

# California High-Speed Train Project



## TECHNICAL MEMORANDUM

### Peer Review of CHSTP Unit Prices TM 100.01

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Prepared by  for the California High-Speed Rail Authority

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## ABSTRACT

In October, 2010, the Authority requested that PMT undertake a cursory review of the key unit prices (Unit Price Elements or UPEs) it developed by selected Regional Consultant (RC) teams to confirm general adequacy of the pricing methods and assumptions relative to the scope and scale of CHSTP.

The UPE categories listed below were determined to affect project costs the most and were chosen for the review in these packages:

- Aerial Structures (Viaducts and Bridges)
- Tunnels (Bored, Excavated and Cut & Cover)
- Depressed Section Structures
- Track and Maintenance Facilities

## 1.0 INTRODUCTION

### 1.1 PURPOSE OF TECHNICAL MEMORANDUM

The purpose of this technical memorandum is to provide the review of the key unit prices by selected Regional Consultant.

### 1.2 GENERAL INFORMATION

The reviews were organized to minimize any disruption to main project activities being undertaken by RC teams while ensuring that each UPE package is reviewed by at least two different RC teams. Peer review assignments are summarized below:

| No. | UPE Review Package               | RC Team             |
|-----|----------------------------------|---------------------|
| 1   | Aerial Structures                | HNTB, AECOM         |
| 2   | Tunnels                          | Hatch Mott, Parsons |
| 3   | Depressed Sections               | HNTB, Parsons       |
| 4   | Track and Maintenance Facilities | STV, AECOM          |

Reviews were largely completed by second week of December of 2010 with an exception of STV team which was not able to complete this peer review of UPEs due to budgetary constraints. Informal meeting and teleconference discussions were held between PMT and RC technical staff to go over comments and findings resulting from the reviews.

## 2.0 DEFINITION OF TECHNICAL TOPIC

None Applicable

## 3.0 ASSESSMENT / ANALYSIS

### 3.1 KEY FINDINGS

All of the major line items and a random sampling of the minor sub-items were reviewed against a database of similar items for various large construction projects throughout the United States and found to be appropriate for the San Francisco region. The detail unit price multiplier to calculate the bid unit price is appropriate and reflects the state of the current market.

#### 3.1.1 Aerial Structures

1. The assumed substructure for the 1-track aerial structures appears to be the same as the substructure for the 2-track aerial structures. It appears the costs for 1-track aerial structures may be conservative.
2. The column size appears small for HSR stiffness requirement and would need to be upsized for Cooper E80 loading for shared use corridors. The impact to the quantities is relatively minor unless this impacts the assumed foundation.
3. Advise increasing the cap width to at least 2-feet greater than the column diameter as it appears a monolithic connection is assumed. The impact to the quantities is relatively minor.
4. It is noted in the general assumptions of the provided information that the UPE's do not reflect all construction items/activities that will ultimately be required as part of the final project. For example, the UPE's for aerial structures are based on simple span precast segmental box girders for all superstructures. Cast-in-place construction may be



appropriate in certain situations such as for variable width structures at sections approaching stations and for longer continuous spans.

### 3.1.2 Tunnels

1. Plant and equipment hourly rates used in the estimates are somewhat low.
2. Recommend adding a Plant & Equipment purchase / salvage / assembly spreadsheet for all major equipment and plants.
3. Travel time within the tunnels from the dry house to the heading and back should be added, a union requirement.
4. Should add cost for major maintenance days or shifts at least once each week.
5. Should adjust the pay hours and rates to reflect the travel time and working through lunch, all that time is overtime.
6. For the road-header work, we believe these costs are very similar to that of drill and blast, and that attempting to differentiate between the two implies a level of accuracy higher than actual.
7. Many of the Sequentially Excavated Method (SEM) configurations reflect individual drifts are too small for support required to be installed.

### 3.1.3 Depressed Section Structures

1. The material used for general embankment and backfilling are assumed to be available from excavated on-site soils. Costs for hauling and disposal will be impacted by this assumption.
2. The retaining walls quantities appear to assume the use of a spread footing for all heights. For heights greater than 16', it would be more appropriate (conservative) to assume pile foundations.
3. The costs for 30-foot deep retained cut are greater than staged 40-foot deep retained cut. This does not appear to be correct.
4. The trench quantities do not appear to include provisions to resist buoyant forces. The provisions could include providing additional dead load or tension anchors. This could significantly impact the cost.
5. The maximum trench depth assumed is 60-feet. Recommend considering deeper trench sections to account for fluctuations in ground elevation that may not be offset or accommodated by modifying the rail profile or re-grading of the surface.

### 3.1.4 Track and Maintenance Facilities

No specific comments were received.

## 3.2 CORRECTIVE ACTIONS

### 3.2.1 Aerial and Depressed Trench Structures

The following adjustments in composition and basic assumptions of aerial and depressed trench structures UPEs have been made in response to the peer review comments:

1. Cost for an average 10-mile haul distance has been added to all earthmoving UPEs.
2. Cost of pile foundations have been reflected in the cost of taller retaining walls UPEs.
3. Revised UPEs for staged 4-track retained cut section.
4. Retained cut UPEs have been revised to include bulkhead with water stop costs.
5. Increase average assumption for steel reinforcement (pounds of steel per cubic yard of concrete) to reflect more realistic structural configuration.



Table below provides a comparative view of changes in unit costs as a result of these adjustments:

| ITEM DESCRIPTION  | ORIGINAL UNIT PRICE | REVISED UNIT PRICE | INCREASE OR DECREASE |
|---|---------------------|--------------------|----------------------|
| At-Grade Track-bed in Cut - 1 Track (5' Avg. Exc Depth)       | 357                 | 418                | 17%                  |
| At-Grade Track-bed in Cut - 1 Track (10' Avg. Exc Depth)      | 529                 | 662                | 25%                  |
| At-Grade Track-bed in Cut - 2 Track (5' Avg. Exc Depth)       | 475                 | 550                | 16%                  |
| At-Grade Track-bed in Cut - 2 Track (10' Avg. Exc Depth)      | 680                 | 843                | 24%                  |
| At-Grade Track-bed in Cut - 2 Track (20' Avg. Exc Depth)      | 1,212               | 1,606              | 32%                  |
| At-Grade Track-bed in Cut - 2 Track (40' Avg. Exc Depth)      | 2,772               | 3,855              | 39%                  |
| At-Grade Track-bed in Cut - 2 Track (60' Avg. Exc Depth)      | 5,022               | 7,113              | 42%                  |
| At-Grade Track-bed in Fill - 2 Track (20' Avg. Fill Ht)       | 681                 | 979                | 44%                  |
| At-Grade Track-bed in Fill - 2 Track (60' Avg. Fill Ht)       | 2,595               | 4,439              | 71%                  |
| Cut & Cover Box - 2 Track / 1 Box (40' Avg. Exc Depth)        | 34,961              | 30,737             | -12%                 |
| Cut & Cover Box - 2 Track/ 2 Box (40' Avg. Exc Depth)         | 50,475              | 41,150             | -18%                 |
| Retained Cut, Trench - 1 Track (10' Avg. Exc Depth)           | 6,119               | 5,623              | -8%                  |
| Retained Cut, Trench - 2 Track (10' Avg. Exc Depth)           | 8,284               | 8,143              | -2%                  |
| Retained Cut, Trench - 2 Track (20' Avg. Exc Depth)           | 20,496              | 19,900             | -3%                  |
| Retained Cut, Staged Trench - 4 Track (40' Avg. Exc Depth)    | 41,935              | 64,301             | 53%                  |
| Retained Cut, Staged Trench - 4 Track (60' Avg. Exc Depth)    | 51,364              | 77,577             | 51%                  |
| Retained Fill, Walls Both Sides - 1 Tracks (20' Avg. Wall Ht) | 2,999               | 5,432              | 81%                  |
| Retained Fill, Walls Both Sides - 2 Tracks (20' Avg. Wall Ht) | 3,147               | 5,642              | 79%                  |
| Retained Fill, Walls Both Sides - 4 Tracks (20' Avg. Wall Ht) | 3,338               | 5,696              | 71%                  |

It should be noted that although increases in unit costs of retained trenches and retained fills appear to be quite substantial, the overall quantities of these elements are relatively small minimizing actual impact of this unit price increase on the total construction costs.

### 3.2.2 Tunnels

In the response of the peer review comments and follow up discussions with the reviewers, the following changes have been made consistently to all tunneling UPEs:

1. Standardizing the hourly and staff crew so similar labor positions are carried in the same cost categories over all the UPEs.
2. Applying basic manpower leveling principals across the production crews to better account for the labor costs. To aid in the development of the manpower leveling, basic schedules are being developed for each UPE to verify the crew durations.
3. Standardizing the location of the surface support equipment and personnel in each of the UPEs and using the schedules to verify the durations.
4. Additional labor costs for travel time, shift differential, and work thru lunch are being accounted for by using the overtime premium override for each schedule attached to crews.
5. Saturday maintenance shifts are being added to the estimates as needed.
6. The linear plant required to excavate the tunnels will be consistently added to all UPEs.



7. A stand alone equipment sheet will be created for each UPEs to verify that the sufficient equipment rental / ownership costs are accounted for.
8. Indirect costs and markups included in the UPEs will be added to each individual estimate instead of being applied as a percentage by excavation class.

Table below provides a comparative view of changes in tunneling unit costs as a result of these adjustments:

| ITEM DESCRIPTION   | ORIGINAL UNIT PRICE | REVISED UNIT PRICE | INCREASE OR DECREASE |
|--|---------------------|--------------------|----------------------|
| TBM Single Track Twin Tunnel 30ft ID Unpressurized TBM in hard rock                              | 23000               | 24000              | 4.3%                 |
| TBM Single Track Twin Tunnel 30ft ID Slurry TBM in hard rock                                     | 34000               | 33500              | -1.5%                |
| TBM Single Track Twin Tunnel 30ft ID Unpressurized TBM in hard rock (pre-cast liners) – new item | NA                  | 29500              | NA                   |

## 4.0 SUMMARY AND RECOMMENDATIONS

### 4.1 CONCLUSION

Draft 15% level design UPEs are being reevaluated by the PMT in order to address comments and observations resulting from the peer review by selected RC teams. Recommended adjustments are being implemented while considering the preliminary nature of current design level.

Once updated, the prototypical UPEs will be distributed to the RC teams seeking further review for any adjustments or additions to the prototypical UPEs that that may be necessary in order to reflect site-specific conditions that may exist on each particular segment. These site specific adjustments will be concurred by both the PMT and RC teams.

## 5.0 SOURCE INFORMATION AND REFERENCES

None Applicable





## **6.0 DESIGN MANUAL CRITERIA**

None Applicable



## **ATTACHMENT 1**

Comments from HNTB Team



**Date**  
11/29/10

**To**  
Dominic Spaethling



**From**  
Tim Cobb

PROJECT  
CORRESPONDENCE

**Subject**  
California High-Speed Train Project  
Peer Review of Unit Price Elements  
Packages 2 and 3

## **INTRODUCTION**

HNTB has been tasked to perform a Peer Review of the Unit Price Elements (UPE's) for the following two packages:

### **Package 2 – Aerial Structures**

Unit Price Estimates – Aerial Structures, Draft Engineering Report dated October 2010  
Cost Elements Spreadsheet - PROTOTYPICAL UPEs (REV2). XLSX  
Unit Price Report – pdf file Unit Price Detail\_10-01-10

### **Package 3 – Walls and Trenches**

Unit Price Estimates – Walls and Trenches, Draft Engineering Report dated October 2010  
Cost Elements Spreadsheet - PROTOTYPICAL UPEs (REV2). XLSX  
Unit Price Report – pdf file Unit Price Detail\_10-01-10

As part of the peer review process, HNTB has performed a cursory review of the prototypical structural systems assumed for the development of the conceptual level costs for the UPE's. A cursory review of the costs was also performed. This memo presents the findings of our review.

## **FINDINGS**

Based on our cursory review of the information provided in Packages 2 and 3, the assumed prototypical structural systems appear appropriate for the development of the conceptual level costs for the UPE's considered. A cursory review of the costs was performed and, in general, they are appropriate for "generic" unit prices. We offer the following observations for consideration:

### **Package 2 – Aerial Structures**

#### *Structure Design*

1. The assumed substructure for the 1-track aerial structures appears to be the same as the substructure for the 2-track aerial structures. It appears the costs for 1-track aerial structures may be conservative.

