COST ESTIMATION METHODOLOGY

Introduction

Project Costing Guidelines were issued by the PMC to provide a uniform approach to the costing of alternatives for the Tier 2 studies yet allowing flexibility to make refinements as warranted. These guidelines were reviewed by INDOT and Federal Highway Administration (FHWA) both at the Indiana Division Level and FHWA Headquarters.

The Project Management Consultant (PMC) investigated recent projects that have been bid, and developed a methodology that would replicate as close as possible the actual bidding to be expected when Plans Specifications and Estimate (P.S. & E.) are available at the end of design. This methodology initial methodology, used in the Section 1 DEIS, was based on a bid year of 2004, and was intended to provide a fairly complete estimate as if plans were already "on the shelf". Since the timing of the Tier 2 Final Environmental Impact Studies varies by section, and issues of funding are not fully resolved, it is not possible at this point in time to definitively schedule the various construction contracts. Accordingly, after the 2004 costs have been developed based on the methodology stated below, they were adjustment to be given in Year 2010 dollars. In 2007 the PMC reviewed recent bid history of construction projects as well as unit prices from American Association of State Highway and Transportation's Officials' (AASHTO's) Trns-port Estimator (construction cost estimating) program and made modifications to the model to reflect costs in 2007 dollars. This methodology was used in the Section 1 FEIS, and in EISs in other sections going forward. These 2007 costs were then inflated to 2010 dollars. After Tier 2 studies are completed, INDOT and FHWA will continue to project these costs out into the future and develop the funding plan to complete the construction of I-69 from Evansville to Indianapolis.

Section 1. Roadway Construction Cost

Methodology. The PMC obtained the itemized bid tabulations (bid tabs) for seventeen (17) roadway projects let by INDOT in 2004; nine (9) of these projects were categorized as new construction projects. These bid tabs were analyzed to obtain various cost components that were provided to estimate the roadway component of the total construction cost within the section. This analysis of Year 2004 cost components was the basis of cost estimates supplied in the Section 1 DEIS. As described below, these cost components were reviewed and updated in 2007; this updated analysis was the basis of cost estimates supplied in the Section 1 FEIS.

During the analysis, the roadway construction costs were divided into five (5) categories for estimating purposes: pavement; earthwork; miscellaneous; percentage costs; and Trns-port items. Unit prices were provided to estimate the construction cost for the pavement, earthwork and miscellaneous items; percentages were provided to estimate the construction cost for the percentage items. Construction cost for the Trns-port items where estimated where appropriate.

Pavement. The analysis of Year 2004 costs used forecasted traffic volumes to determine the number of mainline travel lanes required at various locations. For cost estimating purposes, the total length (in linear feet) of each type of lane configuration (i.e. 4, 6, 8, or 10-lane) was calculated.

Based on the forecasted traffic volumes for each potential interchange, the number of lanes required for each ramp was determined. For cost estimating purposes, the total length (in linear feet) for each type of ramp configuration (i.e. 1 or 2-lane) was calculated.

Other roadways (e.g. frontage roads, realigned roads, improvements to existing roadways, etc.) which will need to be constructed or substantially reconstructed to maintain access to the existing roadway network were identified. Based on forecasted traffic volumes, the number of lanes required for these roadways was determined. For cost estimating purposes, the total length (in linear feet) for each type of roadway configuration (i.e. 2 or 4-lane) was computed.

In 2007 the model was further refined based on Year 2007 costs. These changes accounted for an abnormal spike in construction costs. After many years of relative stability, events such as increased demand for construction materials in developing nations (e.g. China), war in Afghanistan and Iraq, and natural events such as Hurricane Katrina led to much volatility in prices and upward pressure on the producer price index. Consequently, the "per linear foot" pavement costs were "back-figured" into quantities (i. e. square yards of concrete pavement, tons of asphalt) associated with pay items with unit prices in the Trns-port Estimator. This allowed the flexibility to estimate various pavement options (e.g. concrete pavement with concrete shoulders, concrete pavement with bituminous shoulders and full depth asphalt pavement). Using these developed quantities and current prices from Trns-port Estimator, the unit price was determine to arrive at the cost of pavement for various options.

Earthwork. The analysis of Year 2004 costs estimate the earthwork required by identifying the construction techniques to be used at different locations. These techniques included: common excavation (all unconsolidated, overburden soil); common excavation with friable (rippable) rock (use of additional equipment above normal excavating procedures); and common excavation with hard rock (blasting or other removal techniques required). Once these areas were identified, and a profile grade established, earthwork quantities were calculated and an estimated construction cost was determined by using the unit prices estimated from the bid tabs.

Existing ground cross sections along with a proposed roadway template were used to calculate the earthwork quantities by the average end area method. For cost estimating purposes, ditch depths on the outside of the roadway were set a minimum of two (2) feet deep, a fifteen percent (15%) shrinkage factor was used and a 30% swell factor was used for rock fills.

In 2007 the model was further refined based on Year 2007 costs. These changes accounted for the abnormal spike in construction costs described above. The models developed had quantities for earthwork that were consistent with the pay items in the Trns-port Estimator. Further refinements in vertical grades lead to an optimization of earthwork quantities. Using these developed quantities and current prices from Trns-port Estimator, cost of earthwork was determined.

