Cost of Independent Bicycle and Pedestrian Facilities in North Carolina

Final Report

Submitted to

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Research and Analysis Group
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16. Abstract Bicycling and walking are integral components of an efficient transportation network. The cost of constructing new bicycle and pedestrian facilities plays a major role in the process of prioritization, decision making, and allocation of funds for bicycle and pedestrian projects. This report outlines the sampling methods and collection of project cost data, cost categories and elements considered, cost estimates of categories and elements, and the development of cost estimator tools for independent bicycle and pedestrian facilities such as 1) sidewalk; 2) bicycle lane; 3) shared use path; 4) mid-block crosswalk; 5) paved shoulder; 6) pedestrian intersection treatments; 7) bicycle / pedestrian bridge; and 8) shared lane markings.			
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Executive Summary

Bicycling and walking are integral components of an efficient transportation network. The cost of constructing new bicycle and pedestrian facilities plays a major role in the process of prioritization, decision making, and allocation of funds for bicycle and pedestrian projects. An established cost estimation methodology will assist local jurisdictions and state agencies with their project cost computations, and in turn, improve the accuracy of programmed project funds. Also, greater accuracy in a plan's project cost estimates will assist local jurisdictions in making more informed decisions with regards to local funding allocations.

In the past, the North Carolina Department of Transportation (NCDOT) has established procedures for estimating the cost of highway improvement projects and their components (includes bicycle and pedestrian facilities). However, NCDOT does not have established procedures or tools for estimating the cost of independent bicycle and pedestrian facilities. This report outlines the development of cost estimator tools for construction of independent bicycle and pedestrian facilities that include 1) sidewalk; 2) bicycle lane; 3) shared use path; 4) mid-block crosswalk; 5) paved shoulder; 6) pedestrian intersection treatments; 7) bicycle / pedestrian bridge; and 8) shared lane markings.

Information consisting of past projects and relevant costs of available associated cost categories and elements was obtained through a sampling approach. The data sampling was done through 1) a general survey, 2) utilization of a past projects list from NCDOT to contact local agencies that deployed and administered selected bicycle and pedestrian facilities, 3) communication with NCDOT divisions, 4) websites of neighboring state agencies, and, 5) consultant interviews. Overall, details pertaining to construction cost for 88 projects were gathered through various data sampling approaches. They include 50 sidewalk projects, 5 bicycle lane projects, 23 shared use path projects, 1 pedestrian bridge project, 4 trail projects and 5 sidewalk extension projects.

A database was then developed with cost details for the selected bicycle and pedestrian facilities. The primary cost categories considered for the development of the tool are preliminary engineering, design and environmental review costs, right-of-way cost, construction cost (which typically includes overhead cost and mobilization cost), construction engineering and inspection costs, NCDOT oversight cost, and inflation rate. The construction cost for each facility was

computed by estimating the quantity of each construction element required along with its cost from the database.

The developed spreadsheet based tool provides users an option to select the type of facility (as different worksheets) and subsequently more specifics based on the facility type selected. Each of these facility types, in turn, triggers additional user prompts on various other characteristics and design elements.

The database was set up to be as comprehensive as possible given available cost data for all the categories and elements, while being sufficiently simple to allow planners to generate preliminary cost estimates quickly. A description of each construction cost element and minimum, average, and maximum cost estimates as well as percentile cost estimates (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) per unit for each cost element are summarized next to the cost of input cell for an element. Table ES-1 summarizes the range of various construction cost elements.

Table ES-1. Construction Cost of Various Elements - Summary

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table ES-2 summarizes the construction cost of the selected bicycle or pedestrian facilities based on the ranges of various construction cost elements. The minimum, average, and maximum cost estimates along with percentile cost estimates (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) are shown in the table.

Table ES-2. Minimum, Average and Maximum Construction Cost of Selected Facility Types - Summary

Construction Costs	Facility Type							
	Sidewalk (0.25-mile)	Bicycle Lane (0.25-mile)	Shared Use Path (0.25-mile)	Mid-block Crosswalk (1)	Paved Shoulder (0.25-mile)	Pedestrian Intersection Treatments (1)	Bicycle / Pedestrian Bridge (100 ft)	Shared Lane Markings (0.25-mile)
Minimum Cost	$25,760	$33,153	$12,393	$3,340	$20,532	$14,343	$122,992	$7,781
Percentile (10)	$50,320	$54,366	$25,380	$3,542	$29,324	$16,133	$124,934	$11,528
Percentile (25)	$65,571	$77,505	$32,236	$3,809	$41,226	$20,081	$126,062	$16,355
Percentile (50)	$89,364	$112,490	$46,152	$4,323	$64,468	$24,546	$128,121	$26,185
Average Cost	$82,918	$105,099	$70,264	$4,940	$84,092	$25,923	$130,120	$37,829
Percentile (75)	$121,661	$156,596	$72,398	$5,132	$93,438	$28,563	$130,972	$41,919
Percentile (90)	$164,125	$203,395	$108,479	$5,966	$126,145	$32,629	$135,146	$57,410
Maximum Cost	$534,578	$552,659	$437,238	$14,167	$438,737	$56,897	$162,890	$209,319

The preliminary engineering, design, and environmental review costs vary based on the type of project, location and site conditions. It could be a minimum of 10% of the overall construction cost to a maximum of 20% of the overall construction cost. The environmental review costs vary based on the type of environmental study. For example, the costs for flood study could range from $10,000 to $40,000. Similarly, the construction engineering and inspection costs range from 10% to 15% of the overall construction cost. The contingency costs are considered as 30% of the overall construction cost. The overall inflation rate computed based on consumer price index data from 1990 to 2012 is 3.5%. The same growth rate can be used to compute the future costs for any project.

The developed cost estimator tools will help planners estimate the cost of independent bicycle and pedestrian facilities as well as assist NCDOT in making more informed decisions with regards to local funding allocations.

Higher data sample would yield more accurate cost estimates of bicycle and pedestrian facilities. However, obtaining such data was very difficult as most of the local agencies did not

respond to inquiries for data. Many local agencies who responded to the request took more than three months to provide data related to costs incurred for construction of bicycle and pedestrian facilities. Some agencies informed that they were busy with many other things and cannot provide the data requested. A few agencies directed the researchers toward NCDOT for data. However, all required details are not readily available with NCDOT. The data available with NCDOT and its divisional offices include only the construction cost elements that are, typically, federally funded. However, the developed cost estimator tool is flexible enough to account for and add more project data as they become available. NCDOT and local agencies are recommended to document all relevant details to regularly update the database (at least twice a year). Likewise, it is recommended to develop similar templates to estimate the cost of independent bicycle and pedestrian facilities not considered in this study.

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Chapter 1. Introduction

Bicycling and walking are integral components of an efficient transportation network. Building effective livable communities with bicycle and pedestrian accommodations will reduce the auto usage, congestion, and its associated environmental consequences thereby enhancing the quality of life and general public health. According to Sustainable Streets Index 2011, published by the New York Department of Transportation (DOT), improved bicycle and pedestrian facilities not only increase bicycle and pedestrian activities and decrease speeding, but also enhance road safety through a reduction in overall crashes.

The cost of constructing new bicycle and pedestrian facilities plays a major role in the process of prioritization, decision-making, and allocation of funds for bicycle and pedestrian projects. An established cost estimation methodology will assist local jurisdictions and state agencies with their project cost computations, and in turn, improve the accuracy of programmed project funds. Also, greater accuracy in a plan's project cost estimates will assist local jurisdictions in making more informed decisions with regards to local funding allocations. The cost of constructing bicycle and pedestrian facilities may vary based on its area type (rural and urban; flat, rolling or mountainous terrain), location (uninterrupted roadway facility, mid-block location, and intersection), and also by the type of facilities being provided (shared bicycle lane, on-street bicycle lane, crosswalk with median, islands for pedestrian crossings, signs and signals, flashing beacons, pedestrian hybrid beacons, and in-pavement lighting system for pedestrian crossings).

In the past, North Carolina Department of Transportation (NCDOT) has created a cost estimator tool to evaluate highway project construction costs within the prioritization process. These were instrumental in the development of a web-based, cost estimator tool for the state's strategic prioritization process. However, NCDOT does not have established procedures or tools for estimating the cost of independent bicycle and pedestrian facilities. The state's strategic prioritization process instead depends on local entities with support from Highway Division offices to estimate the cost for submitted independent bicycle and pedestrian projects. However, this approach does not provide consistently accurate cost estimates which may be problematic when applying project prioritization ranking criteria and when programming selected projects in the State Transportation Improvement Program (STIP).

Literature documents no methodology or tool to estimate the costs of independent bicycle and pedestrian facilities. Therefore, there is a need to research cost estimates and develop a tool that could help planners estimate the costs of independent bicycle and pedestrian facilities.

1.1. Objectives

The objectives of this research project are:

1) To develop a statistically significant sampling of a variety of bicycle and pedestrian facility types by obtaining a strong sampling of cost data from local jurisdictions across the state or from nearby states where possible;
2) To develop cost estimates across a wide spectrum of bicycle and pedestrian facility types (1) sidewalk; 2) bicycle lane; 3) shared use path; 4) mid-block crosswalk; 5) paved shoulder; 6) pedestrian intersection treatments; 7) bicycle / pedestrian bridge; and 8) shared lane markings);
3) To review NCDOT's highway cost estimator tool's methodology for approximating right-of-way costs and determining its applicability and use in the bicycle and pedestrian field;
4) To determine cost estimates for the varied preliminary engineering, design, and environmental review costs tied to bicycle and pedestrian projects as well as the comprehensive cost estimation methodology;
5) To account for and take into consideration inflation factors, regional locational factors, and mobilization costs when developing cost estimates;
6) To determine contingency costs applied to bicycle and pedestrian projects;
7) To provide preliminary, planning-level cost estimates that will be automatically computed (or cross-referenced) with planning-level user-entered inputs in an Excel-based spreadsheet format supplemented by a text document;
8) To ensure that cost estimation methodologies are available for use with the statewide project prioritization process by focusing on the most common types of facilities; and,
9) To develop a recommended process for future updates to the cost estimation methodology to account for effects (such as change in unit prices) and other variables.

1.2. Organization of Research Project Report

The remainder of this report is comprised of seven chapters. A review of existing literature on projects and tools that were developed in the past to evaluate the cost of independent bicycle and pedestrian facilities are discussed in Chapter 2. A discussion on independent bicycle and pedestrian facility types is presented in Chapter 3. Sampling strategy and data collection is discussed in Chapter 4. Bicycle and pedestrian facilities along with their associated cost elements is presented in Chapter 5. Cost estimates for various cost categories are discussed in Chapter 6. Cost estimator tools developed for each facility type are presented in Chapter 7. Conclusions from this study and scope for further work are discussed in Chapter 8.

Chapter 2. Literature Review

Several research programs were aimed at the implementation of bicycle safety and pedestrian safety plans in the United States over the past two decades. Examples include implementation and evaluation of pedestrian safety plans in the San Francisco area, Miami Dade County and Las Vegas between 2001 and 2010. These implementation programs include conversion of pedestrian signals into countdown signals, conversion into ladder type striping, using more visible fluorescent crossing warning signs and using scramble phasing. The "Yield to Pedestrian" signs and countdown signals were observed to be more effective in improving pedestrian safety by the San Francisco Municipal Transportation Agency. Their study also indicated that flashing beacons make drivers more cautious to yield to pedestrians. The study performed by The University of Florida team in the Miami Dade County observed 51 crashes per year at all considered sites after implementation of several treatments, which accounts to 50% reduction over the baseline condition and 41% reduction from National Highway Traffic Safety Administration (NHTSA) project levels. Pulugurtha and Nambisan (2004) and Nambisan (2008) evaluated fourteen different sites in the Las Vegas metropolitan area. The countermeasures were aimed at changing motorist's behavior as well as changing pedestrian crossing behavior at intersections and mid-block locations. High visibility crosswalks resulted in motorists yielding at higher distances to pedestrians, while pedestrian call buttons resulted in pedestrians not struck in the middle of the street by the time signal went off. Overall, their study recommended various countermeasures, out of which video-based detection system and eliminating permissive left turns were found to incur higher costs than any other recommended countermeasures. Other such efforts related to safety evaluation of bicycle and pedestrian engineering countermeasures include technical memorandums and reports published by Pecheux et al. (2009) and Fitzpatrick et al. (2001).

In addition to an evaluation of bicycle and pedestrian safety countermeasures, literature also documents some efforts on the development of tools to evaluate the cost of bicycle and pedestrian facilities or on cost benefits of implementing bicycle and pedestrian facilities. Wang et al. (2004) obtained the construction and maintenance costs of five bicycle and pedestrian trails from the Department of Parks and Recreation of Nebraska to evaluate the cost per user of each facility. The cost per mile ranged from $5,735 to $54,017 (2002 dollars) and annual cost per user was $235 (2002 dollars). The annual maintenance cost ranged from $4,400 to $5,692 per mile

(2002 dollars). To increase the cost-effectiveness of trails, Wang et al. (2004) recommended exploring means to decrease the total cost and increasing the number of users using the facilities.

Virginia Transportation Research Council developed a Project Cost Estimation System (PCES) in 2004 (Kyte et al., 2004). This system was developed by including construction engineering costs, to be applicable for interstates, and to generate estimates for right-of-way and utilities costs. These were added to the existing Microsoft Excel worksheet tool with roadway and bridge estimates. The variations across the state were modeled and calibrated using the data on completed projects from all Virginia Department of Transportation (VDOT) districts. Results from the testing of tool with a sample of completed VDOT construction projects showed that the estimates from the tool differed by 22% on average when compared to actual final project costs.

