

APPENDIX E  
**Cost Opinion Technical Memorandum**

# I-270/US 33 Northwest Freeway Study

## Conceptual Alternatives - Cost Opinion

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### A. Introduction

This memorandum presents a construction cost-estimate model for the Northwest Freeway Study. Details for the cost model, corridor design assumptions, and the cost estimates are included in the memorandum.

### B. Cost Model and Assumptions

#### 1. Cost Model Description

The cost model used for this analysis relies on estimates of quantities for major construction items such as pavement, structures (by type and special nature), and retaining walls. Costs for other items are estimated as percentages or lump sum values based on experience with similar facilities. The estimates will reflect costs based on the 2006-2007 time frame. Inflation will not be included in the estimates. The cost opinions will need to be adjusted over time.

This cost model is consistent with the level of engineering work that has been performed to date. The cost model relies on quantity estimates derived from measuring dimensions directly from Microstation files. Major items that most influence the construction costs are used including roadway pavement (removal and new pavement), highway bridges (removal, widening, and new structures), and retaining walls (removal and new).

A brief description of cost items and their use in the cost model follows:

- **Pavement Removal**

The area of pavement removal is estimated from the existing aerial photos. The cost analysis assumes removal of all ramp pavement and mainline and arterial shoulders within the project area. Existing pavement on mainline, arterials, and local roads will not be included in the pavement removal quantities. It is assumed that only the costs associated with the additional lanes on these facilities will be included in the cost estimate. Pavement removal quantities are calculated within the proposed roadway improvement limits (mainline, ramps, arterials, local roads), and at locations where existing roadways will be abandoned.

- **New Pavement**

The area of new pavement is estimated from the Microstation files. On mainline, arterial and local road improvements, new pavement costs will be calculated for the additional lanes. All ramp and acceleration and deceleration lane pavement will be included in the cost estimates. The unit cost of new pavement includes the cost of base and subbase materials. A thicker pavement structure is assumed for the

mainline and ramps, as compared to the pavement thickness for arterials and local roads. Thus, different unit costs are used for each. In addition, the assumed unit cost for paved shoulders is conservatively assumed identical to the assumed pavement unit cost. The cost of resurfacing or reconstructing the existing pavement is not included in the planning level cost estimate. The cost for resurfacing existing roadways was determined to be minor compared to the rest of the project costs.

- **Earthwork**

As estimated earthwork quantities are not available at this point, earthwork costs are based on a percentage of roadway pavement costs.

- **Drainage**

Drainage costs are based on a percentage of roadway costs. This item covers all roadway drainage including storm water retention/detention, catch basins, inlets, box culverts, etc.

- **Erosion Control**

The cost of erosion control during construction is based on a percentage of roadway costs.

- **Traffic Control During Construction**

Traffic control during construction is based on a percentage of roadway costs. This item is intended to include all typical costs of traffic control including temporary striping, detours, temporary bridges, barricades, crossovers, signing, etc.

- **Lighting**

The cost of roadway lighting is based on a percentage of roadway costs.

- **Signing and Pavement Marking**

The cost of highway signing and pavement marking is based on a percentage of roadway costs.

- **Utilities**

The cost of typical utilities is based on a percentage of roadway construction costs. Typical utilities are defined as electric service, cable, water, storm and sanitary sewer, telephone, standard gas line, etc.

- **Incidental Items**

Incidental costs are estimated as a percentage of roadway costs. Incidental items include items such as guardrail, median barrier, curb and gutter, landscaping, mobilization, clearing and grubbing, fencing, etc.

- **Traffic Signals**

Traffic signals required for intersection improvements are accounted for based on an individual tabulation of locations.

- **Structures**

Bridge removal, new bridge, and bridge widening costs are calculated based on the proposed roadway width (travel lanes plus shoulders and parapets). An additional percentage is

added to structural costs to account for incidental costs associated with the structures, such as construction staging costs, maintenance of traffic, drainage, erosion control, lighting, pavement markings, and other items.

Structures not associated with interchanges, such as overpasses and mainline bridges, also will be accounted for in the cost estimates. These existing structures will need to be examined to see if they can accommodate future mainline widening.

- **Retaining Walls**

Locations and approximate heights of retaining walls are estimated from the Microstation files. Retaining wall costs are calculated on the basis of 2/3 of the maximum estimated height of the retaining wall. For example, if the height of the structure varies from 0 to 25 feet over a 500 ft. length, then the retaining wall cost is estimated with an assumed height of 17 ft. times the 500 ft. length. A unit cost is applied to determine the cost of each retaining wall.

