APPENDIX H

Cost Estimating Procedures for Roadway System Alternatives

Prepared For:

Illinois Department of Transportation

Indiana Department of Transportation

Prepared By:

Parsons Brinckerhoff

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1.0 Introduction

This document describes the procedures used to prepare the conceptual level cost estimates for all Roadway System Alternatives for the Illiana Corridor study. The estimates are intended to provide an indication of the magnitude of costs for the project components for the Illiana Corridor to be considered in Tier Two Final Environmental Impact Statement (FEIS), and to support the alternatives evaluation process.

2.0 Project Background

The cost analysis is part of a two tiered National Environmental Policy Act (NEPA) process. The Tier One EIS was prepared in January 2013 to resolve issues regarding the transportation mode, facility type, and general location. The Tier One EIS was completed at a sufficient level of engineering and environmental detail to resolve the mode, facility type (e.g., type of roadway), and corridor location. The Tier One EIS resulted in the identification of a preferred corridor; Corridor B3. The selected corridor is a 2,000-foot wide, 50-mile long, east-west oriented corridor with a western terminus at I-55 just north of the City of Wilmington in Illinois and an eastern terminus at I-65 approximately 3 miles north of SR 2 in Indiana. The project is currently in the Tier Two NEPA process. The procedures in this memorandum represents a continuation of the series of cost analyses performed during the Tier One EIS and updated to represent the Corridor B3 utilizing Microstation (V8i) and Geographical Information Systems (GIS). Cost analyses was prepared on the basis of currently available information (e.g. level of design detail and digital terrain modeling), and is structured to support decisions either at-hand or that have been incorporated into the proposed project at this point. The analyses involved providing a range of conceptual cost impacts for the alternatives being considered in the Tier Two study.

3.0 Methodology

The Tier Two cost analyses completed two additional steps in support of the Tier Two cost analysis:

- Unit cost determination and calibration,
- Tier Two DEIS quantity breakdowns and takeoffs

The unit cost determination and calibration began in Tier One with a parametric major pay item estimate using major construction categories and conceptual corridor design alternatives. The Tier Two DEIS provides additional refinement to the major construction categories by providing a list of over 190 unique pay items that were quantified and separated out based on actual design and layout takeoffs.

The unique individual pay item breakouts were calibrated to similar projects and historical unit price tab information from both Illinois and Indiana. The projects were calibrated based on the character of the project, for example rural or urban, project location, order of magnitude of quantities, and year of expenditure.

Example projects used for calibration include I-69 Section 2 and 3 Oakland City to Crane, Brisbin. The Tier Two study continued to use the detailed calibrated pay item list in future cost analyses.

As the project progressed further into Tier Two, additional information was provided for the conceptual design to refine the estimates further, such as additional design information based on NEPA process, detailed topographic and terrain modeling, major utility correspondence, and public feedback. Using the 190+ unique pay items, the Tier Two cost estimate reflects more of a traditional quantity takeoff approach utilizing the unit prices assessed in 2012 dollars with adjustments for the Calibration Stage and adjusted as necessary for conceptual design updates. The Calibration Stage included adjustments for project location, size of project, inflation, and order of magnitudes for quantities. Thus, the Tier Two estimates applies a detailed pay item approach and does not use the standard Phase I parametric pricing.

In addition, the project cost estimates incorporated risk analyses using a Monte Carlo model. The Monte Carlo model is an analytical technique with large numbers of simulations using random quantities to determine variations in a variable (i.e., costs) based on looking at a distribution of results to infer the most likely scenario based on a prescribed level of confidence required. The risk assessment addressed potential quantity and unit cost ranges associated with individual pay items, as well as project risks associated with the overall project affecting schedule and costs. The associated Monte Carlo results are incorporated into the project cost as contingency.

3.1 FHWA Major Project Review

The Federal Highway Administration (FHWA) completed a "Major Project Review" of the project in August 2013. The objective was to conduct an unbiased risk-based review to verify the accuracy and reasonableness of the current estimate and apply an independent risk based probability range for the cost estimate. The findings are discussed in the Tier Two FEIS.