As a part of NCHRP Report-552, Krizek et al. (2006) provided a preliminary cost estimate for various bicycle facilities. In their study, the bicycle facilities were divided into three categories: on-street, off-street, and equipment. Off-street facilities are bicycle facilities that are separate from the motor-vehicle oriented roadway. On-street facilities include bicycle lanes, wide shoulders, wide curb lanes, shared streets and signed routes. Bicycle facilities include several types of equipment while cost varies depending upon the type of equipment. Krizek et al. (2006) developed an online tool to estimate preliminary cost of new bicycle facilities. Users are prompted to input several characteristics about the size and type of proposed facility in three or four modules. Finally, the user is provided with a preliminary cost estimate for the proposed bicycle facility.

Saelensminde (2008) presented a cost-benefit analysis of bicycle and pedestrian facilities in three Norwegian cities. The study analysis incorporated health benefits and also the benefits of reduced insecurity. The reduced costs due to the use of non-motorized modes were also taken into account. The benefit from such facilities was found to be around 4-5 times the costs incurred. The study indicated that “barrier costs” which are associated with the motorized traffic and prevent people from using bicycle or pedestrian facilities are equal to the costs incurred in air pollution and double that of noise costs.

The city of Harrisonburg, Virginia, provided the baseline costs of various facilities in their bicycle and pedestrian plan 2010 (City of Harrisburg, 2010). The values provided include estimated materials, equipment and labor costs. However, their study does not include costs of right-of-way, environmental review or clearances, utility relocation or unusual topographical conditions.

Hollar et al. (2010) developed a regression model to predict preliminary engineering costs of highway projects. Data obtained for 505 NCDOT bridge projects awarded for construction from 1999 through 2008 were analyzed to develop a multiple variable regression model. Results from their study indicate that right-of-way costs, regional location and scope delineators are the most significant parameters that influence preliminary engineering costs of bridge projects. It was concluded that a more accurate model for preliminary engineering costs can be developed by considering additional parameters as independent variables.

Max et al. (2013) acquired costs of various facilities from 40 states across the United States. Costs were updated to 2012 US Dollar equivalents, which included labor, materials, mobilization costs and contractor profits. The costs are presented with a median and average price, the minimum cost, the maximum cost, the unit cost and the number of sources. These were used in computing the basic cost of bicycle and pedestrian facilities.

As a part of FHWA study, Bushell et al. (2013) reported costs for various bicycle and pedestrian facilities based on information collected from different states and cities across the United States. The study developed spreadsheet based tools to estimate costs for 77 bicycle and pedestrian facilities based on observation from 1,700 cases. A pedestrian and infrastructure cost database linked to the infrastructure database was prepared. Bid-letting summaries and infrastructure costs from states across the country were identified and fed into the database. The information was gathered from 2009 and all the costs have been updated to 2012 dollar equivalents. After the database was compiled, interviews with DOT employees were conducted to check for the accuracy of developed average costs.

Metropolitan Transportation Commission (Year Unknown) developed a generic cost estimating tool that can serve as a conceptual planning tool to estimate the cost of pedestrian facility improvements. The tool estimates budget for a set of pedestrian facility improvements based on the inputs about quantities of desired facilities. The template consists of normally used items and its appropriate costs. However, trained engineers are recommended to prepare the final exact costs.

Overall, literature documents several efforts on the effectiveness of engineering treatments to enhance bicyclist and pedestrian safety. Some efforts were expended to examine cost benefits or tools to estimate cost of transportation projects in the past. However, literature documents no methodology or tool to estimate the cost of independent bicycle and pedestrian facilities. This

project report researched cost estimates and tools that could help planners estimate the cost of bicycle and pedestrian facilities.

Chapter 3. Bicycle and Pedestrian Facility Types

The total cost of an independent bicycle or pedestrian project depends on the facility type and elements associated with the facility type. Transportation projects associated with some of the common independent bicycle and pedestrian facility types are discussed next.

3.1. Bicycle Facility Types

This section presents a brief discussion on selected bicycle facility types considered in this study. Selected example bicycle facilities are shown in Figure 1.

Bicycle Lanes: Bicycle lanes are marked travel lanes along a portion of the roadway. They are designated for preferential or exclusive use for bicyclists via pavement markings in compliance with the MUTCD. Further, they are intended for one-way travel, usually in the same direction as the adjacent traffic lane, unless marked and designated as a contra-flow bicycle lane.

The cost for construction of a bicycle lane includes 1) the cost of a bicycle lane or additional width for bicycles (sometimes considered as a part of the larger full depth construction roadway project), 2) removing, changing or adding street striping to provide a designated roadway space for bicycles, and 3) directional signs and markings to help identify single or a series of bicycle lanes.

Shared Lane Markings: Shared lane markings are pavement marking symbols used to indicate a shared lane environment for bicycles and motor vehicles. These markings help assist with bicyclists' positioning and direction of travel on the roadway, indicate a preferred bicycling route, and alert motorists of a bicyclist's likely location on the roadway. These shared lane markings are also called as "sharrows".

Paved Shoulders: Paved shoulders are the portion of the roadway contiguous with the travel lanes that accommodates stopped vehicles, emergency vehicles, and reduces the frequency of pavement maintenance. Shoulders, where paved and of sufficient width, may be used by bicyclists. Bicycle lane pavement markings may be used to designate the shoulder as a bicycle lane. In rural areas, paved shoulders are also used by pedestrians where sidewalk is not present.

Shared Use Path or Off-street Bicycle Facility: The shared use path facility is an off-street bicycle facility that is separated from the motor-vehicle oriented roadway by an open space or physical barrier. The facility accommodates both bicycle and pedestrian modes. It could be designed as a standard shared use path or a sidepath. A sidepath is a specific type of shared use path that is physically separated from the roadway but located within the roadway right-of-way.

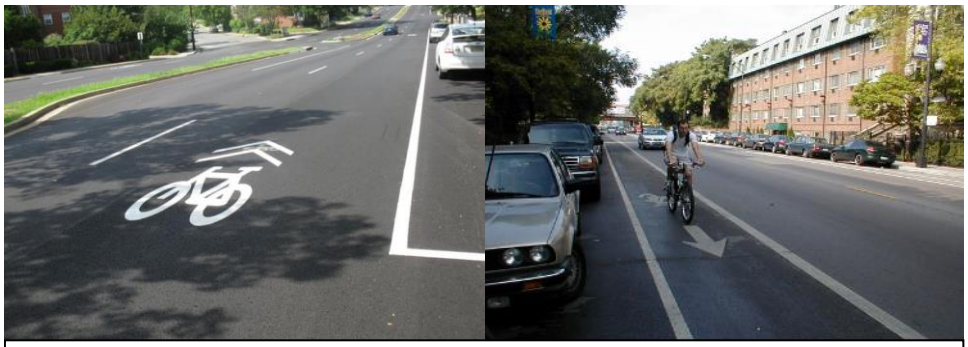
The costs of such facilities depend on the type of surface (fine crushed stone, bituminous concrete, or Portland cement concrete). The cost of off-street bicycle facilities vary widely based on the pre-construction condition of the right-of-way and the elements that are included in the project. The cost of this facility can be expensive if the path is through an overgrown right-of-way with rocky or poor draining soil.

Other elements that can cause costs to vary widely are bridges, drainage, and fencing. For each of these elements the costs can range from zero with no bridges, natural drainage, no fencing or lighting to substantial amounts for multiple custom bridges, a piped storm drain system, fully fenced and fully lighted right-of-way. Landscaping can also vary from low cost seeding to more expensive planting of shrubs, trees, benches, water features, and interpretive signs typical of an urban park.

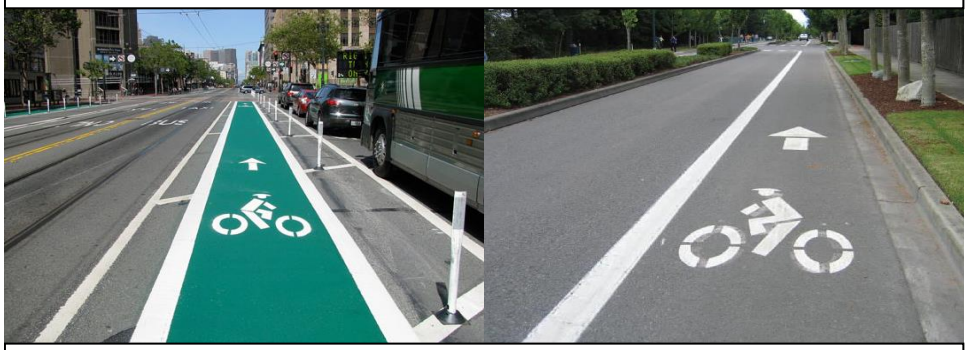
Table 1 summarizes typical elements associated with bicycle facilities. They are categorized into infrastructure, signs, signals, and Intelligent Transportation System (ITS) based devices.

Table 1. Elements Associated with Bicycle Facilities

Infrastructure	Signs	Signals	ITS
Paved Shoulder	Way-finding	Bicycle Signal Heads	Bicycle Detection
Shared Lane Markings	Turn Signals		Smart Lighting
Bicycle Lanes	Markings		No RTOR Signs
Shared Use Paths / Sidepaths	Decision Signs		
Separated Bicycle Lanes	Warning Sign for Motorists		
Bicycle Boulevards			
Intersection Treatments			
Bicycle Parking			



(a) Shared Lane Markings (b) On-street Bicycle Lane - Parking



(c) Green Bicycle Lane (d) On-street Bicycle Lane

Figure 1. Example Bicycle Facilities

3.2. Pedestrian Facility Types

This section presents a brief discussion on selected pedestrian facility types considered in this study.

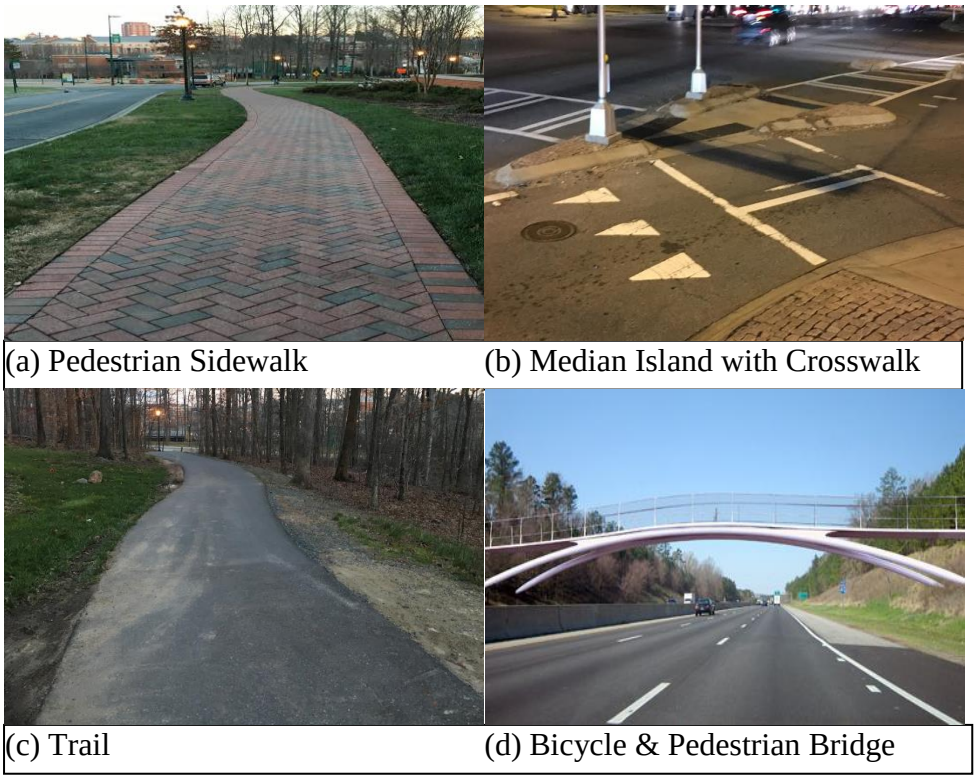
Pedestrian Sidewalk Between Two Intersections: A sidewalk is the portion of a street or highway right-of-way, beyond the curb or edge of roadway pavement, which is intended for use by pedestrians. The cost of pedestrian sidewalk between two intersections may vary with the length of the sidewalk, width, materials used in construction of the sidewalk, soil type, street lighting, landscaping and signboards indicating beginning and end of the sidewalk, markings etc. Landscaping can also vary from low cost loam and seed to more expensive planting of shrubs, trees, benches, and water features. Other elements that can cause costs to vary widely are bicycle / pedestrian bridges, drainage, and fencing. For each of these elements the costs can vary from zero (no bridge, natural drainage, no fence or presence of wide shoulder) to substantially very high amounts.

Pedestrian Crosswalk at a Mid-block Location: A mid-block crossing is a marked crosswalk that occurs in a location other than an intersection. This type of facility is typically provided on roads with lower speed limits. The costs for such facilities depend on the number of lanes in each direction, the presence of a median (to provide a pedestrian island), pedestrian countdown signals if the mid-block location is signalized, flashing beacon signal to alert motorists, in-pavement lighting, smart lighting, pavement makings (example, transverse lines, longitudinal lines or ladder style crosswalk as well as other markings on street), and sign boards such as reduced speed limit, yield signs, stop signs, in-roadway knockdown signs, etc. The cost can be very expensive for facilities which incorporate robust designs such as Danish offset (staggered crosswalks with a median), using solar powered panels, smart lighting, and in-pavement lighting system.

Pedestrian Intersection Treatments: Typical pedestrian intersection treatments include provision of crosswalks, pedestrian signals, median islands, wheelchair ramps, etc. to enhance pedestrian safety at intersections. A crosswalk is the portion of the roadway intended for pedestrians to use in crossing the street. It may be distinctly indicated for pedestrian crossing by lines or other markings on the surface. At intersections with a sidewalk, the crosswalk is the marked or unmarked part of the roadway where the lateral boundary lines of the sidewalk would extend across. The costs for these facilities depend on the type of intersection: stop controlled or signalized, number of approaches / legs for the intersection, the number of lanes at each approach, required number of islands, the number of pedestrian countdown signals, and type of pavement makings (transverse lines, longitudinal lines or ladder style crosswalk). Selected example pedestrian facilities are shown in Figure 2.

