VTrans Vermont Agency of Transportation

Report on Shared-Use Path and Sidewalk Unit Costs

Updated August 2014

Produced by the VTrans Bicycle and Pedestrian Program

For further information or questions, contact Jon Kaplan at (802) 828-0059 or jon.kaplan@state.vt.us

A. Introduction

This report is intended to provide basic unit cost information for bicycle or pedestrian facilities and to provide some basic bid costs for items commonly included on projects that provide improved facilities for bicycling or walking. This is the second revision of a report first published in 2006. The previous report focused on updating cost estimates to be more reflective of typical bid item quantities and total project costs experienced on sidewalk and shared use path projects. This report includes those subjects and also provides more detailed information on project engineering costs, as well as some data regarding on-road bicycle lane costs.

B. Intended use of this data

VTrans staff, RPCs, and municipalities often need to know what the relative cost of proposed bicycle and/or pedestrian infrastructure will be. At the local level, a community may be considering making improvements with a given amount of money and need to determine how much they will be able to accomplish. RPCs sometimes perform or hire consultants to perform feasibility/scoping studies for projects in member towns and need to determine if cost estimates are reasonable. VTrans staff often review applications for bicycle or pedestrian improvement projects and must judge whether presented construction costs are reasonable. VTrans staff may also need preliminary costs when considering the inclusion of bicycle or pedestrian facilities as part of a roadway, bridge, or other transportation project. **The information in this report should be used for planning or checking purposes only and is not intended to substitute for "good engineering judgment" and detailed project cost estimates. The latest VTrans Five Year Averaged Price List (found here http://vtransestimating.vermont.gov/) or Estimator software should be consulted for detailed engineering estimates.**

C. Unit Construction Costs

The unit costs for different configurations of shared-use paths and sidewalks have been factored to include typical project items such as fencing, drainage, lighting, landscaping, mobilization, signs, and other incidental items. They do not account for extreme topographic conditions, structures (bridges, retaining walls, tunnels), and other site-specific conditions that would result in increased construction expense.

The following assumptions for typical sections were used to develop the unit costs for different sidewalk and shared-use path unit costs:

All sidewalks – 12" of sub-base material
Concrete sidewalks – 5" thick concrete
Bituminous sidewalks – 2" thick lift
Aggregate sidewalks – 3" compacted material

All shared-use paths – 6" of sand or earth and 12" of gravel sub-base material
Bituminous paths – 2" thick lift
Aggregate paths – 4" compacted material

An additional resource to use for early planning of projects is the VTRANS Standard Drawings. A full listing of these drawings can be found on the Agency web site at http://vtranscaddhelp.vermont.gov/downloads/standards.

When referencing this data, please cite the source as the 2014 VTrans Bicycle and Pedestrian Program Unit Cost Database.

The tables of unit costs represent construction costs only and do not include other costs associated with developing a shared-use path or sidewalk project such as engineering, administration, right of way or construction inspection. For guidance on those costs, see Section D. - Other Costs. The listed unit (per foot) costs include an allowance for typical associated items such as limited drainage work, signs, fencing, pavement markings, and limited landscaping.

Sidewalk Costs

Although sidewalk and curb can be constructed as a standalone project, it is often included as part of a roadway, bridge or utility project. Savings can result when a sidewalk is incorporated into a larger more comprehensive infrastructure project: when common materials such as concrete or aggregate are purchased in large quantities, the per-unit price is often lower, and when project engineering is completed for a larger project, the ratio of project engineering costs to total costs decreases. The use of different types of curbing, primarily granite compared to concrete, is often a decision that communities struggle with. Although granite curbing has a higher initial cost than concrete, the life cycle cost should be considered. Granite curbing has superior durability and aesthetic qualities and is the preferred curbing treatment in Vermont. Additionally, when a sidewalk needs eventual complete replacement, it is often possible to pull out and re-use granite curbing.

Figure 1 shows the current unit costs of sidewalks compared to those from the 2006 and 2010 Cost Report. Generally, costs have risen over time.