4.0 Major Construction Items and Unit Costs

The cost analyses used in the Tier Two study rely on detailed quantity takeoffs for items that have the greatest influence on construction cost and which can reasonably be defined by preliminary level of Tier Two design. The quantities are grouped into the four headings as listed below.

- Roadway Related Items

- Structures
- Land Acquisition and Right-of-Way Related Items
- Engineering Services

4.1 Roadway Related Items

This category includes pay items related to roadway pavement, demolition and removal, earthwork and grading, utility relocations, tolling facilities, roadway safety, mitigation, general drainage, geotechnical treatments, signing, lighting, striping, signals, intelligent transportation systems (ITS) and advanced traffic management system (ATMS), erosion control and landscaping, unquantifiable pay item allowance, mobilization, and traffic control (maintenance of traffic). Descriptions of these items follow.

Pavement

The project used multiple pavement designs based on roadway classifications and jurisdiction. The cost estimate separated pavement design into four classifications based on pavement design by the state Departments of Transportation (DOTs) and others. The four classifications included mainline pavement, interchange ramps, major local roadway, and minor local roadway. A more durable rigid pavement (Jointed Concrete) structure is assumed for the mainline and ramps. Variable depth flexible pavements are assumed for the major roadways and minor roadways. Paved shoulders varied between flexible and rigid materials based on the adjacent roadway classification. Pavement design and pricing may vary significantly depending on the material selection and agency ownership. The design and pricing are based upon pavement life cycle for the project.

Demolition and Removal

Demolition and removal costs were estimated based on the conceptual footprint limits developed for each alternative including the current property assessment information available in the GIS database. Demolition of existing buildings are calculated individually and quantified as each in the detailed pay item list.

Earthwork and Grading

Roadway profiles and cross sections are developed for all alternatives. The majority of the project is located in fill conditions. Cross-section earthwork quantities were developed for a single alternative and prorated to each of the alternatives based on differences in the mainline and/or ramp linear footage. Mass haul diagrams and hauling distances were considered closely as part of the unit price resulting in lower unit costs. Estimated costs for earthwork and grading in this estimate were calculated per cubic yard. Pavement removal is included in the unit cost of these items.

Utility Relocations

The utility relocations costs consist of identified transmission and non-transmission utilities. The relocations were detailed out into the following three categories; major transmission pipelines per pipe diameter, high tension power lines per voltage size, and non-transmission utilities. Pipeline relocation quantities were conceptually located by

the design teams and verified by the respective utility companies. Unit costs were developed using historical data for projects using similar networks and from preliminary cost estimates provided by the utility. Costs were provided per lineal feet. Electric transmission line quantities were developed conceptually based on potential facility relocations by the design teams, based on correspondence with the utility companies. Unit cost were developed using historical data for projects and utility correspondence based on line voltage. Non-transmission utility costs were determined to be approximately 10 percent of the total transmission costs based on historical data of similar projects. The cost will be updated and modified as the project progresses to include actual work plans and engineering costs provided by the utilities based on a preferred alternative.

Tolling Facilities

The cost of the tolling facilities was conceptually determined based on 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 would 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 the entire facility would be all electronic tolling collection (AETC) and that no additional right-of-way 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. The construction cost includes facilities for tollway staff and maintenance activities.

Roadway Safety

This cost covers the approximate quantities and locations requiring guardrail protection and/or Jersey barrier wall based on design and historical data for similar projects.

Mitigation

This cost is intended to cover the cost of mitigation of wetlands, streams, and trees on a per acre cost basis. The quantities were generated based on the conceptual footprints for each alternative and field-identified wetlands and sensitive trees. Costs were generated using historical data for projects of the same type and in the same geographic location. Mitigation for trees and wetlands generally consisted of mitigating within a range of 3:1 to 5:1 basis for the project.

General Drainage

This cost 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. required for an open drainage system. Box culvert size and lengths were determined based on hydraulic reports produced for the corridor. Quantities for drainage pipe laterals and a closed system on I-55 were estimated based on quantified takeoffs per mile for similar projects within the region. All values

provided in the quantities represent the product of engineering judgment and historical data for projects using similar drainage networks.

Geotechnical Treatments

This cost category is intended to cover roadway geotechnical treatments based on the results of a preliminary geotechnical program and existing GIS soil information. Costs and quantities were based on engineering judgment from the geotechnical program and historical data for projects using similar networks.

