

Alternatives Development and Evaluation Methodology Technical Memorandum (DRAFT)

Illiana Expressway Study

Cost Estimating Procedure for Roadway System Alternatives

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This memorandum describes the procedures that were used to prepare the conceptual level cost estimates for all Roadway System Alternatives for the Illiana Expressway Study. The estimates were intended to provide an early indication of the magnitude of costs for the roadway component of alternatives to be considered, and to support the alternatives evaluation process. This memorandum does not evaluate transit related costs and improvements at this time, although any proposed corridor and/or alternatives to be studied would provide a footprint which allows for the potential accommodations of future multi-modal elements (e.g. light rail, commuter rail, freight rail, etc.) as well as add lanes.

Background

The cost analysis procedures presented in this memorandum represent the first in a series of cost analyses that will be performed during or throughout the current project stage (Tier One studies) utilizing Microstation (V8i) and Geographical Information Systems (GIS). Each cost analysis was prepared on the basis of currently available information (e.g. level of design detail), and is structured to support decisions either at-hand or that are prepared. It is anticipated that the following series of analyses will be performed to support Tier One decisions and documentation:

- 1) Roadway System Alternatives (First Round Screening): Estimates prepared at this stage were based upon only one representative conceptual design layout (i.e. typical section) for roadway improvements, along with associated footprint limits generated for the purposes of developing and testing the cost estimating methodologies and baseline costs. This was the basis for analyses of multiple alternatives within the corridor, in which each alternative a cost estimate was provided. Given the very limited information regarding the alignments and tie-points to the existing roadway infrastructure condition available in the first round screening, these estimates were prepared on the assumption of new mainline rigid pavement and reconstruction of impacted cross roads within the designated footprint areas, and prepared in (2010)

dollars. Estimates considered construction, engineering, and right-of-way acquisition costs. Potential re-use of existing roadways, as well as cost comparisons for alternate conceptual design layouts and treatments (e.g. interchange and structure type alternates) will be considered as part of subsequent Tier Two Studies. There are limited proposed access points to this new proposed freeway. Proposed access points are planned to limited to state routes (service) and interstate (system) facilities.

At this stage, conceptual design layouts for each alternative include required transitions along existing interstate, state, and local roads in the vicinity of new and improved system and diamond interchanges, as well as estimated costs for needed supporting improvements along adjacent existing facilities. Estimated costs for new pavement improvements within the transition sections included are based on the following assumptions:

- Additional construction needed above and beyond the 2040 Baseline condition for these roadways is assumed as new construction quantities.
 - In order to estimate conservatively, the outermost lane for the transitions from Interstates 55, 57 and 65 to the proposed Illiana Expressway are proposed to be reconstructed to accommodate future system interchanges. Any proposed lanes greater than the 2040 Baseline are not considered as part of these estimates at this time. It is assumed that the terminus system interchanges would be more complex in nature and would designed to maximize traffic flow.
- 2) Roadway System Alternatives (Second Round Screening): Estimates prepared at this stage were based on a refined representative conceptual design layout and associated footprint limits from the alignments carried forward from the First Round Screening. A detailed cost analyses for four alignments were performed based on conceptual layouts and treatments (e.g. interchange and structure type alternates) to validate the first round screening parametric cost analyses. After the validation of parametric analysis was performed the first round screening system alternatives was updated. Estimates for improvements along existing roadways were prepared on the assumption of full reconstruction within improvement areas including refinements to tie-in areas where proposed improvements meet existing freeways, and will be prepared in present year (2011) dollars.
- 3) Risk Based Cost Analysis: These estimates will be prepared to support development of the Initial Financial Plan for the preferred system alternative to be identified in the Tier One FEIS. The estimates will be developed to represent the predicted cost range in implementation year terms, based on potential implementation strategy(ies), schedule(s), and consideration of risk factors.