Miscellaneous. The analysis of Year 2004 costs calculated quantities for the following miscellaneous items: square yards (SYS) of Subgrade Treatment; lineal feet (LFT) of underdrains; and lineal feet (LFT) of fencing. If identified as a necessary component of the section, estimates also were made of quantities of the following miscellaneous items: lineal feet (LFT) of concrete median barrier; each (EACH) traffic signal; and each (EACH) type of interchange signing and lighting.

Estimates assume that the Subgrade Treatment extends to a point two (2) feet outside the paved shoulder width. Additionally, Subgrade Treatment will be will be utilized under all pavement (i.e. mainline, ramps, other roadways) in both cut and fill sections.

In 2007 the model was further refined based on Year 2007 costs. These changes accounted for the abnormal spike in construction costs described above. The models developed had quantities for subgrade treatment that were consistent with the pay items in the Trns-port Estimator. Using these developed quantities and current prices from Trns-port Estimator, cost of subgrade treatment was determined.

The analysis of Year 2004 costs provided a unit price per lineal foot of underdrains, and included the costs for the following items: six inch (6”) perforated underdrain pipe; geotextiles placed within the excavated underdrain trench; aggregate used to backfill the underdrain trench; six inch (6”) underdrain outlet pipe; and outlet protectors at 650 foot spacing. The unit price assumed one (1) longitudinal underdrain run; therefore for standard divided typical sections (rural or urban) four (4) runs will be necessary: one (1) on each outside edge of pavement and one (1) on each inside (median) edge of pavement. For an urban typical section with a concrete median barrier, three (3) underdrain runs will be necessary: one (1) on each outside edge of pavement and one (1) next to the median barrier.

In 2007 the model was further refined based on Year 2007 costs. These changes accounted for an abnormal spike in construction costs described above. The costs of underdrain per linear foot were “back-figured” into quantities associated with pay items for Trns-port Estimator. Using these developed quantities and current prices from Trns-port Estimator, cost of underdrain was determined.

The analysis of Year 2004 costs estimated fencing requirements (farm field or chain link) for the right-of-way line on each side of the mainline. Therefore, two (2) runs of fencing are required within each section.

In 2007 the model was further refined based on Year 2007 costs. These changes accounted for the abnormal spike in construction costs described above. The models developed had quantities for fencing that were consistent with the pay items in the Trns-port Estimator. Using these developed quantities and current prices from Trns-port Estimator, cost of fencing was determined.

The analysis of Year 2004 costs estimated the unit price per linear foot of Median Barrier to include the following costs: 45" high, standard, concrete median barrier; H-5 inlets at 500 foot spacing; and twelve inch (12") INDOT Type 2 (storm sewer) pipe. Median barrier was used only in urban sections where providing a (minimum) sixty foot (60') depressed median would result in significantly increased impacts.

The analysis of Year 2004 costs estimated the unit price per Traffic Signal, including all necessary components (signal heads, signal poles, detector loops, controller/cabinet, etc.) to construct a traffic signal at a four-legged intersection. Traffic signal locations (e.g. ramps of an urban diamond interchange, intersections of proposed access/frontage roads, etc.) have been identified.

The analysis of Year 2007 costs estimated the unit price per each type of Interchange Signing and Lighting, including all necessary components (sign trusses, cantilevers, panel signs, light masts, luminaries, wiring, etc.). Based on the location and type of interchange, appropriate costs of signing and lighting have been included.

To account for 2007 increases from 2004, the cost of the median barrier, traffic signal, interchange signing and lighting have been increased by 25%. This represents to change in the producer price index from 2004 to 2007 during the time of price volatility.

Percentage Costs. The analysis of Year 2004 costs estimated the following costs as a percentage of the pavement and earthwork costs: mobilization and demobilization; construction engineering (performed by the contractor, not construction inspection); clearing right-of-way; maintenance of traffic; temporary erosion control; pavement markings; signing; landscaping (e.g. seeding, sodding, etc.); small structures (less than 20' span); and other minor costs. Through the bid tab analysis, as described in the methodology section, the PMC determined that the pavement and earthwork costs account for 60.5% of the overall construction cost for the project with the remaining percentage items accounting for 33.45% of the overall construction cost. The remaining amount is accounted for in the miscellaneous items (e.g. fencing, signing, etc.) For cost estimating purposes, the PMC calculated the sum of the percentage costs as a multiplier of the sum of the pavement and earthwork costs. The ratio of (Percentage Costs)/(Pavement + Earthwork Costs) is 0.553.

The 2007 refinements recognized that the original methodology gives an average value for a wide variety of road projects, and that there is the potential for the costs of some items to be

overestimated or underestimated. Accordingly an adjustment factor was introduced that allow the engineer to consider the unique characteristics the project. It provides latitude to adjust the costs to account for these unique characteristics.