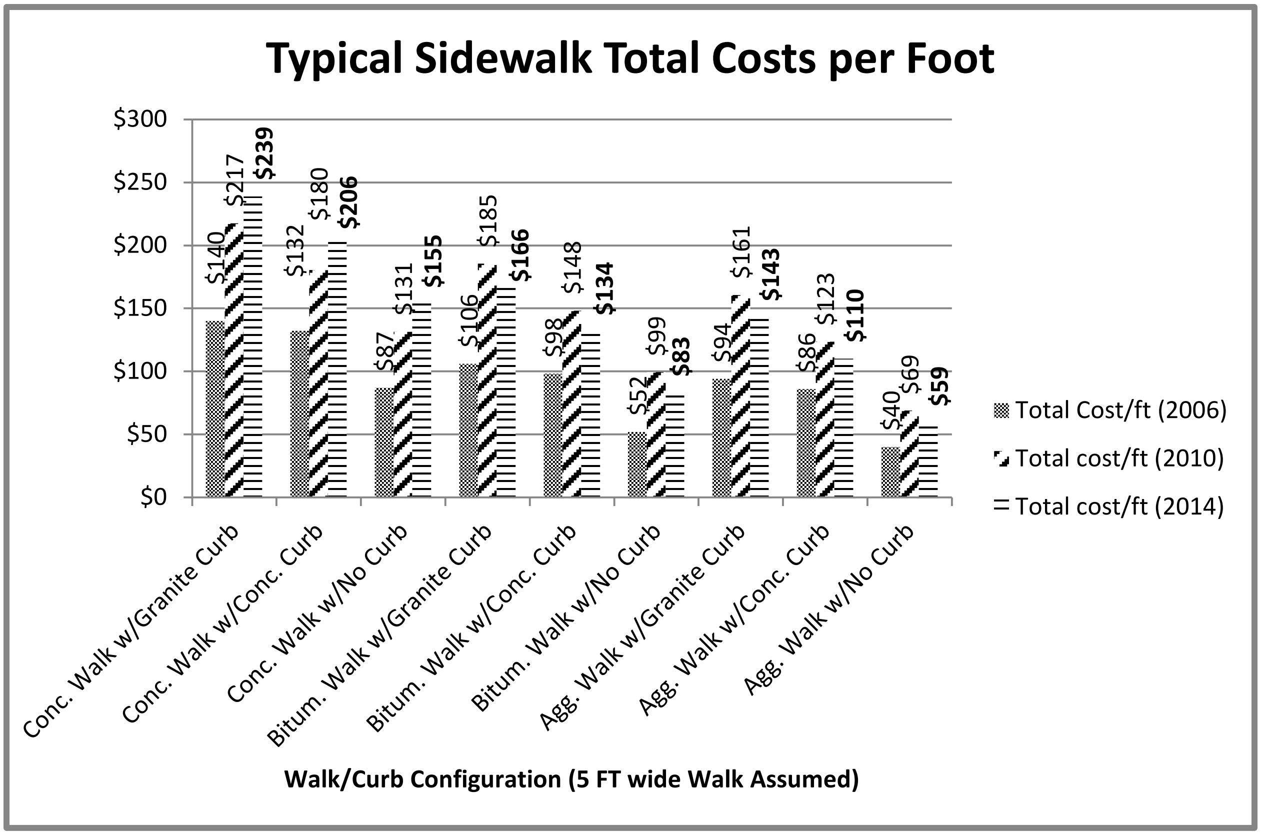

Figure 1 – Sidewalk Unit Cost History

Sidewalk/curb configurations	Total cost/ft (2014)	Basic cost/ft (2014)
5-foot wide concrete sidewalk with granite curb	$239	$99
5-foot wide concrete sidewalk with concrete curb	$206	$85
5-foot wide concrete sidewalk with no curb	$155	$64
5-foot wide bituminous sidewalk with granite curb	$166	$69
5-foot wide bituminous sidewalk with concrete curb	$134	$55
5-foot wide bituminous sidewalk with no curb	$83	$34
5-foot wide aggregate sidewalk with granite curb	$143	$59
5-foot wide aggregate sidewalk with concrete curb	$110	$46
5-foot wide aggregate sidewalk with no curb	$59	$25

Table 1 – Sidewalk Unit Costs

“Basic” costs of sidewalk construction consist solely of the items that are required to build the sidewalk itself, such as gravel sub-base, concrete, and granite curbing, as well as the excavation of the area in which the sidewalk is built. The “total” cost reflects the combined cost of sidewalk construction with other costs that are incidental to the construction. For example, pavement markings, new signs, traffic control, drainage, and landscaping are included in the total costs.

In addition to analyzing an overall unit cost for sidewalks and paths, the range of prices observed on actual construction bids for some of the key pay items was also analyzed. Because only a few paths were constructed since 2010, this analysis was only conducted for key sidewalk pay items.

