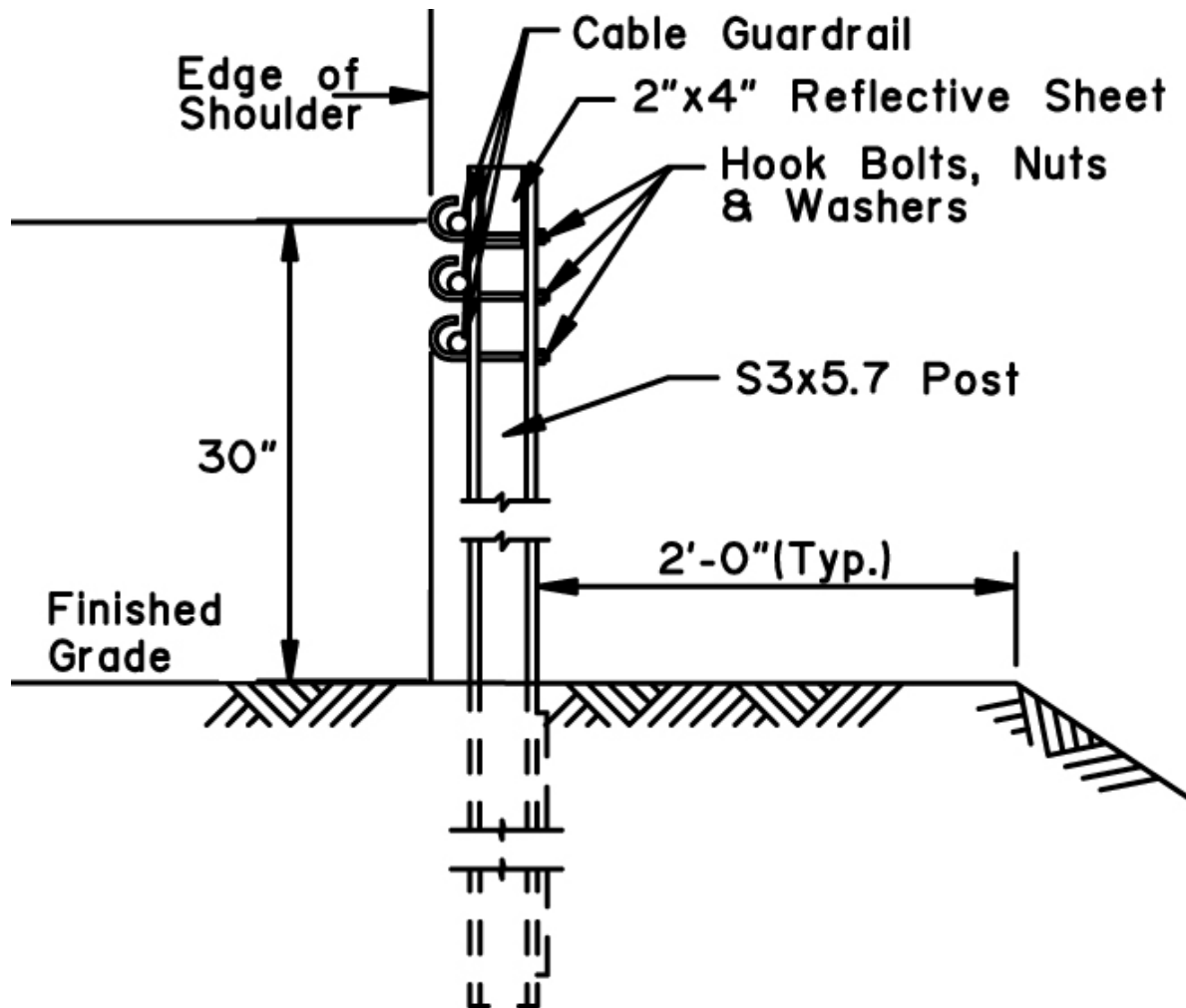
Attachment 4 (cont)

**Box Beam Guardrail is measured to top edge of beam 27 ¾ inches +/- 3 inches.  
Measurement is taken at the face of the beam to the finish grade as depicted below.**



## Attachment 4 (cont)

Cable Guardrail is measured to the center of upper cable 30 inches +/- 3 inches. The measurement is taken at the face of the cable to the finish grade as depicted below.



The FHWA recommends tensioning the cables after installation to improve the performance of the system by reducing deflection and increasing the potential to capture the impacting vehicle. The installation temperature is also a critical factor. A fourth cable may be added to reduce the probability of a small vehicle slipping under the bottom cable. The FHWA recommends agencies specify a minimum tension at a discrete installation temperature, and plan follow-up inspections to ensure the desired tension is maintained.

Tensioning standards have not been set by Alaska DOT&PF at this time because there are only two locations with cable rail. As the use of cable rail increases a standard will be set.

## 15 Attachment 5 – QA Level of Service Goals

**NOTE:** The QA Level of Service goals will be reviewed again before the end of the 2014 calendar year.

### Level of Service Goals - Surface

- Gravel Surface – C
- Cracks – B
- Alligator Cracking – B
- Potholes - B
- Pavement Striping – C
- Pavement Markings – C
- Pavement Rutting – B
- Pavement IRI - B

### Level of Service Goals - Roadside

- Culverts – B
- Ditches – B
- Guardrail Panels – B
- Guardrail Ends – B
- Guardrail Height – B
- Signs – B
- Vegetation - B