Trns-port Items. INDOT provided the PMC with a copy of the American Association of State Highway and Transportation's Officials' (AASHTO's) Trns-port Estimator (construction cost estimating) program for use during the Tier 2 costing process; a list of INDOT Standard Pay Items was also provided for use with the Trns-port program. The provided list of pay items was not intended to be all inclusive. Where additional items necessary to complete an accurate construction cost estimate was needed, a request was made for a pay item number and description for those items. Where any of these items have been identified, they have been included. It should be noted that Trns-port Items are not intended to include items of pavement, earthwork, interchange signing and lighting, and percentage costs, but merely to provide costs for additional items based upon engineering judgment, when these items (such as Mechanically Stabilized Earth walls, paved side ditch, curb, guardrail, etc.) are not included in the other four categories.

For cost estimating purposes, the following parameters were used with the Trns-port Estimator Program to obtain costs for the various items. These cost items are not included in other categories, and are added on a case-by-case basis on the basis of engineering judgment.

- Specification (Spec) Year: 06 (2006)
- Letting Date: 12/13/04[1]
- Unit System: E (English)
- Work Type: G300 New Road Construction
- Highway Type (EEAC to identify appropriate type)
    - INTR Interstate Rural
    - INTU Interstate Urban
- Urban/Rural Type (EEAC to identify appropriate type)
    - R Rural
    - U Urban
- Season: Spri Spring
- County: EEAC to identify appropriate county

Engineering judgment was utilized in determining the validity of each unit price supplied by the Trns-port Estimator program.

Karst Construction. In addition to the five (5) categories listed above, there will be additional costs for portions of the roadway constructed within areas with karst features. The PMC performed an analysis of increased construction costs due to karst features on previous INDOT projects. This analysis showed that an additional five percent (5%) should be added to

[1] This is the letting date for the Year 2004 model used to provide cost estimates in the DEIS. This was modified to a 2007 date for the Year 2007 model used to provide cost estimates in the FEIS.

the estimated roadway construction cost (in areas of karst features) to compensate for the additional cost related to constructing the roadway through areas with karst features. In areas without karst features there will not be an adjustment to the roadway cost.

Roadway Construction Cost. Using the year 2004 costs, a spreadsheet was derived (in Microsoft® Office Excel 2003 format) to calculate the construction cost estimates. The "Roadway Costs" worksheet was used to estimate the construction cost for the pavement, earthwork, miscellaneous and percentage costs items. The total of these costs became known as the Worksheet Roadway Cost. To obtain the Worksheet Roadway Cost, the estimator multiplied the estimated sum of the pavement and earthwork costs by 1.553 (total Pavement + Earthwork Factor for all percentage items) and then added the sum of the miscellaneous items to this product Worksheet Roadway Cost = 1.553*(Pavement + Earthwork) + Miscellaneous. The AASHTO's Trns-port Estimator program was utilized to obtain a total cost of all items on the provided list of INDOT Standard Pay Items identified to be included in the section cost; the total of these costs will be known as the Trns-port Items Cost. Finally, 5% was added to the roadway construction costs for portions of the alignment which pass through areas identified as having karst features. This was designated the Karst Cost. The "Total Section Costs" worksheet is then used to estimate the total roadway construction costs; this cost will be known as the Roadway Construction Cost and is the sum of the Worksheet Roadway Cost, the Trns-port Items Cost and the Karst Cost (Roadway Construction Cost = Worksheet Roadway Cost + Trns-port Items Cost + Karst Cost).

The updated version of the spreadsheet used to provide costs in the FEIS uses Year 2007 construction costs for roadway and bridges in the "total Section Costs" worksheet.

Construction Year. The version of the worksheet used for the DEIS estimated construction costs in year 2004 dollars. The version used for the FEIS estimated construction costs in Year 2007 dollars. In order to have a consistent basis for comparison, it was assumed that construction of all sections of the roadway takes place in 2010. This is only for reporting purposes in the EIS. See Section 4 below for more information.

Section 2. Bridge Construction Cost

Methodology. The analysis of Year 2004 costs for bridges used a price per square foot. More than fifty bridge projects were analyzed to determine these unit costs. Costs from bridge projects that were let previous to 2004 brought to Year 2004 costs with an inflation factor based on the US Department of Labor Producer Price Index for Highway and Street Construction. These bridge projects were then divided into the various types of construction to determine an average cost per square foot by bridge type. These types include: New Bridge / Bridge Replacement, Superstructure Replacement, Deck Replacement, Bridge Widening, and Bridge Maintenance (Milling/Overlay, Joint Replacement, etc.).

This cost included all items associated with the project, from reinforced concrete bridge approach to reinforced concrete bridge approach. For bridges over waterways, bank treatments (riprap, geotextiles, slopewalls, etc.) were included. MSE walls, guardrail, any earthwork to raise (or lower) a roadway for a bridge crossing was estimated and costed separately.

Typical Bridge Construction Cost. The bridge areas were determined using anticipated out-to-out bridge lengths and out-to-out coping widths. The type of work likely to be done to each structure was determined. The appropriate value from Table 1was multiplied by the area of the bridge (in square feet) to estimate its cost. Engineering judgment was used to determine the appropriate type of structure for the crossing. The type of structure is dependent upon the span length, potential clearance problems, etc. The design stage will finalize the type of structure in a Structure Size and Type analysis.