Bicycle / Pedestrian Bridge: A bicycle or pedestrian bridge is a structure that is grade-separated in order to cross a barrier such as a roadway, stream, or any natural feature.

Table 2 summarizes typical elements associated with pedestrian facilities. They are categorized into infrastructure, signs, signals, and ITS based devices.



(a) Pedestrian Sidewalk (b) Median Island with Crosswalk

(c) Trail (d) Bicycle & Pedestrian Bridge

Figure 2. Example Pedestrian Facilities

Table 2. Elements Associated with Pedestrian Facilities

Infrastructure	Signs	Signals	ITS
Sidewalks and Walkways	Shared Lane Markings	Pedestrian Countdown Signals	Automatic Pedestrian Detection Device
Curb Ramps	Warning Sign for Motorists	Pedestrian Activated Flashing Yellow	Smart Lighting
Shared Use Paths / Sidepaths	Yield Signs		No RTOR Signs
Crosswalk at Intersections	Advanced Yield Markings		In-roadway Knockdown Sign
Danish Offset			
Intersection Treatments			
Mid-Block Crosswalk			
Median Refuge Island			

Considering the current need and applicability by NCDOT staff, the following independent bicycle and pedestrian facilities were identified and selected to develop the cost estimator tools.

- Sidewalk
- Bicycle lane
- Shared use path
- Mid-block crosswalk
- Paved shoulder
- Pedestrian intersection treatments
- Bicycle / pedestrian bridge
- Shared lane markings

Chapter 4. Sampling Strategy and Data Collection

This chapter describes the sampling strategy, data sources, and data collection for the development of cost estimator tools.

4.1. Sampling Strategy

The sample size dictates how well the sample reflects the overall independent bicycle and pedestrian projects in the state of North Carolina. The higher the sample size, the more reliably it reflects the mean of all the project cost estimates. Equations 1 and 2 are used to compute the sample size.

$$ss = \frac{p*(1-p)*Z^2}{C^2} \qquad \text{Equation (1)}$$

$$N = \frac{ss}{1+\frac{ss-1}{TP}} \qquad \text{Equation (2)}$$

where,

Z = confidence level, Z value (example, 1.96 for a 95% confidence level),

p = probability or percentage, expressed as decimal (0.5),

c = confidence interval, expressed as decimal (0.1),

ss = sample size,

TP = total number of federally funded independent bicycle and pedestrian projects, and,

N = corrected or adjusted sample size.

The total number of federally funded or similar size independent bicycle and pedestrian projects in the state of North Carolina from year 2006 was expected to be around 500. The final adjusted sample size obtained by substituting this value from equations (1) and (2) is 81. Any sample size of more than 81 independent bicycle and pedestrian projects will increase the accuracy of the tools developed to estimate the project cost.

4.2. Data Collection

A database with all cost categories and elements forms the basis for the development of cost estimator tools. The cost of each category may be based on the percentage of construction costs or estimated from other projects. The developed database should also consist of cost information related to the elements associated with construction of independent bicycle and pedestrian facilities.

The majority of independent bicycle and pedestrian projects have been administered and constructed at the local level. The data may be obtained from local jurisdictions across the state as well as from NCDOT. Mostly, the cost data associated with construction costs may be obtained in the form of bid tabs or invoices from respective jurisdictions.

Obtaining response and data from jurisdictions may be a challenge due to their priorities, resource constraints or other reasons. An important issue to consider is that smaller jurisdictions, typically, with fewer staff, may be less likely to respond to inquiries for data. This could skew response rates toward larger cities or towns with more staff available.

Considering the following sampling approaches may mitigate this concern to some extent.

- General Survey
- Projects list from NCDOT
- Communication with NCDOT Divisions
- Websites of neighboring state agencies
- Consultant Interviews

4.2.1. General Survey

The survey questionnaire (designed in cooperation with both NCDOT staff as well as a small set of local jurisdiction staff) was distributed on-line using an on-line survey platform called "surveymonkey.com". The survey was divided into two parts. The first part asked jurisdictions if they have built any of the relevant independent pedestrian or bicycle facilities. If so, then a short follow-up questionnaire was sent to gather information on numbers, types and cost details of projects completed during the last decade. The second-part of the survey was completed only by respondents who stated that they have built any of the relevant bicycle or pedestrian facilities during the last decade.

The second part of the survey asked more detailed questions about the projects completed, with special attention paid to differing cost tracking systems used by different jurisdictions. At the conclusion of the survey, respondents were also asked if they would be willing to provide their contact information for researchers to conduct individual follow-up calls or emails with respondents, as needed.

Overall, the survey consisted of 14 questions. A copy of the survey questionnaire is presented in Appendix A.

The survey questionnaire was used to develop a preliminary list of local contacts that the researchers were able to utilize to collect detailed project cost information. A web link to the online survey was distributed to local agencies by NCDOT on March 11, 2015. Only 23 respondents have responded to the survey which ended on June 30, 2015.

Out of 23 local agencies, only 12 local agencies have administered federally funded bicycle and / or pedestrian projects in the last decade. Of these, only four local agencies have accepted to be contacted to request cost data for the projects they have administered in the past. The response or participation from local agencies was unexpectedly low. This could be due to lack of time and resources to extract the information in a timely manner or lack of general willingness to support, participate and provide data for research projects. Some local agencies also indicated that most details required for the subject study are readily available with NCDOT.

4.2.2. Projects List from NCDOT and Data from Local Agencies

Overall, the general survey response was a lower number of respondents than expected. Therefore, the researchers requested and received the list of projects implemented by cities and towns in the past 6 years through federal funds from NCDOT. The list has the information related to the type of project and their respective TIP numbers. Overall, 389 federally funded project information (TIP #s) was provided by NCDOT.

Most of the local agencies that were in the list were contacted by phone and email, requesting their help with data to develop cost estimator tools for independent bicycle and pedestrian facilities. Data for 55 projects was obtained through this approach. Five of these projects were either cancelled or not yet completed. Along with individual bid tabs, construction costs of relevant elements from bid averages published by NCDOT for the years 2006-2011 was obtained and used to build the cost database. Based on the sampling strategy, at least 81 data samples are

required. The number of samples obtained (55 projects) through this approach is not large enough to yield accurate project cost estimates at a 95% confidence level.

4.2.3. Communication with NCDOT Divisions

Contacting local agencies by phone and email individually resulted in a better response than the general survey approach. Many were willing to support and provide the data, while a few directed the researchers to contact NCDOT and its division offices.

The Division of Highways for North Carolina is spread across 14 NCDOT transportation divisions. Since data is being collected for federally administered independent bicycle and pedestrian facilities, the cost associated with various categories (in particular, construction cost) that are federally funded for a project has to be approved by the respective division. Not all the cost categories may be federally funded for a given project. For example, the construction cost for a given project could be federally funded and all the remaining expenses could be administered by local agencies. In such a scenario, the respective NCDOT division will only have data pertinent to construction cost and its breakdown by various cost elements.

All the divisions in North Carolina were contacted requesting the cost data related to federally funded categories for the projects in their respective divisions. Out of 14 divisions, 9 responded and provided the data. Overall, data for 69 projects was obtained from the divisions, which include duplicates of data obtained from local agencies and projects with incomplete construction cost breakdown. The complete data obtained through this approach (33) and by contacting the local agencies directly (55) combined (88) is greater than the required sample size (81) at a 95% confidence level. Table 3 summarizes the sample size of data obtained by facility type and cost categories.

In general, a sample size of 30 is considered as a statistically significant size for estimation process. However, more than 30 samples were obtained only for sidewalks. Data for facility types such as mid-block crosswalk, paved shoulder, pedestrian intersection treatments, and shared lane markings could not be obtained. Some of these facilities are observed to be typically part of facility types such as sidewalk, bicycle lane and shared use path.

Table 3. Summary of Sample Size of Projects Based on Facility Type and Cost Category

Facility Type	Summary of Data Sample Size				
	Construction Cost	Preliminary Engineering, Design and Environmental Review Cost	Construction Engineering & Inspection Cost	Right-of-way Cost	NCDOT Oversight Cost
Sidewalk	50	24	27	33	7
Bicycle Lane	5	3	0	2	1
Shared Use Path	23	10	4	2	4
Trail*	4	2	3	1	1
Pedestrian Bridge	1	1	1	1	1
Sidewalk Extension	5	0	0	0	0
Total	88	40	35	39	14

* Trail is an unpaved shared use path used typically in parks.

The construction cost of elements is not expected to vary by facility type. Therefore, the breakdown of construction cost data by elements, for all the 88 projects, was used to compute the overall construction cost for each individual facility type.

The data was obtained from the agencies in the mountainous region (example, Asheville area), Piedmont region (example, Charlotte and Raleigh area), and the coastal region (example, City of Wilmington). The project data collected was observed to be geographically distributed across the state of North Carolina. It includes urban, suburban and rural areas. Therefore, the cost estimates computed from the data collected may well represent the entire state of North Carolina.

4.2.4. Websites of Neighboring State Agencies

To further increase and obtain a statistically significant set of historic projects for a specific project (facility) type, the cost data was collected by contacting staff of agencies in nearby states of North Carolina and / or checking their websites. Bid averages for bicycle and pedestrian facilities were obtained for the state of Virginia (bid averages for 3 years), Tennessee (bid averages for 9 years) and Florida (bid averages for 8 years) and included in this study.

4.2.5. Consultant Interviews

Though most of the costs associated with the projects are obtained from the bid tabs and by contacting local agencies, some of the cost categories such as environmental review costs (wetland, flood study, threatened and endangered species studies, etc.), material testing costs, inflation rates, and permits and relevant fees can best be obtained from experienced consultants. Therefore, consulting firms such as Kimley-Horn & Associates and Stewart Engineering were contacted to better understand the design, survey and permitting services provided by engineering firms, as typically included in federally-funded bicycle and pedestrian projects. These consulting firms were selected as a sample from the industry due to their experience with managing complex, federally-funded bicycle and pedestrian projects in the state of North Carolina.

A questionnaire was designed and sent to the selected consulting firms. A copy of the questionnaire and response received from the selected consulting firms is shown in Appendix B. Ranges associated with various cost categories such as preliminary engineering / design cost, construction engineering and inspection cost, right-of-way cost, and contingency cost were collected through this approach.

The input obtained from consultants indicates that the preliminary engineering, design and environmental review costs vary based on the type of project, location and site conditions. The preliminary engineering and design costs could be a minimum of 10% of the overall construction cost and to a maximum of 20% of the overall construction cost. The environmental review costs vary based on the type of environmental study required for a project. For example, the costs for flood study could range from $10,000 to $40,000. Further, the construction engineering and inspection costs range from 10% to 15% of the overall construction costs.

Chapter 5. Cost Estimation Categories

The total cost of a bicycle or pedestrian facility includes cost categories such as preliminary engineering, design and environmental review cost, right-of-way cost, capital / construction cost (typically includes overhead and mobilization cost), construction engineering and inspection cost, contingency cost, and NCDOT oversight cost.

- Preliminary engineering, design and environmental review cost includes preliminary engineering cost, design cost, permits cost and various environmental review costs.
- Right-of-way costs are costs incurred to acquire any right-of-way to construct the project.
- Capital or construction cost is the expenditures involved in the construction of the facility and procuring the relevant equipment for the same. A detailed description of construction cost is discussed later in this chapter.
- Construction engineering and inspection cost include cost for material testing, inspection and associated fees or permits.
- Contingency cost is cost to account for uncertainty. They are estimated based on past project experience and typically computed as a percentage of the overall construction cost.
- NCDOT oversight costs are usually $5000 or 5% of the total cost of the project.

The cost of constructing a facility varies based on the type of bicycle and pedestrian facility and its location. The cost of construction activities for each type of facility such as type of pavement, striping (removing, changing or adding striping to provide additional space for bicycle lane and sidewalks), signage installation (along bicycle routes and at pedestrian crosswalks) and all other relevant elements are required to compute construction cost. Additionally, construction cost also includes several types of equipment required for bicycle and pedestrian facilities and the cost for their installation. The installation cost may vary based on the type of signs and signals provided at the location. The equipment needed includes signs (guide, regulatory and warning signs), signals (pedestrian countdown signals and signals at mid-block, two-leg & four-leg intersections), barriers, bicycle parking (bicycle racks), need for any hard-wiring, etc. Operational / maintenance cost include the cost of maintenance of the facility, landscaping, security and safety, and supplies needed to conduct these activities.

The primary database consisting of construction cost elements has up to 289 data elements. These 289 data elements were aggregated into 30 different cost elements to develop the cost database. Since, the data obtained for all the cost elements are from different years, the cost associated with each cost element could be different when computed to the current year or year of construction because of inflation. The aggregated costs computed for these 24 different construction cost elements are estimated to the present value with a given inflation rate. Table 4 summarizes the construction cost elements considered in the aggregated cost database.