Methodology

A Unit Cost analyses for the Roadway System Alternatives was prepared to average equivalent unit pay items from Indiana, Illinois, Will County and Illinois Tollway bid tabs to an average price per unit for cost estimating purposes (see Figure 1 below):

Cost opinions for the Roadway System Alternatives were prepared on the basis of the following assumptions:

- Complete construction of mainline, interchanges, state roadways and local roadways, including all pavement and structures within the defined footprint limits; as noted previously, potential re-use of existing pavement will be considered with future Tier Two Studies. Pavement removal, to be consistent with Indiana, is included in the cost of the Earthwork and Grading.
- Right-of-Way (R.O.W.) costs were estimated based on the conceptual footprint limits developed for use as part of the System Alternatives impact analyses, as well as current property assessment information available in the GIS database. The fair market value will be calculated based on the current parcel assessments conducted by each taxing entity (i.e. Will, Kankakee, and Lake County) and refined during Tier Two Studies.
- A one-tenth (0.1) percent construction contingency is included in the total construction cost, during Tier One, to account for unanticipated elements and potential cost increases resulting from subsequent design refinements (Unquantifiable Pay Allowance). Note that the contingency is not intended to cover anticipated inflation.
- At this stage, no R.O.W. contingency is being applied. As the R.O.W. is further refined in Tier Two Studies, a typical thirty (30) percent contingency will be added for items including but not limited to relocation, legal costs, and damages to remainder, is applied to account for the many uncertainties at this stage of the project, but another option could consider the IDOT District One approach to land acquisition from their experiences. This approach would generally consist of multiplying the construction estimate by a magnitude of 1.5 times and assume that all parcels will go to condemnation. Note that the contingency is not intended to cover anticipated inflation.
- Engineering costs for final design (Phase 2 Engineering), construction inspection services (Phase 3 Engineering), and Program Management (PM) was based on a percentage of total construction cost.
- Costs are represented in year 2010 dollars. Construction durations, time between major phases of construction, and inflation have not been considered at this time. As noted previously, predicted costs in implementation year terms will be developed with the subsequent Risk Based Cost Analysis.

Major Construction Items and Unit Costs

The cost model relies on quantity estimates for major items that have the greatest influence on construction cost and which can reasonably be defined at this early stage of concept design. These items include:

- New Pavement
- Demolition and Removal
- Earthwork and Grading
- Interchanges
- Roadway Structures
- Des Plaines or Kankakee River Bridge
- Utility Relocations
- Alternative to include Tolling Facilities
- Roadway Safety
- Mitigation

The quantity basis and suggested unit costs are shown in Tables 1 and 2 for the above items. As the study process moves forward, unit costs may need to be adjusted accordingly to utilize the most construction pricing information.

The cost model accounts for all other items as a percentage of the major construction items listed above. Table 3 presents a suggested percentage range for these items and the basis for which they are applied. All percentages are based on historical construction cost data from projects of a similar nature.

New Pavement

The area of new pavement required was developed using one representative typical section times the conceptual alternative alignment length as depicted in GIS for the mainline, state and local roads. The unit cost of new pavement includes base and sub-base materials. A more durable rigid pavement (Jointed Concrete) structure is assumed for the mainline and ramps. For Collector-Distributor (C-D) roads, a rigid pavement is being proposed as a major portion of the impacted roads (70%), with a portion of the impacted roads being flexible pavement (30%) to come to an average unit costs based on these percentages. In addition, all paved shoulders have been treated the same as the adjacent roadway. Pavement design and pricing could vary significantly depending on the material selection and agency ownership. The detailed analyses performed in the second round screening validated the unit costs and assumptions provided in the first round screening. The design and pricing should be evaluated further based upon pavement life cycle during the Tier Two Studies. Estimated costs for new pavement in this opinion of costs are calculated as "Lane/Mile" for mainline pavement and a per "Mile" basis for all other roads.