Table 1 Bridge Costs (Year 2004 dollars)

Construction Type:	Cost / ft^2
New Bridge / Bridge Replacement:	
Prestressed Concrete:	
Bulb-Tee Beams:	$80
I-Beams:	$80
Box Beams:	$80
Steel Beams:	
Rolled Girders:	$110
Plate Girders:	$110
Reinforced Concrete Slab:	$105
Box Culvert (Spans ≥ 20 ft):	$100
Pedestrian:	$100
Superstructure Replacement:	
Prestressed Concrete Beams:	
Bulb-Tee Beams:	
I-Beams:	$75
Box Beams:	
Steel Beams:	
Rolled Girders:	$90
Plate Girders:	
Reinforced Concrete Slab:	$75
Deck Replacement:	$40
Bridge Widening:	
(Superstructure Replacement Widening)	
Prestressed Concrete Beams:	
Bulb-Tee Beams:	
I-Beams:	$75

Box Beams:	
Steel Beams:	
Rolled Girders:	$95
Plate Girders:	
Reinforced Concrete Slab:	$75
(Deck Replacement Widening)	
Prestressed Concrete Beams:	
Bulb-Tee Beams:	
I-Beams:	
Box Beams:	
Steel Beams:	
Rolled Girders:	$80
Plate Girders:	
Reinforced Concrete Slab:	
(Widening Only)	
Prestressed Concrete Beams:	
Bulb-Tee Beams:	
I-Beams:	$45
Box Beams:	
Steel Beams:	
Rolled Girders:	$60
Plate Girders:	
Reinforced Concrete Slab:	
Bridge Maintenance:	$30

Complex Bridge Construction Cost. Complex bridges will be required in single point interchanges, directional interchanges or over significant waterways. Four similar projects were studied to estimate the costs associated with such bridges.

Indianapolis International Airport (Midfield Terminal) Interchange at I-70, Indianapolis, Indiana: Three complex bridges were included in this new directional interchange. These bridges are Cast-In-Place Continuous Post Tensioned Box Girder bridges. The bridge carrying an eastbound ramp over I-70, an interchange ramp and collector-distributor routes is seven spans,

with a total length of 1354 feet. The longest span length is 220 feet. The width of this bridge is typically 53'-4" but varies at select locations. The bridge carrying an eastbound ramp over I-70 and eastbound & westbound collector-distributor routes is four spans, with a total length of 820'-7". The longest span length is 221'-8". The width of this bridge is typically 53'-4" but varies at select locations. The bridge carrying a westbound ramp over two westbound collector-distributor routes is two spans, with at total length of 347 feet. The longest span length is 169'-4". The width of this bridge typically is 37'-4", but varies. This project was let in May 2003. Its cost was adjusted to bring it to Year 2004 dollars, based on the US Department of Labor Producer Price Index for Highway and Street Construction. The three bridges were similar in nature, and their square foot cost was determined to be $160/ft^2 in Year 2004 dollars.

SR 66 (Lloyd Expressway) over Green River Road, Evansville, Indiana: Twin structures were built to carry SR 66 over Green River Road. The previous diamond interchange was replaced with an Urban Single Point. The bridges are Continuous Post-Tensioned Bulb Tee Beam bridges. They are three single-span bridges, with a total length of 96.762 m (317.5 feet). The longest span length is 41.509 m (136.2 feet). The width of each bridge is 17.207 m (56.5 feet). As is typical with Single Point interchanges, sight distance is a critical design element. Therefore a more complex substructure configuration was required in the design of this bridge. The square foot cost of these bridges was determined to be $100/ft^2.

This bridge was built in phased construction. Temporary sheeting and shoring was required to stabilize the portion of the roadway that was open to traffic. This project was let in November 2002. Its cost was adjusted to bring it to Year 2004 dollars based on the US Department of Labor Producer Price Index for Highway and Street Construction. The square foot cost of these bridges without the temporary sheeting and shoring was determined to be $100/ft^2, and $135/ft^2 including temporary sheeting and shoring. These costs are in Year 2004 dollars.

Emerson Road over I-465, Indianapolis, Indiana: This structure was built to carry Emerson Road over I-465. The previous diamond interchange was replaced with an Urban Single Point. The bridge is a Continuous Composite Steel Plate Girder bridge. It has two spans, with a total length of 48.751 m (160 feet). Each span length is 24.0 m (78.7 feet). The width of the bridge varies from 75.058 m (246.3 feet) at the end bents to 43.07 m (141.3 feet) at the pier. This bridge is complex in nature because the Emerson Road intersection passes over I-465. Since the focal point of this interchange is on the bridge, the geometry of this bridge is unusual. The project was let in February 1999. Its cost was adjusted to bring it to Year 2004 dollars, based on the US Department of Labor Producer Price Index for Highway and Street Construction. The square foot cost of this bridge was determined to be $140/ft^2 in Year 2004 dollars.