Table 4. Summary of Aggregated Construction Cost Elements

Cost Elements	Description
Asphalt Paving	This is the process of installing pavement. Paving of asphalt includes installation base, intermediate and surface concrete course.
Clearing and Grubbing	This consists of clearing, removal and disposal of debris and vegetation in the project area limits. Clearing involves cutting of trees, shrubs, vines, trash and other debris from the site. Grubbing is removing roots, weeds and logs following the clearing process.
Concrete Barrier	A concrete barrier acts as a safety structure by controlling the direction of a colliding vehicle. It also reduces risk on pedestrian and bicyclists from errant vehicles.
Crosswalk	A crosswalk is a designated path for pedestrians to cross roadway and at intersections. It typically includes stripes, which are white vertical or oblique stripes.
Curb and Gutter	Curb and gutter is typically used in urban environments to reduce the overall "footprint" of the roadway, and quite often accompanies sidewalk and bicycle lanes.
Drainage	A comprehensive drainage plan is essential to drain the roadways and prevent them from deterioration. The size, type, location and construction criteria are decided based on hydraulic calculations and environmental considerations.
Erosion Control	Erosion control involves covering bare ground with seeds, mat, and mulch to prevent movement of sediments, during and even after road construction.
Fencing	It is a barrier used for security/safety purposes or to prevent access to or from adjacent property.
Guardrail	A guardrail is a safety rail or barrier installed to prevent vehicles proceeding past into dangerous area. The guardrail face redirects vehicle back onto road absorbing energy generated from impact.
Handrail	Handrails support and protect pedestrians from accidents like vertical drop-offs to provide stability. They are less restrictive than guardrails.
Median Island	Medians provide safety features by separating traffic movements. They may be raised, flushed or depressed relative to the travel way. Raised medians and islands provide space for pedestrian signals and features installation.
Mobilization	Mobilization consists of preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site.
Pavement Marking	Pavement markings are used to separate traffic, provide direction, guidance and alert about the upcoming events and hazards.
Pavement Widening	Pavement widening concerns the widening of the existing roadway for provision of a bicycle lane.
Retaining Wall	Retaining walls are structures built to retain any material (usually earth) and prevent it from sliding or eroding away and can significantly reduce the right-of-way required by a project.
Sidewalk Concrete	A path provided for pedestrians along the roadway usually separated from the vehicular traffic by a curb.
Signalization	Signalization is the process of installing signals at a study location.
Signing	Signing provides directional, warning, regulatory and spatial information.
Stop-bars	A stop bar is a 12-24" wide solid white line, extending across the lanes in both directions for motor vehicles to stop at signs or signals.
Traffic Control	This covers all temporary work and items used to protect workers, motorists and pedestrians during the construction of a facility.
Utilities	Utilities include the demolition, construction and relocation of public and private facilities used to deliver goods and/or services to customers. Examples include the following: water, sewer, gas, electricity and telecom.
Curb / Wheelchair Ramp	These ramps provide access for the wheelchair users and are common at bicycle and pedestrian facilities and exist in pairs.

Chapter 6. Cost Estimates for Bicycle and Pedestrian Facility Types

The cost categories such as preliminary engineering, design and environmental review cost, construction cost, construction engineering and inspection cost, and right-of-way cost are common for construction of any facility type. However, the cost estimates of these categories could vary from one facility to other. Also, the cost elements associated with the construction of each facility will vary based on the type of bicycle and pedestrian facility. The inflation rate is another key variable that could have a bearing on the cost estimates. A brief description of each cost category and related estimates are discussed next.

6.1. Preliminary Engineering, Design and Environmental Review Cost

Data pertaining to preliminary engineering, design and environmental review cost was collected as a part of this study. When compared to the construction cost data obtained, the data samples obtained for preliminary engineering, design and environmental review cost is very low. This is primarily because many cities and towns conduct this work internally and associated costs are reflected as zero.

Further, the estimates from the data obtained indicate that preliminary engineering, design and environmental review cost is as high as 50% of the construction cost. This could be because the independent bicycle or pedestrian project was not constructed completely or that the estimates include costs, for which details were not documented and could not be obtained easily. Therefore, along with the data obtained from cities and towns, information collected through questionnaires sent to the consulting firms is presented in the cost estimator tools. Data collected through the questionnaires from the consultants is shown in Appendix B and discussed in Section 4.2.5.

6.2. Right-of-Way Costs

The NCDOT's highway cost estimator tool's methodology for approximating right-of-way costs was reviewed. The cost of acquiring right-of-way is estimated as equal to 40-50% of the total construction cost for highway projects in urban areas, while it is estimated as equal to 20-25% of the total construction cost for highway projects in rural areas.

Data based on previous right-of-way costs for selected bicycle and pedestrian facility types was obtained through project bids from NCDOT and local agencies. It was observed that the right-

of-way cost for most of the independent bicycle and pedestrian projects is zero, as the land was donated to the local agencies or is owned by the local agency. This indicates that adopting NCDOT's highway cost estimator tool's methodology for approximating right-of-way costs may yield inaccurate estimates and is not applicable for use in the bicycle and pedestrian field. However, the right-of-way cost is included as one of the input variables in the cost estimator tool in order to account for this cost based on obtained project cost data, if needed, for a specific project.

6.3. Construction Costs

Table 5 summarizes the construction cost elements associated with each selected bicycle and pedestrian facility type in the cost estimator tool.

Tables 6 through 12 show the computed minimum, maximum, and average cost estimates as well as percentile cost estimates (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) of each construction cost element based on facility type (sidewalk, bicycle lane, shared use path, mid-block crosswalk, paved shoulder, pedestrian intersection treatments, bicycle / pedestrian bridge, and shared lane markings, respectively).

Some local agencies have used cost estimates for the crosswalk, while others have used crosswalk stripes length for cost estimates. Both the cost estimates are provided in the tables though it is a normal practice to use one or the other.

Facilities such as shared use path include all structures such as bridges and culverts. A list of features associated with each construction cost element is provided in Appendix C.

Table 5. Summary of Construction Cost Elements by Facility Type

Facility Type	Construction Cost Elements
Sidewalk	Clearing and Grubbing, Crosswalk, Curb and Gutter, Drainage (Per Ft), Earthwork (grading) (CY/Ft), Erosion Control (AC/Ft), Pavement Marking, Sidewalk Concrete, Signalization (EA), Signing, Traffic Control, Utilities and Wheelchair Ramp
Bicycle Lane	Clearing and Grubbing, Crosswalk, Curb and Gutter, Drainage (Per Ft), Earthwork (grading) (CY/Ft), Erosion Control (AC/Ft), Pavement Marking, Signalization (EA), Signing, Traffic Control, Utilities, Pavement Widening and Wheelchair Ramp
Shared Use Path	Clearing and Grubbing, Concrete Barrier, Crosswalk, Crosswalk Stripes, Curb and Gutter, Drainage (Per Ft), Earthwork (grading) (CY/Ft), Erosion Control (AC/Ft), Pavement Marking, Asphalt Surface for Greenway, Signalization (EA), Signing, Traffic Control, Utilities, and Wheelchair Ramp
Mid-block Crosswalk	Crosswalk, Pavement Marking, Signalization (EA), Signing, Median Island, Traffic Control and Wheelchair Ramp
Paved Shoulder	Clearing and Grubbing, Earthwork (grading) (CY/Ft), Erosion Control (AC/Ft), Pavement Marking, Signing, Traffic Control, Utilities and Pavement Widening
Pedestrian Intersection Treatments	Crosswalks, Pavement Marking, Signalization (EA), Median Island and Wheelchair Ramp
Bicycle / Pedestrian Bridge	Clearing and Grubbing, Concrete Barrier, Curb and Gutter, Drainage (Per Ft), Earthwork (grading) (CY/Ft), Erosion Control (AC/Ft), Pavement Marking, Sidewalk Concrete, Signalization (EA), Signing, Traffic Control, Utilities, Reinforced Steel (Bridge), Bar Metal Rail, Concrete Barrier Rail, Chain Link Fence and Wheelchair Ramp
Shared Lane Markings	Pavement Marking, Signing, Traffic Control, Utilities and Pavement Widening

Table 6. Construction Cost Breakdown for Sidewalk

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 7. Construction Cost Breakdown for Bicycle Lane

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 8. Construction Cost Breakdown for Shared Use Path

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Ashphalt Surface for Greenway (2")	SqYd	$36.63	$36.63	$36.63	$36.63	$36.63	$36.63	$36.63	$36.63
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 9. Construction Cost Breakdown for Mid-Block Crosswalk

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Crosswalks	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Pavement Marking	(Per Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Median Island	(SqYd)	$258.14	$259.05	$260.40	$262.66	$262.66	$264.92	$266.28	$267.18
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 10. Construction Cost Breakdown for Paved Shoulder

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53

Table 11. Construction Cost Breakdown for Pedestrian Intersection Treatments

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Crosswalk Stripes	(LF)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Crosswalks	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Median Island	(SqYd)	$258.14	$259.05	$260.40	$262.66	$262.66	$264.92	$266.28	$267.18
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 12. Construction Cost Breakdown for Bicycle / Pedestrian Bridge

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.08	$3.95	$9.29	$16.91	$18.52	$24.07	$37.24	$45.61
Erosion Control (AC/Ft)	(AC/Ft)	$0.13	$0.75	$1.49	$3.64	$6.55	$5.08	$8.52	$90.45
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Reinforced Steel (Bridge)	(Per Ft)	$8.61	$8.61	$8.61	$8.61	$8.61	$8.61	$8.61	$8.61
Bar Metal Rail	(Per Ft)	$162.51	$162.51	$162.51	$162.51	$162.51	$162.51	$162.51	$162.51
Concrete Bridge	(Cubic Yard)	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03
Chain Link Fence	(Per Ft)	$21.15	$21.15	$21.15	$21.15	$21.15	$21.15	$21.15	$21.15
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 13. Construction Cost Breakdown for Shared Lane Markings

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53

6.4. Construction Engineering and Inspection Cost

Data pertaining to construction engineering and inspection cost was also collected as a part of this study. Similar to preliminary engineering, design and environmental review cost, the data samples obtained for construction engineering and inspection cost is very low. The estimates from the data obtained indicate that construction engineering and inspection cost could be as high as 50% of the construction cost. These estimates may include costs, for which details were not documented and could not be obtained easily. Also, the estimates are higher than 10-15% normally used by consulting firms. Therefore, along with the data obtained from cities and towns, information collected through questionnaires sent to the consulting firms is presented in the cost estimator

tools. Data collected through the questionnaires from the consultants is shown in Appendix B and discussed in Section 4.2.5.

6.5. Overhead and Mobilization Costs

Overhead and mobilization costs are usually based on a percentage of the overall project cost. An overhead is the general cost of running a business that cannot be directly attributed to a specific part of a work operation. Cost-related overhead includes (but may not be limited to) licenses, permits, bonding, liability insurance, and profit. The costs are usually included in preliminary engineering, design and environmental review costs and / or contingency cost.

According to Public Contract Code, mobilization costs includes preparatory work and operation, including, but not limited to, those necessary for movement of personnel, equipment, supplies and incidentals to the project site, for other work and operations which must be performed or cost incurred prior to beginning work on various items on the project site. While project bid prices and data from the previous projects were reviewed to assess mobilization costs based on the facility type, they are considered to be part of the contingency cost in the cost estimator tools.

6.6. Inflation Factor

The inflation factor was incorporated in the tool as a variable to evaluate build year costs. The inflation rate that should be applied to independent bicycle and pedestrian projects was computed by comparing the consumer price index (CPI) with Florida DOT's Present Day Cost (PDC) multiplier. The PDC multiplier is a method to adjust cost estimates based on determining a present cost for a project that was estimated in a previous year as shown in Table 14. The PDC provides a multiplier to apply to a project cost estimate depending on the year the estimate was initially produced. For example, if a project's cost estimate was $1,000,000 in 2000, a PDC multiple of 1.63 should be applied to estimate the cost in 2012, making the cost estimate as equal to $1,630,000.

Taking this data from 1990 to 2012, the inflation rate for each year in that period was computed by evaluating the time difference in years (t) between 2012 and the computation year. The Goal Seek function in Microsoft Excel was then used to compute inflation for that year (i) using the formula $F = P(1+i)^t$. The correct value for (i) would be the value that equaled the PDC multiplier in the $F = P(1+i)^t$ function. The (i) for each year between 1990 and 2012 were averaged

to equal 3.5%. This compares to a 2.72% average for the CPI. The PDC computed inflation rate of 3.5% was used due to the observation that construction commodity prices have risen significantly more than the CPI over this same period. For computing the future growth, the computed inflation rate of 3.5% (average growth rate for the past 22 years) could be used.

Table 14. Average Inflation Rate Over Time - Summary

Year	Average CPI	FDOT PDC Multiplier	1/(PDC Multiplier)	FDOT Inflation	Time (Years)	Inflation
1990	5.4	2.08	0.48			
1991	4.2	2.01	0.50	3.5%	22	3.4%
1992	3	2.01	0.50	0.0%	21	3.4%
1993	3	2.02	0.50	-0.5%	20	3.6%
1994	2.6	1.99	0.50	1.5%	19	3.8%
1995	2.8	1.88	0.53	5.9%	18	3.9%
1996	3	1.82	0.55	3.3%	17	3.8%
1997	2.3	1.78	0.56	2.2%	16	3.8%
1998	1.6	1.8	0.56	-1.1%	15	3.9%
1999	2.2	1.75	0.57	2.9%	14	4.3%
2000	3.4	1.63	0.61	7.4%	13	4.4%
2001	2.8	1.62	0.62	0.6%	12	4.2%
2002	1.6	1.66	0.60	-2.4%	11	4.5%
2003	2.3	1.63	0.61	1.8%	10	5.2%
2004	2.7	1.5	0.67	8.7%	9	5.6%
2005	3.4	1.33	0.75	12.8%	8	5.2%
2006	3.2	1.2	0.83	10.8%	7	4.2%
2007	2.8	1.14	0.88	5.3%	6	3.1%
2008	3.8	1	1.00	14.0%	5	2.7%
2009	-0.4	1.08	0.93	-7.4%	4	0.0%
2010	1.6	1.03	0.97	4.9%	3	2.6%
2011	3.2	1.01	0.99	2.0%	2	1.5%
2012	2.1	1	1.00	1.0%	1	1.0%
Average Inflation Rate					**3.5%**	

Chapter 7. Cost Estimator Tools

Cost estimator tools were developed for the selected bicycle and pedestrian facilities discussed in the previous chapters. The Microsoft Excel spreadsheet based application consists of several tabs where each tab has a cost estimator tool for a specific facility type. The first four tabs in the application serve as the database for these tools in addition to database instructions and tools related instructions.