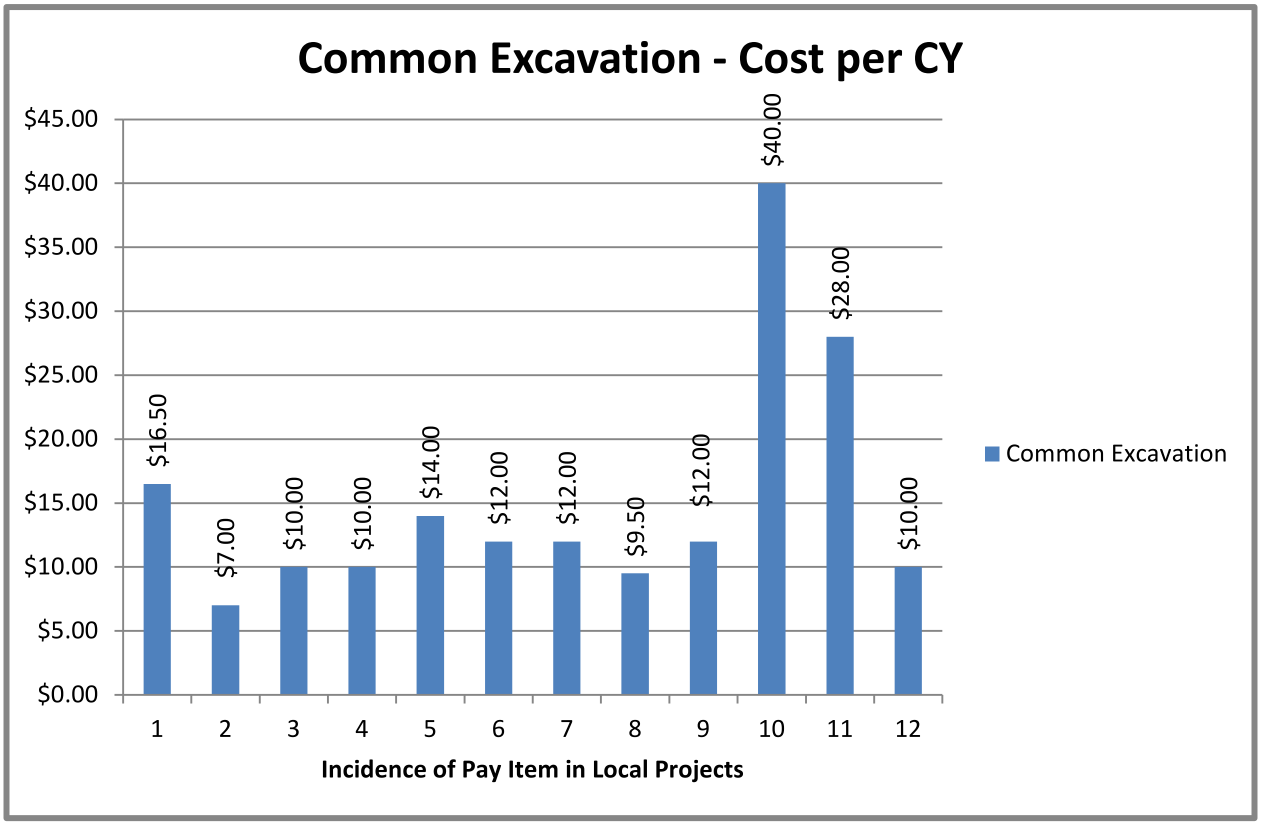

Figure 2 – Common Excavation Bid Costs

High – $40
Low – $7
Estimator – $15.27
Avg. - $15.10

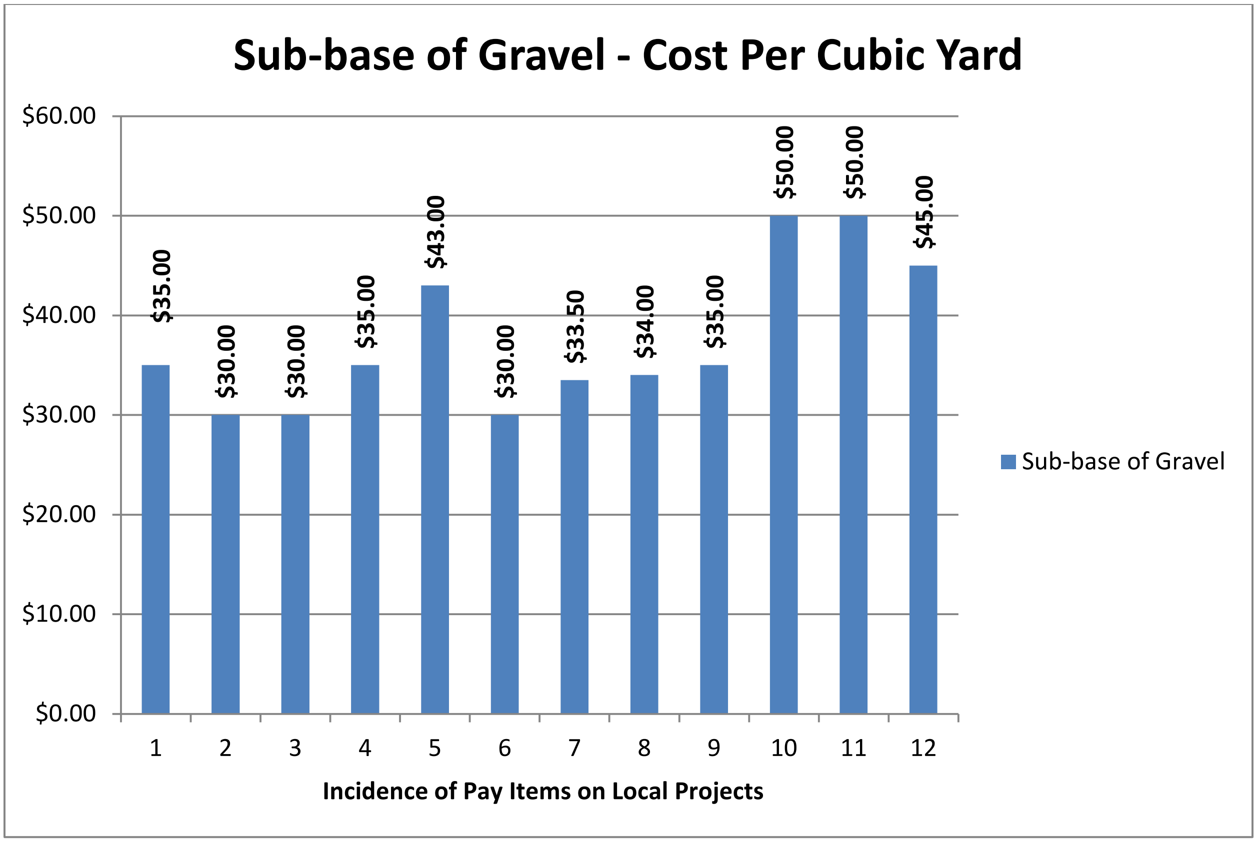

Figure 3 – Sub-base of Gravel Bid Costs

High – $50
Low – $30
Estimator – $30.07
Avg. - $36.97

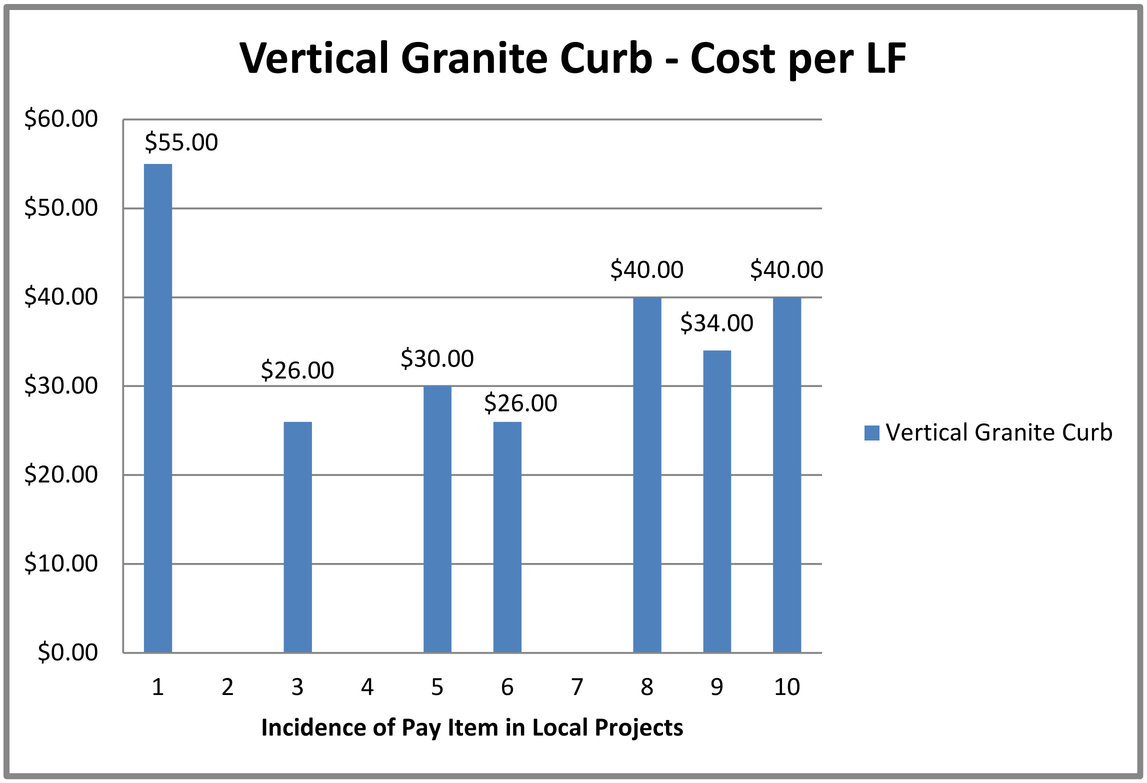

Figure 4 – Granite Curb Bid Costs

High – $55
Low – $26
Estimator – $25.07
Avg. - $34.51

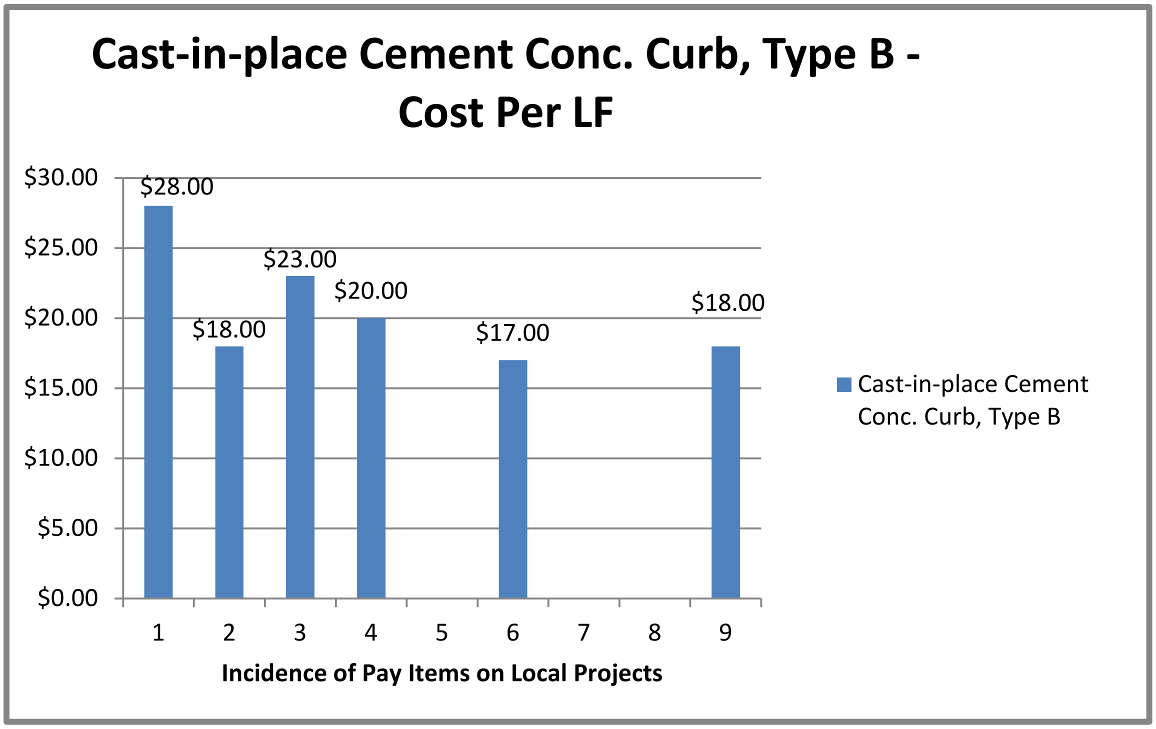