2. The assumed column sizes are shown on TYPICAL COLUMN CROSS SECTIONS, Drawing TTM 1.1.21-0. The smallest column size noted is 6'x8'. The column size appears small for HSR stiffness requirement and would need to be upsized for Cooper E80 loading for shared use corridors. The impact to the quantities is relatively minor unless this impacts the assumed foundation.
3. The assumed foundation type and sizes are shown on TYPICAL COLUMN CROSS SECTIONS, Drawing TTM 1.1.21-0. The footing dimensions and the number, size and length of piles are grouped based on column heights of less than 30-feet, 30 to 50-feet, and 50 to 90-feet. As the foundation cost appears to be a significant portion of the total structure cost, the resulting cost is effectively a "step function" based on the three groupings of column height as demonstrated by the costs for the UPE's. For example, for a 2-track aerial structure the cost difference between a column height of 20 and 30-feet is 22% while the cost difference between a column height of 30 and 50-feet is only 4%.
4. The assumed pile type is a drilled shaft, uncased in soft rock. It is uncertain from the information provided if the foundation costs are sensitive to the assumed pile type.
5. The assumed bent cap dimensions for straddle bents are shown on STRADDLE BENT OVER 2 RR TRACKS, Drawing MISC-007 TTM 1.1.21-0 and STRADDLE BENT OVER 4 RR TRACKS, Drawing MISC-008. We advise increasing the cap width to at least 2-feet greater than the column diameter as it appears a monolithic connection is assumed. The impact to the quantities is relatively minor.
6. It is noted in the general assumptions of the provided information that the UPE's do not reflect all construction items/activities that will ultimately be required as part of the final project. For example, the UPE's for aerial structures are based on simple span precast segmental box girders for all superstructures. Cast-in-place construction may be appropriate in certain situations such as for variable width structures at sections approaching stations and for longer continuous spans.

### **Package 3 – Walls and Trenches**

#### ***Structure Design***

1. It is noted in the general assumptions of the provided information that the material used for general embankment and backfilling are assumed to be available from excavated on-site soils. Costs for hauling and disposal will be impacted by this assumption.
2. The retaining walls quantities appear to assume the use of a spread footing for all heights. For heights greater than 16', it would be more appropriate/conservative to assume pile foundations.
3. The costs for Retained Cut, Trench - 4 Track (30' Avg. Exc. Depth) are greater than Retained Cut, Staged Trench - 4 Track (40' Avg. Exc. Depth). This does not appear to be correct.
4. The Retained Cut, Trench – 4 Track quantities do not appear to include waterproofing.
5. The calculations provided for the trench wall thicknesses assume ground water at 5-feet below the ground surface. The trench quantities do not appear to include provisions to resist buoyant forces. The provisions could include providing additional dead load or tension anchors. This could significantly impact the cost.

6. For long sections of trench, it is not clear how the street and drainage crossings over the trench are accounted for.
7. The maximum trench depth assumed is 60-feet. Recommend considering deeper trench sections in the UPE's to account for fluctuations in ground elevation that may not be offset or accommodated by modifying the rail profile or re-grading of the surface.

### **Cost Estimate**

1. All of the major line items and a random sampling of the minor sub-items were reviewed against a database of similar items for various large construction projects throughout the United States. In general, the cost data is appropriate for the San Francisco region.
2. The detail unit price multiplier to calculate the bid unit price is appropriate and reflects the state of the current market.
3. Our recommendations for formatting changes for clarity are as follows:
  - a. Embed the header in the worksheet (similar to FTA SCC Worksheet)
  - b. Include the location (SF or LA) and the date these numbers are referring to (i.e. 2010) in the header of each worksheet.
  - c. Add a location code to each sub-category so that it is clear which location the cost number is for.
  - d. Rename the worksheets in the workbook so that it is clear what location and item they are for.
  - e. Clearly delineate either direct unit cost or bid unit cost. Some of the spreadsheets say only unit cost and it is unclear which one they are referring to.

## **ATTACHMENT 2**

Comments from Parsons Team



MEMO TO: CHST PMT

FROM: Dave Wemmer, Colman Mullin, Arthur Pazdan

DATE: December 2<sup>nd</sup>, 2010

SUBJECT: CHST - Peer Review of Unit Prices for Trench, Wall, and Tunnel costs

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We have reviewed the prototypical unit prices provided by PMT on October 27<sup>th</sup>, 2010. Our review was conducted within the limitations of TM 1.1.19 *Capital Cost Estimating Methodology for the 15% Design Level* and the assumptions listed in the reference materials provided by PMT. For example, no structural design was provided in the draft *Unit Price Estimates for Walls and Trenches* (October 2010), so any quantity takeoff backup provided for a line item unit price had to be taken at face value as accurate. This complicated our ability to review costs for the Unit Price Elements (UPE), as we could not adequately validate any UPE scope, schedule or method. Therefore, only pricing was considered, and not validity of work item scope, schedule or method.

Unit prices were provided by PMT for the twenty-one (21) UPE's under *C-3 Structures – Walls* and forty-five (45) UPE's under *Tunneling*. The unit prices are not un-reasonable for several of the UPE's where we could properly assess scope, schedule or method. Attached in Appendix A you will find a report of expected price ranges for the work as defined by the PMT. Due to the undefined or unfinished nature of some UPE's, however, we were unable to determine a confidence level for the potential variance in cost all of the UPE's. Also, several UPE's used the same unit cost for sub-items despite orders of magnitude difference in quantity between UPE's. Please consider our attached detailed study of the subject UPE's, along with recommendations for which sub-items of work should be better defined in order to validate the unit prices with any acceptable level of confidence.

Several dozen UPE's were provided for trenches and walls, yet there are in reality only two or three construction methods being considered. At the 15% design level as identified by the PMT, there are essentially two options being considered for retained cut trench construction. For shallow trenches (less than 30' depth) a soldier pile wall is proposed with temporary lagging and permanent concrete walls. For deep trenches (greater than 30' depth) a slurry wall is proposed. Other retained cut trench construction methods should be considered by the PMT to give greater flexibility to the Regional Consultants for 15% design and cost development. Similarly, only one method, cast-in-place concrete walls are proposed for retained fill sections. Again, more cost-effective retained fill construction methods like MSE walls should be considered by the PMT.

Understandably, the 15% design level is meant to study alignment alternatives, and not to value engineer any one alignment. The desire to keep a simple uniform approach to program corridor design should be balanced with a more robust selection of trench, wall and tunnel work item alternatives. A more balanced design approach will provide the Authority with a better value design and more appealing bid environment for whatever project delivery method is chosen. We encourage the PMT to consider our concerns with the development of prototypical UPE's.

## **Appendix A: Unit Price Review**

### **Trenches, Walls, and Cut & Cover Tunnels**

#### **GENERAL COMMENTS AND ISSUES OF CONCERN:**

- Parsons used the items listed, quantities and descriptions as given.
- Pricing includes use of contaminated material generated on site for construction – this is material generated on site with fixed contamination. Examples include asphalt millings, native serpentine (asbestos), cinnabar (mercury), etc.
- Excavation Support – 60 foot depth excavation (all widths) with a equivalent of a single 6” strut every 500 square feet. Observed 50 foot wide with depth varying from 30 feet to 70 feet had
- Maintenance and protection of traffic – this can significantly increase the price of project
- Maintenance and protection of utilities – utility relocations are covered in another unit price, however maintenance of utilities, including support/protection of large parallel utilities and almost all perpendicular utilities is not addressed.
- Conditions imposed for construction:
  - Conditions imposed on easements by railroads, CALTRANS, utility owners, and other governmental bodies
  - Conditions imposed by authorities having jurisdiction
  - Commitments made as part of environmental process
  - Requirements of governmental bodies having precedence (federal, state, etc.)
- Reinforcing steel – estimate has as little as 50 lb/yd<sup>3</sup>. The lowest observed in any CALTRANS structure is 187 lb/yd<sup>3</sup> and for large moment structures is usually well over 200 lb/yd<sup>3</sup>. Some structures exceeded 1,000 lb/yd<sup>3</sup>.
- Fixed Price – Certain items (primarily allowances) have insufficient information to evaluate. Parsons incorporated the fixed price value below the line due to our inability to evaluate.
- Certain items were left un-priced since there was insufficient information to identify scope of listed items.

#### **DOCUMENTS FURNISHED:**

The following documents were furnished via e-mail (chronological order):

- Package3-Walls.zip
  - Binder3.pdf
  - PrototypicalUPes(REV2).xlsx
  - Unit Price Detail\_10\_01\_10.pdf
- Appendix 1 \_ CAHSPR Conceptual Unit Costs.pdf
- Package 1 – Tunnels.zip
  - 2010ProgrammaticUnitCosts(REV3).xlsx
  - Binder1.pdf
  - Unit Price Detail\_10\_01\_10.pdf
- Tunnel Unit Cost Reports.zip:
  - IndirectCostReport UCC01.pdf
  - IndirectCostReport UCC05r1.pdf
  - IndirectCostReportUCC17r1.pdf
  - IndirectCostReportUCC29r1.pdf
  - UCC01costreport.pdf
  - UCC02costreport.pdf
  - UCC03costreport.pdf
  - UCC04Bcostreport.pdf (sub B)
  - UCC04costreport.pdf
  - UCC05costreport.pdf (no 6 or 7)
  - UCC08costreport.pdf
  - UCC09costreport.pdf (no 10 or 11)
  - UCC12costreport.pdf
  - UCC13costreport.pdf (no 14 or 15)
  - UCC16costreport.pdf
  - UCC17costreport.pdf (no 18 or 19)



- UCC20costreport.pdf
- UCC21costreport.pdf (no 22 or 23)
- UCC24costreport.pdf
- UCC25costreport.pdf (no 26 or 27)
- UCC28costreport.pdf
- UCC29costreport.pdf (no 30 or 31)
- UCC32costreport.pdf
- UCC33costreport.pdf (no 34 or 35)
- UCC36costreport.pdf
- UCC37costreport.pdf (no 38 or 39)
- UCC40costreport.pdf
- UCC41costreport.pdf (no 42)
- UCC43costreport.pdf
- UCC44costreport.pdf
- UCC45costreport.pdf

**Unit Price Elements analyzed (37 UPE):**

This portion of review covers:

- Trench Structures / Retaining walls
- Cut and cover tunnels
- Support elements for the above items

Mined tunnels are covered in another analysis (see Appendix B).

**Cut & Cover Pricing (12 UPE):**

- 10.06.114 - Cut & Cover Box - 1 Track/ 1 Box (40' Avg. Exc Depth)
- 10.06.115 - Cut & Cover Box - 1 Track/ 1 Box (50' Avg. Exc Depth)
- 10.06.116 - Cut & Cover Box - 1 Track/ 1 Box (60' Avg. Exc Depth)
- 10.06.214 - Cut & Cover Box - 2 Track / 1 Box (40' Avg. Exc Depth)
- 10.06.215 - Cut & Cover Box - 2 Track / 1 Box (50' Avg. Exc Depth)
- 10.06.216 - Cut & Cover Box - 2 Track / 1 Box (60' Avg. Exc Depth)
- 10.06.224 - Cut & Cover Box - 2 Track/ 2 Box (40' Avg. Exc Depth)
- 10.06.225 - Cut & Cover Box - 2 Track / 2 Box (50' Avg. Exc Depth)
- 10.06.226 - Cut & Cover Box - 2 Track / 2 Box (60' Avg. Exc Depth)
- 10.06.414 - Cut & Cover Box - 4 Track / 1 Box (40' Avg. Exc Depth)
- 10.06.415 - Cut & Cover Box - 4 Track / 1 Box (50' Avg. Exc Depth)
- 10.06.416 - Cut & Cover Box - 4 Track / 1 Box (60' Avg. Exc Depth)
- 10.06.922 - Double Deck - 2 Track Trench on Top of 2 Track C&C Box

**U-Wall Segments (17 UPE):**

- 10.08.211 - Retained Cut, Trench - 1 Track (10' Avg. Exc Depth)
- 10.08.212 - Retained Cut, Trench - 1 Track (20' Avg. Exc Depth)
- 10.08.213 - Retained Cut, Trench - 1 Track (30' Avg. Exc Depth)
- 10.08.221 - Retained Cut, Trench - 2 Track (10' Avg. Exc Depth)
- 10.08.222 - Retained Cut, Trench - 2 Track (20' Avg. Exc Depth)
- 10.08.223 - Retained Cut, Trench - 2 Track (30' Avg. Exc Depth)
- 10.08.241 - Retained Cut, Trench - 4 Track (10' Avg. Exc Depth)
- 10.08.242 - Retained Cut, Trench - 4 Track (20' Avg. Exc Depth)
- 10.08.243 - Retained Cut, Trench - 4 Track (30' Avg. Exc Depth)
- 10.08.344 - Retained Cut, Staged Trench - 4 Track (40' Avg. Exc Depth)
- 10.08.346 - Retained Cut, Staged Trench - 4 Track (60' Avg. Exc Depth)
- 10.08.411 - Retained Fill, Walls Both Sides - 1 Tracks (10' Avg. Wall Ht)
- 10.08.412 - Retained Fill, Walls Both Sides - 1 Tracks (20' Avg. Wall Ht)
- 10.08.413 - Retained Fill, Walls Both Sides - 1 Tracks (30' Avg. Wall Ht)
- 10.08.421 - Retained Fill, Walls Both Sides - 2 Tracks (10' Avg. Wall Ht)
- 10.08.422 - Retained Fill, Walls Both Sides - 2 Tracks (20' Avg. Wall Ht)
- 10.08.423 - Retained Fill, Walls Both Sides - 2 Tracks (30' Avg. Wall Ht)

C+C Tunnel and U-Wall support elements (8 UPE):

- 10.07.801 - Ventilation Shaft
- 10.07.802 - Mid-Line Ventilation Structure
- 10.07.803 - Tunnel Portal Structure
- 10.07.805 - Emergency Access Shaft
- 10.07.850 - Pumping Station
- 10.07.901 - Mechanical & Electrical Allowance for Underground (Single)
- 10.07.902 - Mechanical & Electrical Allowance for Underground (Double)
- 10.07.920 - Ventilation Equipment Allowance
- 10.07.950 - Allowance for Construction Monitoring

**METHODOLOGY:**

Assumption: 80% of the cost is a small % of the items – candidate for Pareto analysis

Technique:

A review is usually done in several parts:

- Arithmetic check
- Scope review
- Quantity review
- Pricing review0

Approach – identification of target UPEs for review:

Due to time constraints for this review, only certain items could be reviewed the following approach was used:

1. Extract cost details of each UPE
2. Sort the details of each UPE by Bid Total (decreasing)
3. Identify % of individual UPE Bid Total attributed to each line
4. Do a cumulative sum of %'s starting with the largest
5. Identify which items comprise 80% of UPE cost – these are the cost drivers
6. Make a list of the cost drivers
7. Extract and count the number of times each cost driver occurs
8. Perform review on the most common cost drivers (see list below)
9. Review all elements to see if scope issues are part of another UPE
10. Review list for unexpected cost drivers – Items normally not in top costs

Actions during on review:

A review is usually done in several parts:

- Arithmetic check – This check is only sampling for assurance that arithmetic is correct. Estimate sheets furnished appear to have been prepared using a database type software. As software typically uses the same algorithm a sampling of line items was done on 8 items involving 3 UPEs. Calculations and extensions appear to be correct and applied properly
  - Quantity X rate
  - Labor hours X wage rate
  - Line sum total
  - Summary of line items for UPE
  - UPE back calculation to unit price.
- Scope review – This is the primary area of review. We reviewed to the extent possible for completeness of title scope and looked for other items which may contain associated scope for UPE (example: Utility relocation with U-Wall and Cut & Cover Tunnel). Gaps in scope were noted. Please see description of the approach and comments.
- Quantity review – As the documents are schematic in nature we are unable to validate that quantities are correct.
- Pricing review – Due to the issues on scope and quantities we are not able to determine if unit rates are appropriate or reasonable.