I-465 / I-74 Interchange, Indianapolis, Indiana: Four bridges were included in the I-465 / I-74 Interchange contract. Three of these bridges are within this Directional Interchange, and were studied as a complex structure. In this contract, each of these bridges were designed and detailed twice (generally one design used Steel Girders, and the other design used one of two concrete bridge types, Prestressed Concrete or Cast-in-Place Concrete Box Girders). The contractor

bidding on this project was then given the responsibility to determine the most economic bridge for each of these three structures. For each bridge, the top three bidders based their bids on the same bridge option.

The bridge carrying the southbound I-465 to eastbound I-74 ramp over I-465 is an elevated ramp, and I-74 is a Continuous Composite Curved Steel Plate Girder bridge. It has eleven spans, with a total length of 522.064 m (1712.8 feet). The longest span length is 60.5 m (198.5 feet). The width of this bridge is 12.0 m (39.4 feet). The square foot cost of this bridge was determined to be $\$100/ft^2$ in Year 2004 dollars.

The bridges carrying I-74 over I-465 is a Continuous Composite Prestressed Concrete Bulb Tee Beam bridge. This bridge has three spans, with a total length of 97.967 m (321.4 feet). The longest span length is 40.7 m (133.5 feet). The widths of these bridges vary. The Westbound structure width varies, 16.7 m (54.8 feet) to 17.244 m (56.6 feet). The Eastbound structure width varies, 16.7 m (54.8 feet) to 17.897 m (58.7 feet). The square foot cost of these bridges was determined to be $\$80/ft^2$ in Year 2004 dollars.

The bridge carrying the westbound I-74 to southbound I-465 ramp over I-74, I-465 and a collector-distributed route is a Continuous Composite Curved Steel Plate Girder bridge. It has nine spans, with a total length of 358.054 m (1174.7 feet). The longest span length is 52.304 m (171.6 feet). The width of this bridge is 12.0 m (39.4 feet). The square foot cost of this bridge was determined to be $\$90/ft^2$ in Year 2004 dollars.

This project was let in January 2001. Its cost was adjusted to bring it to Year 2004 dollars, based on the US Department of Labor Producer Price Index for Highway and Street Construction.

Where the need for a complex structure was identified, preliminary layout of the location of the complex structure including spans and pier locations was determined. Using this layout, the parameters (span lengths, required clearances, construction depth, etc.) were used to determine the most economical type of structure for the location. Once the structure type was identified, the costs associated with these example complex structures as well as any other project information found for similar structures, was used to determine the square foot cost to be used for the bridges studied. This determination of the structure size and type was submitted to the PMC for approval. Costs ranged from $100 to $180 per square foot.

As a part of the 2007 review of the Tier 2 costing methodology, these projects were revisited to determine their cost in Year 2007 dollars. Four different methods were used to determine the Year 2007 bridge costs. These methods are as follows:

Method 1: For each New Bridge / Bridge Replacement projects, the bridge items were put into Trns-port with a letting date of 2007. The unit costs from the INDOT Design Manual, Part 6, Figure 06-16A (English units) were used for prestressed concrete structural members and structural steel.

Method 2: For each of the New Bridge / Bridge Replacement projects, the bridge items were put into Trns-port with a letting date of 2007. Since the INDOT Design Manual (IDM) has a fixed cost for prestressed concrete members, actual costs are expected to be higher in succeeding years. A different cost was determined for the prestressed concrete structural members for the Interchange reconstruction project for I-64 / US 231 in Dubois County, let in April 2006. The unit costs for structural members in that contract were, on average, 35% higher than the costs in Figure 06-16A of the IDM. So, for this method, the IDM costs were increased at a rate of 35%.

Method 3: For each of the New Bridge / Bridge Replacement projects, the bridge items were put into Trns-port with a letting date of 2007. The original 2004 bid prices for prestressed concrete structural members and structural steel were increased by the Producer Price Index Inflation Rate of 28.9% (from 2004 – 2007) to determine unit costs.

Method 4: To analyze contractor bids in 2007, nine bridge projects let between January 2007 and March 2007 were analyzed. Some of these bridges were part of significantly larger Interchange Reconstruction or New Interchange Construction projects. Because there is limited information at this time for 2007 construction projects, some types of bridges were not represented in this study.

The results of this new analysis are shown in Table 2. Based on this analysis, a Year 2007 cost of $\$110/ft^2$ is recommended for all typical bridges. During the design phase of this project, a Structure Size & Type analysis will determine the most economical type of structure for each location. Unit costs for complex bridges will be determined as detailed in the Project Guidance Manual. For purposes of this study, cost comparisons for grade separation bridges with spill through slopes were compared with costs for abutment type structures with MSE walls performing that function. If it was more economical to use shorter bridges with the MSE walls, then those costs are used.