Signing, Lighting, and Striping

This cost category is intended to cover the cost of the roadway signing, lighting, striping, signals, ITS, and ATMS. Lighting is anticipated at the system to system interchanges.

Erosion Control and Landscaping

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

Unquantifiable Pay Item Allowance

This cost is intended to cover other general roadway project related pay items not detailed out within the over 190 pay items for the project. These general items may include curb and gutter, bike/pedestrian improvements, raised medians, signals, ITS, and ATMS.

Mobilization

This cost is intended to cover the cost of mobilization of the construction workforce based on a percentage of the total construction related cost.

Traffic Control (Maintenance of Traffic)

This cost is intended to cover the cost of traffic control during construction and is based on a percentage of the total construction 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. Since the proposed facility would be constructed in a green-field, the majority of traffic control would be limited to where the new facility crosses existing transportation facilities. It is anticipated that the overall cost for traffic control would be lower than normal costs associated with construction and/or reconstruction of an existing facility.

4.2 Structural Related Items

This category includes pay items related to roadway structures, and retaining walls and noise walls. Descriptions of these items follow.

Roadway Structures

Roadway structures consist of grade-separated and waterway crossing structures. New bridge costs were calculated based on conceptual design using a proposed width based on the roadway geometry (travel lanes plus shoulders and parapets or walls) and a detailed list of bridge pay items. Structures were determined to be either a simple span or a complex structure based on DOT definitions. All existing railroads were bridged by roadway structures based on a cost/benefit analysis. Waterway crossings for streams and other water features were assumed to be bridge structures. The Kankakee River bridge was evaluated in detail to determine its cost and was separated out as separate line item due to the complexity, type, and size of the structure.

Retaining Walls and Noise Walls

This cost is intended to cover the location and approximate heights of the retaining walls. Approximate retaining wall locations were determined based on roadway profiles and cross sections. Generally, the retaining walls were determined to be mechanically stabilized earth walls at this time. The locations of the noise abatement walls are approximate as the final noise study is underway. The estimated construction costs are based on the plan length of each noise wall and an average height (10-15 feet is estimated based on engineering judgment and historical data for projects using similar networks) assumed throughout the alternatives. The types of noise abatement walls have not been determined at this time.

4.3 Engineering Services

This category includes pay items related to design engineering and services, construction inspection and services, and program management. Descriptions of these items follow.

Design Engineering and Services (Phase 2)

This cost 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 be included with a public-private-partnership (P3) agreement after the approval of environmental documents.

Construction Inspection and Services (Phase 3)

This cost category is intended to cover the associated construction inspection services to observe and construct 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 be included with the P3 agreement after approval of the environmental documents.

Program Management

This cost category is intended to cover associated DOT 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, if required, after the approval of the P3 contract plans.

4.4 Land Acquisition and Right-of-Way Related Items

Land acquisition costs were estimated for each alternative based on the conceptual footprint limits as well as current property assessment information available in the GIS database. The fair market value is calculated based on the current parcel assessments conducted by each taxing entity (i.e. Will, Kankakee, and Lake counties) and would be refined during future land acquisition activities by the DOTs. Another round of screening would be completed to refine and determine fair market costs. Additionally, this screening would be conducted to determine whether full and/or partial acquisitions are required. The current cost estimate makes an assumption on the full and/or partial acquisitions based on available design impacts and information. Impacted parcels also are grouped by type (residential, nonagricultural, and agricultural). An additional cost was provided to each impacted parcel with an existing structure based on the parcel type identified. Estimated costs for right-of-way acquisition are calculated as per acre. Miscellaneous relocation costs and land acquisition costs were are included to account for items such as restoration of minor impacts to properties or relocation associated costs.

Impacted parcels also are grouped by type (residential, nonagricultural, and agricultural). An additional cost was provided to each impacted parcel with an existing structure based on the parcel type identified. Another round of screening will be completed to refine and determine fair market costs. Additionally, this screening would be conducted to determine whether full and/or partial acquisitions are required. The current cost estimate makes an assumption on the full and/or partial acquisitions based on available design impacts and information.

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