**Major cost line items (covering 80%+ of cost):**

**5 most common (major cost driver in 75% of all UPE):**

- Reinforcing Steel
- Soldier Pile & Lagging
- Structural Concrete, In Place, Walls, Formed 1 Side
- Structural Concrete, In Place, Slab on Grade
- Structural Concrete, In Place, Elevated Slab

**Unexpected major cost items:**

- 6 ft. Chain Link Fence, Wall Mounted
- Architectural Finish Allowance, Non-Public Space
- Track-way Drainage Allowance, Ballasted

| <u>Rank</u> | <u>Description</u>                                  | <u>Count</u> |
|-------------|---|--------------|
| 1           | Reinforcing Steel                                   | 30           |
| 2           | Structural Concrete, In Place, Walls, Formed 1 Side | 28           |
| 3           | Soldier Pile & Lagging                              | 25           |
| 4           | Structural Concrete, In Place, Slab on Grade        | 23           |
| 5           | Structural Concrete, In Place, Elevated Slab        | 14           |
| 6           | Structural Excavation                               | 12           |
| 7           | Structural Concrete, In Place, Footing              | 6            |
| 8           | Sheet Waterproofing                                 | 4            |
| 9           | Electrical Allowance, Misc. Structure               | 3            |
| 10          | Architectural Finishes Allowance, Non-Public Space  | 2            |
| 11          | Fire Protection Allowance, Tunnel                   | 2            |
| 12          | Slurry Wall   | 2            |
| 13          | Structural Concrete, In Place, Beams & Girders      | 2            |
| 14          | Ventilation Allowance, Tunnel                       | 2            |
| 15          | 6 ft. Chain Link Fence, Wall Mounted                | 1            |
| 16          | Cable Duct, At-Grade Guideway                       | 1            |
| 18          | Embankment w/Haul & Compaction                      | 1            |
| 20          | Haul and Dispose of Excavated Material              | 1            |
| 21          | Mechanical Allowance, Misc. Structure               | 1            |
| 22          | Track-way Drainage Allowance, Ballasted             | 1            |
| 23          | Ventilation Building Louver/Screen Allowance        | 1            |
|             | Occurrences   | 162          |
|             | UPE Evaluated                                       | 37           |

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**Line item analysis of each element:**

**General issues associated with unit pricing:**

- No actual design information for verification of quantities or scope
- No maintenance of traffic
- No protection of utilities in place parallel or perpendicular (relocations priced elsewhere)
- Depth of the U-wall / tunnel is normally referenced with top of rail or top of slab
- Statewide pricing
- All labor markets
- All jurisdictions
- Which is applicable wage adjustment?
  - Federal (Davis-Bacon)
  - California (Dept. of Industrial Relations)
- Pay adjustments for insurances and taxes
- Adjustments for work week and possible work hour limitations

## **Soldier Pile & Lagging**

### Undefined in Scope

Quantity based on exposed face not full height of soldier piles

No information on embedment beyond face

Removal of soldier piles and lagging

Same unit price for all depths

NOTE: Tunnel depth varies

Tie back information

Bracing steel quantity = ~ 6" standard weight tube steel every 525 sf of face

Shear resistance

Dealing with any bracing, whalers, or shear resistance in construction of walls and slabs and roof

Why is soldier pile and lagging used over slurry wall?

### Observations:

Same price at all depths

Same price at all widths

## **Reinforcing Steel**

### Undefined in Scope:

- Rebar accessories
- Rebar welding
- Rebar bonding / grounding (there is an allowance for corrosion control)
- Rebar splices
- Dowelling between segments
- Coating
- NDE
- Inspection
- Testing
- Dental concrete (equipment pads, pedestals, block outs)
- Area adjustments
- Wage adjustment for Federal (Davis-Bacon) or CA (Dept. of Industrial Relations)
- Total pay adjustments for insurances or taxes

### Observations:

Same price at all depths

Same price at all widths

All soil types (there is an allowance for corrosion control)

Adequacy of amount of reinforcing steel is not addressed

All cut & cover prices have ~150 lb/cy

All U-Wall segments

- ~150 lb/cy for Retained cut
- ~60 lb/cy for Retained fill

In other tunnel structures:

- 200 lb/cy for Ventilation shaft & mid-line, portal structure, and emergency access shaft
- 150 lb/cy for pumping station

## **Slab on Grade (both Cut & Cover and U-walls):**

### Undefined in Scope:

No adjustment for seismic loading or uplift

No adjustment for buoyancy

Form accessories

Miscellaneous metal

Bracing & work around internal bracing

Joint cleaning

Bulkhead formwork  
Preparation for 2nd pour (track concrete)  
Water-stop  
Admixtures  
Curing & Sealing compounds  
Cooling during curing (up to 6' thick)  
Grouting  
Mud slab (working slab at bottom)  
Dental concrete (equipment pads, pedestals, block outs)  
Hydrostatic loading (dewatering allowance in construction items)

Observations:

Same price at all depths  
Same price at all widths  
Thickness only varies by depth, not width  
It is not clear soldier piles and lagging are removed  
Provisions for embedded utilities

- Allowance for Cable Duct
- Allowance for Dewatering (during construction?)

**Exterior walls – forming one side (both Cut & Cover and U-walls)**

Undefined in Scope:

- Adjustment for seismic loading or uplift
- Removal of soldier piles and lagging
- Form accessories
- Provisions for embedded utilities
- Miscellaneous metal
- Form bracing
- Bracing & work around internal bracing
- Joint cleaning
- Preparation for 2nd pour (track concrete)
- Water-stop
- Admixtures
- Sealing compounds
- Cooling
- Grouting
- Mud slab
- Dental concrete (equipment pads, pedestals, block outs)

Observations:

- Same price at all depths
- Same price at all widths
- Sketch shows 31' between bottom slab (top) and underside of roof – may be more than 1 lift.
- Thickness only varies by depth, not width
- Provisions for embedded utilities
  - Allowance for Cable Duct
  - Allowance for Dewatering (during construction?)
- Adjustment to thickness for depth but no adjustment for span

**Roof Slab (Cut & Cover only)**

Undefined in Scope:

- Same thickness for all spans (1 track & 2 track), Thickness normally varies with depth
- No adjustment for seismic loading or uplift
- Credit for use of shoring system for bottom of deck form support
- Provisions for embedded utilities
- Form accessories

- Miscellaneous metal
- Bracing & work around internal bracing
- Joint cleaning
- Preparation for 2nd pour (track concrete)
- Water-stop
- Admixtures
- Sealing compounds
- Cooling during curing (up to 4'+ thick)
- Grouting
- Mud slab
- Dental concrete (equipment pads, pedestals, block outs)

Observations:

- Same price at all depths
- Same price at all widths.

Programmatic Unit Price Elements  
Los Angeles City Factor  
12/2/2010

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$ | Bid Unit \$    | Code1    | P | Code2  | Notes      | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|------|--|-----------|-----------|----------|--------|----------------|----------|---|--------|------------|-------------|--------------|-------------|----------------|----------------|
| 10.06.114          |             | CC   | Cut & Cover Box - 1 Track/ 1 Box (40' Avg. Exc Depth)            |           |           |          |        |                | CC       | P | CC-Det |            |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 2,118.000 | lb        | 1.30     | 2,754  | 3,485          | 1.65     | P | CC-Det | 150 lb/cy  | \$ 0.60     | \$ 5.68      | \$ 1,271    | \$ 12,030      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 3,730     | cy        | 320.03   | 1,194  | 1,505          | 403.39   | P | CC-Det |            | \$ 250.00   | \$ 1,153.85  | \$ 933      | \$ 4,304       |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 6,670     | cy        | 395.18   | 2,636  | 3,324          | 498.33   | P | CC-Det |            | \$ 230.00   | \$ 702.00    | \$ 1,534    | \$ 4,682       |                |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 3,730     | cy        | 546.16   | 2,037  | 2,569          | 688.65   | P | CC-Det |            | \$ 440.00   | \$ 2,200.00  | \$ 1,641    | \$ 8,206       |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 1,000     | lf        | 45.48    | 45     | 57             | 57.10    | P | CC-Det |            | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702         |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 132,000   | sf        | 6.19     | 817    | 1,027          | 7.78     | P | CC-Det |            | \$ 4.05     | \$ 18.16     | \$ 535      | \$ 2,397       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 74,000    | sf        | 2.08     | 154    | 192            | 2.59     | P | CC-Det |            | \$ 4.00     | \$ 17.00     | \$ 296      | \$ 1,258       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.56   | P | CC-Det |            | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 3,190     | sy        | 5.54     | 18     | 23             | 7.09     | P | CC-Det |            | \$ 0.35     | \$ 6.00      | \$ 1        | \$ 19          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 44,720    | cy        | 21.83    | 976    | 1,250          | 27.95    | P | CC-Det |            | \$ 4.00     | \$ 185.00    | \$ 179      | \$ 8,273       |                |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 5,320     | cy        | 17.17    | 91     | 117            | 21.98    | P | CC-Det |            | \$ 10.00    | \$ 506.00    | \$ 53       | \$ 2,692       |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 80,000    | sf        | 72.32    | 5,786  | 7,266          | 90.83    | P | CC-Det |            | \$ 133.97   | \$ 347.78    | \$ 10,718   | \$ 27,822      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 1,000     | lf        | 41.74    | 42     | 52             | 52.27    | P | CC-Det |            | \$ 3.50     | \$ 615.00    | \$ 4        | \$ 615         |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1,000     | lf        | 3.35     | 3      | 4              | 4.20     | P | CC-Det |            |             |              | FP          | FP             |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 1,000     | lf        | 27.19    | 27     | 34             | 34.00    | P | CC-Det |            | \$ 9.00     | \$ 225.00    | \$ 9        | \$ 225         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 39,400    | cy        | 12.96    | 511    | 628            | 15.94    | P | CC-Det |            | \$ 1.00     | \$ 110.00    | \$ 39       | \$ 4,334       |                |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 1,000     | lf        | 15.00    | 15     | 17             | 17.25    | P | CC-Det |            | \$ 2.25     | \$ 285.00    | \$ 2        | \$ 285         |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 3,750     | sy        | 49.76    | 187    | 232            | 61.95    | P | CC-Det |            | \$ 12.00    | \$ 238.80    | \$ 45       | \$ 896         |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.090     | ton       | 2,103.44 | 189    | 238            | 2,639.11 | P | CC-Det | 1.16 tn/lf | \$ 600.00   | \$ 20,000.00 | \$ 54       | \$ 1,800       |                |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 3,750     | sy        | 0.49     | 2      | 2              | 0.63     | P | CC-Det |            | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 7           |                |
|                    |             |      | Cut & Cover Box - 1 Track/ 1 Box (40' Avg. Exc Depth)            | 1,000     | RF        |          | 17,593 | 22,163         |          | P | CC-Det |            |             |              | Subtotal    | \$ 18,634      | \$ 84,660      |
|                    |             |      |  |           |           |          |        | \$ 120,000,000 | Per Mile |   |        |            |             |              | Fixed Price | \$ 4           | \$ 4           |
|                    |             |      |  |           |           |          |        |                |          |   |        |            |             |              | Total       | \$ 18,638      | \$ 84,665      |
|                    |             |      |  |           |           |          |        |                |          |   |        |            |             |              | Per Mile    | \$ 100,000,000 | \$ 450,000,000 |
| 10.06.115          |             | CC   | Cut & Cover Box - 1 Track/ 1 Box (50' Avg. Exc Depth)            |           |           |          |        |                | CC       | P | CC-Det |            |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 2,489.000 | lb        | 1.30     | 3,236  | 4,096          | 1.65     | P | CC-Det | 150 lb/cy  | \$ 0.60     | \$ 5.68      | \$ 1,493    | \$ 14,138      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 4,410     | cy        | 320.03   | 1,411  | 1,779          | 403.39   | P | CC-Det |            | \$ 250.00   | \$ 1,153.85  | \$ 1,103    | \$ 5,088       |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 7,780     | cy        | 395.18   | 3,075  | 3,877          | 498.33   | P | CC-Det |            | \$ 230.00   | \$ 702.00    | \$ 1,789    | \$ 5,462       |                |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 4,410     | cy        | 546.16   | 2,409  | 3,037          | 688.66   | P | CC-Det |            | \$ 440.00   | \$ 2,200.00  | \$ 1,940    | \$ 9,702       |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 1,000     | lf        | 45.48    | 45     | 57             | 57.10    | P | CC-Det |            | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702         |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 136,000   | sf        | 6.19     | 842    | 1,059          | 7.78     | P | CC-Det |            | \$ 4.05     | \$ 18.16     | \$ 551      | \$ 2,470       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 76,000    | sf        | 2.08     | 158    | 197            | 2.59     | P | CC-Det |            | \$ 4.00     | \$ 17.00     | \$ 304      | \$ 1,292       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.56   | P | CC-Det |            | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 3,310     | sy        | 5.54     | 18     | 23             | 7.08     | P | CC-Det |            | \$ 0.35     | \$ 6.00      | \$ 1        | \$ 20          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 55,090    | cy        | 21.83    | 1,203  | 1,540          | 27.95    | P | CC-Det |            | \$ 4.00     | \$ 185.00    | \$ 220      | \$ 10,192      |                |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 13,220    | cy        | 17.17    | 227    | 291            | 21.98    | P | CC-Det |            | \$ 10.00    | \$ 506.00    | \$ 132      | \$ 6,689       |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 100,000   | sf        | 72.32    | 7,232  | 9,083          | 90.83    | P | CC-Det |            | \$ 133.97   | \$ 347.78    | \$ 13,397   | \$ 34,778      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 1,000     | lf        | 41.74    | 42     | 52             | 52.26    | P | CC-Det |            | \$ 3.50     | \$ 615.00    | \$ 4        | \$ 615         |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1,000     | lf        | 3.35     | 3      | 4              | 4.21     | P | CC-Det |            |             |              | FP          | FP             |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 1,000     | lf        | 27.19    | 27     | 34             | 34.00    | P | CC-Det |            | \$ 9.00     | \$ 225.00    | \$ 9        | \$ 225         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 41,870    | cy        | 12.96    | 543    | 667            | 15.94    | P | CC-Det |            | \$ 1.00     | \$ 110.00    | \$ 42       | \$ 4,606       |                |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 1,000     | lf        | 15.00    | 15     | 17             | 17.25    | P | CC-Det |            | \$ 2.25     | \$ 285.00    | \$ 2        | \$ 285         |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 3,860     | sy        | 49.76    | 192    | 239            | 61.95    | P | CC-Det |            | \$ 12.00    | \$ 238.80    | \$ 46       | \$ 922         |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.140     | ton       | 2,103.50 | 294    | 370            | 2,639.29 | P | CC-Det |            | \$ 600.00   | \$ 20,000.00 | \$ 84       | \$ 2,800       |                |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 3,860     | sy        | 0.50     | 2      | 2              | 0.63     | P | CC-Det |            | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 7           |                |
|                    |             |      | Cut & Cover Box - 1 Track/ 1 Box (50' Avg. Exc Depth)            | 1,000     | RF        |          | 21,084 | 26,565         |          | P | CC-Det |            |             |              | Subtotal    | \$ 22,439      | \$ 104,105     |
|                    |             |      |  |           |           |          |        | \$ 150,000,000 | Per Mile |   |        |            |             |              | Fixed Price | \$ 4           | \$ 4           |
|                    |             |      |  |           |           |          |        |                |          |   |        |            |             |              | Total       | \$ 22,443      | \$ 104,109     |
|                    |             |      |  |           |           |          |        |                |          |   |        |            |             |              | Per Mile    | \$ 120,000,000 | \$ 550,000,000 |

