APPENDIX D

COST ESTIMATION METHODOLOGY

Tier 2 Environmental Impact Statement

I-69 Section 6

Martinsville to Indianapolis

September 26, 2017

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1 Introduction

This document describes the methodology and basis of the cost estimates developed for the alternatives considered in the I-69 Section 6 Tier 2 EIS. Initial cost comparison of four reasonable alternatives supported the selection of a preferred alternative (Alternative C4) in the DEIS. The DEIS preferred alternative was presented at the public hearing and comments were solicited on the DEIS. The DEIS preferred alternative was refined to address public and stakeholder input, to reflect additional information and design data obtained by the project team, and to incorporate recommendations from a Value Engineering Study. A cost estimate was then developed for the Refined Preferred Alternative (RPA) that incorporated refinements and additional information. The refinements and additional information allowed some adjustments to cost estimating assumptions and methods to more accurately predict costs. The cost estimate for the RPA also reflects adjustments made during a cost estimating review (CER) conducted by INDOT and FHWA in August 2017.

This report identifies the methods, parameters, scope of work, assumptions and exclusions used in the development of the cost estimates. Alternative designs are at a preliminary stage and all elements of the project have not yet been fully detailed and designed. Therefore, assumptions were used to generate quantities and costs when needed. INDOT standards and specifications were used to help define work and material requirements.

2 Project Alternatives

2.1 Reasonable Alternatives

Preliminary project design files and documents were used to determine anticipated construction costs for DEIS Alternatives C1, C2, C3, and C4. The scope of work for construction of the four DEIS alternatives is summarized in **Chapter 3, Alternatives**. Geometric layouts of the four DEIS alternatives were developed on digital aerial photography using MicroStation V8i CAD software by Bentley System, Inc. All DEIS alternatives assume that existing SR 37 is upgraded to an interstate highway facility. This involves removing all at-grade intersections and individual parcel access drives from SR 37, and providing grade-separated interchanges at key crossroads. Access from businesses and residential properties would be provided by local service roads that connect to the proposed interchanges.

2.2 Refined Preferred Alternative (RPA)

Additional engineering refinement was performed on Alterative C4 after it was identified as the preferred alternative in the DEIS. The result of this additional work is the RPA, which is described in **Chapter 3, Alternatives** of the FEIS. This alternative includes engineering changes to reduce project impacts, reduce cost, or to address public comments on the draft EIS. The RPA also incorporates accepted recommendations from a value engineering study conducted by INDOT in May 2017.

3 Methodology and Assumptions

Cost estimates for the I-69 Section 6 alternatives were developed using a technique known as "cost-based estimating." Cost-based estimating identifies the major tasks required to construct a project and estimates the time, labor, equipment, and materials necessary to complete each task. Reasonable amounts for a contractor's overhead and profit are also included. This estimating method can more easily account for unique project characteristics, geographical influences, market factors and material price fluctuations than methods based on historical unit pricing.

Quantity surveys ("takeoffs") have been developed for each alternative based on preliminary engineering drawings and project descriptions. These quantities are used throughout the estimate and are supported by details (either developed or assumed) for the element being estimated. In addition to the project descriptions, the information used for cost estimating includes CAD design files showing the preliminary alignment and bridge locations for each of the reasonable alternates, roadway cross-sections, earthwork summary reports, roadway typical sections, and other miscellaneous reference and design information.

Sage Timberline Estimating Software was used to develop detailed road construction cost estimates for each alternative based on quantity surveys and assumptions identified in this document. At the lowest level, the cost estimates are structured using standard INDOT bid items to provide transparency. The pay items are aggregated into the work elements necessary to construct each designated subsection of I-69 Section 6. Where sufficient detail is available from preliminary layouts, quantities and pricing have been estimated based on this information. Pricing components include labor, equipment, materials, and subcontractors. Material suppliers and product vendors were contacted during the estimating process to obtain current pricing and transportation costs applicable to the I-69 Section 6 project.

