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MEMORANDUM

Date: April 2, 2019
To: Kevin Tilbury, AICP, Cambridge Systematics
From: Kevin Luecke; Mike Loughran, P.E.
Project: Indiana State Bicycle & Trails Report
Subject: Shared Use Path Opinion of Probable Unit Costs

PURPOSE OF THE MEMORANDUM

This memo and the accompanying spreadsheet cost calculator provide planning-level opinions of probable cost for the development of new trails (also known as shared use paths) in Indiana.

TRAIL CONSTRUCTION COSTS

The cost to plan, design, and build trails or shared use paths vary widely based on a variety of conditions. Topography, urban versus rural settings, the presence of wetlands or other environmentally sensitive areas, and other conditions all play a significant role in the cost of building trails. Until specific trail corridors are known and an individual analysis can be developed for each corridor, it is not possible to provide cost opinions that are anything more than an order of magnitude.

This memo and the associated spreadsheet-based cost calculator provide opinions of probable cost for the construction of trails at the conceptual level under a variety of conditions. The costs were developed by identifying the major components of trail construction and establishing rough quantities to determine a rough order of magnitude cost. The components included in the cost opinion are:

- Earthwork and Grading (Based on 2017 INDOT average unit cost)
- Aggregate Base Material (Based on 2017 INDOT average unit cost)
- Surface Material (Based on 2017 INDOT average unit cost)
- Landscaping (5% of subtotal)
- Drainage (10% of subtotal)
- Maintenance of Traffic (5% of subtotal)
- Utility Adjustments (10% of subtotal)
- Design (20% of construction total)
- A design cost escalator based on the funding source to account for additional documentation and review

The cost opinions do not include:

- Easement and right-of-way acquisition
- Permitting, inspection, or construction management
- Extensive surveying, geotechnical investigation, documentation, or mitigation

- Significant retaining walls or landscaping
- User amenities including trail waysides, lighting, benches, bike racks, or water fountains
- Special site remediation
- Escalation
- The cost for ongoing maintenance

It is recommended that planning-level cost opinions include a 30 percent contingency to cover items that are undefined or are typically unknown early in the planning phase of a project. This contingency is to cover construction-related costs and does not account for the items listed above. A cost range has been assigned to certain general categories such as utility relocations; however, these costs can vary widely depending on the exact details and nature of the work.

The overall cost opinions are intended to be general and used only for planning purposes.

Toole Design Group, LLC makes no guarantees or warranties regarding the cost opinion herein. Construction costs will vary widely based on the ultimate project scope, actual site conditions and constraints, schedule, and economic conditions at the time of construction.

COST CALCULATOR

A spreadsheet-based cost calculator was developed to allow a user to input parameters to develop a planning-level cost opinion for trails. The calculator uses the base costs previously described, and multipliers to adjust the base cost per mile depending on varying conditions. Table 1 displays the base cost per mile for construction of a ten-foot wide shared use path in rural and urban settings; design and contingency costs are not included in Table 1.

Table 1: Base planning-level cost opinion for trail construction in a rural setting (no design or contingency factors)

Setting	Crushed Stone	Asphalt	Concrete
Rural Cost per Mile	$265,000	$532,000	$586,000
Urban Cost per Mile	Not recommended in urban areas	$798,000	$879,000

Table 2 displays multipliers used in the calculator to develop costs based on varying conditions where a path may be installed. The multipliers are applied to the cost subtotal before the contingency is applied.

Table 2: Cost multipliers for developing shared use path cost opinions

Condition	Variable	Multiplier	Notes
Setting	Rural Urban	1.0 1.5	Accounts for increased crossings, utility adjustments
Terrain	Flat Hilly	1.0 1.2	Accounts for increased cost of mobilization, more extensive grading
Former Railroad Grade	No Yes	1.0 0.5	Accounts for reduced grading and mobilization costs
Along Stream/River	No Yes	1.0 1.2	Accounts for increased environmental constraints
Funding Source Design Escalation	Local State Federal	0% 30% 50%	Applies to design cost, not construction cost Accounts for increased permitting, environmental review

The calculator also allows users to input a custom amount for the project contingency, and to update INDOT's average unit costs in future years.

Cost Examples

Construction of trails varies greatly in cost based on local conditions, funding sources, and other features. A typical trail, with no unusual site conditions can cost in the range of $700,000 per mile, but costs often range into the millions of dollars per mile for shared use paths with challenging terrain, significant utility relocation, in urban areas, or with many amenities. Tables 3 and 4 provide basic cost assumptions for two different example paths.