Figure 5 – Cast in Place Curb Bid Costs

High – $28
Low – $17
Estimator – $22.71
Avg. - $20.96

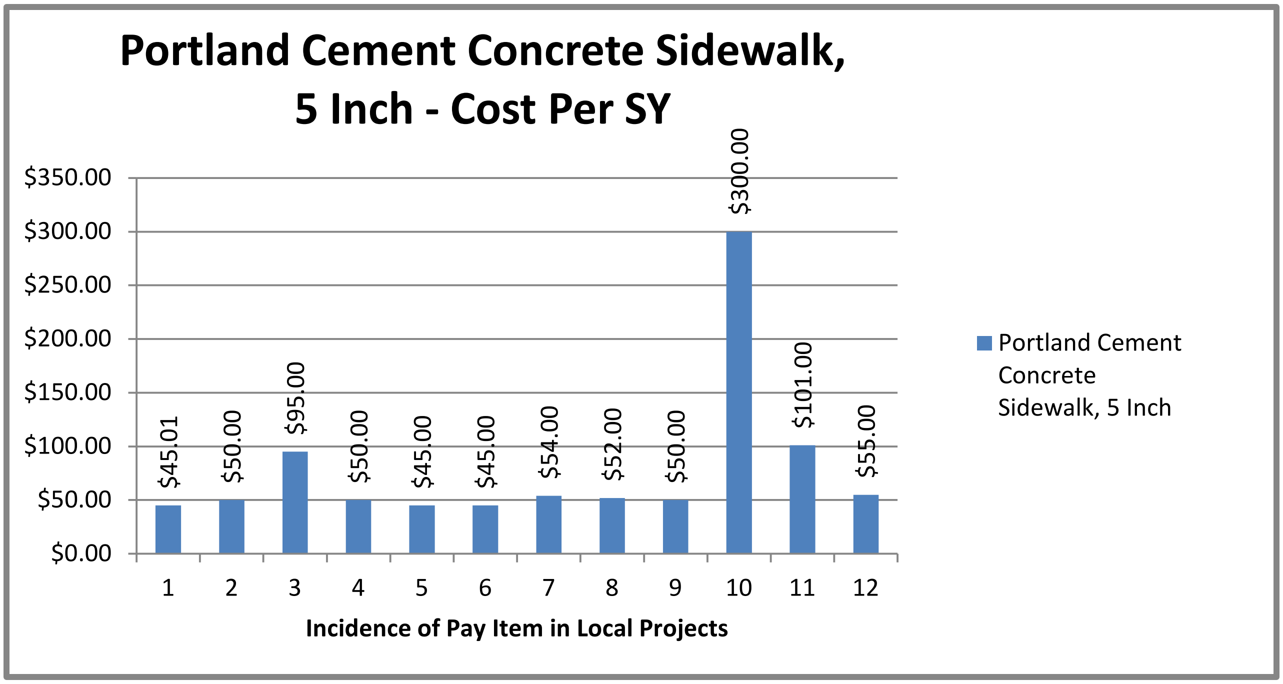

Figure 6 – PCC Sidewalk, 5-inch Bid Costs

High – $300
Low – $45
Estimator – $40.87
Avg. - $56.91 (Without $300 outlier)

<u>Shared Use Path Costs</u>

There were fewer shared use path projects constructed since the 2010 update of unit costs, but for those that were constructed, fairly consistent unit prices and individual item prices were observed. Unlike with sidewalks, the unit cost of paths declined slightly. Many paths have a bituminous concrete surface, and because of the volatility of prices for petroleum products, the cost of paved paths can also change quickly. Figure 7 shows the current unit costs of paths compared to those from the 2006 and 2010 Cost Report. The variation in cost may be due to changes in petroleum product prices.