In some instances, unit costs were applied for non-major items of work such as erosion control and pavement markings in lieu of developing a full detailed estimate. Unit costs were developed using historical data developed from recent INDOT bid tabulations and other estimating and construction experience. INDOT pay items were referenced for select items to complete the cost estimate. Cost estimates for some other items not directly related to road construction were also developed using historical data from previous similar projects. These include estimates for utility relocation and environmental mitigation.

The procedures used in developing the I-69 Section 6 cost estimates are consistent with AACE International, formerly known as the Association for the Advancement of Cost Engineering.

INDOT and FHWA conducted a cost estimate review on August 15-17, 2017. The CER involved a detailed examination of the cost estimating assumptions used for the I-69 Section 6 project, as well as an examination of project risks and contingency amounts. During this review, adjustments were made to several project assumptions. In addition, overall unallocated project contingencies were reduced in lieu of estimating the costs and probabilities of occurrence for identified risks. This review was only performed for the RPA cost estimate, and adjustments were not incorporated into the cost estimates previously developed for the DEIS alternatives.

Because of the additional engineering development and the adjustments made during the FHWA CER process, some of the cost estimating assumptions and methodologies used for the RPA differ from those used for the DEIS alternatives. The differences are identified in this document. These differences in level of detail and assumptions should be considered when comparing the RPA cost estimate to the estimates developed for the DEIS alternatives.

3.1 Earthwork

Earthwork includes the roadway excavation, embankment, topsoil placement and grading required for construction of the project. Estimated earthwork volumes are based on cross-sections and earthwork reports available at the time. Quantities were assumed for locations where cross sections are not yet developed, including I-465, proposed interchange ramps, and some local service roads. Minimal earthwork was assumed for the construction of local streets, with only minor subgrade preparation assumed for these locations. Earthwork information for drainage ponds was not available, and these were excluded from the estimate.

For purposes of this estimate, all excavated material was assumed to be reused, to the extent possible, as embankment on this project. All topsoil required on the project was assumed to be generated on site with no import of topsoil material. The estimated volume of select backfill for mechanically stabilized earth (MSE) walls was deducted from the cross-section embankment quantity to calculate the total ordinary fill volume needed. After analysis of the earthwork volumes it was determined that material would need to be imported to complete the embankment. All imported material was assumed to be a granular type material.

In accordance with the Indiana Design Manual Figure 17-2C, the fill quantities were adjusted with a 1.20 shrinkage factor. Three INDOT pay items (specifically described units of work for which prices are provided in a construction contract) are used for the placement of fill on the project:

- 203-02055 Embankment: Used for placing fill material generated from on-site excavation
- 203-02070 Borrow: Used for furnishing and placing imported ordinary fill
- 211-02050 B Borrow: Used for furnishing and placing imported MSE select fill

All DEIS alternatives were shown to impact the Hanson quarry north of I-465, which would require substantial earthwork. However, this earthwork was not calculated because it was assumed that the alignment of ramps at the I-69/I-465 interchange could be refined to avoid the quarry. This realignment was included with the RPA.

The four DEIS alternatives all assumed that the quarry pond south of the proposed I-69/I-465 interchange would require some extent of dewatering and filling to accommodate the proposed ramp alignments. Alternative C1 has an alignment that shows the proposed ramps constructed over the eastern side of the pond. This alternative assumed that the entire quarry pond would be dewatered and backfilled. Alternatives C2, C3, and C4 show an alignment where only the northwestern portion of the pond would be affected. These alternatives assumed a partial

dewatering and backfill of the shallower northwestern portion of the pond. The alignment of the RPA was modified so that it does not impact the quarry pond.

3.2 Roadway

Lane requirements for the I-69 mainline were identified based on preliminary traffic forecasts developed for the project. All DEIS alternatives assumed four through lanes from Indian Creek to SR 144, six through lanes from SR 144 to Southport Road, and eight through lanes from Southport Road to I-465. An additional mainline truck climbing lane was assumed in two separate locations on the north side of Martinsville, where climbing lanes currently exist on SR 37. Detailed traffic analysis performed for the RPA resulted in extending the northern limit of the four-lane mainline section to Olive Branch Road, which eliminated approximately 6 lane-miles of freeway mainline. The climbing lanes assumed for the DEIS alternatives were also found to be unnecessary, and were eliminated from the RPA.