Demolition and Removal

Demolition and removal costs were estimated based on the conceptual footprint limits developed for use as part of the System Alternatives impact analyses, as well as current property assessment information available in the GIS database. As a first cut, impacted parcels are grouped by type (commercial, farm, residential/Unknown) and historical

demolition and removal costs were used. At this stage, a cost was provided if the impacted parcel type was impacted by the corridor of each alignment on a per each basis. In the second round screening, these impacts will be refined and fair market costs will be calculated based on the tax assessment values obtained from each County agency for each parcel type. Additionally, in the second screening an analysis will be conducted to determine whether full and/or partial acquisitions are required (The costs of land acquisition are to be included in the ROW acquisitions costs). If full acquisition is required and impacts to that particular unit of the parcel are impacted, a cost will be provided as a per each basis to remove and demolition that particular unit of parcel type.

Earthwork and Grading

Roadway profiles and cross sections were not developed in the first round screening for all alternatives; thus, earthwork quantities were based on a conceptual typical section freeway cross-section. The cost is the product of an assumed depth multiplied by the trapezoidal width multiplied by the total lane miles of proposed pavement. In the subsequent second round screening, conceptual roadway profiles and cross-sections were developed to validate the quantity and unit costs. Hauling distances were considered more closely as part of the second round screening resulting in a lower unit costs. Estimated costs for earthwork and grading in this estimate were calculated as per cubic yard and converted to a per mile basis. As noted previously, pavement removal is included in the unit cost of this category and can be broken out independently as part of future Tier Two Studies. Potential re-use of existing pavement will also be considered with future Tier Two Studies.

Interchanges

Interstate (System) Interchanges:

System interchanges were estimated from the conceptual plan view information in GIS and then refined conceptually in the second round screening in V8i. Each interchange is evaluated based on complexity and various alignment alternatives. The cost for system interchanges is identified as per each system interchange at a lump sum cost. This cost category consists of the following:

- At this stage, the conceptual estimate includes a more durable rigid pavement, base and sub-base materials for mainline and transitional pavement adjacent to ramps, pavement on the ramps, shoulders, flyovers, structures, minor clearing operations, earthwork and grading, erosion control, drainage, guardrail, lighting, signage and pavement markings, traffic control, temporary traffic control, curb and gutter, environmental mitigation, incidental items, slopewall, parapets, retaining walls, channel excavation, and utility relocations. The unit costs assumed were based on past experiences with other planning level projects and engineering judgment. A higher level conceptual cost comparison for alternate design layouts and treatments (e.g. interchange and structure type alternates) will be considered as part of subsequent Tier Two Studies.

State Roadway (Service) Interchanges:

Service interchanges were estimated from the conceptual plan view information in GIS and then refined conceptually in the second round screening in V8i. The cost for service interchanges is identified as per each service interchange at a lump sum cost. This cost category consists of the following:

- New overhead bridge costs were calculated based on the width of the roadway (5 - 12 foot lanes plus 2 - 8 foot shoulders and parapets or walls). Mainline rigid pavement, C-D rigid pavement, transitional pavement adjacent to ramps, ramps, shoulders, traffic signals, minor clearing operations, earthwork and grading, erosion control, drainage, guardrail, lighting, signage and pavement markings, traffic control, temporary traffic control, curb and gutter, environmental mitigation, incidental items, sloped wall, parapets, retaining walls, channel excavation, and utility relocations. The unit costs assumed were based on past experiences with other planning level projects and engineering judgment. Potential re-use of existing roadways, as well as cost comparisons for alternate design layouts and treatments (e.g. interchange and structure type alternates) will also be considered as part of subsequent Tier Two Studies.

Roadway Structures

The roadway structures category consists of multiple cost categories identified in the cost estimate and are categorized as the following: Mainline, Overhead, Railroad, Roadway Crossings, and Waterway Crossing structures. New bridge costs were calculated based on the width of the roadway (travel lanes plus shoulders and parapets or walls) for all non-interchange structures. In the first round screening, the structure limits were estimated from using a typical bridge cross-section for a mainline or overhead type structure using similar facility types to estimate a typical square footage times each crossing identified in GIS and validated in the second round screening. Potential re-use of existing roadways, as well as cost comparisons for alternate design layouts will be considered as part of subsequent Tier Two Studies. Railroad Crossing Bridges consisted of structures that would carry a railroad facility and were estimated using similar facility types to estimate a typical square footage times each crossing identified in GIS and the limits of the structures were refined as part of the second round screening. Roadway Crossings are categorized as crossings that would carry larger tributary areas and/or floodplains as identified in GIS and refined with engineering judgment in the second round screening. Waterway crossings were assumed to be a box culvert type structure (assumed 200 feet in length for a 10' x 4' Precast box culvert) that would carry minor tributary areas as identified in GIS and modified as part of the second round screening. Estimated costs for Mainline, Overhead, Railroad, and Roadway Crossings in this estimate are calculated as per square foot (ft²). Estimated costs for Waterway Crossings in this estimate are calculated as per each basis (Each).