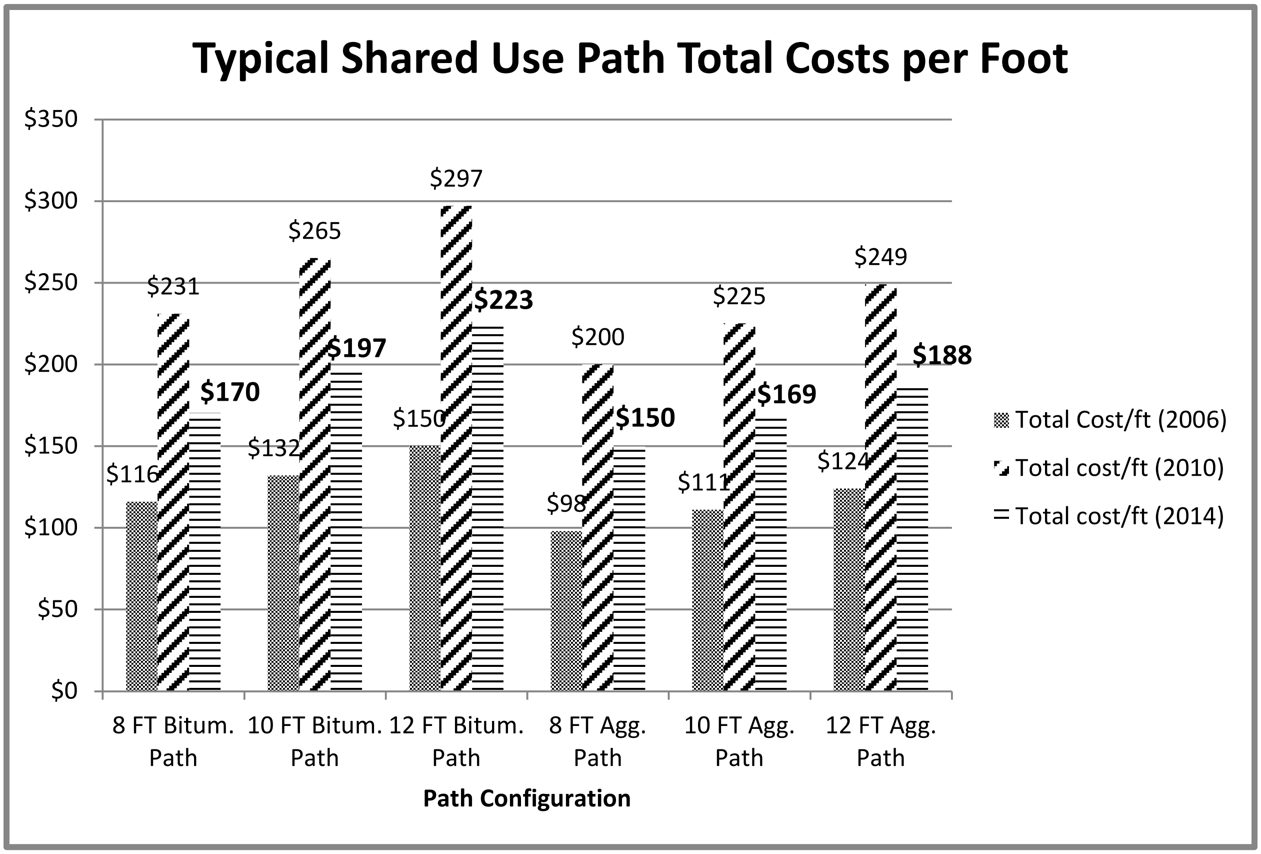

Figure 7 – Shared Use Path Unit Cost History

Bike path configurations	Total cost/ft (2014)	Basic cost/ft (2014)
8-foot wide bituminous concrete path	$170	$59
10 foot bituminous concrete path	$197	$69
12-foot bituminous concrete path	$223	$78
8-foot wide aggregate surface path	$150	$52
10-foot wide aggregate surface path	$169	$59
12-foot wide aggregate surface path	$188	$66

Table 2 – Shared Use Path Unit Costs

As with sidewalks, the “Basic” costs of path construction consist solely of the items that are required to build the path itself, such as excavation, gravel sub-base, and bituminous concrete pavement. The “total” cost reflects the combined cost of path construction with other costs that are incidental to the construction. For example, pavement markings, new signs, traffic control, drainage, and landscaping are included in the total costs.

On-Road Bicycle Lanes

It is difficult to provide a consistent estimate of the costs of installing bicycle lanes on already existing roadways. This is partially because such projects are rarely undertaken as a stand-alone project, but are usually included as a part of a project with a broader scope of work. Where adequate width exists, the primary cost of converting an existing paved shoulder to a bike lane is the addition of bike lane symbols and some new signs.

The 2006 cost report listed the cost of on-road bicycle lane construction between $4,000 and $9,000 per mile. The primary source of the variability in these estimates is durable pavement markings, such as thermoplastic, as opposed to regular paint. Durable pavement markings can be many times as expensive as standard paint.