CAD layouts were used to determine the location of full reconstruction, widening, and resurfacing of the existing roadway. This information was used to determine the quantities of proposed pavement and pavement removal. In areas where existing pavement was assumed to be reused, some patching was assumed, and full depth widening of travel lanes and shoulders was included as needed according to typical sections.

For the DEIS alternatives, roadway work on I-465 was assumed to be widening of the existing pavement to accommodate 24 feet of new pavement (new 12-foot lane and 12-foot shoulder) in each direction. As the RPA was developed, the need for full pavement reconstruction on I-465 was identified and assumed. This included raising the profile grade of I-465 by up to 2 feet to meet vertical clearance standards for new bridges over Harding Street, Bluff Road, Meridian Street, and the Indiana Rail Road.

The limits of local street work were identified from CAD layouts of the alternatives. Widths were assumed based on typical sections and anticipated needs for each roadway. Concrete curb was added to some of the proposed ramp or crossing locations based on review of the existing intersection or the proposed ramp design. Concrete sidewalk and curb ramps items were not included in the estimates for the DEIS alternatives because proposed locations had not been identified. Sidewalk and curb ramp were included in the RPA estimate based on preliminary identification of proposed locations. Roadway underdrains were included as shown on the typical sections, with a 4-inch assumed diameter.

The roadway pavement sections shown in **Table 1** were used to develop cost estimates, based on pavement design recommendations provided by INDOT.

Table 1: Roadway Pavement Sections

Location	Pavement Structure	Notes
I-69 HMA	165#/SYS HMA, 4, 70, Surface, 9.5mm 330#/SYS HMA, 4, 70, Intermediate, 19.0mm 715#/SYS HMA, 4, 64, Base, 19.0 mm 275#/SYS HMA, 5, 76, Intermediate, OG 19.0mm 330#/SYS HMA, 4, 64, Base, 19.0mm Subgrade Treatment Type I	Assumed for travel lanes and shoulders to approximately Station 1420+00
I-69 JPCP	13" PCCP 6" Subbase for PCCP Subgrade Treatment Type I	Assumed for proposed I-69 north of approximate Station 1420+00 to I-465
Ramps on I-69 and I-465	13" PCCP 6" Subbase for PCCP Subgrade Treatment Type I	For all proposed ramps on I-69 and I-465
I-465	14" PCCP 6" Subbase for PCCP Subgrade Treatment Type I	For all proposed travel lanes and shoulders of I-465
High Volume Ramps on I-69	165#/SYS HMA, 4, 70, Surface, 9.5mm 330#/SYS HMA, 4, 70, Intermediate, 19.0mm 605#/SYS HMA, 4, 64, Base, 19.0 mm 275#/SYS HMA, 5, 76, Intermediate, OG 19.0mm 330#/SYS HMA, 4, 64, Base, 19.0mm Subgrade Treatment Type I	For all proposed ramps on I-69 south of approximate Station 1420+00
Local Streets	165#/SYS HMA, 2, 64, Surface, 9.5mm 275#/SYS HMA, 2, 64, Intermediate, 9.5mm 440#/SYS HMA, 2, 64, Base, 19.0 mm Subgrade Treatment Type I	For all proposed local streets

3.3 Bridges

Bridges were identified wherever a freeway or other road crosses over a body of water, railroad, or another roadway. During cost estimating for the reasonable alternatives, all bridges were assumed to be new, and all existing bridges within the new alignment were assumed to be removed. An assessment of existing bridges along SR 37 and I-465 was conducted during the development of the RPA to determine which structures could be reused.