Programmatic Unit Price Elements  
Los Angeles City Factor  
12/2/2010

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$         | Bid Unit \$ | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|------|--|-----------|-----------|----------|----------------|-------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
| 10.06.116          |             | CC   | Cut & Cover Box - 1 Track/ 1 Box (60' Avg. Exc Depth)            |           |           |          |                |             | CC       | P | CC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 3,264.000 | lb        | 1.30     | 4,244          | 5,371       | 1.65     | P | CC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 1,958    | \$ 18,540      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 5.880     | cy        | 320.03   | 1,882          | 2,372       | 403.38   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 1,470    | \$ 6,785       |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 10.000    | cy        | 395.18   | 3,952          | 4,983       | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 2,300    | \$ 7,020       |                |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 5.880     | cy        | 546.16   | 3,211          | 4,049       | 688.65   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 2,587    | \$ 12,936      |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 1.000     | lf        | 45.48    | 45             | 57          | 57.10    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702         |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 144.000   | sf        | 6.19     | 891            | 1,121       | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 583      | \$ 2,615       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 80.000    | sf        | 2.08     | 166            | 207         | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 320      | \$ 1,360       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110            | 141         | 281.54   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 3.530     | sy        | 5.54     | 20             | 25          | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 1        | \$ 21          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 70.560    | cy        | 21.83    | 1,541          | 1,972       | 27.95    | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 282      | \$ 13,054      |                |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 23.520    | cy        | 17.17    | 404            | 517         | 21.98    | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 235      | \$ 11,901      |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 120.000   | sf        | 72.32    | 8,679          | 10,899      | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 16,076   | \$ 41,734      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 1.000     | lf        | 41.74    | 42             | 52          | 52.27    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 4        | \$ 615         |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3              | 4           | 4.20     | P | CC-Det |           |             |              | FP          | FP             |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 1.000     | lf        | 27.19    | 27             | 34          | 34.03    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 9        | \$ 225         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 47.040    | cy        | 12.96    | 610            | 750         | 15.94    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 47       | \$ 5,174       |                |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 1.000     | lf        | 15.00    | 15             | 17          | 17.25    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 2        | \$ 285         |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 4.080     | sy        | 49.77    | 203            | 253         | 61.95    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 49       | \$ 974         |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.190     | ton       | 2,103.40 | 400            | 501         | 2,639.26 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 114      | \$ 3,800       |                |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 4.080     | sy        | 0.50     | 2              | 3           | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 7           |                |
|                    |             |      | Cut & Cover Box - 1 Track/ 1 Box (60' Avg. Exc Depth)            | 1.000     | RF        | 26,446   | 33,329         |             |          | P | CC-Det |           |             |              | Subtotal    | \$ 27,359      | \$ 131,861     |
|                    |             |      |  |           |           |          | \$ 180,000,000 | Per Mile    |          |   |        |           |             |              | Fixed Price | \$ 4           | \$ 4           |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Total       | \$ 27,363      | \$ 131,865     |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Per Mile    | \$ 150,000,000 | \$ 700,000,000 |



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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$ | Bid Unit \$    | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total      | Hi Total       |            |
|--------------------|-------------|------|--|-----------|-----------|----------|--------|----------------|----------|---|--------|-----------|-------------|--------------|----------------|----------------|------------|
| 10.06.214          |             | CC   | Cut & Cover Box - 2 Track / 1 Box (40' Avg. Exc Depth)           |           |           |          |        |                | CC       | P | CC-Det |           |             |              |                |                |            |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 3,414.000 | lb        | 1.30     | 4,439  | 5,618          |          | P | CC-Det | 216 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,048       | \$ 19,392      |            |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 6,940     | cy        | 320.03   | 2,221  | 2,800          | 403.39   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 1,735       | \$ 8,008       |            |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 6,670     | cy        | 395.18   | 2,636  | 3,324          | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 1,534       | \$ 4,682       |            |
|                    | 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                | 2,220     | cy        | 470.28   | 1,044  | 1,315          | 592.37   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 511         | \$ 1,558       |            |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 6,940     | cy        | 546.16   | 3,790  | 4,779          | 688.66   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 3,054       | \$ 15,268      |            |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2,000     | lf        | 45.48    | 91     | 114            | 57.09    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460         | \$ 1,404       |            |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 181.000   | sf        | 6.19     | 1,120  | 1,409          | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 733         | \$ 3,287       |            |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 74.000    | sf        | 2.08     | 154    | 192            | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 296         | \$ 1,258       |            |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.54   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090       | \$ 4,113       |            |
|                    | 31-22-16.10 | A010 | Finish Grading   | 5.940     | sy        | 5.54     | 33     | 42             | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2           | \$ 36          |            |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 83.220    | cy        | 21.83    | 1,817  | 2,326          | 27.95    | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 333         | \$ 15,396      |            |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 9.910     | cy        | 17.17    | 170    | 218            | 21.97    | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 99          | \$ 5,014       |            |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 80.000    | sf        | 72.32    | 5,786  | 7,266          | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 10,718      | \$ 27,822      |            |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74    | 83     | 105            | 52.27    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7           | \$ 1,230       |            |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3      | 4              | 4.21     | P | CC-Det |           |             |              | FP             | FP             |            |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19    | 54     | 68             | 34.01    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18          | \$ 450         |            |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00    | 30     | 35             | 17.25    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2           | \$ 220         |            |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 73.310    | cy        | 12.96    | 950    | 1,168          | 15.94    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 165         | \$ 20,893      |            |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00 | 9      | 11             | 3,613.33 | P | CC-Det | 333 ft/ea | \$ 865.00   | \$ 17,000.00 | \$ 3           | \$ 51          |            |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 6.500     | sy        | 49.77    | 323    | 403            | 61.96    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 78          | \$ 1,552       |            |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.230     | ton       | 2,103.44 | 484    | 607            | 2,639.22 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 138         | \$ 4,600       |            |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 6.500     | sy        | 0.49     | 3      | 4              | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0           | \$ 12          |            |
|                    |             |      | Cut & Cover Box - 2 Track / 1 Box (40' Avg. Exc Depth)           | 1.000     | RF        |          | 25,351 | 31,948         |          | P | CC-Det |           |             |              | Subtotal       | \$ 23,024      | \$ 136,247 |
|                    |             |      |  |           |           |          |        | \$ 170,000,000 | Per Mile |   |        |           |             | Fixed Price  | \$ 4           | \$ 4           |            |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             | Total        | \$ 23,028      | \$ 136,251     |            |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             | Per Mile     | \$ 130,000,000 | \$ 720,000,000 |            |