In 2010, the town of Shelburne undertook a project to add a total of four miles of bike lanes to Spear Street, at a cost of approximately $76,000 per mile. This included adding five feet of shoulder to each side of the road, in addition to a two foot wide gravel shoulder.[1] Using VTrans average bid prices, a cost of $300,000 per mile for the same type of work was estimated. This is typical of the difference seen between prices of projects done at the local level compared with contracts put out by the state.

The UNC Highway Safety Research Center issued a report for FHWA and the Robert Wood Johnson foundation in 2013 that includes costs for a wide range of bicycle and pedestrian facilities. The full report can be found at http://www.pedbikeinfo.org/data/library/details.cfm?id=4877

An excerpt from a table in the report can be seen below. This supports the range of costs for bike lanes that have been observed in Vermont.

Infrastructure	Description	Median	Average	Minimum	Maximum	Cost Unit	Number of Sources (Observations
Bikeway	Bicycle Lane	$89,470	$133,170	$5,360	$536,680	Mile	6 (6)

Table 3: Costs for Bike Lanes

One reason that the cost of bike lanes is so variable is that if road widening is necessary, the conditions encountered e.g. ledge, re-ditching or the need for additional Right of Way, will be different in every situation. As was mentioned before, the most cost effective way to add a bike lane is to include it as an element of a new road construction, road resurfacing or reconstruction project.

For example, the city of South Burlington included bike lanes as part of major road reconstruction projects on Shelburne Road and on Kennedy Drive. These projects involved adding extra lanes to the

[1] Gagnon, Bernard. Director of Public Works, Shelburne VT. "Re: ProjAcceptMemo." Message to Jon Kaplan. 4 June 2010. E-mail.

existing road, necessitating significant expenditures for right of way, excavation, repaving, and moving utilities. In this case, the cost of adding eight extra feet of excavation, paving, and striping was relatively low compared to the overall cost of the projects.[2]

The estimates provided below take these conditions into account. In Table 4, Vermont Agency of Transportation (VTRANS) bid prices are used to compare the cost of using regular paint vs. durable pavement markings. For striping a bike lane, the main costs will be the required pavement markings. But for adding a shoulder, excavation, fill, and new pavement will be required. These costs are drawn from both individual items costs generated by this cost report and by the VTrans list of two-year average bid prices. For comparison, a cost estimate generated by an online web application called "Benefit-Cost Analysis of Bicycle Facilities" was also included in Table 4.

This application was created by the Active Communities/Transportation (ACT) Research Group, and can be found at http://www.bicyclinginfo.org/bikecost/index.cfm. The cost estimate generated by the ACT web application compares well with the estimated cost of installing bike lanes using data from the VTrans bid history.

Cost estimate for marking bike lanes on existing shoulders	**VTRANS estimate (regular paint)**	**VTRANS estimate (durable markings)**	**ACT Web Application (regular paint)**
Striping and signing only (per mile)	$2,700 - $6,000	$8,700 - $10,500	$10,000

Table 4 – Cost to sign and mark bike lanes (no road work)

Table 5 shows the range of costs to add width to a road to provide bike lanes. For planning purposes, it is recommended to use $150,000 per mile if widening is needed on both sides of the road.

Cost estimate for widening one mile of road 4 feet on each side to provide bike lanes	**Town of Shelburne**	**VTrans average Bid prices**	**ACT Web application**
Per Mile Cost	$79,000	$300,000	$230,000

Table 5 – Cost to widen for bike lanes

Structure Costs

If a proposed path project requires a bridge, the cost can vary widely depending on which design choices are made. A common material for pedestrian or path bridges has been weathering steel and treated

[2] Conner, Paul. City Planner, South Burlington VT. "Re: Bike Lanes!" 20 July 2010. E-mail.

wood decking. There have been some performance issues with weathering steel and its use has fallen somewhat out of favor. The most common alternative to weathering steel is galvanized steel, which is more expensive but is more resistant to corrosion and has a longer service life. Alternatives to treated wood decking include ipe wood, and wood-plastic composite (WPC) decking. All of these have trade-offs regarding service life, cost, and environmental impact. Ipe wood is an extremely dense, extremely hard wood from tropical forests in South America; it requires no treatment and yet has a service life of 30-40 years, as compared to the 15-20 year service life of treated wood, and it is more expensive than treated wood. WPC is generally more expensive, longer-lasting, and stronger than treated wood, but its specific design parameters vary greatly, depending on its manufacturer.

In Table 6, the average costs for different types of pre-fabricated bridges are shown. The cost of constructing a shared-use path bridge can vary anywhere between approximately $89 and $142 per square foot, which comes out to roughly $900 - $1600 per linear foot, assuming a length of 100 feet and depending on which materials were chosen. Increasing the width or length of a pre-fabricated bridge can cause the price to increase dramatically: for example, a 14-foot wide bridge would need to be split into two pieces for shipping, which could add up to 30% to the transportation costs. These figures are the result of estimates for pre-fabricated bridge construction provided by five different bridge manufacturing companies.