Two types of abutment were assumed for this project: a concrete abutment wall and an end bent placed above a MSE wall. Concrete abutment walls were generally assumed for all bridges over creeks and waterways. The abutment wall was assumed to be constructed on a concrete footing, with small wingwalls. Minimum clearance for all new bridges was assumed to be 16.5 feet based on INDOT Design Manual Chapter 402. End bents with MSE walls were assumed at all other bridge locations with the exception of the bridges on I-465 and the bridges at the I-69/I-465 interchange, where concrete abutment walls were assumed. End bents were assumed to have a cross sectional dimension of 3-feet wide by 3.5-feet tall. All bridges with piers, with the exception of the flyover bridges, were assumed to consist of a concrete footing with a solid, constant width stem wall. Piers for the flyover bridges were assumed to use a concrete footing

with a variable width stem wall. All substructure concrete was assumed to be constructed as cast-in-place units. Reinforcing steel quantities were estimated using ratios based on concrete volume.

Concrete surface sealer and anti-graffiti coating were assumed to be applied to all exposed faces of the substructure units. In addition, the visible face of the exterior girder, underside of the bridge overhang, deck edge and full face of the bridge railing was assumed to have the concrete surface sealer and anti-graffiti coating applied. Reinforcing steel for all applications was assumed to be epoxy coated.

Bridges were priced based on an average cost per square foot of bridge deck given the above conditions. Rehabilitated bridges were assumed to be widened by 12 feet, have concrete abutments, and have the other features identified above.

3.4 Retaining Walls

Approximate locations of retaining walls were identified where the construction limits have significant impact on existing right of way and as part of proposed bridges over roadways. All retaining walls on this project are assumed to be MSE type retaining walls. The location and heights of most retaining walls were identified from plans and typical sections. Wall heights were assumed where the vertical alignment of adjacent ramps or local roads had not yet been determined. A 1-foot wide by 6-inch deep concrete leveling pad was assumed at all wall locations. The select backfill and strap zone was assumed to be approximately 70 percent of the wall height. A standard MSE coping was assumed on top of all walls. Concrete surface sealer and anti-graffiti coating were assumed to be applied to the exposed face of MSE walls.

Sections of I-69 would be elevated with each alternative. It was assumed that temporary MSE walls would be used to retain new elevated construction while the traffic is maintained at the existing lower level. Locations and heights of the assumed temporary MSE walls were generated from the cross sections, and costs for these walls are included in the estimates.

3.5 Drainage

The drainage on the project was assumed to be a modification of the existing drainage systems. In most cases the assumption was that existing drainage features would be used and pipes would be extended where possible. Where the alignment was changed and the existing drainage system could not be reused, the existing drainage features were assumed to be removed and replaced.

The existing drainage system consists of the following:

- Catch basins and manholes along existing SR-37 and I-465
- CMP and PVC pipe with end treatments
- Large diameter CMP culverts with headwalls
- Concrete box culverts with headwalls

The scope of work for the proposed drainage system was assumed to be the following:

- Pipe extensions
    - Excavate, lay, and backfill new pipe
    - Connect new pipe to existing pipe
    - Install new end treatment
- Large diameter CMP culvert extensions
    - Excavate, lay, and backfill new pipe
    - Connect new pipe to existing pipe
    - Place riprap end treatment
    - Extend headwall
- Concrete box culvert extensions
    - Extend existing box culvert with precast segments
    - Construct concrete headwall

3.6 Traffic and Lighting Items

3.6.1 Guardrail

Two different guardrail treatments were assumed for purposes of these estimates, metal beam guardrail and median cable rail. Metal beam guardrail was assumed at the following locations:

- At the four corners of all bridges on the project, for an assumed constant length.
- Along tops of retaining walls.
- In median of roadway at bridge pier locations.

The RPA, along with DEIS Alternatives C2, C3, and C4, use existing alignments and pavement in many locations. For these alternatives, the I-69 median would meet AASHTO minimum design standards, but would likely require significant extents of median cable rail. Installation of median cable rail was assumed for these alternatives from just north of Martinsville to the I-69/I-465 interchange to compensate for the narrow medians. The I-69 median for Alternative C1 would be wider and would not require median cable rail.