The unit cost for a retaining wall is related to the height of the wall. In the case of very high walls, the unit price goes up exponentially, not linearly. See Figure 1 for details.

- **Special Features**

Any special or unusual features that are known should be called out specifically and estimated. For example, an alternative that would remove a power substation or cell tower should be noted in the cost opinion.

- **Engineering**

Engineering costs are estimated separately for Preliminary Design, Final Design, and Construction Engineering. The engineering costs are estimated as a variable percentage of the total roadway and structure construction costs at rates consistent with Ohio DOT direction.

- **Right-of-Way Acquisition**

Right-of-way acreage and displacements at each interchange will be estimated by CH2M HILL and ms Consultants. Prime Engineering and Burgess & Niple will calculate estimated right-of-way acreage and displacements for the "off-freeway" facilities. Right-of-way costs will be the last component of the cost opinion to be calculated.

- **Contingency**

A contingency is applied to the cost estimate to account for the many unknowns at this stage of a planning level estimate. For a planning level estimate, ODOT recommends a contingency percentage of 25% to 35% be used to account for unknown factors (soil conditions, environmental concerns, bridge sizes, etc.). Note that the contingency is not intended to cover future inflation or cost increases in right-of-way acquisition costs.

## 2. **Unit Cost Assumptions**

The quantity basis and assumed unit prices for roadway pavement and structures are shown in tables 1 and 2, respectively. Note that the unit prices for structures vary for different structure types and configurations. Retaining wall unit costs are assumed to be a function of retaining wall height. The assumed percentages, as a percent of roadway costs, for all other construction items, contingency, and engineering costs are listed in table 3 (mainline and ramp costs) and table 4 (local roadway costs). The percentages shown in table 3 and table 4 are used for mainline & interchange and local roadway cost analyses.

**TABLE 1**  
 Roadway Pavement Unit Costs Used in Cost Model

<b>Item</b>	<b>Unit Price</b>	<b>Unit</b>
Pavement Removal	\$7.00	yd <sup>2</sup>
Mainline and Ramp Pavement (including shoulders)	\$55.00	yd <sup>2</sup>
Local Roadway Pavement (including shoulders)	\$40.00	yd <sup>2</sup>

**TABLE 2**  
 Structure Unit Costs Used in Cost Model

<b>Item</b>	<b>Unit Price</b>	<b>Unit</b>
Total Bridge Removal	\$10 - \$25	ft <sup>2</sup>
Bridge Superstructure Removal	\$8 - \$10	ft <sup>2</sup>
New Bridge (mainline over ground)	\$90 - \$250	ft <sup>2</sup>
New Bridge (ramp/overpass)	\$85 - \$250	ft <sup>2</sup>
New Bridge (mainline over water)	\$160 - \$560	ft <sup>2</sup>
Bridge Widening including parapet, new beams and additional substructure	\$65 - \$120	ft <sup>2</sup>
Retaining Wall	\$52 - \$140	ft <sup>2</sup>

**TABLE 3**  
 Mainline and Ramp Construction Cost Percentages Used in Cost Model

<b>Item</b>	<b>Percent of Roadway Costs</b>	<b>Cost Basis</b>
Earthwork	25%-30%	Roadway Cost
Drainage	9%	Roadway Cost
Erosion Control	5%	Roadway Cost
Traffic Control During Construction	8%-16%	Roadway Cost
Lighting	2%-4%	Roadway Cost
Signing and Pavement Marking	8%-10%	Roadway Cost
Typical Utilities	5%-10%	Roadway Cost
Incidental Items*	20%	Roadway Cost
Engineering		
Preliminary Design	6%	Roadway Cost
Final Design	6%	Structure Cost
Construction	6%	Roadway Cost
Construction	5%	Structure Cost
Contingency	35%	Total Construction Cost
		Total Construction Costs

\* Incidental items include guardrail, barrier, landscaping, mobilization, clearing and grubbing, etc.