Des Plaines or Kankakee River Bridge

Due to the complexity and many options of the type and size of the structure, the Des Plaines or Kankakee River Bridge may need to be broken out separately in the Tier Two Studies. Depending on the crossing location, the magnitude of the bridge can vary

vastly. At this stage, it was assumed that the structure type that would carry the proposed mainline over the Des Plaines or Kankakee River for each of the various alternatives and would be similar in nature to the Interstate 355 Structure over the Des Plaines River and be included in the cost of the I-55 Interchange. The I-355 bridge was 1.3 miles in length and consisted of pre-stressed bulb tee girders, 34 piers, and 270 foot post tension concrete girders, which was \$50 million cheaper than steel girders.

Utility Relocations

The utility relocations category consists of multiple cost categories identified in the cost estimate and identify major specialized utilities into the following two categories; Pipelines and High Tension Power Lines. Field and data investigations, along with utility correspondence will have to be undertaken to discover any other potential "Special Utilities" in Tier Two to identify actual project impacts. Pipeline relocation costs were conceptually located in GIS and unit cost were developed using historical data for projects using similar networks at a typical cost per lineal feet. High Tension Power Lines were conceptually located in GIS and unit cost were developed using historical data for projects using similar networks at a typical cost per each.

Alternative to include Tolling Facilities

The cost of each tolling facility was conceptually located by the product of engineering judgment and historical data for projects using similar tolling networks. It is assumed that each alternative will carry the same amount of mainline tolling facilities. Ramp facilities will be designed based on effective toll collection layout with minimal collection site cost impacts but no free ride basis. Collection method may not be common for all design scenarios based on number of access points or configuration of system interchanges. It is assumed at this time that each facility would be all electronic tolling collection (AETC) and that no additional ROW would be required to accommodate such facilities. A significant cost that will be considered as part of a tolling facility is the fiber optic communications network. The unit cost will support all materials, installation and the system components required to transmit the data and video.

Roadway Safety

This cost category is intended to cover the locations and approximate heights of the Jersey barrier wall (42") and or guardrail can be conceptually located by the product of engineering judgment and historical data for projects using similar networks at a typical cost per mile. The location and layout assumptions will be modified as part of the subsequent Tier Two Studies.

Mitigation

This cost category is intended to cover the cost of mitigation of wetlands on a per acre cost basis. These costs were generated using historical data for projects of the same type and in the same geographic location. Mitigation generally consists of mitigating wetlands on a 1:1 basis. A more detailed analysis, along with alignment modification in Tier Two will allow for the modification of the mitigation ratio, the costs of the mitigation, and provide various mitigation alternatives.

General Drainage

This cost category is intended to cover all roadway drainage including storm water retention/detention, median drains, catch basins, inlets, box culverts, laterals, bio-swales, roadside ditches, etc. Drainage costs have been based on a percentage of the roadway pavement cost at this stage. As part of the subsequent Tier Two Studies, a more detailed estimate can be provided. However, for the Tier One study, a conceptual understanding of cross-sections (open/closed drainage) allows for a high level assumption of a percentage of the total pavement costs. In cases where special drainage features are anticipated (e.g. pump stations), a separate line item will be provided for these costs in the Tier Two Studies. All values provided in the cost summary tables represent the product of engineering judgment and historical data for projects using similar drainage networks.