3.6.2 Intelligent Transportation Systems (ITS)

ITS technologies help INDOT to monitor traffic flow, respond to incidents, and inform travelers of conditions on the state's highway system. The INDOT Traffic Management Strategic Deployment Plan, Version 2.4 dated 2008, identifies the planned deployment of ITS technology statewide. This includes deployment along I-69 and I-465 within the I-69 Section 6 project area.

Based on this document, cost estimating for all alternatives, including the RPA, include the following ITS elements deployed on I-69 from SR-144 to I-465:

- Side-fire vehicle detection system every ½ mile
- Closed Circuit Television (CCTV) surveillance systems every mile, with two additional CCTV systems assumed at interchanges in Subsections 2, 4, 5, 6, and 7.
- Traditional inductive loops
- Conduits and fiber optic cables

New and replacement Dynamic Messages Signs (DMS) at locations on I-69 and I-465 identified in the strategic deployment plan. An estimated cost of $325,000 per each ATMS location was provided in the above referenced deployment plan. This cost plus a 10 percent addition for inflation since 2008 was used in the estimates.

During development of the RPA, INDOT provided more specific information about planned ITS equipment for I-69 Section 6, along with recent unit pricing information. ITS equipment was included as far south as Liberty Church Road. Proposed equipment and locations are identified in **Table 7.7** of the INDOT Engineer's Report.

Along with the major equipment items identified by INDOT, other ITS items in the estimate include:

- Controller cabinets with foundation assumed as one per subsection of I-69
- Junction boxes assumed as one per 1,000 linear foot of mainline roadway
- Electric service assumed as two per subsection of I-69

3.6.3 Lighting

The following scope and extents were assumed for the I-69 roadway lighting system during cost estimating for all alternatives, including the RPA:

- Continuous freeway lighting, including complete interchange lighting from SR 39 to SR 44
- Continuous freeway lighting, including interchange lighting from County Line Road to I-465
- Complete lighting at the SR 144 and Smith Valley Road interchanges
- Partial lighting at the Henderson Ford Road interchange

Lighting requirements were updated during development of the RPA, and the final proposed scope of lighting is identified in Section 7.13 of the INDOT Engineer's Report. For those locations where lighting is proposed, the following items were assumed in the cost estimate:

- 40-foot light poles, spaced at 260 linear feet on mainline roadways, ramps, and local streets (only within interchanges for local streets)

- 250W high pressure sodium luminaires
- Buried 2-inch PVC schedule 40 conduit with express cable (2-C#8) between light poles
- Local cable (4C #4 and 2 C#6G) within the light pole and luminaire
- Junction boxes one per 1,000 linear foot along the express cable alignment

3.6.4 Signalization

A preliminary identification of traffic signal locations was made for the DEIS alternatives based on preliminary traffic forecasts. Detailed traffic analysis was used to confirm proposed traffic signal locations for the RPA. The following assumptions were made for the traffic signalization:

- Traffic signal pole height of 36 foot with signal mast arm length of 30 feet
- Single mast arms at three-way intersections
- Double mast arms at four-way intersections
- Traffic signal heads as 3-section, 12 inch (red, yellow, and green lights)
- Conduits 1-inch and 2-inch diameters
- Electrical conductors as #14
- Traffic signal junction boxes at each intersection
- Signal cabinets and controllers as one each per intersection

3.6.5 Roadway Signage

All existing roadway signage was assumed to be removed, including post mount signs and overhead sign structures. New roadway signage was assumed to replace existing, with enhanced signage along the proposed alignment. The following assumptions were used in the estimate:

- Small post mounted signs to replace existing at new ramps and local streets, included at intervals based on the alignment
- Overhead sign cantilever structures at varying heights (25-, 30-, and 35-foot) based on the roadway cross sections and included at locations estimated based on the alignment
- Overhead sign cantilever structures for exit signage estimated at 25-foot height at each exit location
- Overhead signage attached to bridge structures included at locations based on the alignment

A cost allowance was added to the RPA to account for signage replacement and adjustments at I-465 interchanges between I-69 Section 6 and existing I-69 on the northeast side of Indianapolis. It was assumed that guide signs will be changed as part of the I-69 Section 6 project so that they reference the route of I-69 along the east leg of I-465 through Marion County.