The data collected for all the categories (including construction cost elements) is saved in the preliminary database - a single large cost database. This database includes all the facility types along with all their cost elements. As stated in Chapter 5, this master cost database is converted into a consolidated database with 30 construction cost elements. The cost estimator tool for each facility type retrieves data from this consolidated database. Each cost element in the consolidated database is computed by aggregating one or more cost elements from the preliminary database. For example, utilities cost include cost of water valve adjustment, cost of utility relocation, cost of fire hydrant relocation, cost of water meter relocation and cost of paved trenching. Likewise, erosion control as well as clearing and grubbing costs include soil stabilization and stormwater drainage related costs. The sidewalk or driveway concrete depth can be increased to accommodate heavier traffic. Overhead and mobilization costs are included in the contingency cost. A detailed description of costs associated with each construction cost element is shown in Appendix C. Formulae are built in the tool such that any observed outliers in the data are automatically eliminated. For example, in order to remove the outliers related to the wheelchair ramp data, the tool considers only the 10^{th} percentile and greater than 10^{th} percentile costs.

Table 15 summarizes the minimum, average, and maximum cost estimates as well as percentile cost estimates (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) of various construction cost elements. Table 16 summarizes the minimum, average, and maximum construction cost estimates and percentile construction cost estimates (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) of the selected bicycle and pedestrian facilities. The growth rate of 3.5% was used to compute the present value or future costs for any project. All the cost estimates presented in tables 15 and 16 are present day costs for the year 2016. In general, the tools estimate costs for the proposed or indicated year of construction.

Table 15. Cost of Various Elements - Summary

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

Table 16. Minimum, Average and Maximum Construction Costs - Summary

Construction Costs	Facility Type							
	Sidewalk (0.25-mile)	Bicycle Lane (0.25-mile)	Shared Use Path (0.25-mile)	Mid-block Crosswalk (1)	Paved Shoulder (0.25-mile)	Pedestrian Intersection Treatments (1)	Bicycle / Pedestrian Bridge (100 ft)	Shared Lane Markings (0.25-mile)
Minimum Cost	$25,760	$33,153	$12,393	$3,340	$20,532	$14,343	$122,992	$7,781
Percentile (10)	$50,320	$54,366	$25,380	$3,542	$29,324	$16,133	$124,934	$11,528
Percentile (25)	$65,571	$77,505	$32,236	$3,809	$41,226	$20,081	$126,062	$16,355
Percentile (50)	$89,364	$112,490	$46,152	$4,323	$64,468	$24,546	$128,121	$26,185
Average Cost	$82,918	$105,099	$70,264	$4,940	$84,092	$25,923	$130,120	$37,829
Percentile (75)	$121,661	$156,596	$72,398	$5,132	$93,438	$28,563	$130,972	$41,919
Percentile (90)	$164,125	$203,395	$108,479	$5,966	$126,145	$32,629	$135,146	$57,410
Maximum Cost	$534,578	$552,659	$437,238	$14,167	$438,737	$56,897	$162,890	$209,319

The preliminary engineering, design and environmental review costs vary based on the type of project, location and site conditions. These costs could be a minimum of 10% of the overall construction cost and up to a maximum of 20% of the overall construction cost. The environmental

review costs vary based on the type of environmental study. For example, the costs for flood study could range from $10,000 to $40,000. The construction engineering and inspection costs range from 10% to 15% of the overall construction costs. The contingency costs are considered as 30% of the overall construction costs.

The following sections discuss each cost estimator tool for each considered bicycle and pedestrian facility in detail.

7.1. Sidewalk

In the cost estimator tool for construction of a sidewalk, the user is asked to enter the following information.

1. Length of the sidewalk in feet. The default value is taken as a quarter-mile (1,320 feet).
2. Width of the sidewalk in feet. The user can select the width from the dropdown menu.
3. Depth of sidewalk in inches. The default depth is taken as 4” based on the data obtained from the local agencies.
4. Required length of curb and gutter in feet. Since, a few segments of the roadway might already have curb and gutter, and few segments may not require the curb and gutter, the length of curb and gutter may not be equal to the length of sidewalk being constructed. The drainage cost associated with construction of sidewalk will depend on the current and required length of curb and gutter.
5. Number of intersections for the planned sidewalk.
6. Total number of signals required at the intersections (as a few intersections could be unsignalized).
7. Number of driveways. Based on the number of driveways and intersections, the total number of wheelchair ramps required is computed.
8. Terrain dropdown has three options; level, rolling and mountainous. The earthwork cost, clearing and grubbing, retaining wall, erosion control, and other could vary based on the terrain. The minimum, average and maximum costs incurred for earthwork computed from the cost database are used for level, rolling and mountainous terrains, respectively.

9. A few projects have the total length of crosswalk stripes in their bid tabs with cost per feet, whereas a few projects have used the total cost for a crosswalk in their bid tabs. So, both these options are provided to the user to enter whichever value is known.
10. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for construction of a sidewalk facility.

Table 17 shows the template of cost estimator tool for construction of a sidewalk. The template shows cost estimates for a 1,320 feet long sidewalk, 5 feet in width, 4 inches in depth, with 10 driveways and planned for construction along a level terrain. The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are also included in the estimates (not done internally).

7.2. Bicycle Lane

In the cost estimator tool for construction of a bicycle lane, the user is asked to enter the following information.

1. Length of the bicycle lane in feet. The default value is taken as a quarter-mile (1,320 feet)
2. Width of the bicycle lane in feet. The user can select the width from the dropdown menu.
3. Required length of curb and gutter in feet. The drainage cost associated with the construction of bicycle lane will depend on the current and required length of curb and gutter.
4. Number of intersections for the planned bicycle lane.
5. Total number of signals required at the intersections (as a few intersections could be unsignalized).

6. Terrain dropdown has three options; level, rolling and mountainous. The earthwork cost, clearing and grubbing, retaining wall, erosion control, and other could vary based on the terrain. The minimum, average and maximum costs incurred for earthwork computed from the cost database are used for level, rolling and mountainous terrains, respectively.
7. A few projects bids have the total length of crosswalk stripes in their bid tabs with cost per feet, whereas a few projects have used the total cost for a crosswalk in their bid tabs. Therefore, both these options are provided to the user to enter whichever value is known.
8. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for construction of a bicycle facility.

Table 18 shows the template of cost estimator tool for construction of a bicycle lane. The template shows cost estimates for a 1,320 feet long bicycle lane, 5 feet in width, with 10 driveways and planned for construction along a level terrain. The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are not included in the estimates (say, done internally).

7.3. Shared Use Path

In the cost estimator tool for construction of a shared use path facility, the user is asked to enter the following information.

1. Length of the shared use path in feet. The default value is taken as a quarter-mile (1,320 feet).
2. Width of the shared use path in feet. The user can select the width from the dropdown menu.

3. Required length of curb and gutter in feet. Shared use path is an off-road facility. One would not expect the need for curb and gutter. However, project cost data collected for this study have related cost details. Further, a few segments of the roadway might already have curb and gutter while a few segments may not require the curb and gutter i.e., the length of curb and gutter may not be equal to the length of shared use path being constructed. The drainage cost associated with construction of shared use path will depend on the current and required length of curb and gutter.
4. Number of intersections for the planned shared use path.
5. Total number of signals required at the intersections (as a few intersections could be unsignalized).
6. Number of driveways. Based on the number of driveways and intersections, the total number of wheelchair ramps required is computed.
7. Terrain dropdown has three options; level, rolling and mountainous. The earthwork cost, clearing and grubbing, retaining wall, erosion control, and other could vary based on the terrain. The minimum, average and maximum costs incurred for earthwork computed from the cost database are used for level, rolling and mountainous terrains, respectively.
8. A few projects have the total length of crosswalk stripes in their bid tabs with cost per feet, whereas a few projects have used the total cost for a crosswalk in their bid tabs. So, both these options are provided to the user to enter whichever value is known.
9. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for construction of a shared use path facility.

Table 19 shows the template of cost estimator tool for construction of a shared use path facility. The template shows cost estimates for 1,320 feet long shared use path, 8 feet in width and planned for construction along a level terrain. The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are also included in the estimates (not done internally).

7.4. Mid-Block Crosswalk

In the cost estimator tool for construction of a mid-block crosswalk facility, the user is asked to enter the following information.

1. Total number of mid-block crosswalks.
2. Total number of lanes in both directions at the proposed mid-block crosswalk location.
3. If there is any planned pedestrian median island along with the crosswalk, the user can enter the total number of pedestrian median islands for all the proposed mid-block crosswalks.
4. Length of the median island in feet.
5. Width of the median island in feet.
6. A few projects have the total length of crosswalk stripes in their bid tabs with cost per feet, whereas a few projects have used the total cost for a crosswalk in their bid tabs. So, both these options are provided to the user to enter whichever value is known.
7. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for construction of a mid-block crosswalk facility.

Table 20 shows the template of cost estimator tool for construction of a mid-block crosswalk facility. The template shows cost estimates for one mid-block crosswalk along a street with six lanes in both directions. A six feet long and six feet wide median are also included. The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are not included or applicable in this case.

7.5. Paved Shoulder

In the cost estimator tool for construction of a paved shoulder facility, the user is asked to enter the following information.

1. Length of the shoulder in feet. The default value is taken as a quarter-mile (1,320 feet).
2. Width of the shoulder in feet. The user can select the width from the dropdown menu.
3. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for construction of a paved shoulder facility.

Table 21 shows the template of cost estimator tool for construction of a paved shoulder facility. The template shows cost estimates for a 1,320 feet long and 5 feet wide paved shoulder. The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are not included in the estimates (say, done internally).

7.6. Pedestrian Intersection Treatments

In the cost estimator tool for pedestrian intersection treatments, the user is asked to enter the following information.

1. Number of intersections for treatment.
2. Number of lanes at each intersection.
3. If there is any planned pedestrian median island at each approach of the intersection, the user can enter the total number of pedestrian median islands for the intersection.
4. Length of the median island in feet.
5. Width of the median island in feet.
6. A few projects have the total length of crosswalk stripes in their bid tabs with cost per feet, whereas a few projects have used the total cost for a crosswalk in their bid tabs. So, both these options are provided to the user to enter whichever value is known.
7. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for pedestrian intersection treatments.

Table 22 shows the template of cost estimator tool for pedestrian intersection treatments. The template shows cost estimates for one intersection with a total of 12 lanes and four median islands (each six feet long and six feet wide). The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are not included in the estimates (say, done internally).

7.7. Bicycle / Pedestrian Bridge

In the cost estimator tool for construction of bicycle / pedestrian bridge, the user is asked to enter the following information.

1. Length of the bicycle / pedestrian bridge in feet. The default value is taken as 100 feet.
2. Width of the bicycle / pedestrian bridge in feet. The user can select the width from the dropdown menu.
3. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for construction of a bicycle / pedestrian bridge.

Table 23 shows the template of cost estimator tool for construction of a bicycle / pedestrian bridge. The template shows cost estimates for a 100 feet long bicycle / pedestrian bridge, 5 feet in width and 4 inches in depth. The preliminary engineering, design and environmental review cost are not included in the estimates (say, done internally).

The bicycle / pedestrian bridge is assumed to be a steel deck to evaluate the total cost. In case of reinforced concrete bridges, other cost estimation methods are recommended.

7.8. Shared Lane Markings

In the cost estimator tool for shared lane markings, the user is asked to enter the following information.

1. Length of bicycle lane in feet. The default value is taken as a quarter-mile (1,320 feet).
2. Pavement widening required in feet. The user can select the width from the dropdown menu.

3. The preliminary engineering, design and environmental review as well as construction engineering and inspection are done internally by some agencies, while there may be no need to acquire the right-of-way. If so, the costs associated with these categories will be zero. The dropdown "Yes" indicates inclusion of these cost estimates as a percent of construction cost and "No" indicates that these costs are internal.

Upon entering all the required information, the minimum, average, maximum and percentile costs (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) for all the cost categories and associated construction cost elements are computed and shown. Based on the costs associated with each cost category, contingency costs and NCDOT oversight costs are computed to evaluate the total cost (minimum, average, maximum and percentile costs) for shared lane markings.

Table 24 shows the template of cost estimator tool for shared lane markings. The template shows cost estimates for 1,320 feet long and 2 feet wide shared lane markings project. The preliminary engineering, design and environmental review cost, right-of-way cost and construction engineering and inspection cost are generally not applicable in this case.