Retaining Walls and Noise Walls

This cost category is intended to cover the location and approximate heights of the retaining walls. This analysis has not been determined at this time since roadway profiles and cross sections were not developed in detail; thus, the estimated construction cost is based on a percentage of roadway pavement cost. To be conservative on the percentage, the percentage is assumed to be weighted to take into consideration that fifty (50) percent of all retaining walls are soldier pile walls and fifty (50) percent are MSE walls. As part of the subsequent Tier Two Studies, the face area of exposed retaining wall will be determined from the conceptual plan view information in V8i. The type of retaining wall has not been considered at this time. Locations of the noise abatement walls will be estimated for each alternative, at locations adjacent to residential areas. The estimated construction costs are based on the plan length of each noise wall and an average height (10-15 feet at this point used based on the product of engineering judgment and historical data for projects using similar networks) assumed throughout the alternatives. As part of the subsequent Tier Two Studies, the face area of exposed noise abatement walls will be based upon the conceptual plan view information in V8i. The type of noise abatement walls have not been considered at this time.

Geotechnical Treatments

This cost category is intended to cover all roadway geotechnical treatments based on a percentage of the total pavement cost which was based on the product of engineering judgment and historical data for projects using similar networks. Detailed coring of the corridor could be performed in Tier Two Studies, which would allow for the refinement of the percentage of this estimate and alternative remediation options.

Signing, Lighting, Striping, Signals, ITS, and ATMS

This cost category is intended to cover the cost of the roadway signing, lighting, striping, signals, ITS, and ATMS are being represented on a percentage of the total pavement costs.

Soil Remediation

This cost category is intended to cover the cost of the project's special waste sites within the roadway improvement limits, based on GIS data provided by published sources and governmental agencies including the Environmental Protection Agency. The identified

sites include: Comprehensive Environmental Response and Liability Information System (CERCLIS) (Active); CERCLIS (Archived); Leaking Underground Storage tanks (LUST); UST; Resource Conservation and Recovery Act (RCRA); Site Remediation Program (SRP); Toxic Release Information (TRI) and Landfills. These sites vary by size and type and are represented as a data point in the GIS database. At this stage, impacts are accounted for as percentage of the total pavement costs. With the exception of areas of high More accurate estimates of site remediation requirements will be developed with future Tier Two Studies.

General Other (Unquantifiable Pay Allowance)

This cost category is intended to cover all other general roadway and structural incidental items that will be evaluated and refined as part of the Tier Two Studies. These general items represent items such as; minor utility impacts, bike/pedestrian facilities (including paved trails and crossing locations within roadway improvement limits), curb and gutter, landscaping, mobilization, clearing and grubbing, access fencing, temporary shoring for bridges and roadway items directly associated with structure construction. These unknown associated costs, at this stage are being represented on a percentage of the total pavement cost.

Erosion Control and Landscaping

This cost category is intended to cover the cost of erosion control and landscaping costs during construction and is based on a percentage of the total pavement cost. Erosion control and landscaping costs include all sediment and erosion control, seeding, mulching, etc. to minimize erosion measures.

Mobilization

This cost category is intended to cover the cost of mobilization based on a percentage of the total pavement cost.

Traffic Control (Maintenance of Traffic)

This cost category is intended to cover the cost of traffic control during construction and is based on a percentage of the total pavement cost. This category includes all typical traffic control and detours including, but not limited to; temporary signing, temporary pavement and pavement marking, temporary signalization, channelizing devices, barricades, etc. However, with the new proposed facility to be constructed in a green-field, the traffic control will be limited to where the new facility crosses the existing facilities. Costs will be refined at the Tier Two Studies, but we anticipate that this cost will be lower than construction and/or reconstruction of an existing facility.

Engineering (Phase 2)

This cost category is intended to cover all the associated design documentation to construct the proposed project (Phase 2). These assumed costs are estimated as a percentage of the total construction cost at this time. It is assumed that this task will require a more detailed Professional Services Agreement after the approval of the Tier Two Studies.