3.6.6 Pavement Markings

Pavement markings were estimated based on the four, six, and eight lane configurations of proposed I-69 and I-465. Only basic marking types were considered at this time. The types of pavement markings in the estimate include:

- Solid roadway edge lines - white and yellow
- Skip lines for lane delineation - white

3.7 Utility Relocations

Utility relocation cost estimates were developed based on the assumption that all utility facilities located within the limited access right of way would be relocated. It was also assumed that all utilities located within the construction limits of local access roads and interchanges would be relocated. The cost of each utility relocation was estimated by developing a standard unit cost per linear foot of impact for each impacted utility type. The unit costs were based on historic utility relocation project costs, including easement acquisition, engineering, materials, and construction. The INDOT Office of Utilities and Railroads provided historic data.

Some utilities are currently located parallel to the SR 37 alignment for long distances and would be impacted at several locations. It would not be practical for a utility company to conduct separate relocations only where it is directly impacted. The utility company would be more likely to relocate the entire facility. These facilities tended to be large transmission facilities with a large unit price. Smaller facilities, such as buried communications cable and utilities attached to poles owned by others, were generally not considered directly in the cost analysis. Based on early coordination meetings with utilities, a per subsection lump sum amount of $1,500,000 for rural subsections and $3,000,000 for urban subsections was included in the estimate to reflect the anticipated relocation costs for smaller distribution facilities. This anticipates 15 to 30 individual relocations of these smaller facilities per subsection, each at $100,000. The higher dollar value for urban subsections recognizes the greater number of utilities located there.

3.8 Maintenance of Traffic

Maintenance of traffic quantities and costs were generated on a per mile basis. Maintenance of two lanes of traffic in each direction was assumed to be preferred on SR 37. Temporary pavement was assumed to be required along the corridor to maintain the two lanes of traffic in each direction throughout construction. This was assumed to be a 16-foot width for Alternative C1 and 12-foot width for Alternatives C2, C3, C4, and the RPA. The assumed pavement section for the temporary pavement was 8 inches of aggregate base and 6 inches of asphalt.

Temporary concrete barrier wall and temporary pavement markings were estimated throughout the corridor. Maintenance of traffic devices were also included, based on an estimated dollar amount per mile of roadway. Labor to maintain and adjust devices and to set up lane closures was also considered in the estimates.

3.9 Erosion Control

Erosion and sediment control measures were estimated based on standard best management practices (BMPs). The following BMPs were assumed for preliminary estimating purposes:

- Temporary seeding
- Check dams
- Silt fence
- Inlet protection

Other erosion and sediment control measures, such as sediment basins, will be considered as earthwork, drainage and erosion control needs are further developed.

3.10 Right of Way

The right of way estimates include the cost to acquire property and to relocate displaced residences and businesses. The estimated costs for the acquisition of real estate and relocation benefits were developed by Indiana licensed real estate appraisers, real estate brokers, and certified real estate relocation specialists using industry standard methods. The preliminary cost estimates for land, land improvements and other improvements were based on the anticipated right of way limits for each alternative. The variation in market values for commercial, industrial, residential, multi-family, and agricultural land in the project area was considered during the valuation process. An allocation based in part on market rates was used to determine land improvement and structure value estimates. County assessment records were referenced to provide information on local market trends and to provide a reasonable baseline.

Damage payments for land and/or improvements that would not be acquired for the project but would no longer be useable because of the project were estimated based on previous INDOT land acquisition experience.

Relocation costs were estimated based on the number of displaced structures identified for each alternative. A factor was applied based on local market conditions to estimate the number of tenant-occupied properties. The estimates of relocation costs also included business re-establishment costs for residential (single and multi-unit rentals), commercial, and industrial properties. Professional judgment was used to determine where changes in the highest and best use of properties could also cause the potential relocation of a business or residence.