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| 10.06.215   | CC   | Cut & Cover Box - 2 Track / 1 Box (50' Avg. Exc Depth)            |              |           |          |               |                |          |  | Code1 | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|-------------|------|---|--------------|-----------|----------|---------------|----------------|----------|--|-------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
|             | A010 | Reinforcing Steel   | 3,922.000    | lb        | 1.30     | 5,099         | 6,454          | 1.65     |  | CC    | P | CC-Det |           |             |              |             |                |                |
| 03-21-10.60 | A145 | Structural Concrete, In Place, C&C Slab on Grade                  | 8.070        | cy        | 320.03   | 2,583         | 3,255          | 403.39   |  |       | P | CC-Det | 217 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,353    | \$ 22,277      |                |
| 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side  | 7.780        | cy        | 395.18   | 3,075         | 3,877          | 498.33   |  |       | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,018    | \$ 9,312       |                |
| 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                 | 2.220        | cy        | 470.28   | 1,044         | 1,315          | 592.37   |  |       | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 511      | \$ 1,558       |                |
| 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                      | 8.070        | cy        | 546.16   | 4,407         | 5,557          | 688.66   |  |       | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 3,551    | \$ 17,754      |                |
| 05-53-16.50 | A010 | Service/Safety Walkway  | 2.000        | lf        | 45.48    | 91            | 114            | 57.09    |  |       | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460      | \$ 1,404       |                |
| 07-13-53.10 | A010 | Sheet Waterproofing   | 185.000      | sf        | 6.19     | 1,145         | 1,440          | 7.78     |  |       | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 749      | \$ 3,360       |                |
| 07-17-13.10 | A010 | Composite Drainage Board  | 76.000       | sf        | 2.08     | 158           | 197            | 2.59     |  |       | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 304      | \$ 1,292       |                |
| 31-23-19.20 | A010 | Dewatering Allowance  | 0.500        | day       | 219.96   | 110           | 141            | 281.54   |  |       | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
| 31-22-16.10 | A010 | Finish Grading  | 6.060        | sy        | 5.54     | 34            | 43             | 7.09     |  |       | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 36          |                |
| 31-23-16.16 | A010 | Structural Excavation   | 100.930      | cy        | 21.83    | 2,204         | 2,821          | 27.95    |  |       | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 404      | \$ 18,672      |                |
| 31-23-23.14 | A010 | Structural Backfill   | 24.220       | cy        | 17.17    | 416           | 532            | 21.98    |  |       | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 242      | \$ 12,255      |                |
| 31-52-16.10 | A010 | Soldier Pile & Lagging  | 100.000      | sf        | 72.32    | 7,232         | 9,083          | 90.83    |  |       | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 13,397   | \$ 34,778      |                |
| 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                  | 2.000        | lf        | 41.74    | 83            | 105            | 52.27    |  |       | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                |
| 26-05-26.80 | A010 | Corrosion Control Allowance                                       | 1.000        | lf        | 3.35     | 3             | 4              | 4.22     |  |       | P | CC-Det |           |             |              | FP          | FP             |                |
| 05-52-13.50 | A010 | Safety Railing  | 2.000        | lf        | 27.19    | 54            | 68             | 34.02    |  |       | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                |
| 10-14-19.10 | A050 | Signage Allowance, Tunnels  | 2.000        | lf        | 15.00    | 30            | 35             | 17.25    |  |       | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                |
| 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                            | 76.710       | cy        | 12.96    | 994           | 1,222          | 15.94    |  |       | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 173      | \$ 21,862      |                |
| 31-74-13.30 | A120 | Crosspassage Doors  | 0.003        | ea        | 2,883.00 | 9             | 11             | 3,613.33 |  |       | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                |
| 32-06-10.10 | A100 | Site Restoration Allowance  | 6.610        | sy        | 49.77    | 329           | 410            | 61.96    |  |       | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 79       | \$ 1,578       |                |
| 05-12-23.77 | A010 | Structural Steel (for Bracing)                                    | 0.350        | ton       | 2,103.43 | 736           | 924            | 2,639.20 |  |       | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 210      | \$ 7,000       |                |
| 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                            | 6.610        | sy        | 0.49     | 3             | 4              | 0.63     |  |       | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 12          |                |
|             |      | <b>Cut &amp; Cover Box - 2 Track / 1 Box (50' Avg. Exc Depth)</b> | <b>1.000</b> | <b>RF</b> |          | <b>29,839</b> | <b>37,612</b>  |          |  |       | P | CC-Det |           |             |              | Subtotal    | \$ 27,362      | \$ 164,677     |
|             |      |   |              |           |          |               | \$ 200,000,000 | Per Mile |  |       |   |        |           |             |              | Fixed Price | \$ 4           | \$ 4           |
|             |      |   |              |           |          |               |                |          |  |       |   |        |           |             |              | Total       | \$ 27,366      | \$ 164,681     |
|             |      |   |              |           |          |               |                |          |  |       |   |        |           |             |              | Per Mile    | \$ 150,000,000 | \$ 870,000,000 |

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$         | Bid Unit \$ | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total      | Hi Total         |            |
|--------------------|-------------|------|--|-----------|-----------|----------|----------------|-------------|----------|---|--------|-----------|-------------|--------------|----------------|------------------|------------|
| 10.06.216          |             | CC   | Cut & Cover Box - 2 Track / 1 Box (60' Avg. Exc Depth)           |           |           |          |                |             | CC       | P | CC-Det |           |             |              |                |                  |            |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 4,972.000 | lb        | 1.30     | 6,464          | 8,182       | 1.65     | P | CC-Det | 219 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,983       | \$ 28,241        |            |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 10.460    | cy        | 320.03   | 3,348          | 4,219       | 403.39   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,615       | \$ 12,069        |            |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 10.000    | cy        | 395.18   | 3,952          | 4,983       | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 2,300       | \$ 7,020         |            |
|                    | 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                | 2.220     | cy        | 470.28   | 1,044          | 1,315       | 592.37   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 511         | \$ 1,558         |            |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 10.460    | cy        | 546.16   | 5,713          | 7,203       | 688.65   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 4,602       | \$ 23,012        |            |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2.000     | lf        | 45.48    | 91             | 114         | 57.09    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460         | \$ 1,404         |            |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 193.000   | sf        | 6.19     | 1,195          | 1,502       | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 782         | \$ 3,505         |            |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 80.000    | sf        | 2.08     | 166            | 207         | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 320         | \$ 1,360         |            |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110            | 141         | 281.56   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090       | \$ 4,113         |            |
|                    | 31-22-16.10 | A010 | Finish Grading   | 6.280     | sy        | 5.54     | 35             | 45          | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2           | \$ 38            |            |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 125.560   | cy        | 21.83    | 2,741          | 3,509       | 27.95    | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 502         | \$ 23,229        |            |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 41.850    | cy        | 17.17    | 718            | 920         | 21.98    | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 419         | \$ 21,176        |            |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 120.000   | sf        | 72.32    | 8,679          | 10,899      | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 16,076      | \$ 41,734        |            |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74    | 83             | 105         | 52.26    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7           | \$ 1,230         |            |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3              | 4           | 4.22     | P | CC-Det |           |             |              | FP             | FP               |            |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19    | 54             | 68          | 34.02    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18          | \$ 450           |            |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00    | 30             | 35          | 17.25    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2           | \$ 220           |            |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 83.710    | cy        | 12.96    | 1,085          | 1,334       | 15.94    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 188         | \$ 23,857        |            |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00 | 9              | 11          | 3,610.00 | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3           | \$ 51            |            |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 6.830     | sy        | 49.76    | 340            | 423         | 61.95    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 82          | \$ 1,631         |            |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.480     | ton       | 2,103.44 | 1,010          | 1,267       | 2,639.23 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 288         | \$ 9,600         |            |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 6.830     | sy        | 0.49     | 3              | 4           | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0           | \$ 12            |            |
|                    |             |      | Cut & Cover Box - 2 Track / 1 Box (60' Avg. Exc Depth)           | 1.000     | RF        |          | 36,873         | 46,491      |          | P | CC-Det |           |             |              | Subtotal       | \$ 33,251        | \$ 205,510 |
|                    |             |      |  |           |           |          | \$ 250,000,000 | Per Mile    |          |   |        |           |             | Fixed Price  | \$ 4           | \$ 4             |            |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             | Total        | \$ 33,255      | \$ 205,514       |            |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             | Per Mile     | \$ 180,000,000 | \$ 1,090,000,000 |            |

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$     | Bid \$         | Bid Unit \$ | Code1      | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|------|--|-----------|-----------|------------|----------------|-------------|------------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
| 10.06.224          |             | CC   | Cut & Cover Box - 2 Track/ 2 Box (40' Avg. Exc Depth)            |           |           |            |                |             | CC         | P | CC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 4,236.000 | lb        | 1.30       | 5,507          | 6,971       |            | P | CC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,542    | \$ 24,060      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 7.450     | cy        | 320.03     | 2,384          | 3,005       | 403.38     | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 1,863    | \$ 8,596       |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 13.330    | cy        | 395.18     | 5,268          | 6,643       | 498.33     | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 3,066    | \$ 9,358       |                |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 7.450     | cy        | 546.16     | 4,069          | 5,131       | 688.66     | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 3,278    | \$ 16,390      |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2.000     | lf        | 45.48      | 91             | 114         | 57.09      | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460      | \$ 1,404       |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 411.000   | sf        | 6.19       | 2,544          | 3,199       | 7.78       | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,665    | \$ 7,464       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 148.000   | sf        | 2.08       | 308            | 383         | 2.59       | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 592      | \$ 2,516       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96     | 110            | 141         | 281.54     | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 6.390     | sy        | 5.54       | 35             | 45          | 7.09       | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 38          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 89.440    | cy        | 21.83      | 1,953          | 2,500       | 27.95      | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 358      | \$ 16,546      |                |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 10.650    | cy        | 17.17      | 183            | 234         | 21.98      | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 107      | \$ 5,389       |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 160.000   | sf        | 72.32      | 11,571         | 14,533      | 90.83      | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 21,435   | \$ 55,645      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74      | 83             | 105         | 52.26      | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2.000     | lf        | 3.35       | 7              | 8           | 4.22       | P | CC-Det |           |             |              | FP          | FP             |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19      | 54             | 68          | 34.02      | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 78.790    | cy        | 12.96      | 1,021          | 1,256       | 15.94      | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 177      | \$ 22,455      |                |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00      | 30             | 35          | 17.25      | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 7.500     | sy        | 49.76      | 373            | 465         | 61.96      | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 90       | \$ 1,791       |                |
|                    | 31-74-13.30 | A100 | Crosspassage Allowance, 60' to 70' Tunnel Centerlines            | 0.001     | ea        | 600,000.00 | 600            | 690         | 690,000.00 | P | CC-Det |           |             |              | FP          | FP             |                |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00   | 9              | 11          | 3,610.00   | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.180     | ton       | 2,103.44   | 379            | 475         | 2,639.28   | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 108      | \$ 3,600       |                |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 7.500     | sy        | 0.49       | 4              | 5           | 0.63       | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 14          |                |
|                    |             |      | Cut & Cover Box - 2 Track/ 2 Box (40' Avg. Exc Depth)            | 1.000     | RF        |            | 36,583         | 46,015      |            | P | CC-Det |           |             |              | Subtotal    | \$ 36,862      | \$ 181,330     |
|                    |             |      |  |           |           |            | \$ 250,000,000 | Per Mile    |            |   |        |           |             |              | Fixed Price | \$ 698         | \$ 698         |
|                    |             |      |  |           |           |            |                |             |            |   |        |           |             |              | Total       | \$ 37,560      | \$ 182,028     |
|                    |             |      |  |           |           |            |                |             |            |   |        |           |             |              | Per Mile    | \$ 200,000,000 | \$ 970,000,000 |

Programmatic Unit Price Elements  
Los Angeles City Factor  
12/2/2010

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$     | Bid \$ | Bid Unit \$    | Code1      | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total      | Hi Total         |            |
|--------------------|-------------|------|--|-----------|-----------|------------|--------|----------------|------------|---|--------|-----------|-------------|--------------|----------------|------------------|------------|
| 10.06.225          |             | CC   | Cut & Cover Box - 2 Track / 2 Box (50' Avg. Exc Depth)           |           |           |            |        |                | CC         | P | CC-Det |           |             |              |                |                  |            |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 4,978.000 | lb        | 1.30       | 6,472  | 8,192          | 1.65       | P | CC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,987       | \$ 28,275        |            |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 8.810     | cy        | 320.03     | 2,819  | 3,554          | 403.39     | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,203       | \$ 10,165        |            |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 15.560    | cy        | 395.18     | 6,149  | 7,754          | 498.33     | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 3,579       | \$ 10,923        |            |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 8.810     | cy        | 546.16     | 4,812  | 6,067          | 688.65     | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 3,876       | \$ 19,382        |            |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2.000     | lf        | 45.48      | 91     | 114            | 57.09      | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460         | \$ 1,404         |            |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 423.000   | sf        | 6.19       | 2,618  | 3,293          | 7.78       | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,713       | \$ 7,682         |            |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 152.000   | sf        | 2.08       | 316    | 394            | 2.59       | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 608         | \$ 2,584         |            |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96     | 110    | 141            | 281.52     | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090       | \$ 4,113         |            |
|                    | 31-22-16.10 | A010 | Finish Grading   | 6.610     | sy        | 5.54       | 37     | 47             | 7.09       | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2           | \$ 40            |            |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 110.190   | cy        | 21.83      | 2,406  | 3,080          | 27.95      | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 441         | \$ 20,385        |            |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 26.440    | cy        | 17.17      | 454    | 581            | 21.98      | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 264         | \$ 13,379        |            |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 200.000   | sf        | 72.32      | 14,464 | 18,166         | 90.83      | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 26,794      | \$ 69,556        |            |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74      | 83     | 105            | 52.27      | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7           | \$ 1,230         |            |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2.000     | lf        | 3.35       | 7      | 8              | 4.22       | P | CC-Det |           |             |              | FP             | FP               |            |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19      | 54     | 68             | 34.01      | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18          | \$ 450           |            |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00      | 30     | 35             | 17.25      | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2           | \$ 220           |            |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 83.750    | cy        | 12.96      | 1,085  | 1,335          | 15.94      | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 188         | \$ 23,869        |            |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 7.720     | sy        | 49.76      | 384    | 478            | 61.95      | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 93          | \$ 1,844         |            |
|                    | 31-74-13.30 | A100 | Crosspassage Allowance, 60' to 70' Tunnel Centerlines            | 0.001     | ea        | 600,000.00 | 600    | 690            | 690,000.00 | P | CC-Det |           |             |              | FP             | FP               |            |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00   | 9      | 11             | 3,613.33   | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3           | \$ 51            |            |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.280     | ton       | 2,103.46   | 589    | 739            | 2,639.25   | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 168         | \$ 5,600         |            |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 7.720     | sy        | 0.50       | 4      | 5              | 0.63       | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0           | \$ 14            |            |
|                    |             |      | Cut & Cover Box - 2 Track / 2 Box (50' Avg. Exc Depth)           | 1.000     | RF        |            | 43,593 | 54,854         |            | P | CC-Det |           |             |              | Subtotal       | \$ 44,497        | \$ 221,165 |
|                    |             |      |  |           |           |            |        | \$ 290,000,000 | Per Mile   |   |        |           |             | Fixed Price  | \$ 698         | \$ 698           |            |
|                    |             |      |  |           |           |            |        |                |            |   |        |           |             | Total        | \$ 45,195      | \$ 221,863       |            |
|                    |             |      |  |           |           |            |        |                |            |   |        |           |             | Per Mile     | \$ 240,000,000 | \$ 1,180,000,000 |            |