Table 17. Template of Cost Estimator Tool for a Sidewalk

Pedestrian Sidewalk Cost Estimator Tool

Name of Project:		**Current Date (mm/dd/yy)**	**Proposed Year of Construction**
Location/Description:			**2016**

Enter the Following Information for Cost Estimate

Length of Sidewalk (Feet)	**1320**	
Width of Sidewalk (Feet)	**5**	
Depth of Sidewalk (Inches)	**4**	The default value is 4" based on the data obatained from municipalities
Required Length of Curb & Gutter (Feet)	**1320**	Enter the required length of curb & gutter to be constructed
No. of Intersections	**0**	
No. of Signal Heads	**0**	Enter the total number of signal heads required for the project
No. of Pedestrian Signal Heads	**0**	Enter the total number of pedestrian signal heads required
No. of Driveways	**10**	
Terrain	**Level**	
Crosswalk Thermoplastic Lines Length (Feet)	**0**	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known
No. of Crosswalks	**0**	
Include Preliminary Eng., Design & Environmental Review	**YES**	Select 'NO' if these costs are internal
Include Right-of-Way	**YES**	
Include Construction Engineering & Inspection	**YES**	

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

COST CATEGORIES	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)	$8,136.44	$19,308.16	$30,617.27	$57,336.94	$68,889.75	$81,097.58	$144,936.00	$191,528.03
Right-of-Way Cost	$1,188.00	$4,377.43	$8,035.53	$17,482.11	$57,905.26	$32,773.36	$113,571.29	$517,274.79
Construction Cost	$25,760.34	$50,319.77	$65,570.92	$89,364.28	$82,918.01	$121,660.75	$164,125.00	$534,577.70
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)	$1,464.77	$3,396.67	$16,701.97	$22,318.65	$29,524.13	$44,110.31	$55,357.21	$93,041.86
Contingency (30%)	$7,728.10	$15,095.93	$19,671.28	$26,809.28	$24,875.40	$36,498.23	$49,237.50	$160,373.31
NCDOT Oversight Costs ($5000 or 5% whichever is greater)	$5,000.00	$5,000.00	$7,029.85	$10,665.56	$13,205.63	$15,807.01	$26,361.35	$74,839.78
TOTAL COST	$49,277.65	$97,497.96	$147,626.83	$223,976.84	$277,318.18	$331,947.24	$553,588.35	$1,571,635.47

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Table 18. Template of Cost Estimator Tool for a Bicycle Lane

Bicycle Lanes Cost Estimator Tool									
Name of Project:				**Current Date (mm/dd/yy)**		**Proposed Year of Construction**			
Location/Description:						**2016**			
Enter the Following Information for Cost Estimate									
Length of Bicycle Lane (Feet)	**1320**								
Width of Bicycle Lane (Feet)	**5**								
Required Length of Curb & Gutter (Feet)	**1320**	Enter the required length of curb & gutter to be constructed							
No. of Intersections	**0**								
No. of Signal Heads	**0**	Enter the total number of signal heads required for the project							
No. of Pedestrian Signal Heads	**0**	Enter the total number of pedestrian signal heads required							
No. of Driveways	**10**								
Terrain	**Level**								
Crosswalk Thermoplastic Lines Length (Feet)	**0**	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known							
No. of Crosswalks	**0**								
Include Preliminary Eng., Design & Environmental Review	**NO**	Select 'NO' if these costs are internal							
Include Right-of-Way	**NO**								
Include Construction Engineering & Inspection	**NO**								
You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.									
Construction Costs Breakdown									
Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37
COST CATEGORIES		**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Right-of-Way Cost		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Construction Cost		$33,153.08	$54,366.06	$77,504.64	$112,489.89	$105,098.64	$156,596.09	$203,395.39	$552,659.25
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contingency (30%)		$9,945.92	$16,309.82	$23,251.39	$33,746.97	$31,529.59	$46,978.83	$61,018.62	$165,797.77
NCDOT Oversight Costs ($5000 or 5% whichever is greater)		$5,000.00	$5,000.00	$5,037.80	$7,311.84	$6,831.41	$10,178.75	$13,220.70	$35,922.85
TOTAL COST		$48,099.00	$75,675.87	$105,793.83	$153,548.70	$143,459.64	$213,753.66	$277,634.71	$754,379.87

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Table 19. Template of Cost Estimator Tool for a Shared Use Path

Shared Use Path Cost Estimator Tool

Name of Project:		**Current Date (mm/dd/yy)**	**Proposed Year of Construction**
Location/Description:			**2016**

Enter the Following Information for Cost Estimate		
Length of Shared Use Path / Greenway (Feet)	**1320**	
Width of Shared Use Path / Greenway (Feet)	**8**	
Required Length of Curb & Gutter (Feet)	**1320**	Enter the required length of curb & gutter to be constructed
No. of Intersections	**0**	
No. of Signal Heads	**0**	Enter the total number of signals required for the project
No. of Pedestrian Signal Heads	**0**	Enter the total number of pedestrian signal heads required
No. of Driveways	**0**	
Terrain	**Level**	
Crosswalk Thermoplastic Lines Length (Feet)	**0**	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known
No. of Crosswalks	**0**	
Include Preliminary Eng., Design & Environmental Review	**YES**	Select 'NO' if these costs are internal
Include Right-of-Way	**YES**	
Include Construction Engineering & Inspection	**YES**	

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Ashphalt Surface for Greenway (2")	SqYd	$36.63	$36.63	$36.63	$36.63	$36.63	$36.63	$36.63	$36.63
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

COST CATEGORIES	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)	$8,393.27	$19,308.16	$30,617.27	$46,573.24	$62,150.35	$81,097.58	$144,936.00	$247,232.43
Right-of-Way Cost	$23,026.67	$23,026.67	$23,026.67	$23,026.67	$23,026.67	$23,026.67	$23,026.67	$23,026.67
Construction Cost	$12,393.29	$25,379.56	$32,236.27	$46,152.30	$70,263.93	$72,397.69	$108,478.67	$437,237.90
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)	$3,784.09	$3,396.67	$16,701.97	$22,318.65	$18,884.74	$44,110.31	$55,357.21	$31,017.00
Contingency (30%)	$3,717.99	$7,613.87	$9,670.88	$13,845.69	$21,079.18	$21,719.31	$32,543.60	$131,171.37
NCDOT Oversight Costs ($5000 or 5% whichever is greater)	$5,000.00	$5,000.00	$5,612.65	$7,595.83	$9,770.24	$12,117.58	$18,217.11	$43,484.27
TOTAL COST	$56,315.30	$83,724.92	$117,865.72	$159,512.37	$205,175.10	$254,469.14	$382,559.25	$913,169.64

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Table 20. Template of Cost Estimator Tool for a Mid-Block Crosswalk

Midblock Crosswalk Cost Estimator Tool

Name of Project:		**Current Date (mm/dd/yy)**	**Proposed Year of Construction**
Location/Description:			**2016**

Enter the Following Information for Cost Estimate

No. of Midblock Croswalks	**1**	
No. of Lanes in Both Directions	**6**	
Pedestrian Median Island	**1**	
Length of Median Island (Feet)	**6**	
Width of Median Island (Feet)	**6**	
No. of Signal Heads	**0**	Enter the total number of signals required for the project
No. of Pedestrian Signal Heads	**0**	Enter the total number of pedestrian signal heads required
Crosswalk Thermoplastic Lines Length (Feet)	**0**	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known
No. of Crosswalks	**1**	
Include Preliminary Eng., Design & Environmental Review	**NO**	Select 'NO' if these costs are internal
Include Right-of-Way	**NO**	
Include Construction Engineering & Inspection	**NO**	

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Crosswalks	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Pavement Marking	(Per Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Median Island	(SqYd)	$258.14	$259.05	$260.40	$262.66	$262.66	$264.92	$266.28	$267.18
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

COST CATEGORIES	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Right-of-Way Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Construction Cost	$3,339.79	$3,542.05	$3,808.76	$4,322.78	$4,940.06	$5,132.29	$5,965.95	$14,166.64
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contingency (30%)	$1,001.94	$1,062.62	$1,142.63	$1,296.84	$1,482.02	$1,539.69	$1,789.79	$4,249.99
NCDOT Oversight Costs ($5000 or 5% whichever is greater)	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
TOTAL COST	$9,341.73	$9,604.67	$9,951.39	$10,619.62	$11,422.08	$11,671.98	$12,755.74	$23,416.63

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Note 3: The above cost estimates are based on project cost data obtained from various sources. The project costs vary with type, location and site conditions. Environmental review costs were not available for inclusion in the cost estimates. They have to be considered based on site conditions and added to the above total cost estimates.

Cost Elements	**Minimum Cost**	**Average Cost**	**Maximum Cost**
Environmental Review Cost*			
Flood Study	$10,000	$25,000	$40,000
Endangered Species Study	N/A	N/A	N/A

Table 21. Template of Cost Estimator Tool for a Paved Shoulder

Paved Shoulder Cost Estimator Tool									
Name of Project:				**Current Date (mm/dd/yy)**		**Proposed Year of Construction**			
Location/Description:						**2016**			
Enter the Following Information for Cost Estimate									
Length of Shoulder (Feet)	**1320**								
Width of Shoulder (Feet)	**5**								
Include Preliminary Eng., Design & Environmental Review	**NO**								
Include Right-of-Way	**NO**	Select 'NO' if these costs are internal							
Include Construction Engineering & Inspection	**NO**								
You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.									
Construction Costs Breakdown									
Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.05	$3.81	$8.98	$16.34	$17.89	$23.25	$35.98	$44.06
Erosion Control (AC/Ft)	(AC/Ft)	$0.12	$0.72	$1.44	$3.51	$6.33	$4.91	$8.23	$87.39
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53
COST CATEGORIES		**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Right-of-Way Cost		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Construction Cost		$20,531.73	$29,323.79	$41,225.90	$64,468.40	$84,091.53	$93,438.25	$126,145.07	$438,737.07
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contingency (30%)		$6,159.52	$8,797.14	$12,367.77	$19,340.52	$25,227.46	$28,031.48	$37,843.52	$131,621.12
NCDOT Oversight Costs ($5000 or 5% whichever is greater)		$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,465.95	$6,073.49	$8,199.43	$28,517.91
TOTAL COST		$31,691.24	$43,120.92	$58,593.67	$88,808.92	$114,784.94	$127,543.22	$172,188.01	$598,876.10

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Note 3: The above cost estimates are based on project cost data obtained from various sources. The project costs vary with type, location and site conditions. Environmental review costs were not available for inclusion in the cost estimates. They have to be considered based on site conditions and added to the above total cost estimates.

Cost Elements	**Minimum Cost**	**Average Cost**	**Maximum Cost**
Environmental Review Cost*			
Flood Study	$10,000	$25,000	$40,000
Endangered Species Study	N/A	N/A	N/A

* Engineering review cost will vary based on the site and existing conditions.

Table 22. Template of Cost Estimator Tool for Pedestrian Intersection Treatments

Pedestrian Intersection Treatments Cost Estimator Tool

Name of Project:		**Current Date (mm/dd/yy)**	**Proposed Year of Construction**
Location/Description:			**2016**

Enter the Following Information for Cost Estimate

No. of Intersections	**1**	
No. of Lanes at the Intersection	**12**	
Pedestrian Median Island	**4**	
Length of Median Island (Feet)	**6**	
Width of Median Island (Feet)	**6**	
No. of Signal Heads	**0**	Enter the total number of signals required for the project
No. of Pedestrian Signal Heads	**0**	Enter the total number of pedestrian signal heads required
Crosswalk Thermoplastic Lines Length (Feet)	**0**	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known
No. of Crosswalks	**4**	
Include Preliminary Eng., Design & Environmental Review	**NO**	Select 'NO' if these costs are internal
Include Right-of-Way	**NO**	
Include Construction Engineering & Inspection	**NO**	

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Crosswalk Stripes	(LF)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Crosswalks	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Median Island	(SqYd)	$258.14	$259.05	$260.40	$262.66	$262.66	$264.92	$266.28	$267.18
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

COST CATEGORIES	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Right-of-Way Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Construction Cost	$14,342.76	$16,132.96	$20,080.77	$24,545.96	$25,922.55	$28,563.40	$32,629.00	$56,896.73
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contingency (30%)	$4,302.83	$4,839.89	$6,024.23	$7,363.79	$7,776.76	$8,569.02	$9,788.70	$17,069.02
NCDOT Oversight Costs ($5000 or 5% whichever is greater)	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
TOTAL COST	$23,645.59	$25,972.84	$31,105.00	$36,909.75	$38,699.31	$42,132.42	$47,417.70	$78,965.75

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Note 3: The above cost estimates are based on project cost data obtained from various sources. The project costs vary with type, location and site conditions. Environmental review costs were not available for inclusion in the cost estimates. They have to be considered based on site conditions and added to the above total cost estimates.

Cost Elements	**Minimum Cost**	**Average Cost**	**Maximum Cost**
Environmental Review Cost*			
Flood Study	$10,000	$25,000	$40,000
Endangered Species Study	N/A	N/A	N/A

Table 23. Template of Cost Estimator Tool for a Bicycle/Pedestrian Bridge

Pedestrian Bridge Cost Estimator Tool

Name of Project:		**Current Date (mm/dd/yy)**	**Proposed Year of Construction**
Location/Description:			**2016**

Enter the Following Information for Cost Estimate

Length of Bridge (Feet)	**100**	
Width of Bridge (Feet)	**5**	
Depth of Bridge (Inches)	**4**	The default value is 4" based on the data obatained from municipalities
Required Length of Curb & Gutter (Feet)	**100**	Enter the required length of curb & gutter to be constructed
No. of Signal Heads	**0**	Enter the total number of signals required for the project
No. of Pedestrian Signal Heads	**0**	Enter the total number of pedestrian signal heads required
Crosswalk Thermoplastic Lines Length (Feet)	**0**	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known
No. of Crosswalks	**0**	
Include Preliminary Eng., Design & Environmental Review	**NO**	Select 'NO' if these costs are internal
Include Right-of-Way	**NO**	
Include Construction Engineering & Inspection	**NO**	

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51
Earthwork (grading) (CY/Ft)	(CY/Ft)	$1.08	$3.95	$9.29	$16.91	$18.52	$24.07	$37.24	$45.61
Erosion Control (AC/Ft)	(AC/Ft)	$0.13	$0.75	$1.49	$3.64	$6.55	$5.08	$8.52	$90.45
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Sidewalk Concrete	(SqYd)	$14.76	$27.79	$29.74	$35.65	$36.94	$40.72	$47.51	$84.87
Signal Heads (EA)	(EA)	$950.15	$1,069.03	$1,536.57	$1,852.40	$1,947.92	$2,170.96	$3,058.00	$3,175.17
Pedestrian Signal Heads (EA)	(EA)	$646.92	$883.59	$1,130.70	$2,528.30	$2,108.99	$2,806.60	$3,077.08	$4,004.16
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Reinforced Steel (Bridge)	(Per Ft)	$8.61	$8.61	$8.61	$8.61	$8.61	$8.61	$8.61	$8.61
Bar Metal Rail	(Per Ft)	$162.51	$162.51	$162.51	$162.51	$162.51	$162.51	$162.51	$162.51
Concrete Bridge	(Cubic Yard)	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03	$1,377.03
Chain Link Fence	(Per Ft)	$21.15	$21.15	$21.15	$21.15	$21.15	$21.15	$21.15	$21.15
Wheelchair Ramp	(EA)	$127.23	$264.00	$636.14	$974.69	$992.44	$1,183.39	$1,428.52	$2,375.37