Demolition costs were estimated based on the average size of a single-unit residential dwelling, with an appropriate consideration for the percentage of homes with basements or other attributes that could affect demolition expense. A fixed estimate per structure was applied and then adjusted in consideration of the square footage and construction material.

Professional service fees associated with real estate acquisition include right of way engineering, appraisal, and buying. The fee estimates were based on the current approved per unit and per

parcel fees used by INDOT. Settlement and legal costs were estimated based on condemnation rates for similar projects.

While the real estate acquisition cost estimates attempt to reflect the total of actual market values, actual acquisition costs will be based on individual appraisals for each specific property conducted after approval of the EIS.

3.11 Mitigation

Unit costs for environmental mitigation were developed based on historical costs for INDOT projects. Estimated costs are included for the following mitigation components of the project described below.

Wetland Mitigation. The acreage needed for wetland mitigation was determined for each alternative based on the expected impact acreage, type of wetland, and jurisdiction using mitigation ratios described in **Chapter 7, Mitigation and Commitments**. A 25 percent buffer was added to the total mitigation area. The cost of this mitigation includes purchase of suitable parcels, design and construction of wetlands, and administration.

Forest Mitigation. The acres needed for forest mitigation were determined for each alternative based on the expected impact acreage using a 3:1 ratio (with the goal being 1:1 for reforestation, to replace direct impacts, and 2:1 for preservation of existing forests). The cost of this mitigation includes acquisition of suitable parcels, site design and tree planting, and administration.

Other Riparian Areas. “Riparian areas” refer to non-wetland land located immediately adjacent to streams. The width of these riparian areas can vary, and is generally wider in the upland areas where topography is more rugged and narrower in the flatter lowlands where agricultural fields use more of the land (see **Section 5.19**). In general, impacts to these riparian areas are expected to be mitigated through the forest mitigation program wherever possible, but in some instances may be treated separately. Since some riparian areas are wooded but do not meet the USDA technical definition of “forest”, these areas are not included in the forest mitigation, but instead would be mitigated at the 1:1 ratio for mitigation of other (non-wetland) riparian habitat.

Noise Impact Mitigation. While a final determination on noise abatement will be made during the design phase, an estimated square foot construction cost is included in the cost estimate for potential noise barriers at locations identified by modeling. Additional analysis will be performed during final design to determine the placement of noise barriers.

Stream Mitigation. Mitigation costs for stream impacts were estimated based on the length of impact. The estimated cost of this mitigation includes: securing suitable parcels; conducting site design for stream stabilization projects; erosion control devices; stream mitigation and monitoring plans; filter strips; planting of woody and herbaceous vegetation to stabilize banks and provide foraging cover for many species, and; administration. A separate cost was added for a large bank stabilization mitigation project along the White River near its confluence with Stotts Creek.

Historic Resources. A lump sum value is applied to the entire I-69 Section 6 project to represent potential cost to mitigate for impacts to aboveground and archaeological resources that are eligible or listed in the National Register of Historic Places. This value was developed by pro-rating the mitigation cost for historic resources developed in Tier 1 by the proportion of the entire project's length that is in I-69 Section 6. As included in the Section 106 Memorandum of Agreement (MOA) for Tier 1 mitigation funding would be to complete the resurvey of aboveground resources in the counties mentioned here for the Indiana Historic Sites and Structures Inventory (IHSSI), and the data collected during the survey will be uploaded into the State Historic Architectural and Archaeological Research Database (SHAARD). Additional mitigation measures for I-69 Section 6 is finalized through the Section 106 MOA and is specific for Tier 2.

Section 4(f). The Southside German Market Gardeners Historic District is the only resource that would have a Section 4(f) use. Mitigation will be developed for impacts to the Southside German Market Gardeners Historic District as part of the Section 106 consultation process with the SHPO and consulting parties. Mitigation costs for the Section 4(f) use of this historic resources are included with the historic resource costs described above.