Construction Inspection Services (Phase 3)

This cost category is intended to cover all the associated construction inspection services to observe the proposed project (Phase 3). These assumed costs are estimated as a percentage of the total construction cost at this time. It is assumed that this task will require a more detailed Professional Services Agreement after the approval of the Phase 2 Contract Plans.

Program Management (PM)

This cost category is intended to cover all the associated program management costs to oversee the Phase 2 and Phase 3 portion of the proposed project. These assumed costs are estimated as a percentage of the total construction cost at this time. It is assumed that this task will require a more detailed Professional Services Agreement after the approval of the Phase 2 Contract Plans.

Right-of-Way Acquisition

R.O.W. costs were estimated based on the conceptual footprint limits developed for use as part of the System Alternatives impact analyses, as well as current property assessment information available in the GIS database. The fair market value will be calculated based on the current parcel assessments conducted by each taxing entity (i.e. Will, Kankakee, and Lake County) and refined during Tier Two Studies. Once the Finalist System Build Alternatives are carried forward, a more detailed R.O.W. cost analysis will be conducted. As part of the second round screening the R.O.W. was modified for the two corridors. These corridors were reflected with one representative typical section, along with conceptual access control at the interchanges in order to validate the first round screening assumptions. The quantity included in the Estimated R.O.W. acquisition costs reflect only permanent property impacts identified to date with conceptual design studies. Detailed R.O.W. acquisition requirements, including temporary and permanent easements will need to be developed during future Tier Two Studies. Estimated costs for R.O.W. acquisition in this estimate are calculated as per acre.

Table 1 - Roadway Pavement and Interchange Costs

Item	Unit Cost	Unit
Pavement (CRCP includes shoulders)	\$371K	Lane/Mile
Pavement HMA C-D and/or shoulders)	\$354K	Mile
Demolition and Removal - Residential/Unknown, Commercial & Farms	\$200K	Each
Earthwork and Grading	\$3.01M	Mile
Interchanges with Interstates (I-55)	\$15M	Lump Sum
Interchanges with Interstates (I-57)	\$5M	Lump Sum
Interchanges with Interstates (I-65)	\$16M	Lump Sum
Service Interchanges	\$3M	Each
Utility Relocations- -Pipelines -High Tension Power Lines	\$3.5K \$500K	Lineal Feet Each
Tolling Facilities- -Mainline -Ramp -Fiber Optic	\$300K \$125K \$250K	Each Each Mile
Roadway Safety -Barrier Wall -Guardrail	\$370K \$352.5K	Mile Mile
Mitigation	\$75K	Acre

Table 2 - Structure Costs

Item	Unit Cost	Unit
Roadway Structures -Mainline -Overhead -RR Crossings -Roadway Crossings -Waterway Crossings	\$221 \$146.2 \$150 \$110.5 \$1.43M	Square Foot Square Foot Square Foot Square Foot Each
Des Plaines River Bridge	\$110M	Lump Sum
Kankakee River Bridge	\$80M	Lump Sum

Table 3 – Other Cost Items Based on Major Construction Costs

Item	Percent of Costs	Cost Basis
General Drainage	4%	Total Pavement Cost
Structure - Retaining Walls	0.1%	Total Pavement Cost
Structure - Noise Walls	3.8%	Total Pavement Cost
Geotechnical Treatments	8-11.5%	Total Pavement Cost
Utility Relocations	5%	Total Pavement Cost
Signing, Lighting, Striping, Signals, ITS, and ATMS	1.5%	Total Pavement Cost
Soil Remediation	8-16%	Total Construction Cost
General Other (Unquantifiable Pay Allowance)	0.1%	Total Construction Cost
Erosion Control and Landscaping	1.5-2.5%	Total Construction Cost
Mobilization	1.5%	Total Construction Cost
Traffic Control (MOT)	5%	Total Construction Cost
Engineering (Phase 2)	4%	Total Construction Cost
Construction Inspection Services (Phase 3)	8%	Total Construction Cost
Program Management (PM)	2%	Total Construction Cost
Risk and Unallocated Pay Item Contingency	30%	Total Cost