Programmatic Unit Price Elements  
Los Angeles City Factor  
12/2/2010

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$     | Bid \$         | Bid Unit \$ | Code1 | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                  |
|--------------------|-------------|------|--|-----------|-----------|------------|----------------|-------------|-------|---|--------|-----------|-------------|--------------|-------------|----------------|------------------|
| 10.06.226          |             | CC   | Cut & Cover Box - 2 Track / 2 Box (60' Avg. Exc Depth)           |           |           |            |                |             | CC    | P | CC-Det |           |             |              |             |                |                  |
| TRUE               | 03-21-10.60 | A010 | Reinforcing Steel  | 6,528.000 | lb        | 1.30       | 8,487          | 10,743      |       | P | CC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 3,917    | \$ 37,079      |                  |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 11.760    | cy        | 320.03     | 3,764          | 4,744       |       | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,940    | \$ 13,569      |                  |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 20.000    | cy        | 395.18     | 7,904          | 9,967       |       | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 4,600    | \$ 14,040      |                  |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 11.760    | cy        | 546.16     | 6,423          | 8,099       |       | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 5,174    | \$ 25,872      |                  |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2.000     | lf        | 45.48      | 91             | 114         |       | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460      | \$ 1,404       |                  |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 447.000   | sf        | 6.19       | 2,767          | 3,479       |       | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,810    | \$ 8,118       |                  |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 160.000   | sf        | 2.08       | 332            | 414         |       | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 640      | \$ 2,720       |                  |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96     | 110            | 141         |       | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                  |
|                    | 31-22-16.10 | A010 | Finish Grading   | 7.060     | sy        | 5.54       | 39             | 50          |       | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 42          |                  |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 141.110   | cy        | 21.83      | 3,081          | 3,944       |       | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 564      | \$ 26,105      |                  |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 47.040    | cy        | 17.17      | 808            | 1,034       |       | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 470      | \$ 23,802      |                  |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 240.000   | sf        | 72.32      | 17,357         | 21,799      |       | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 32,153   | \$ 83,467      |                  |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74      | 83             | 105         |       | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2.000     | lf        | 3.35       | 7              | 8           |       | P | CC-Det |           |             |              | FP          | FP             |                  |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19      | 54             | 68          |       | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                  |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00      | 30             | 35          |       | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                  |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 94.070    | cy        | 12.96      | 1,219          | 1,499       |       | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 212      | \$ 26,810      |                  |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 8.170     | sy        | 49.76      | 407            | 506         |       | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 98       | \$ 1,951       |                  |
|                    | 31-74-13.30 | A100 | Crosspassage Allowance, 60' to 70' Tunnel Centerlines            | 0.001     | ea        | 600,000.00 | 600            | 690         |       | P | CC-Det |           |             |              | FP          | FP             |                  |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00   | 9              | 11          |       | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                  |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.370     | ton       | 2,103.46   | 778            | 977         |       | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 222      | \$ 7,400       |                  |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 8.170     | sy        | 0.49       | 4              | 5           |       | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 15          |                  |
|                    |             |      | Cut & Cover Box - 2 Track / 2 Box (60' Avg. Exc Depth)           | 1.000     | RF        |            | 54,353         | 68,430      |       | P | CC-Det |           |             |              | Subtotal    | \$ 54,384      | \$ 278,459       |
|                    |             |      |  |           |           |            | \$ 370,000,000 | Per Mile    |       |   |        |           |             |              | Fixed Price | \$ 698         | \$ 698           |
|                    |             |      |  |           |           |            |                |             |       |   |        |           |             |              | Total       | \$ 55,082      | \$ 279,157       |
|                    |             |      |  |           |           |            |                |             |       |   |        |           |             |              | Per Mile    | \$ 300,000,000 | \$ 1,480,000,000 |

| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$         | Bid Unit \$ | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                  |
|--------------------|-------------|------|--|-----------|-----------|----------|----------------|-------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|------------------|
| 10.06.414          |             | CC   | Cut & Cover Box - 4 Track / 1 Box (40' Avg. Exc Depth)           |           |           |          |                |             | CC       | P | CC-Det |           |             |              |             |                |                  |
| TRUE               | 03-21-10.60 | A010 | Reinforcing Steel  | 5,000.000 | lb        | 1.30     | 6,500          | 8,228       | 1.65     | P | CC-Det | 231 lb/cy | \$ 0.60     | \$ 5.68      | \$ 3,000    | \$ 28,400      |                  |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 11.670    | cy        | 320.03   | 3,735          | 4,708       | 403.39   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,918    | \$ 13,465      |                  |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 6.670     | cy        | 395.18   | 2,636          | 3,324       | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 1,534    | \$ 4,682       |                  |
|                    | 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                | 3.330     | cy        | 470.29   | 1,566          | 1,973       | 592.37   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 766      | \$ 2,338       |                  |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 11.670    | cy        | 546.16   | 6,374          | 8,037       | 688.66   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 5,135    | \$ 25,674      |                  |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 4.000     | lf        | 45.48    | 182            | 228         | 57.09    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                  |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 254.000   | sf        | 6.19     | 1,572          | 1,977       | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,029    | \$ 4,613       |                  |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 74.000    | sf        | 2.08     | 154            | 192         | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 296      | \$ 1,258       |                  |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110            | 141         | 281.54   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                  |
|                    | 31-22-16.10 | A010 | Finish Grading   | 10.000    | sy        | 5.54     | 55             | 71          | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 4        | \$ 60          |                  |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 140.000   | cy        | 21.83    | 3,057          | 3,913       | 27.95    | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 560      | \$ 25,900      |                  |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 16.670    | cy        | 17.17    | 286            | 366         | 21.98    | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 167      | \$ 8,435       |                  |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 80.000    | sf        | 72.32    | 5,786          | 7,266       | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 10,718   | \$ 27,822      |                  |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 4.000     | lf        | 41.74    | 167            | 209         | 52.26    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 14       | \$ 2,460       |                  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2.000     | lf        | 3.35     | 7              | 8           | 4.22     | P | CC-Det |           |             |              | FP          | FP             |                  |
|                    | 05-52-13.50 | A010 | Safety Railing   | 4.000     | lf        | 27.19    | 109            | 136         | 34.02    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 36       | \$ 900         |                  |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00    | 30             | 35          | 17.25    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                  |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 123.330   | cy        | 12.96    | 1,598          | 1,965       | 15.94    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 277      | \$ 35,149      |                  |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00 | 9              | 11          | 3,610.00 | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                  |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 10.560    | sy        | 49.76    | 526            | 654         | 61.96    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 127      | \$ 2,522       |                  |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.350     | ton       | 2,103.43 | 736            | 924         | 2,639.20 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 210      | \$ 7,000       |                  |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 10.560    | sy        | 0.49     | 5              | 7           | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 19          |                  |
|                    |             |      | Cut & Cover Box - 4 Track / 1 Box (40' Avg. Exc Depth)           | 1.000     | RF        |          | 35,199         | 44,372      |          | P | CC-Det |           |             |              | Subtotal    | \$ 28,804      | \$ 197,889       |
|                    |             |      |  |           |           |          | \$ 240,000,000 | Per Mile    |          |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8             |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Total       | \$ 28,812      | \$ 197,897       |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Per Mile    | \$ 160,000,000 | \$ 1,050,000,000 |

Programmatic Unit Price Elements  
Los Angeles City Factor  
12/2/2010

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$         | Bid Unit \$ | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                  |
|--------------------|-------------|------|--|-----------|-----------|----------|----------------|-------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|------------------|
| 10.06.415          |             | CC   | Cut & Cover Box - 4 Track / 1 Box (50' Avg. Exc Depth)           |           |           |          |                |             | CC       | P | CC-Det |           |             |              |             |                |                  |
| TRUE               | 03-21-10.60 | A010 | Reinforcing Steel  | 5,711.000 | lb        | 1.30     | 7,425          | 9,398       | 1.65     | P | CC-Det | 232 lb/cy | \$ 0.60     | \$ 5.68      | \$ 3,427    | \$ 32,438      |                  |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 13.480    | cy        | 320.03   | 4,314          | 5,438       | 403.39   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 3,370    | \$ 15,554      |                  |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 7.780     | cy        | 395.18   | 3,075          | 3,877       | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 1,789    | \$ 5,462       |                  |
|                    | 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                | 3.330     | cy        | 470.29   | 1,566          | 1,973       | 592.37   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 766      | \$ 2,338       |                  |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 13.480    | cy        | 546.16   | 7,362          | 9,283       | 688.66   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 5,931    | \$ 29,656      |                  |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 4.000     | lf        | 45.48    | 182            | 228         | 57.09    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                  |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 258.000   | sf        | 6.19     | 1,597          | 2,008       | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,045    | \$ 4,685       |                  |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 76.000    | sf        | 2.08     | 158            | 197         | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 304      | \$ 1,292       |                  |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110            | 141         | 281.54   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                  |
|                    | 31-22-16.10 | A010 | Finish Grading   | 10.110    | sy        | 5.54     | 56             | 72          | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 4        | \$ 61          |                  |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 168.520   | cy        | 21.83    | 3,679          | 4,710       | 27.95    | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 674      | \$ 31,176      |                  |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 40.440    | cy        | 17.17    | 694            | 889         | 21.98    | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 404      | \$ 20,463      |                  |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 100.000   | sf        | 72.32    | 7,232          | 9,083       | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 13,397   | \$ 34,778      |                  |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74    | 83             | 105         | 52.27    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2.000     | lf        | 3.35     | 7              | 8           | 4.22     | P | CC-Det |           |             |              | FP          | FP             |                  |
|                    | 05-52-13.50 | A010 | Safety Railing   | 4.000     | lf        | 27.19    | 109            | 136         | 34.02    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 36       | \$ 900         |                  |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00    | 30             | 35          | 17.25    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                  |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 128.080   | cy        | 12.96    | 1,660          | 2,041       | 15.94    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 288      | \$ 36,503      |                  |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00 | 9              | 11          | 3,613.33 | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                  |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 10.670    | sy        | 49.76    | 531            | 661         | 61.95    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 128      | \$ 2,548       |                  |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.540     | ton       | 2,103.46 | 1,136          | 1,425       | 2,639.26 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 324      | \$ 10,800      |                  |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 10.670    | sy        | 0.49     | 5              | 7           | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 20          |                  |
|                    |             |      | Cut & Cover Box - 4 Track / 1 Box (50' Avg. Exc Depth)           | 1.000     | RF        |          | 41,020         | 51,724      |          | P | CC-Det |           |             |              | Subtotal    | \$ 33,910      | \$ 237,095       |
|                    |             |      |  |           |           |          | \$ 280,000,000 | Per Mile    |          |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8             |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Total       | \$ 33,918      | \$ 237,103       |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Per Mile    | \$ 180,000,000 | \$ 1,260,000,000 |



Programmatic Unit Price Elements  
Los Angeles City Factor  
12/2/2010

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$         | Bid Unit \$ | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                  |
|--------------------|-------------|------|--|-----------|-----------|----------|----------------|-------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|------------------|
| 10.06.416          |             | CC   | Cut & Cover Box - 4 Track / 1 Box (60' Avg. Exc Depth)           |           |           |          |                |             | CC       | P | CC-Det |           |             |              |             |                |                  |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 7,166.670 | lb        | 1.30     | 9,317          | 11,794      |          | P | CC-Det | 235 lb/cy | \$ 0.60     | \$ 5.68      | \$ 4,300    | \$ 40,707      |                  |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 17,220    | cy        | 320.03   | 5,511          | 6,946       | 403.39   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 4,305    | \$ 19,869      |                  |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 10,000    | cy        | 395.18   | 3,952          | 4,983       | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 2,300    | \$ 7,020       |                  |
|                    | 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                | 3,330     | cy        | 470.29   | 1,566          | 1,973       | 592.38   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 766      | \$ 2,338       |                  |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 17,220    | cy        | 546.16   | 9,405          | 11,859      | 688.66   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 7,577    | \$ 37,884      |                  |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 4,000     | lf        | 45.48    | 182            | 228         | 57.09    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                  |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 266,000   | sf        | 6.19     | 1,646          | 2,071       | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,077    | \$ 4,831       |                  |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 80,000    | sf        | 2.08     | 166            | 207         | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 320      | \$ 1,360       |                  |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110            | 141         | 281.54   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                  |
|                    | 31-22-16.10 | A010 | Finish Grading   | 10,330    | sy        | 5.54     | 57             | 73          | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 4        | \$ 62          |                  |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 206,670   | cy        | 21.83    | 4,512          | 5,776       | 27.95    | P | CC-Det |           | \$ 4.00     | \$ 185.00    | \$ 827      | \$ 38,234      |                  |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 68,890    | cy        | 17.17    | 1,183          | 1,514       | 21.98    | P | CC-Det |           | \$ 10.00    | \$ 506.00    | \$ 689      | \$ 34,858      |                  |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 120,000   | sf        | 72.32    | 8,679          | 10,899      | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 16,076   | \$ 41,734      |                  |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2,000     | lf        | 41.74    | 83             | 105         | 52.27    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2,000     | lf        | 3.35     | 7              | 8           | 4.21     | P | CC-Det |           |             |              | FP          | FP             |                  |
|                    | 05-52-13.50 | A010 | Safety Railing   | 4,000     | lf        | 27.19    | 109            | 136         | 34.02    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 36       | \$ 900         |                  |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2,000     | lf        | 15.00    | 30             | 35          | 17.25    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                  |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 137,780   | cy        | 12.96    | 1,785          | 2,196       | 15.94    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 310      | \$ 39,267      |                  |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00 | 9              | 11          | 3,613.33 | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                  |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 10,890    | sy        | 49.76    | 542            | 675         | 61.96    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 131      | \$ 2,601       |                  |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.720     | ton       | 2,103.44 | 1,514          | 1,900       | 2,639.21 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 432      | \$ 14,400      |                  |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                           | 10,890    | sy        | 0.49     | 5              | 7           | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 20          |                  |
|                    |             |      | Cut & Cover Box - 4 Track / 1 Box (60' Avg. Exc Depth)           | 1.000     | RF        |          | 50,371         | 63,536      |          | P | CC-Det |           |             |              | Subtotal    | \$ 41,172      | \$ 294,506       |
|                    |             |      |  |           |           |          | \$ 340,000,000 | Per Mile    |          |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8             |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Total       | \$ 41,180      | \$ 294,514       |
|                    |             |      |  |           |           |          |                |             |          |   |        |           |             |              | Per Mile    | \$ 220,000,000 | \$ 1,560,000,000 |

| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$ | Bid Unit \$    | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|------|--|-----------|-----------|----------|--------|----------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
| 10.06.922          |             | CC   | Double Deck - 2 Track Trench on Top of 2 Track C&C Box           |           |           |          |        |                | CC       | P | CC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 4,498.000 | lb        | 1.30     | 5,848  | 7,402          |          | P | CC-Det | 205 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,699    | \$ 25,549      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 10.930    | cy        | 320.03   | 3,498  | 4,409          | 403.39   | P | CC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,733    | \$ 12,612      |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 8.760     | cy        | 395.18   | 3,462  | 4,365          | 498.33   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 2,015    | \$ 6,150       |                |
|                    | 03-30-53.40 | A160 | Structural Concrete, In Place, C&C Interior Walls                | 2.220     | cy        | 470.28   | 1,044  | 1,315          | 592.37   | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 511      | \$ 1,558       |                |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 8.070     | cy        | 546.16   | 4,407  | 5,557          | 688.66   | P | CC-Det |           | \$ 440.00   | \$ 2,200.00  | \$ 3,551    | \$ 17,754      |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 4.000     | lf        | 45.48    | 182    | 228            | 57.09    | P | CC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 317.500   | sf        | 6.19     | 1,965  | 2,471          | 7.78     | P | CC-Det |           | \$ 4.05     | \$ 18.16     | \$ 1,286    | \$ 5,766       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 105.500   | sf        | 2.08     | 219    | 273            | 2.59     | P | CC-Det |           | \$ 4.00     | \$ 17.00     | \$ 422      | \$ 1,794       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.56   | P | CC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 6.060     | sy        | 5.54     | 34     | 43             | 7.09     | P | CC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 36          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 100.930   | cy        | 21.83    | 2,204  | 2,821          | 27.95    | P | CC-Det | Fill?     | \$ 4.00     | \$ 185.00    | \$ 404      | \$ 18,672      |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 100.000   | sf        | 72.32    | 7,232  | 9,083          | 90.83    | P | CC-Det |           | \$ 133.97   | \$ 347.78    | \$ 13,397   | \$ 34,778      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 4.000     | lf        | 41.74    | 167    | 209            | 52.26    | P | CC-Det |           | \$ 3.50     | \$ 615.00    | \$ 14       | \$ 2,460       |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2.000     | lf        | 3.35     | 7      | 8              | 4.21     | P | CC-Det |           |             |              | FP          | FP             |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 4.000     | lf        | 27.19    | 109    | 136            | 34.02    | P | CC-Det |           | \$ 9.00     | \$ 225.00    | \$ 36       | \$ 900         |                |
|                    | 10-14-19.10 | A050 | Signage Allowance, Tunnels                                       | 2.000     | lf        | 15.00    | 30     | 35             | 17.25    | P | CC-Det |           | \$ 1.00     | \$ 110.00    | \$ 2        | \$ 220         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 100.930   | cy        | 12.96    | 1,308  | 1,609          | 15.94    | P | CC-Det |           | \$ 2.25     | \$ 285.00    | \$ 227      | \$ 28,765      |                |
|                    | 31-74-13.30 | A120 | Crosspassage Doors   | 0.003     | ea        | 2,883.00 | 9      | 11             | 3,613.33 | P | CC-Det |           | \$ 865.00   | \$ 17,000.00 | \$ 3        | \$ 51          |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 6.610     | sy        | 49.77    | 329    | 410            | 61.95    | P | CC-Det |           | \$ 12.00    | \$ 238.80    | \$ 79       | \$ 1,578       |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.570     | ton       | 2,103.44 | 1,199  | 1,504          | 2,639.23 | P | CC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 342      | \$ 11,400      |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 6.610     | sy        | 0.49     | 3      | 4              | 0.63     | P | CC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 12          |                |
|                    |             |      | Double Deck - 2 Track Trench on Top of 2 Track C&C Box           | 1.000     | RF        |          | 33,365 | 42,035         |          | P | CC-Det |           |             |              | Subtotal    | \$ 29,732      | \$ 176,975     |
|                    |             |      |  |           |           |          |        | \$ 222,000,000 | Per Mile |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 29,740      | \$ 176,983     |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 160,000,000 | \$ 940,000,000 |
| 10.07.801          |             | SS   | Ventilation Shaft  |           |           |          |        |                | SS       | P | SS-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 1,300.000 | lb        | 1.30     | 1,690  | 2,139          | 1.65     | P | SS-Det | 200 lb/cy |             |              |             |                |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 0.700     | cy        | 320.03   | 224    | 282            | 403.37   | P | SS-Det |           |             |              |             |                |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 5.300     | cy        | 395.19   | 2,094  | 2,641          | 498.33   | P | SS-Det |           |             |              |             |                |                |
|                    | 03-30-53.40 | A165 | Structural Concrete, In Place, C&C Roof Slab                     | 0.500     | cy        | 546.16   | 273    | 344            | 688.66   | P | SS-Det |           |             |              |             |                |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 72.000    | sf        | 6.19     | 446    | 560            | 7.78     | P | SS-Det |           |             |              |             |                |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 72.000    | sf        | 2.08     | 150    | 187            | 2.59     | P | SS-Det |           |             |              |             |                |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.900     | day       | 219.96   | 198    | 253            | 281.54   | P | SS-Det |           |             |              |             |                |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 0.700     | sy        | 5.54     | 4      | 5              | 7.09     | P | SS-Det |           |             |              |             |                |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 12.000    | cy        | 21.83    | 262    | 335            | 27.95    | P | SS-Det |           |             |              |             |                |                |
|                    | 31-23-23.14 | A010 | Structural Backfill  | 1.800     | cy        | 17.17    | 31     | 40             | 21.98    | P | SS-Det |           |             |              |             |                |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 72.000    | sf        | 72.32    | 5,207  | 6,540          | 90.83    | P | SS-Det |           |             |              |             |                |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 10.200    | cy        | 12.96    | 132    | 163            | 15.94    | P | SS-Det |           |             |              |             |                |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.700     | sy        | 49.76    | 35     | 43             | 61.94    | P | SS-Det |           |             |              |             |                |                |
|                    | 22-03-00.10 | A015 | Mechanical Allowance, Misc. Structure                            | 19.400    | sf        | 10.00    | 194    | 223            | 11.50    | P | SS-Det |           |             |              |             |                |                |
|                    | 26-03-00.10 | A015 | Electrical Allowance, Misc. Structure                            | 19.400    | sf        | 22.00    | 427    | 491            | 25.30    | P | SS-Det |           |             |              |             |                |                |
|                    |             |      | Ventilation Shaft  | 1.000     | VF        |          | 11,367 | 14,247         |          | P | SS-Det |           |             |              | Subtotal    | \$ -           | \$ -           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Fixed Price | \$ -           | \$ -           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ -           | \$ -           |



Programmatic Unit Price Elements  
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| Unit Price Element | CSI No.     | Item | Description  | TO Qty  | Dir Un \$ | Dir \$     | Bid \$    | Bid Unit \$ | Code1      | P | Code2  | Notes     | Low \$'s  | High \$'s   | Low total    | Hi Total                     |               |
|--------------------|-------------|------|--|---------|-----------|------------|-----------|-------------|------------|---|--------|-----------|-----------|-------------|--------------|------------------------------|---------------|
| 10.07.803          |             | SS   | Tunnel Portal Structure                            |         |           |            |           |             | SS         | P | SS-Det |           |           |             |              |                              |               |
|                    | 03-21-10.60 | A010 | Reinforcing Steel                                  | 644,000 | lb        | 1.30       | 837,262   | 1,059,769   | 1.65       | P | SS-Det | 200 lb/cy | \$ 0.60   | \$ 5.68     | \$ 386,400   | \$ 3,657,920                 |               |
|                    | 03-30-53.40 | A115 | Structural Concrete, In Place, Slab on Grade       | 880     | cy        | 226.71     | 199,506   | 250,965     | 285.19     | P | SS-Det |           | \$ 250.00 | \$ 1,153.85 | \$ 220,000   | \$ 1,015,388                 |               |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls               | 1,000   | cy        | 373.37     | 373,371   | 470,618     | 470.62     | P | SS-Det |           | \$ 230.00 | \$ 702.00   | \$ 230,000   | \$ 702,000                   |               |
|                    | 03-30-53.40 | A130 | Structural Concrete, In Place, Beams & Girders     | 170     | cy        | 790.45     | 134,377   | 169,698     | 998.22     | P | SS-Det |           | \$ 575.00 | \$ 2,200.00 | \$ 97,750    | \$ 374,000                   |               |
|                    | 03-30-53.40 | A140 | Structural Concrete, In Place, Elevated Slab       | 940     | cy        | 451.00     | 423,944   | 532,849     | 566.86     | P | SS-Det |           | \$ 440.00 | \$ 2,200.00 | \$ 413,600   | \$ 2,068,000                 |               |
|                    | 03-30-53.40 | A125 | Structural Concrete, In Place, Columns             | 230     | cy        | 757.86     | 174,308   | 219,662     | 955.05     | P | SS-Det |           | \$ 405.00 | \$ 816.00   | \$ 93,150    | \$ 187,680                   |               |
|                    | 07-17-13.10 | A010 | Composite Drainage Board                           | 15,950  | sf        | 2.08       | 33,142    | 41,318      | 2.59       | P | SS-Det |           | \$ 4.00   | \$ 17.00    | \$ 63,800    | \$ 271,150                   |               |
|                    | 31-23-19.20 | A010 | Dewatering Allowance                               | 180     | day       | 219.95     | 39,591    | 50,676      | 281.53     | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 31-22-16.10 | A010 | Finish Grading                                     | 1,900   | sy        | 5.54       | 10,524    | 13,471      | 7.09       | P | SS-Det |           | \$ 0.35   | \$ 6.00     | \$ 665       | \$ 11,400                    |               |
|                    | 31-23-16.16 | A010 | Structural Excavation                              | 21,300  | cy        | 21.83      | 465,064   | 595,282     | 27.95      | P | SS-Det |           | \$ 4.00   | \$ 185.00   | \$ 85,200    | \$ 3,940,500                 |               |
|                    | 31-23-23.14 | A010 | Structural Backfill                                | 950     | cy        | 17.17      | 16,310    | 20,877      | 21.98      | P | SS-Det |           | \$ 10.00  | \$ 506.00   | \$ 9,500     | \$ 480,700                   |               |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging                             | 15,950  | sf        | 72.32      | 1,153,528 | 1,448,711   | 90.83      | P | SS-Det |           | \$ 133.97 | \$ 347.78   | \$ 2,136,822 | \$ 5,547,091                 |               |
|                    | 03-30-53.40 | A010 | Mud Slab   | 320     | cy        | 201.31     | 64,418    | 81,050      | 253.28     | P | SS-Det |           | \$ 250.00 | \$ 1,153.85 | \$ 80,000    | \$ 369,232                   |               |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                          | 1,000   | lf        | 2.47       | 2,473     | 3,139       | 3.14       | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 09-03-00.10 | A050 | Architectural Finishes Allowance, Non-Public Space | 22,430  | sf        | 50.00      | 1,121,500 | 1,289,725   | 57.50      | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material             | 26,500  | cy        | 12.96      | 343,395   | 422,320     | 15.94      | P | SS-Det |           | \$ 1.00   | \$ 110.00   | \$ 26,500    | \$ 2,915,000                 |               |
|                    | 03-41-23.50 | A010 | Precast Stairs                                     | 80      | vlf       | 284.69     | 22,775    | 28,494      | 356.17     | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                         | 1,900   | sy        | 49.76      | 94,551    | 117,714     | 61.95      | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                     | 15      | ton       | 2,103.45   | 31,552    | 39,588      | 2,639.22   | P | SS-Det |           | \$ 600.00 | \$ 2,000.00 | \$ 9,000     | \$ 30,000                    |               |
|                    | 22-03-00.10 | A015 | Mechanical Allowance, Misc. Structure              | 22,430  | sf        | 10.00      | 224,300   | 257,945     | 11.50      | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 26-03-00.10 | A015 | Electrical Allowance, Misc. Structure              | 22,430  | sf        | 22.00      | 493,460   | 567,479     | 25.30      | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 26-03-00.10 | A110 | Lighting Allowance, Station                        | 22,430  | sf        | 8.00       | 179,440   | 206,356     | 9.20       | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 23-03-00.10 | A100 | Ventilation Building Louver/Screen Allowance       | 1       | ls        | 250,000.00 | 250,000   | 287,500     | 287,500.00 | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 32-31-13.20 | A010 | 6 ft. Chain Link Fence                             | 2,150   | lf        | 29.63      | 63,695    | 79,402      | 36.93      | P | SS-Det |           | \$ 6.00   | \$ 140.00   | \$ 12,900    | \$ 301,000                   |               |
|                    | 32-31-13.20 | A060 | Chain Link Gates, 20' Opening                      | 1       | opng      | 1,668.76   | 1,669     | 2,092       | 2,092.24   | P | SS-Det |           | \$ 300.00 | \$ 7,000.00 | \$ 300       | \$ 7,000                     |               |
|                    | 33-47-13.53 | A010 | Storm Water Management Pond                        | 1,110   | sy        | 22.78      | 25,285    | 32,243      | 29.05      | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    | 32-11-23.23 | A010 | Aggregate Base (cy)                                | 490     | cy        | 23.84      | 11,683    | 14,737      | 30.08      | P | SS-Det |           | \$ 19.00  | \$ 250.00   | \$ 9,310     | \$ 122,500                   |               |
|                    | 32-12-16.13 | A010 | Asphalt Concrete Paving                            | 635     | ton       | 75.00      | 47,627    | 59,416      | 93.57      | P | SS-Det |           | \$ 80.00  | \$ 2,000.00 | \$ 50,800    | \$ 1,270,000                 |               |
|                    | 33-41-13.60 | A100 | Roadway Drainage, Allowance                        | 1,325   | lf        | 67.96      | 90,043    | 113,315     | 85.52      | P | SS-Det |           |           |             | FP           | FP                           |               |
|                    |             |      | Tunnel Portal Structure                            | 1       | LS        |            | 6,928,792 | 8,476,410   |            | P | SS-Det |           |           |             | Subtotal     | \$ 3,925,697                 | \$ 23,270,561 |
|                    |             |      |  |         |           |            |           |             |            | P |        |           |           | Fixed Price | \$ 2,954,586 | \$ 2,954,586                 |               |
|                    |             |      |  |         |           |            |           |             |            | P |        |           |           | Total       | \$ 6,880,283 | \$ 26,225,147                |               |
|                    |             |      |  |         |           |            |           |             |            | P |        |           |           |             |              | <b>Cut &amp; Cover Model</b> |               |