**TABLE 4**  
 Local Roadway Construction Cost Percentages Used in Cost Model

<b>Item</b>	<b>Percent of Roadway Costs</b>	<b>Cost Basis</b>
Earthwork	12%	Road Construction Cost
Drainage	15%	Road Construction Cost
Erosion Control	5%	Road Construction Cost
Traffic Control During Construction	5%	Road Construction Cost
Lighting	6%	Road Construction Cost
Signing and Pavement Marking	6%	Road Construction Cost
Typical Utilities	10%	Road Construction Cost
Incidental Items*	20%	Road Construction Cost
Engineering		
Preliminary Design	6%	Roadway Cost
	6%	Structure Cost
Final Design	6%	Roadway Cost
	5%	Structure Cost
Construction	6%	Total Construction Cost
Contingency	35%	Total Construction Costs

\* Incidental items include guardrail, barrier, landscaping, mobilization, clearing and grubbing, etc.

## D. Cost Model Structure

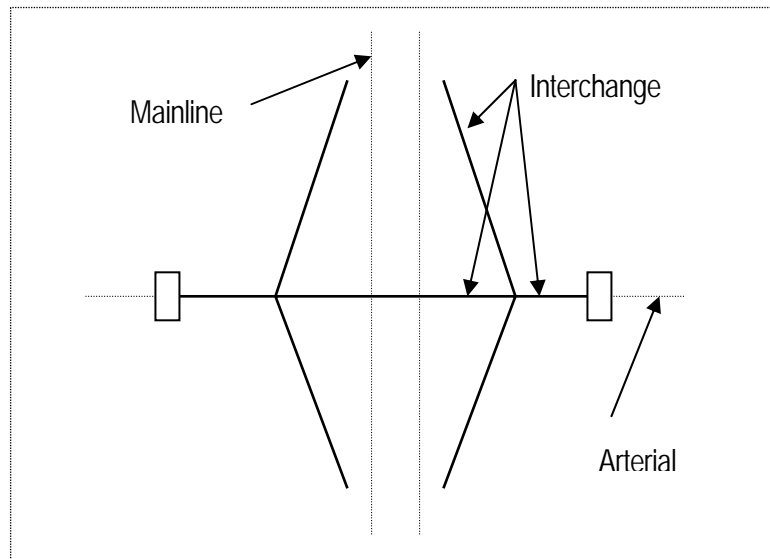
To provide flexibility and consistency when moving forward with the strategic plan, cost analyses should be developed for the staging of projects of the corridor as described below:

- **System Interchanges: I-270/US 33 and I-270/I-70**

Cost estimates will be provided for each construction phase and for the overall project cost. All ramp and acceleration/deceleration lane costs will be included.

- **Service Interchanges**

The cost for each service interchange will include ramps, acceleration/deceleration lanes, arterial section between ramp terminals, arterial sections to the next traffic light beyond the ramp terminals (in urban areas) and the ramp terminal signalization.



- **Mainline**

Mainline pavement costs will be calculated independently of the interchanges. Mainline costs will include the construction of the additional lanes, median barrier, and shoulders required to meet the ultimate cross section of I-270 and US 33. Mainline costs will be developed for each section between interchanges.

- **Interchange Arterials and Local Roads**

Costs for improvements to the interchange arterial outside the interchange area and local road improvements needed to improve the arterial intersections will be included in the cost estimates.

- **“Off-System” Arterials**

MORPC will generate cost estimates for the “off-system” arterial improvements recommended to the Funding Partners.

## E. Corridor Design Assumptions

### 1. Typical Section

Lane and shoulder dimensions for mainline, ramps and arterials are based from ODOT standards in L&D Volume 1. The proposed median width for I-270 is 36 feet. US 33 will have a median width of 26 feet.

## **2. Structures**

Structures should be consistently shown in terms of an appropriate dimension. In urban areas, the team shall assume an abutment offset of 30' off mainline edge of pavement. In rural areas (US 42/US 33 and Mitchell-DeWitt/US33) the abutment will be located 80' from the mainline edge of pavement.

Structure widths for arterials shall include 6' sidewalks on both sides. Where multi-use paths are used, an 8' width shall be used on each side of the structure.

Existing structures not associated with the interchanges will need to be examined for the following situations: 1) can the structure be widened as needed? 2) does the structure need replacement because of mainline capacity expansion (i.e. Post Road)?

## **3. Retaining Wall Locations and Heights**

Retaining wall locations and heights are estimated for the purposes of cost estimation. Retaining walls should be shown wherever right-of-way acquisition is required. This includes strip takes along I-270 or US 33 in which buildings or structures are not involved.

## **4. Right-Of-Way**

The cost of right of way will be included in the cost estimates. Displacements and relocation costs will also be estimated and included in this estimate. Burgess & Niple will provide relocation costs for the estimates.

### RETAINING WALL UNIT COST Figure 1