Table 2

Construction Type	2004 Cost (original Tier 2 Costs)	2007 Cost Method 1	2007 Cost Method 2	2007 Cost Method 3	2007 Cost Method 4
Prestressed Concrete Bulb Tee:	$80/ft^2	$95/ft^2	$105/ft^2	$90/ft^2	$110/ft^2
Prestressed Concrete I-Beam	$80/ft^2	$80/ft^2	$85/ft^2	$85/ft^2	$110/ft^2
Prestressed Concrete Box Beam	$80/ft^2	$80/ft^2	$80/ft^2	$80/ft^2	$110/ft^2
Steel Plate Girder	$110/ft^2	$115/ft^2	$135/ft^2	$120/ft^2	---
Steel Rolled Girder	$110/ft^2	$100/ft^2	$115/ft^2	$110/ft^2	---
Reinforced Concrete Slab Bridge	$105/ft^2	$90/ft^2	$90/ft^2	$90/ft^2	---
Box Culvert	$100/ft^2	$115/ft^2	$115/ft^2	$115/ft^2	$290/ft^2 *
* 2007 Contracts for Method 4 had only two contracts with large box culverts. This value may not be an accurate representation of the actual square foot cost for box culverts.					

Construction Year. The model to estimate construction costs in the DEIS gave these costs in year 2004 dollars. For comparison purposes, costs were inflated to the Year 2010. The cost model used in the FEIS provided costs in Year 2007 dollars. In both the DEIS and FEIS, costs were inflated to the Year 2010 for comparison purposes. See Section 4 below for information on how costs were inflated to provide Year 2010 costs.

Section 4. Tier 2 Studies Reporting Cost Year Costs Adjustments

Construction Year. The estimated construction cost for roadway and bridges for the DEIS were developed in year 2004 dollars, and then inflated to Year 2010 costs. The PMC analyzed of the U.S. Department of Labor, Bureau of Labor Statistics' Producer Price Index (PPI) for Highway and Street Construction for the period from 1987 to 2004. This analysis determined that the six (6) year inflation factor to be used to convert the estimated 2004 construction cost to 2010 is 37.98% (Construction Cost, 2010 = 1.3798*Construction Cost, 2004).[2]

[2] Between 2004 and 2006, the increase in the Highway and Street Construction PPI was 23.55%. Based on an analysis of the average 10-year increase in the PPI between 1987 and 2005, an annual inflation rate of 2.8% was forecasted for the period between 2006 and 2010. These factors compounded provide an inflation adjustment factor of 1.3798.

The cost methodology used in the FEIS provides Year 2007. Prior to adjusting these costs for inflation, a 10% contingency was added to the 2007 Roadway Cost. This Year 2007 Roadway Cost, with the 10% contingency, was escalated at an annual inflation rate of 3.5% to provide Year 2010 costs. The 3.5% inflation after 2007 represents the standard INDOT inflation value being used by INDOT in its 2007 Long Range Plan Update to project all their projects out to future year of construction.

Design Modifications. At the onset of a large project, the scope of both design and construction may not be easily definable. Additionally, even if a clearly defined scope is determined, the scope may change during the development of the project due to unforeseen circumstances. These potential design modifications can materially affect the final cost of the project. The 2010 construction costs for both roadway and bridges were adjusted to account for design modifications. Roadway and bridge costs were inflated by 2 to 4 percent to account for possible design modifications. These percentages were applied in the cost models used in both the DEIS and FEIS.

Construction Change Orders. After projects are bid there is an increased cost for changes that occur during construction. These "change orders" result in increases in construction costs above the bid price. These changes can occur due to unforeseen field conditions and/or quantities that exceed those estimated (e.g. driving piles longer than anticipated). Once the Year 2010 construction costs were obtained for both roadway and bridges, they were increases by 2.5% to 5% to account for potential change orders. These percentages were applied in the cost models used in both the DEIS and FEIS.

Section 5. Design Costs

Highway Design Engineering. The cost for Highway Design Engineering is a percentage of the Roadway Construction Cost described in Section 1 (above). Different percentages were used depending on if the construction is in an urban or a rural area. For rural areas, the Highway Design Engineering was estimated to range from 4-5 % of the Roadway Construction Cost. Due to the potential for more design complexities within an urban area, Highway Design Engineering in urban areas was estimated to range from 7-8% of the Roadway Construction Cost.

Bridge Design Engineering. The cost for Bridge Design Engineering is a percentage of the Bridge Construction Cost as described in Section 2 (above). The Bridge Design Engineering was estimated at seven to eight percent (7-8%) of the Bridge Construction Cost.

Right-of-Way Engineering and Services. The cost for Right-of-Way Engineering & Services is developed as a part of the Right-of-Way Cost described in Section 7 (below). The Right-of-Way Engineering & Services is the administrative cost listed in that section.

Section 6. Construction-Agency Administration Cost

In order to oversee construction activities, INDOT incurs additional costs which are difficult to quantify. These costs include, but are not limited to: construction inspection, general project administration (e.g. reproduction of construction plans and contract documents), and public outreach. To account for these costs, 7.5 percent of the total constructed cost has been added to the cost estimate in both the DEIS and FEIS cost estimates.

Section 7. Right-of-Way Cost

Relocation and Right-of-way Acquisition Cost Methodology.

The projected relocation and right-of-way acquisition costs for the Tier 2 EIS include right-of-way costs for acreage and improvements required for actual construction, relocation costs, costs for acquiring structures and improvements due to lost access, and administrative fees. These costs were estimates based on field surveys. A windshield survey was conducted to evaluate the properties that would be impacted by the various working alignments.