Table 3: Example of planning-level cost opinion for construction of a ten mile long, 10-foot wide crushed stone shared use path in a rural setting using local funds

Item	Multiplier	Running Subtotal
Crushed Stone Surface	N/A	-
Length (miles)	10.0	-
Width (feet)	10.0	$2,650,000
Setting: Rural	1.0	$2,650,000
Terrain: Flat	1.0	$2,650,000
RR Grade: Yes	0.5	$1,325,000
Stream/River: No	1.0	$1,325,000
Contingency	30%	$1,723,000
Design	20%	$1,988,000
Funding: Local	0%	$1,988,000
	Total	**$1,988,000**
	Avg. Cost/Mile	**$199,000**

Table 4: Example of planning-level cost opinion for construction of a two mile long, 12-foot wide asphalt shared use path in an urban setting using Federal funds

Item	Multiplier	Running Subtotal
Asphalt Surface	N/A	-
Length (miles)	2.0	-
Width (feet)	12.0	$1,232,000
Setting: Urban	1.5	$1,848,000
Terrain: Flat	1.0	$1,848,000
RR Grade: No	1.0	$1,848,000
Stream/River: Yes	1.2	$2,218,000
Contingency	30%	$2,884,000
Design	20%	$3,328,000
Funding: Federal	50%	$3,550,000
	Total	**$3,550,000**
	Avg. Cost/Mile	**$1,775,000**

As is shown in the tables, the cost per mile for the two examples varies dramatically. As specific projects are developed, more accurate cost estimates can be developed based on local conditions.

ADDITIONAL COSTS

A variety of additional costs are typically incurred when developing and constructing trails. Some of these costs are described below.

Land Acquisition

Acquiring adequate right of way to construct a trail can be the most time-consuming portion of a project. Land acquisition for trail construction may involve negotiations with many different land owners, some of whom may not be willing partners in the project. In particular, negotiation with railroads for land acquisition or easements is often very challenging. Projects that involve land acquisition may not be eligible for grant funding until all land necessary for the project has been acquired or the appropriate easements obtained. It is not uncommon for the land acquisition process for a project to take between three and five years depending on the number of properties involved, and a single holdout can derail a project or require significant changes to the project. Eminent domain is sometimes used for trail construction but presents issues of its own.

The cost for land acquisition for trail construction varies widely by location. Acquisition costs can range from 10 percent or less of construction costs in rural areas to over 200 percent of construction costs in urban areas.

Design and Environmental Review Costs

Design costs for trails typically are 20 percent to 25 percent of the construction costs, typical for both federally and locally funded projects. An added cost for federally funded projects is the more detailed environmental documentation (NEPA) needed for federal projects. The added documentation for federal funding can run from $15,000 to $30,000 for a simple categorical exclusion, to the hundreds of thousands of dollars for a full Environmental Impact Statement (EIS). Shared use path projects typically require only a categorical exclusion, however, the presence of wetlands, floodplain, rare/threatened/endangered species, historic/cultural resources, etc. may push the environmental documentation to a higher level or review and cost. It should also be noted that certain federal agencies often require a higher level of environmental documentation/approval than a typical transportation agency. Environmental requirements related to both funding source and land ownership should be assessed as part of determining the overall cost of each project.

The cost calculator accounts for typical environmental review through the funding source escalation, but does not account for extensive environmental review and documentation including development of an EIS.

Structures

Structure costs associated with shared use paths also vary in cost, depending on the circumstance. Numerous factors impact the cost of structures including the terrain the structure is traversing, the depth that supports need to be placed, the available access for heavy equipment, loading needs, decorative features, and other factors. Table 5 provides low and high planning-level cost estimates for common structure types.

Table 5: Planning-level cost estimates for common trail structure types

Item	Unit	Unit Cost - Low	Unit Cost – High	Comment
Boardwalk	SF	$75	$250	Assumes structure types range from simple timber boardwalks to prefabricated concrete boardwalks.*
Prefabricated Pedestrian Bridge	SF	$250	$400	Assumes steel truss structure prefabricated offsite with poured concrete surface and abutments.*
Concrete or Steel Bridge	SF	$350	$500+	Assumes majority of structure is constructed onsite.*

** If required based on site conditions, deep foundations may increase costs above the values shown.*

Street Crossings

The cost of at-grade crossings at intersections or mid-block locations depends on the level of infrastructure that is proposed, and the width of the street being crossed.