COST CATEGORIES	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Preliminary Engineering / Design Cost (Typically, 10% -20% of Construction Cost)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Right-of-Way Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Construction Cost	$122,991.85	$124,933.80	$126,062.24	$128,121.06	$130,119.91	$130,971.95	$135,146.33	$162,890.07
Construction Engineering & Inspection Cost (Typically, 10% -15% of Construction Cost)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contingency (30%)	$36,897.55	$37,480.14	$37,818.67	$38,436.32	$39,035.97	$39,291.59	$40,543.90	$48,867.02
NCDOT Oversight Costs ($5000 or 5% whichever is greater)	$7,994.47	$8,120.70	$8,194.05	$8,327.87	$8,457.79	$8,513.18	$8,784.51	$10,587.85
TOTAL COST	$167,883.87	$170,534.64	$172,074.96	$174,885.25	$177,613.68	$178,776.72	$184,474.74	$222,344.94

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Table 24. Template of Cost Estimator Tool for Shared Lane Markings

Shared-Use Markings Cost Estimator Tool

Name of Project:		**Current Date (mm/dd/yy)**	**Proposed Year of Construction**
Location/Description:			**2016**

Enter the Following Information for Cost Estimate

Length of Bikelane (Feet)	**1320**
Pavement Widening (Width in Feet)	**2**

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	**Units**	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Pavement Marking	(LF/Ft)	$0.12	$0.27	$0.44	$1.21	$7.53	$4.82	$7.26	$100.42
Signing	(Per Ft)	$0.12	$0.14	$0.23	$0.49	$1.95	$1.50	$4.61	$19.38
Traffic Control	(Per Ft)	$0.00	$0.61	$1.02	$2.07	$2.85	$3.63	$6.62	$10.57
Utilities	(Per Ft)	$0.14	$0.31	$0.47	$1.14	$1.39	$2.17	$2.54	$3.87
Pavement Widening	(SqYd)	$24.84	$33.31	$46.01	$67.18	$67.18	$88.35	$101.06	$109.53

COST CATEGORIES	**Minimum Cost**	**Percentile (10)**	**Percentile (25)**	**Percentile (50)**	**Average Cost**	**Percentile (75)**	**Percentile (90)**	**Maximum Cost**
Construction Cost	$7,781.43	$11,528.48	$16,354.73	$26,184.80	$37,829.32	$41,918.73	$57,409.76	$209,319.23
Contingency (30%)	$2,334.43	$3,458.55	$4,906.42	$7,855.44	$11,348.80	$12,575.62	$17,222.93	$62,795.77
NCDOT Oversight Costs ($5000 or 5% whichever is greater)	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$13,605.75
TOTAL COST	$15,115.86	$19,987.03	$26,261.15	$39,040.24	$54,178.12	$59,494.34	$79,632.68	$285,720.75

Note 1: Percentile indicates value below which the given percentage of cost estimates fall. For example, the 50th percentile is the cost estimate below which 50% of the observed cost estimates may be found.

Note 2: "N/A" indicates data is not available from past project information obtained from various sources. Suggest including estimates based on local experience and adding it to the total cost.

Note 3: The above cost estimates are based on project cost data obtained from various sources. The project costs vary with type, location and site conditions. Environmental review costs were not available for inclusion in the cost estimates. They have to be considered based on site conditions and added to the above total cost estimates.

Cost Elements	**Minimum Cost**	**Average Cost**	**Maximum Cost**
Environmental Review Cost*			
Flood Study	$10,000	$25,000	$40,000
Endangered Species Study	N/A	N/A	N/A

* Engineering review cost will vary based on the site and existing conditions.

7.9. Estimating Future Costs

The cost estimator tool developed allows NCDOT personnel to add data to the existing database. Based on the data entered for each type of facility, the minimum, average and maximum cost as well as the percentile costs of various categories and elements in each tool is automatically updated. All the costs obtained from the tool are estimated as the present value. The computed inflation rate (3.5%; average growth rate from 1990 to 2012) is also used to estimate the cost of any independent bicycle or pedestrian project for a future year.

7.10. Significance of Research

The cost estimator tools developed play a significant role in the statewide project prioritization process. They help consistently estimate the cost of independent bicycle and pedestrian facilities in North Carolina. This minimizes possible bias because of using different estimates as well as helps NCDOT avoid marginal practices that fail to incorporate proven and consistent estimates in the allocation of resources.

Chapter 8. Conclusions

Microsoft Excel spreadsheet based cost estimator tools to estimate the cost of independent bicycle and pedestrian facilities was developed and presented in this research project report. The facilities considered include 1) sidewalk; 2) bicycle lane; 3) shared use path; 4) mid-block crosswalk; 5) paved shoulder; 6) pedestrian intersection treatments; 7) bicycle / pedestrian bridge; and 8) shared lane markings. The cost estimator tools extract data from a consolidated database built using sample project data gathered from multiple sources primarily for the state of North Carolina. The present value of the costs was estimated based on a constant inflation rate of 3.5%. It should be noted that the estimated costs in each scenario for all the facility types and their associated cost elements may not accurately mimic the current market costs and could differ from actual costs.

The average construction cost of a 0.25-mile sidewalk is estimated as $82,918 while the average construction cost of a 0.25-mile bicycle lane is estimated as $105,099. The average construction cost of 0.25-mile shared use path, 0.25-mile paved shoulder and shared lane markings are estimated as $70,264, $84,091 and $37,829, respectively. The pedestrian treatments for one intersection costs $25,923, on average, while construction of one mid-block crosswalk costs $4,940. The minimum, average, maximum as well as percentile cost estimates do vary based on required design features.

The cost estimator tools were developed to assist local jurisdictions and state agencies with their project cost computations, understand the overall costs involved in planning and building bicycle and pedestrian facilities and, in turn, improve the accuracy of programmed project funds. Also, the developed tool helps planners estimate the cost of various independent pedestrian and bicycle facilities and assist NCDOT in making more informed decisions with regards to local funding allocations.

8.1. Recommendations for Improving Cost Database and Accuracy of Estimates

Details pertaining to construction cost for 88 projects were gathered through various data sampling approaches. They include 50 sidewalk projects, 5 bicycle lane projects, 23 shared use path projects, 1 pedestrian bridge project, 4 trail projects and 5 sidewalk extension projects. The data was observed to be geographically distributed across the state of North Carolina and the cost estimates well represent the entire state. Unarguably, higher data sample yields accurate cost estimates of

bicycle and pedestrian facilities. In particular, project cost data for bicycle lane, mid-block crosswalk, paved shoulder, pedestrian intersection treatments, bicycle / pedestrian bridge and shared lane markings are recommended to be gathered and added to the cost database; preferably 30 data samples for each facility type, for more realistic cost estimates.

Obtaining project cost data was very difficult as several local agencies did not respond to inquiries for data. Those local agencies who responded to the request took more than three months to provide data related to costs incurred for construction of bicycle and pedestrian facilities. A few local agencies informed that they were busy with many other things (time and staffing limitations) and cannot provide the data requested, while some others directed the researchers towards NCDOT for data. Based on conversations with NCDOT divisions, the data provided by them includes only the cost elements that are federally funded and need to be reviewed by NCDOT. All other associated costs for the construction of independent bicycle and pedestrian facilities that are not federally funded are not available with NCDOT as these costs are not part of the review process. Primarily, data for cost categories such as preliminary engineering, design and environmental review costs and constructing engineering and inspection costs are not available for most of the projects.

The lack of information related to the above cost categories is that these efforts were expended internally or that they are not federally funded. Likewise, right-of-way acquisition was not required for most of the projects for which data was obtained for this project. The lower sample size or lack of information for these cost categories makes it difficult to accurately estimate these costs. Further, with growing emphasis on sustainability and eco-friendly environment, considering and incorporating wetland study, flood study, threatened and endangered species studies, etc. and including their related costs in the estimates is gaining significance. So, it is recommended to document and collect additional data belonging to all cost categories to not only generate accurate or more reliable estimates but also to track and examine future trends.

Overall, NCDOT and local agencies are recommended to document all relevant details to regularly update the developed cost database (at least twice a year). The developed cost estimator tools are robust to automatically generate updated cost estimates from such newly input data samples. Likewise, it is recommended to develop similar templates to estimate the cost of independent bicycle and pedestrian facilities not considered in this study. Furthermore, it is also recommended to conduct interviews with NCDOT staff and selected local agencies to check for

the accuracy of developed cost estimates for the selected independent bicycle and pedestrian facilities.

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Appendix A

2015 NCDOT - Cost of Independent Bicycle and Pedestrian Facilities Survey

1. How many federally - funded bicycle and/or pedestrian projects has your local government administered in the past 10 years (federal fiscal years 2004 – 2014)?

2. Enter information for 1st Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

3. Enter information for 2nd Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

4. Enter information for 3rd Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

5. Enter information for 4th Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

6. Enter information for 5th Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

7. Enter information for 6th Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

8. Enter information for 7th Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

9. Enter information for 8th Project
   Project Name:
   TIP #:
   Agreement #:
   Brief Project description:
   Date of Agreement (MM/YEAR):
   Date of Project Completion (MM/YEAR):

10. Enter information for 9th Project
    Project Name:
    TIP #:
    Agreement #:
    Brief Project description:
    Date of Agreement (MM/YEAR):
    Date of Project Completion (MM/YEAR):

11. Enter information for 10th Project
    Project Name:
    TIP #:
    Agreement #:
    Brief Project description:
    Date of Agreement (MM/YEAR):
    Date of Project Completion (MM/YEAR):

12. May we contact you if we have additional questions about your survey responses and/or to request cost data for the projects you listed in this survey? If yes, please provide your contact information below:

13. Is there a second person we should contact to request cost data for the projects you listed in this survey? If yes, please provide that person's contact information below:

14. Please use the textbox below for any additional comments you would like to share with us regarding your survey responses and/or about the study in general.

Appendix B

Project Title: Cost of Independent Bicycle and Pedestrian Facilities (NC)

Thank you for your time and participation. Answers to the following questions are expected to help improve pedestrian/bike cost estimator tool developed by the University of North Carolina at Charlotte project team to assist NCDOT and other local agencies.

1. **The project team has considered the following cost elements in the development of the tool. Please let us know if any other cost elements would play a significant role in estimating the cost of pedestrian/bike facilities**.

   - Preliminary Engineering / Design Cost
   - Right-of-Way Cost
   - Overhead Cost
   - Construction Engineering & Inspection Cost
   - NCDOT Review Costs ($5000 or 5% whichever is greater)
   - Contingency

2. **What are the possible sub-cost elements that could be included in the PE costs and CEI costs? Also please indicate the range of the costs associated with each of the sub-cost element as the percentage of construction cost or based on a specific unit (please mention the unit).**

Preliminary Engineering Sub-Cost Elements Checklist			Estimated Costs	
			Minimum Cost	Maximum Cost
1	Site Inspection Costs			
2	Design Costs			
3	Costs for Permits			
4	Environmental Costs			
	4.1	Flood Study		
	4.2	Bat Study		
	4.3			
	4.4			
Please list any other associated sub-cost elements below				
5				
6				
7				
8				

Figure B-1: Questionnaire to Consultants - Page 1

Construction Engineering & InspectionSub-Cost Elements Checklist		Estimated Costs	
		Minimum Cost	Maximum Cost
1	Material Testing		
2	Construction Inspection		
Please list any other associated sub-cost elements below			
5			
6			
7			
8			

3. **Can the overhead cost be included in the contingency costs?**

4. **What could be the minimum and maximum cost in dollars or in percent of total construction cost for each of the elements below? Does the dollar amount vary based on the type of facility (pedestrian sidewalk, bike lanes, greenway, etc.)?**

Cost Elements Checklist		Estimated Costs	
		Minimum Cost	Maximum Cost
1	Preliminary Engineering Cost		
2	Right of Way Cost		
3	Overhead Cost		
4	Construction Engineering & Inspection Cost		
5	NCDOT Review Costs	$5,000	5% of Overall Costs
6	Contingency Cost		
7			
8			
9			
10			

5. **What is the closest inflation rate you would take that could help estimate the present value of the cost elements accurately?**

Figure B-2: Questionnaire to Consultants - Page 1

Project Title: Cost of Independent Bicycle and Pedestrian Facilities (NC)

Thank you for your time and participation. Answers to the following questions are expected to help improve pedestrian/bike cost estimator tool developed by the University of North Carolina at Charlotte project team to assist NCDOT and other local agencies.

1. **The project team has considered the following cost elements in the development of the tool. Please let us know if any other cost elements would play a significant role in estimating the cost of pedestrian/bike facilities**.

- Preliminary Engineering (PE) / Design Cost
  - Project Management (4-6 Hours per month)
  - Survey
    - Topographic Surveys
    - Boundary Surveys
    - Easement Acquisition Support – Easement Exhibits and Platting
  - Sub-Surface Utility Investigations (Level of Investigation Varies)
    - Quality Level D. QL-D is the most basic level of information for utility locations. It comes solely from existing utility records or verbal recollections, both typically unreliable sources. It may provide an overall "feel" for the congestion of utilities, but is often highly limited in terms of comprehensiveness and accuracy. QL-D is useful primarily for project planning and route selection activities.
    - Quality Level C. QL-C is probably the most commonly used level of information. It involves surveying visible utility facilities (e.g., manholes, valve boxes, etc.) and correlating this information with existing utility records (QL-D information). When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, is primarily on rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.
    - Quality Level B. QL-B involves the application of appropriate surface geophysical methods to determine the existence and horizontal position of virtually all utilities within the project limits. This activity is called "designating". The information obtained in this manner is surveyed to project control. It addresses problems caused by inaccurate utility records, abandoned or unrecorded facilities, and lost references. The proper selection and application of surface geophysical techniques for achieving QL-B data is critical. Information provided by QL-B can enable the accomplishment of preliminary engineering goals. Decisions regarding location of storm drainage systems, footers, foundations and other design features can be made to successfully avoid conflicts with existing utilities. Slight adjustments in design can produce substantial cost savings by eliminating utility relocations.
    - Quality Level A. QL-A, also known as "locating", is the highest level of accuracy presently available and involves the full use of the subsurface utility engineering services. It provides information for the precise plan and profile mapping of underground utilities through the nondestructive

Figure B-3: Questionnaire to Consultants - Participant 1, Page 1

exposure of underground utilities, and also provides the type, size, condition, material and other characteristics of underground features.