The properties were categorized into ranges of values as shown on Table 3. The following statement regarding relocation procedures will be included in each Tier 2 EIS: "Final right-of-way requirements have not yet been determined and are only estimated at this time. A home or business was considered displaced if it was located within the project right-of-way or if reasonable access to the property could not be maintained. The displacement of structures is estimated based upon predicted right-of-way requirements. These costs and relocation numbers are for comparison purposes only. They could change after more precise right-of-way requirements have been determined."

The costs shown in Table 3 will be in each Section to reflect local circumstances. These detailed cost estimate tables were used for estimation purposes only and are not included in the EIS documents. Only the totals are reported in the environmental document. Explanations of items in the table are included in the notes following the table:

Table 3
Relocation and Right-of-way Cost (Example)
I-69 Section X
Date:

TYPE	NUMBER (Properties)	COST	NUMBER RELOCATEES	ADMINIS TRATIVE FEE	RELOCATION COSTS	TOTAL COST
Residential-Sp	1	$10,000 (-)	1	$10,000	$20,000	$40,000
Residential-1	1	$10,000	1	$10,000	$20,000	$40,000
Residential-2	1	$20,000	1	$10,000	$20,000	$50,000
Residential-3	1	$50,000	1	$10,000	$20,000	$80,000
Residential-4	1	$75,000	1	$10,000	$20,000	$105,000
Residential-5	1	$100,000	1	$10,000	$20,000	$130,000
Residential-6	1	$125,000	1	$10,000	$20,000	$155,000
Residential-7	1	$150,000	1	$10,000	$20,000	$180,000
Residential-8	1	$200,000	1	$10,000	$20,000	$230,000
Residential-9	1	$250,000	1	$10,000	$20,000	$280,000
Residential-10	1	$300,000	1	$10,000	$20,000	$330,000
Residential-XXX	1	$600,000	1	$10,000	$20,000	$630,000
Farm Homestead	1	$300,000	1	$10,000	$20,000	$330,000
Multi-Family Housing	5	$35,000	1	$10,000	$8,000	$193,000
Church-1	1	$250,000	1	$10,000	$*	$
Church-2	1	$400,000	1	$10,000	$*	$
Church-3	1	$500,000	1	$10,000	$*	$
Gas Station	1	$500,000	1	$10,000	$*	$
Gas Station/Conv Store	1	$750,000	3	$10,000	$*	$
Specialty		$400,000	1	$10,000	$*	$
Commercial-1	1	$100,000	1	$10,000	$*	$
Commercial-2	1	$150,000	1	$10,000	$*	$
Commercial-3	1	$200,000	2	$10,000	$*	$
Commercial-4	1	$250,000	2	$10,000	$*	$
Commercial-5	1	$300,000	2	$10,000	$*	$
Commercial-6	1	$400,000	2	$10,000	$*	$
Commercial-7	1	$500,000	2	$10,000	$*	$

TYPE	NUMBER (Properties)	COST	NUMBER RELOCATEES	ADMINIS TRATIVE FEE	RELOCATION COSTS	TOTAL COST
Commercial-8	1	$750,000	2	$10,000	$*	$
Bill Boards	1		1	$10,000	*	$
Special (Large facility)		$0	0	$10,000	*	$0
Damages	NA	$3,500,000	0		*	$3,500,000
SUB-TOTAL						$
	Area (AC)			Unit Cost ($/AC)		
Aggregate Land Value Estimate		1		$10,000		$10,000
Unimproved Parcel Estimate**	10			$10,000		$100,000
SUB-TOTAL						$
TOTAL						**$**

* To be determined by estimator.

** Includes additional parcels and parcels without significant structures. This includes unimproved farmland, pasture and forest.

Notes for Above Table:

1) Effective dates for cost estimates were 2005 dollars. Final reported costs were updated to 2010 dollars. The section following these notes explains how these cost adjustments were made.

2) For purposes of this study, the Administrative Fee per parcel was $10,000 (see Table 3). The estimate for multi-family and commercial relocatees is modified based on individual circumstances. The Administrative Fee of $10,000 per parcel covers the cost of R/W Services. Right-of-way services include appraisals, reviews, buying, recording and property management. This figure is an estimate based on recent INDOT right-of-way acquisitions.

3) A Relocation Cost Estimate of $20,000 per single-family residential relocation and $8,000 for each residential unit in a multi-family development was used in the table for an average

cost. This fee includes differential housing payments, closing expenses and other residential relocation benefits. This figure is an estimate based on recent INDOT relocation costs. The figure was revised if local circumstances warranted a revision.

4) Utility-related costs for impacts to large transmission lines, service structures and substations include only land values. Utility relocation costs were estimated as part of construction costs.

5) Billboards are included in the R/W estimate and considered as individual parcels. Large business signs that are located on the business site were included as a part of the property acquisition at that site.

6) Commercial and industrial properties were considered to only have sites large enough to sufficiently support the existing improvements. Cost is the estimated market value of the improvements on only a site large enough to support the improvements. Excess land associated with a particular facility was included under aggregate land values.

7) Working farms are evaluated as businesses, separate from the household relocations. The farm was considered to be separate business relocation.

8) For illustrative purposes the commercial/office/industrial section was divided into eight (8) categories. These were adapted to suit the section being studied.