Table 6: Planning-level cost estimates for common shared-use path street crossing treatments

Item	Unit	Unit Cost	Comment
ADA-Compliant Pedestrian Ramp	Each	$2,500	2 ramps required per crossing. Does not include drainage or utility relocation.
Crosswalk – Standard	Each	$750	Includes pavement marking only.
Crosswalk – High Visibility	Each	$2,600	Includes pavement marking only.
Curb Extension	Each	$12,000	Does not include drainage or utility relocation. Does not include green infrastructure stormwater facilities.
Rectangular Rapid Flash Beacon	Each	$15,000 - $25,000	Dependent on power source and type of actuation or detection. Does not include electrical service, utility relocation, or other crossing improvements.
Pedestrian Hybrid Beacon	Per Intersection	$75,000 - $200,000	Does not include utility relocation or other crossing improvements.

Lighting

The cost of lighting along a shared use path depends on context, as will the light height, spacing, brightness, proximity to a power source, and many of other factors. For planning purposes, $500,000 to $1 million per mile is a reasonable range estimate based on pedestrian-scale lighting. If something like bollard lights or solar or battery powered lighting is desired, the costs can vary widely depending on the technology.

Wayfinding Signage

Wayfinding signs help direct trial users along their route as well as to nearby destinations. Signage can include information such as the direction to specific destinations, distances to destinations, and confirmation that users are on the route they think they are on. In a rural setting, where signs and destinations are infrequent, the cost for planning, fabricating and installing wayfinding signs can be in the range of $3,000 per mile. In urban settings, where street crossings, signs, and destinations are much more frequent, the cost can be $6,000 per mile.

Trail Amenities

It is often desirable to provide amenities along trails for users. These amenities can include benches and areas to rest, shelters, informational kiosks, and other items. Typical costs for common amenities are provided below. Amenities that require running water, such as drinking fountains and restrooms, are not included as the cost for providing water service can vary by orders of magnitude depending on proximity to existing water lines.

- Bench: $2,500 installed
- Trash/Recycling Receptacle: $1,800 installed
- Picnic Shelter: $30,000 - $100,000 installed; materials, location, and size substantially impact cost
- Trail Kiosk: $10,000 installed
- Bike Rack: $500 - $2,500 installed depending on capacity

Maintenance

Once a trail is constructed, regular maintenance is required to ensure that the trail is usable and attractive. Maintenance activities include mowing and vegetation management, tree removal (when necessary), sweeping and trail clearing, surface repairs such as grading of unpaved trails and crack-sealing of paved trails, trash removal, maintenance of pavement markings, and snow removal. Costs for maintenance vary widely by agency. In its 2015 report *Maintenance Practices and Costs of Rail -Trails*, the Rails to Trails Conservancy estimated that trail maintenance costs $1,000 to $2,000 per mile per year. However, a report for the U.S. Forest Service by Trails Unlimited estimates maintenance costs at $2,500 to $6,000 per mile per year. Other estimates and reviews of trail maintenance procedures produce estimates as high as $10,000 per mile per year. It should be noted that these figures do not include any extensive or exceptional repairs and the lower figures are assumed to include

only the most basic maintenance tasks needed to keep the trail usable. Agencies maintaining trails are urged to provide adequate maintenance budgets for trails under their jurisdiction to protect the initial investment in the trail and prolong the lifespan of the trail.

Below is a breakdown of the typical maintenance activities for shared use paths and trails, although maintenance may be necessary at any time to address immediate concerns. It is recommended that agencies budget for all of these items when constructing a trail.

Twenty Times Per Year:

- Sweeping/Blowing to Remove Debris
- Trash Removal
- Mowing Trail (Three foot minimum on each side of trail)

Ten Times Per Year:

- Application of Herbicide or Pesticides

Four Times Per Year:

- Drainage Maintenance (power washing, silt removal, etc.)
- Seasonal Plantings

Two Times Per Year:

- Vegetation Management (leaf clearing, pruning of trees, etc.)

Annually:

- Minor repairs
- Maintenance and Supplies
- Equipment Fuel and Repairs

Three To Five Years:

- Restriping

Ten To Twenty Years:

- Resurfacing

The frequency each item is performed can fluctuate and will be based on a community's needs and/or desires.

Cost Escalation

Over the past few years, construction cost escalation has been relatively flat, at approximately 2.0 to 2.5 percent. A conservative value to use for cost escalation is 3 percent per year. Potential impacts due to trade tariffs on steel or other raw materials are unknown at this time but may increase escalation further. Unit costs should be adjusted for future projects based on historic bid costs, if available. In the absence of historic bid costs, adjustments should be made based on one of the industry standard cost indices like the National Highway Construction Cost Index.