Context Sensitive Solutions. These costs include community requested features such as bicycle and pedestrian accommodations and aesthetic treatments. Specific features have not been identified or quantified at this time. It is assumed that the estimated construction cost contingencies for the project are sufficient to cover the cost of context sensitive solutions that will be identified during development of the preferred alternative.

4 General Estimate Parameters and Assumptions

4.1 Procurement Method and Schedule

At the time of this estimate the procurement method for this entire project is not known. The initial design contract, from SR 39 to Morgan Street, is planned to be procured using a design-bid-build procurement method. Design contracts north of this location are not yet known but could utilize design-bid-build or a combination of design build procurement methods. It is anticipated that decisions on future procurement methods will be evaluated and announced in 2018.

For purposes of projecting construction costs in the year of expenditure, design activities were assumed to begin in January of 2018, with construction ending in December FY 2027. No construction schedule has been developed at this time.

4.2 Contingencies

Due to the early stage of project development, cost contingencies were added to account for unknown conditions. A 20 percent contingency was added to project construction costs, utility

relocation, and mitigation costs for Alternatives C1, C2, C3 and C4. Utility relocation and mitigation contingencies were reduced to 8 percent for the RPA as more information was determined.

4.3 Professional Services

The cost of preliminary engineering for I-69 Section 6 was estimated to be 7 percent of the project construction cost, including construction cost contingency. Preliminary engineering includes survey and design costs but excludes preparation of the environmental document. The cost of construction administration was estimated to be 9 percent of the construction cost with contingency for Alternatives C1, C2, C3, and C4, but it was reduced to 5 percent of the RPA construction cost based on recent INDOT experience with large projects. Construction Administration includes construction inspection, construction management services, and public outreach during construction. The costs of professional services for right of way acquisition and relocations are included within the cost estimates for right of way. The costs of professional services for utility relocation are included in the estimates of utility relocation costs.

4.4 Cost Escalation

Costs were estimated in 2016 dollars (for reasonable alternatives) or 2017 dollars (for the Refined Preferred Alternative) and were escalated to an anticipated year of expenditure to account for cost increases over time. Escalation has been included in the estimate at 3.5 percent to the midpoint of construction. This rate is based on industry forecasts, including the Ohio Department of Transportation July 2016 Construction Cost Outlook and Forecast.[1] The midpoint of construction is estimated to be July of 2023.

4.5 Labor Rates

This estimate used 2016 labor rates, adjusted to the Indianapolis, Indiana market, in the calculation of construction costs. The estimate assumes standard 40-hour work weeks for labor. Additional labor costs for overtime were not applied. Labor costs were escalated to an anticipated year of expenditure as part of the overall cost escalation described in **Section 4.4**

4.6 Overhead and Profit

Contractor overhead and profit were assumed to be 18 percent of the project labor and materials costs and were included in the cost of construction.

[1] *Ohio Department of Transportation. July 2016 Construction Cost Outlook and Forecast. Available online at http://www.dot.state.oh.us/Divisions/ConstructionMgt/Estimating/TrendsAndForecasts/Jul2016_Construction_Cost_Forecast_Revised.pdf. Accessed on September 19, 2016.*

4.7 Bonds and Insurances

The costs of bonds and insurance were estimated at 1.5 percent of the construction cost and were allocated throughout the estimate.

4.8 Sales Tax

Indiana state sales tax of 7 percent was applied to material purchases.

4.9 Excluded Costs

The following items were not specifically considered in the cost estimates developed for the reasonable alternatives:

- Costs of project financing
- Costs of transportation demand management or system management strategies during construction
- Special insurances (railroad, builder's risk, etc.)
- Hazardous or contaminated material abatement and/or removal
- Landscaping and plantings (trees, shrubs, plants, etc.)
- Costs of constructing ponds for flood control and stormwater runoff treatment
- All other costs not specifically called out in this report or the estimates

The following items were excluded from the DEIS alternative cost estimates, but they were indirectly considered in the RPA cost by estimating the probability of occurrence and potential cost and schedule implications.

- Archaeological finds and/or associated delays
- Delays that could be caused by third party utility relocation
- Unforeseen conditions due to additional borings or geotechnical information