9) Commercial/office/industrial parcels may also include additional relocatees, such as tenants and related businesses.

10) Landlocked parcels and damaged parcels (where acquisition involves a portion of the property) were grouped under Damages. Landlocked parcels, land and homes without legal access to a road or highway were considered as being purchased. Parcels that were damaged by loss of value or utility such as parking, setbacks and other losses were noted and included under Damages.

11) Since this study was done with limited title information, the estimator may have included additional parcels in the estimate to cover title issues. The Estimator made this determination based on the quality, quantity and availability of information.

12) Unimproved right-of-way to be acquired is included in the aggregate land section. The aggregate land value is a weighted average of the land to be acquired within each section. The aggregate land value estimate is an average of the different land types (commercial, agricultural, residential, etc.) weighted and combined to derive a weighted average rate.

13) This will be a Limited Access Facility and access rights will be acquired as part of the project. Therefore any damages incurred were included in the right-of-way cost estimates.

Tier 2 Studies R/W Reporting Cost Adjustments

The value of property along with administrative costs and costs for relocation services were obtained in the Year 2005 and noted as the present value. For reporting purposes in the Tier 2 studies, the values were adjusted to expected value in the year 2010. Additional information was obtained to make projections of future property values for southwest Indiana.

For Tier 2 I-69 Sections 1 through 4 – A 4.0% per year increase was applied to total right-of-way and relocation costs to obtain Year 2010 costs.

For Tier 2 I-69 Sections 5 and 6 - A 4.5% per year increase will be applied to total right-of-way and relocation costs to obtain Year 2010 costs.

These inflation rates are average percent per year increases for the various types of property along the corridor, i.e., residential, farmland, developing land etc. It also is necessary to account for increases in administrative costs and costs for relocation services associated with the property acquisitions. These administrative costs are not increasing at the same rate as property values. INDOT estimates that administrative costs are increasing at approximately 1% per year.

Following are the sources for the inflation rates estimated above:

1. Office of Federal Housing Enterprise Oversight - 10 year House Price Index for Indiana (including the Evansville, Bloomington and Indianapolis MSA's).
Bloomington MSA - 4.2% yearly increase in House Price Index for past 10 years
Indianapolis MSA - 4.1% yearly increase
Evansville MSA - 4.9% yearly increase
Indiana - 4.5% increase

2. 2005 Outlook for Indiana Farmland Values and Cash Rent, Craig L. Dobbins - Department of Agricultural Economics, Purdue University, August 2004.
Percent Change in land values (June 2003 to June 2004) for top and average land:
Southwest Indiana - 3.5% to 5.3% (includes Vanderburgh, Gibson, Pike, Daviess and Greene Counties)
Southeast Indiana - 3.1% to 6.1% (includes Morgan and Monroe Counties)
Central Indiana - 6.3% to 6.4% (includes Johnson and Marion Counties)

3. INDOT Production Management Division - Real Estate (Estimates for administrative costs and relocation services) assume about a 1% increase per year. These costs make up about 10 to 20% of the total right-of-way and relocation cost.

Consequently, the adjustments of R/W and relocation costs obtained above were determined by multiplying the cost by the factor to get values for the year 2010. For Sections 1 through 4, an

adjustment factor of 1.217 (5 years at 4% (uncompounded)) was used. For Sections 5 and 6, an adjustment factor of 1.246 (5 years at 4.5% (uncompounded)) will be used.

Section 8. Utility Relocation Costs

Ongoing coordination has occurred with local utilities regarding potential conflicts with their facilities. Where it was determined that a major utility (e.g. electric transmission lines, gas transmission pipelines, etc) would need to be relocated due to the proposed construction, and if the relocation is determined to be eligible for reimbursement (i.e. the utility company has an easement for their facilities), then an estimated relocation cost from the affected utility company was determined through consultation with that utility. The total cost of all necessary relocations for each alternative studied is the Utility Relocation Cost. Costs of Relocation of major facilities developed for the present year were projected into the future to 2010 dollars. For the DEIS cost estimates, the increase in construction costs projection of 37.98% from 2004 to 2010 was applied to utility relocations. Consequently the utility relocation costs determined in 2005 were increased by a factor of 1.3798 to reflect 2010 dollars. For the FEIS cost estimates, utility relocation costs in 2007 dollars were increased 20% to get to 2010 dollars. This represents about 11% in inflation with the remainder representing a contingency in that more refined estimates from utilities will be forthcoming during design and that the location of additional facilities which could not be identified at this time, or for new facilities constructed in the project area prior to the construction of the project.

Section 9. Mitigation Costs

The PMC was responsible for providing guidance regarding mitigation information (cost, amount, location, etc.) for all mitigation that will take place outside of the proposed right-of-way for each section (e.g. wetland mitigation, core forest mitigation, etc.). Much of this base information for determining costs was provided by INDOT. This Section's study identified potential mitigation measures and associated costs for each proposed alternative, as well as mitigation that is to be applied to account for impacts within the Section. Mitigation costs are estimated for all of Section 1, since they are not easily broken down by subsection. See Chapter 7.4 for a discussion on these mitigation costs.