- Geotechnical Investigations
  - Foundation Structures
  - Pavement Design
  - Soil Condition Analysis for Quantity Takeoffs (Undercut Allowances)
- Natural Systems Investigations
  - Wetland and Stream Delineation
  - Threatened and Endangered Species Investigations
  - Natural Resources Technical Report (NRTR)
- Hydraulic Analysis
  - CLOMR/LOMR (NCFPM & FEMA Coordination)
  - No-Rise Analysis and Permitting (Local Floodplain Coordination)
  - Bridge Layout Report
- Drainage Design
  - Closed Drainage
  - Open Drainage
  - Stormwater Design and Local Permitting
- Alternative Analysis
  - Horizontal Alignment Analysis
  - Cost Estimating
- Public Involvement
  - Public Meetings – Traditional, Pop-Up, Presentations to Established Meeting Groups
  - Public Input Surveying
  - Small Group Meetings
  - Stakeholder Coordination/Steering Committee
  - Renderings and Visualizations
    - 3D Modeling – Corridor Modeler
    - Artistic Representations
  - Presentations to Council and Boards
- 25% Design
  - Horizontal & Vertical Alignment
  - Structure Type, Location and Layout
  - Drainage Design
  - Property Impact Analysis
  - Cost Estimate
  - Quality Assurance / Quality Control
- Environmental Documentation
  - Programmatic Categorical Exclusion (PCE)
  - Categorical Exclusion (CE)
  - Environmental Analysis / Finding of No Significant Impact (EA/FONSI)
- ROW Plans
  - Horizontal & Vertical Alignment
  - Slope Stake Design
  - Structure Design
  - Drainage Design
  - Easement Exhibits
  - Cost Estimate
  - Quality Assurance / Quality Control
  - PS&E Submittal to NCDOT and Revisions
- Utility Coordination
  - Utility by Other (UBO) Coordination
  - Utility by Owner Coordination, Design, Review and Approval
- Permitting
  - 401/404 Water Quality Permitting
  - Local Site Plan Review
  - NCDENR Land Disturbance

Figure B-4: Questionnaire to Consultants - Participant 1, Page 2

- Final Plans
  - Final Trail, Sidewalk, Bike lane Design
  - Final Structure Design
  - Final Drainage
  - Specifications
  - Final Cost Estimate
  - Right-of-Way Certification Coordination
  - Quality Assurance / Quality Control
  - PS&E Submittal to NCDOT and Revisions
- Bidding Assistance
  - Run/Support Pre-bid Meeting
  - Run/Support Bid-Opening
  - Prepare and Coordinate Final Bid-Tab

- Right-of-Way Cost
- Construction Cost
- Overhead Cost
- Construction Engineering & Inspection Cost
- NCDOT Review Costs ($5000 or 5% whichever is greater)
- Contingency

2. **What are the possible sub-cost elements that could be included in the PE costs and CEI costs? Also, please indicate the range of the costs associated with each of the sub-cost element as the percentage of construction cost or based on a specific unit (please mention the unit).**

   Projects vary so dramatically I do not feel comfortable providing costs.

3. **What is the range of overhead costs? Would you consider overhead cost separate from the contingency costs? Why?**

   Professional Engineering Firms are audited annually to determine their overhead rate. These rates vary considerably between 120% - 200%.

4. **What could be the minimum and maximum cost in dollars or in percent of total construction cost for each of the elements below? Does the dollar amount vary based on the type of facility (pedestrian sidewalk, bike lanes, greenway, etc.)?**

   Again the variety in project type, location, conditions make it impossible to provide useful ranges.

5. **What is the inflation rate you would use to estimate the present value of the cost elements accurately?**

   We do not inflate estimates for "present" year projects, rather we use the latest bid tabs. Depending on the construction year we inflate 3-6% per year based on market conditions.

Figure B-5: Questionnaire to Consultants - Participant 1, Page 3

Project Title: Cost of Independent Bicycle and Pedestrian Facilities (NC)

Thank you for your time and participation. Answers to the following questions are expected to help improve pedestrian/bike cost estimator tool developed by the University of North Carolina at Charlotte project team to assist NCDOT and other local agencies.

1. **The project team has considered the following cost elements in the development of the tool. Please let us know if any other cost elements would play a significant role in estimating the cost of pedestrian/bike facilities**.

   - Preliminary Engineering (PE) / Design Cost (~15%)
   - Right-of-Way Cost
   - Construction cost
   - Overhead Cost
   - Construction Engineering & Inspection Cost (~10%)
   - NCDOT Review Costs ($5000 or 5% whichever is greater)
   - Contingency
   - Mitigation
   - Structures (pedestrian bridge, culverts)
   - Utility Relocations

2. **What are the possible sub-cost elements that could be included in the PE costs and CEI costs? Also, please indicate the range of the costs associated with each of the sub-cost element as the percentage of construction cost or based on a specific unit (please mention the unit).**

Preliminary Engineering Sub-Cost Elements Checklist			Estimated Costs	
			Minimum Cost	Maximum Cost
1	Site Inspection Costs*		10%	15%
2	Design Fees / Costs*		10%	20%
3	Costs for Permits		**	
4	Environmental Costs		***	
	4.1	Flood Study****	$10,000	$40,000
	4.2	Bat Study		
	4.3			
	4.4			
Please list any other associated sub-cost elements below				
5				
6				
7				
8				

Figure B-6: Questionnaire to Consultants - Participant 2, Page 1

* This is the engineering cost for the entire project (prime and sub-consultants). It typically is a percentage of construction cost.
** Engineering costs would be covered under the Design Fee section. Actual permit fees are: Erosion Control is $65/disturbed acre;
401 permit fee http://portal.ncdenr.org/web/wq/swp/ws/401/certsandpermits/apply/fees;
CLMOR $6,750
*** Engineering costs would be covered under the Design Fee section. Actual mitigation fees are: http://portal.ncdenr.org/web/eep/fee-schedules Mitigation ratios are typically 2:1 and rounded up the nearest 0.25 acre increment.
**** Engineering costs will vary based on the site and existing conditions. The cost for a CLMOR is listed in section 3.

Construction Engineering & Inspection Sub-Cost Elements Checklist		Estimated Costs	
		Minimum Cost	Maximum Cost
1	Material Testing		
2	Construction Inspection		
3	Any Permits or Fees?		
Please list any other associated sub-cost elements below			
4			
5			
6			
7			

3. **What is the range of overhead costs? Would you consider overhead cost separate from the contingency costs? Why?**

Overheads vary. NCDOT should have a range for this – they establish a negotiated overhead rate with each Consultant providing them services. Overhead is typically a cost of doing business. Contingency costs allow for additional scope items to be added.

4. **What could be the minimum and maximum cost in dollars or in percent of total construction cost for each of the elements below? Does the dollar amount vary based on the type of facility (pedestrian sidewalk, bike lanes, greenway, etc.)?**

The construction costs will vary by type of project and existing conditions of project. It is difficult to provide a range for construction dollars by the categories listed.

Figure B-7: Questionnaire to Consultants - Participant 2, Page 2

Cost Elements Checklist		Estimated Costs	
		Minimum Cost	Maximum Cost
1	Preliminary Engineering Cost		
2	Right of Way Cost		
3	Overhead Cost		
4	Construction Engineering & Inspection Cost		
5	NCDOT Review Costs	$5,000	5% of Overall Costs
6	Contingency Cost		
7			
8			
9			
10			

5. **What is the inflation rate you would use to estimate the present value of the cost elements accurately?**
   NCDOT should have a good range to apply. On a recent NCDOT project they recommended a 4% inflation rate. We have seen this range between 3% and 4% in previous studies.

Figure B-8: Questionnaire to Consultants - Participant 2, Page 3

Appendix C

Table C-1: Summary of Features Associated with Each Cost Element

Cost Element	List of Elements
Clearing and Grubbing	Clearing and Grubbing
Crosswalk	Crosswalk Markings
Crosswalk Stripes	Crosswalk Thermoplastic Lines (8",24")
Curb and Gutter	Curb and Gutter (30")
	30" curb and gutter transition
Erosion Control (AC/Ft)	Silt Fence
	Tree Protection Fence
	Silt/Tree Protection Combo Fence
	Erosion Control Matting - Excelsior Curlex
	Temporary silt fence outlets
	Stone for Erosion Control, Class A
	Stone for Erosion Control, Class B
	Stone for Erosion Control, Class I
	Sediment Control stone
	Coir Fiber matting
	Install SOD
	Temporary Check Dam/ Stone Inlet Protection
	Temporary Mulching
	Seed for Temporary Seeding
	Fertilizer for Temporary Seeding
	Silt Excavation
	1/4" Hardware Cloth
	Mowing
	Seed for Repair Seeding
	Fertilizer for Repair Seeding
	Seed for Supplemental Seeding
	Fertilizer for Top Dressing
	Temporary construction entrance
	Temporary skimmer basin
	Temporary sediment trap
	Slopes
	Temporary silt fence outlets
	Temporary diversion swale
	Temporary rock pipe inlet
	Rip rap for outlet apron
	Filter fabric for Rip rap class B ditch lining
	Temporary gravel check dam
	Temporary seed, mulch and trek
	Permanent seed, mulch and trek
	Storm Drain Inlet Protection
	Permanent Soil Reinforcement Mat

Cost Element	List of Elements
	Foundation Conditioning Fabric (Geotextile)
	Fertilizer Topdressing
	Mulch for Planting
Earthwork (grading) (CY/Ft)	Grading
Drainage (Per Ft)	Drainage
	Fabric (Geotextile) for Soil Stabilization
	15" RCP Culvert, Class III
	18" RCP Culvert, Class III
	18" Pipe End Section
	Rip Rap, Class B
	Masonry Drainage Structure
	Frame w/ Grate (NCDOT SD 840.16)
	Concrete Apron for Yard Inlet
	Curb Inlet Frame, Grate & Hood (NCDOT SD 840.03)
	Manhole Frame & Cover (NCDOT SD 840.54)
	Rip Rap, Class I
	15" Pipe End section
	12" RCP Culvert, Class III
	24" RCP Culvert, Class III
	24" Pipe End Section
	12" RC Pipe CL IV
	18" RC Pipe CL IV
	12" RC Flared End Section
	18" RC Flared End Section
	Pipe Collars
	Tie to Existing Catch Basin
	Adjustment of Manhole
	Adjustment of Manhole > 2'
	Filter fabric for Drainage
	15" RCP Storm Drainage
	Adjustment of Manhole
	Adjustment of Manhole > 2'
	Filter fabric for Drainage
	Foundation Conditioning Material, Minor Structures
	18" Drainage Pipe
	24" Drainage Pipe (CL III RDP)
	Thermoplastic Pavement Marking Lines (4")
	Endwalls
	Frame with Grate & Hood, STD 840.03 Type F
	Frame with Grate & Hood, STD 840.03 Type G
	Adjustment of Drop Inlets
	Geotextile for Drainage
	Concrete Paved ditch, 4"
	15" RCP culverts, Class IV
	18" RCP culverts, Class IV
	36" RCP culverts, Class III
	Masonary Drainage Structure , NCDOT 840.01

Cost Element	List of Elements
	Masonary Drainage Structure , NCDOT 840.14 (DI)
	Masonary Drainage Structure , NCDOT 840.32 (JB)
	Masonary Drainage Structure , NCDOT 840.51 (MH)
	Frame w/ Grate and Hood, Std. NCDOT 840.03, Type E (NCDOT SD 840.16)
	Frame w/ Grate and Hood, Std. NCDOT 840.03, Type F (NCDOT SD 840.16)
	Frame w/ Grate and Hood, Std. NCDOT 840.03, Type G (NCDOT SD 840.16)
	Pipe Plugs, NCDOT 840.71
	Special drop Inlet (BL Sta 35+18)
	15" RC Flared End Section
	Flowable fill
	Install 15" RCP
	Install 20" RCP
	Install 24" RCP
	Install 30" RCP
	Install 36" RCP
	36" Flared End Section
	Catch Basin Frame, Grate and Hood
	15" Side Drain Pipe
	18" RCP Pipe
	Pipe Removal
	Masonry Drainage Structures, Additional Depth
	Masonry Open Throat Catch Basin; Ncdot Std. 840.05
	Drop Inlet Frame and Grate, NCDOT Std. 840.16
	Adjustment of Catch Basins
	Convert Existing Structure to Drop Inlet
	Foundation Conditioning Fabric (Geotextile)
	Frame with Two Grates, STD. 840.29
	42" RCP Culverts, Class IV
Pavement Marking	Thermo Pavement Marking Symbol
	Thermoplastic Lines (4")
	Thermoplastic Pavement Marking Lines (24")
	Thermoplastic Pavement Marking Lines (4")
	Thermoplastic Pavement Marking Characters
	Thermoplastic Pavement Marking Lines (8")
Sidewalk Concrete	4" Concrete Sidewalk
	6" Concrete Sidewalk
	4.5" concrete sidewalk
	5" concrete sidewalk
Signalization (EA)	Vehicle Signal head (12", 1/3 section)
	Signal Pedestal w/ Foundation
Signing	Signing
	Contractor Furn, Type D Sign (R10-15)
	Sign Erection, Type D
	Sign Erection, Relocation Type D
	Sign Erection, Relocation Type E

Cost Element	List of Elements
	Sign Erection, Relocation Type F
	Contractor Furnished type E design
	Sign Erection, Type E
	Generic Signing Item-Furnish and Install "In Street Ped Crossing Sign"
	Project signage
	Remove And Replace Private Business Sign
	Existing street sign removal and replacement
	Supp, 3lb Stl U-channel
Traffic Control	Traffic Control
Utilities	Water Valve Adjustment
	Utility Relocation
	Fire Hydrant Relocation
	Water Meter Relocation
	Paved Trenching (1 Conduit, 2")
Wheelchair Ramp	Wheelchair Ramp