Assumed length of bridge: 100 feet	**Weathering steel, treated decking**	**Weathering steel, ipe decking**	**Galvanized steel, treated decking**	**Galvanized steel, ipe decking**
10' width: Cost per square foot	$87	$98	$112	$132
12' width: Cost per square foot	$90	$102	$113	$132

Table 6 – Path bridge Costs per Square Foot

Based on available data for path or sidewalk bridges constructed since 2006, shown in Table 7, a wide variation in the per-square-foot cost is seen, but is within the range of the estimates offered above.

Town	**Year**	**Length**	**Width**	**Cost per square foot**
Brattleboro	2006	90	10	$167.14
Burlington	2004	67	12	$140.78
Essex	2003	125	12	$79.36
LVRT Bridge #1	2013	110	10	$116
LVRT Bridge #2	2013	74	10	$116

Table 7 – Bid Costs of Path Bridges

Other structures that could significantly increase the cost of a project are retaining walls or underpasses. The variability of costs given different site conditions makes it impossible to provide estimates for the costs of such structures.

D. Other Project Costs

It is important to note that the construction cost of a project is only a portion of the overall cost. Other costs that are associated with a shared-use path or sidewalk project include:

- Engineering costs (more on this below)
- Municipal project management costs (generally range from 10% to 15% of construction)
- Right of Way costs (extremely variable)
- Construction inspection costs (generally range from 10% to 25% of construction costs, depending on the complexity of the project and the amount of oversight that is needed)

These percentages should be used as rough guidelines only. For simpler, more straightforward, projects the lower range can be used, but for more complex projects, the upper end of the range is appropriate.

<u>Engineering Costs</u>

In 2010, the relationship between Project Engineering (PE) costs and total construction costs was evaluated. The spread of the ratio of PE costs to total construction was quite large, ranging between 6% and 42%, with an average percentage of 16%. For estimating purposes, it is recommended to use at least 20% of the construction cost for engineering costs. There is a slight correlation between increased length of the project and the decreasing ratio of PE to construction costs. It generally costs just as much to complete project engineering for a project 500 feet long as it does for a project one mile long.

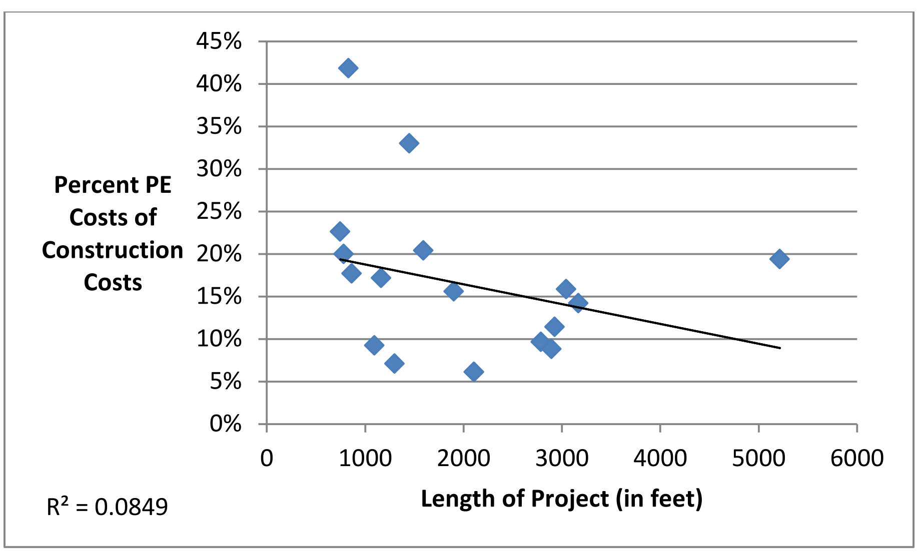

Figure 8 – Engineering Cost vs. Project Length

E. Methodology

Data for this report was obtained from the bid analyses and plans of sidewalk and path projects completed between 2010 and 2013. In order to compare basic costs to total project costs, the cost of built structures was excluded from the total price of the project, as bridges or other structures can significantly increase the cost of a project. Using the average quantities for actual projects, unit prices were also generated from the Estimator software. The overall average price was then a combination of the Estimator price averaged with the actual bid prices for the basic items.

For those path and/or sidewalk configurations for which there were no actual bid costs, the basic versus total cost percentage from the actual project low bids was applied to the cost of the basic items for an average path or sidewalk quantity to yield the total unit cost for that configuration.

Engineering costs were taken from VTRANS's project database and reflect actual costs incurred by towns; these costs were compared to bid costs of the same projects in order to compare engineering to construction costs.

Cost estimates for pre-fabricated pedestrian bridges were provided by five different bridge manufacturing companies. In speaking to the engineers at these companies, it became apparent that there is a large range of opinion about the ideal materials to use for a pre-fabricated bridge in Vermont. Providing cost estimates for different combinations of the most popular materials options was a good way to demonstrate the trade-offs and possibilities of choices such as treated wood vs. tropical hardwood (ipe), and weathering vs. galvanized steel.