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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$ | Bid Unit \$    | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|------|--|-----------|-----------|----------|--------|----------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
| 10.08.212          |             | OC   | Retained Cut, Trench - 1 Track (20' Avg. Exc Depth)              |           |           |          |        |                | OC       | P | OC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 1,526.000 | lb        | 1.30     | 1,984  | 2,511          |          | P | OC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 916      | \$ 8,668       |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 4.150     | cy        | 320.03   | 1,328  | 1,674          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 1,038    | \$ 4,788       |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 6.030     | cy        | 395.18   | 2,383  | 3,005          | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 1,387    | \$ 4,233       |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 1.000     | lf        | 45.48    | 45     | 57             | 57.08    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702         |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 110.500   | sf        | 6.19     | 684    | 860            | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 448      | \$ 2,007       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 54.500    | sf        | 2.08     | 113    | 141            | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 218      | \$ 927         |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.56   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 3.110     | sy        | 5.54     | 17     | 22             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 1        | \$ 19          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 28.260    | cy        | 21.83    | 617    | 790            | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 113      | \$ 5,228       |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 54.500    | sf        | 72.32    | 3,942  | 4,950          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 7,301    | \$ 18,954      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 1.000     | lf        | 41.74    | 42     | 52             | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 4        | \$ 615         |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3      | 4              | 4.21     | P | OC-Det |           |             |              | FP          | FP             |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.130     | ton       | 2,103.46 | 273    | 343            | 2,639.23 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 78       | \$ 2,600       |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 1.000     | lf        | 27.19    | 27     | 34             | 34.02    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 9        | \$ 225         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 28.260    | cy        | 12.96    | 366    | 450            | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 64       | \$ 8,054       |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.220     | sy        | 49.77    | 11     | 14             | 61.95    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53          |                |
|                    | 33-41-13.60 | A020 | Trackway Drainage Allowance, Underground                         | 1.000     | lf        | 128.92   | 129    | 165            | 164.99   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 283      | \$ 1,484       |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 3.110     | sy        | 0.49     | 2      | 2              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 6           |                |
|                    |             |      | Retained Cut, Trench - 1 Track (20' Avg. Exc Depth)              | 1.000     | RF        |          | 12,077 | 15,216         |          | P | OC-Det |           |             |              | Subtotal    | \$ 13,182      | \$ 62,674      |
|                    |             |      |  |           |           |          |        | \$ 90,000,000  |          |   |        |           |             |              | Fixed Price | \$ 4           | \$ 4           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 13,186      | \$ 62,678      |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 70,000,000  | \$ 340,000,000 |
| 10.08.213          |             | OC   | Retained Cut, Trench - 1 Track (30' Avg. Exc Depth)              |           |           |          |        |                | OC       | P | OC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 3,408.000 | lb        | 1.30     | 4,431  | 5,608          | 1.65     | P | OC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,045    | \$ 19,357      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 7.940     | cy        | 320.03   | 2,541  | 3,203          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 1,985    | \$ 9,162       |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 14.780    | cy        | 395.18   | 5,841  | 7,365          | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 3,399    | \$ 10,376      |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 1.000     | lf        | 45.48    | 45     | 57             | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702         |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 145.500   | sf        | 6.19     | 901    | 1,133          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 589      | \$ 2,642       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 79.500    | sf        | 2.08     | 165    | 206            | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 318      | \$ 1,352       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.54   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 3.670     | sy        | 5.54     | 20     | 26             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 1        | \$ 22          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 48.580    | cy        | 21.83    | 1,061  | 1,358          | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 194      | \$ 8,987       |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 79.500    | sf        | 72.32    | 5,750  | 7,221          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 10,651   | \$ 27,649      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 1.000     | lf        | 41.74    | 42     | 52             | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 4        | \$ 615         |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3      | 4              | 4.20     | P | OC-Det |           |             |              | FP          | FP             |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.190     | ton       | 2,103.40 | 400    | 501            | 2,639.21 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 114      | \$ 3,800       |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 1.000     | lf        | 27.19    | 27     | 34             | 34.01    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 9        | \$ 225         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 48.580    | cy        | 12.96    | 630    | 774            | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 109      | \$ 13,845      |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.220     | sy        | 49.77    | 11     | 14             | 62.00    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53          |                |
|                    | 33-41-13.60 | A020 | Trackway Drainage Allowance, Underground                         | 1.000     | lf        | 128.92   | 129    | 165            | 164.98   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 283      | \$ 1,484       |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 3.670     | sy        | 0.50     | 2      | 2              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 7           |                |
|                    |             |      | Retained Cut, Trench - 1 Track (30' Avg. Exc Depth)              | 1.000     | RF        |          | 22,107 | 27,864         |          | P | OC-Det |           |             |              | Subtotal    | \$ 21,025      | \$ 104,389     |
|                    |             |      |  |           |           |          |        | \$ 150,000,000 | Per Mile |   |        |           |             |              | Fixed Price | \$ 4           | \$ 4           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 21,029      | \$ 104,393     |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 112,000,000 | \$ 560,000,000 |

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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$ | Bid Unit \$    | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total      |                |
|--------------------|-------------|------|--|-----------|-----------|----------|--------|----------------|----------|---|--------|-----------|-------------|--------------|-------------|---------------|----------------|
| 10.08.221          |             | OC   | Retained Cut, Trench - 2 Track (10' Avg. Exc Depth)              |           |           |          |        |                | OC       | P | OC-Det |           |             |              |             |               |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 576.000   | lb        | 1.30     | 749    | 948            | 1.65     | P | OC-Det | 149 lb/cy | \$ 0.60     | \$ 5.68      | \$ 346      | \$ 3,272      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 2.860     | cy        | 320.04   | 915    | 1,154          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 715      | \$ 3,300      |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 1.000     | cy        | 395.18   | 395    | 498            | 498.34   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702        |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2.000     | lf        | 45.48    | 91     | 114            | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460      | \$ 1,404      |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 132.500   | sf        | 6.19     | 820    | 1,031          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 537      | \$ 2,406      |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 29.500    | sf        | 2.08     | 61     | 76             | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 118      | \$ 502        |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.54   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113      |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 5.720     | sy        | 5.54     | 32     | 41             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 34         |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 28.130    | cy        | 21.83    | 614    | 786            | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 113      | \$ 5,204      |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 29.500    | sf        | 72.32    | 2,133  | 2,679          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 3,952    | \$ 10,260     |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74    | 83     | 105            | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230      |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3      | 4              | 4.22     | P | OC-Det |           |             |              | FP          | FP            |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.130     | ton       | 2,103.46 | 273    | 343            | 2,639.15 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 78       | \$ 2,600      |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19    | 54     | 68             | 34.02    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450        |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 28.130    | cy        | 12.96    | 365    | 448            | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 63       | \$ 8,017      |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.220     | sy        | 49.77    | 11     | 14             | 62.00    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53         |                |
|                    | 33-41-13.60 | A020 | Trackway Drainage Allowance, Underground                         | 1.000     | lf        | 128.92   | 129    | 165            | 164.99   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 283      | \$ 1,484      |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 5.720     | sy        | 0.49     | 3      | 4              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 10         |                |
|                    |             |      | Retained Cut, Trench - 2 Track (10' Avg. Exc Depth)              | 1.000     | RF        |          | 6,843  | 8,619          |          | P | OC-Det |           |             |              | Subtotal    | \$ 8,015      | \$ 45,040      |
|                    |             |      |  |           |           |          |        | \$ 46,000,000  | Per Mile |   |        |           |             |              | Fixed Price | \$ 4          | \$ 4           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 8,019      | \$ 45,044      |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 43,000,000 | \$ 240,000,000 |
| 10.08.222          |             | OC   | Retained Cut, Trench - 2 Track (20' Avg. Exc Depth)              |           |           |          |        |                | OC       | P | OC-Det |           |             |              |             |               |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 2,160.000 | lb        | 1.30     | 2,808  | 3,555          | 1.65     | P | OC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 1,296    | \$ 12,269     |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 8.370     | cy        | 320.03   | 2,679  | 3,376          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,093    | \$ 9,658      |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 6.030     | cy        | 395.18   | 2,383  | 3,005          | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 1,387    | \$ 4,233      |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 2.000     | lf        | 45.48    | 91     | 114            | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460      | \$ 1,404      |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 167.500   | sf        | 6.19     | 1,037  | 1,304          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 678      | \$ 3,042      |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 54.500    | sf        | 2.08     | 113    | 141            | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 218      | \$ 927        |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.56   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113      |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 6.280     | sy        | 5.54     | 35     | 45             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 38         |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 57.020    | cy        | 21.83    | 1,245  | 1,594          | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 228      | \$ 10,549     |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 54.500    | sf        | 72.32    | 3,942  | 4,950          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 7,301    | \$ 18,954     |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2.000     | lf        | 41.74    | 83     | 105            | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230      |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 1.000     | lf        | 3.35     | 3      | 4              | 4.21     | P | OC-Det |           |             |              | FP          | FP            |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.220     | ton       | 2,103.46 | 463    | 581            | 2,639.23 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 132      | \$ 4,400      |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2.000     | lf        | 27.19    | 54     | 68             | 34.02    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450        |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 57.020    | cy        | 12.96    | 739    | 909            | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 128      | \$ 16,251     |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.220     | sy        | 49.77    | 11     | 14             | 61.91    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53         |                |
|                    | 33-41-13.60 | A020 | Trackway Drainage Allowance, Underground                         | 1.000     | lf        | 128.92   | 129    | 165            | 164.99   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 283      | \$ 1,484      |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 6.280     | sy        | 0.49     | 3      | 4              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 11         |                |
|                    |             |      | Retained Cut, Trench - 2 Track (20' Avg. Exc Depth)              | 1.000     | RF        |          | 15,928 | 20,073         |          | P | OC-Det |           |             |              | Subtotal    | \$ 15,325     | \$ 89,064      |
|                    |             |      |  |           |           |          |        | \$ 110,000,000 | Per Mile |   |        |           |             |              | Fixed Price | \$ 4          | \$ 4           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 15,329     | \$ 89,068      |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 81,000,000 | \$ 480,000,000 |



Programmatic Unit Price Elements  
Los Angeles City Factor  
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| Unit Price Element | CSI No.     | Item      | Description  | TO Qty       | Dir Un \$ | Dir \$   | Bid \$        | Bid Unit \$    | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|-----------|--|--------------|-----------|----------|---------------|----------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
| <b>10.08.223</b>   |             | <b>OC</b> | <b>Retained Cut, Trench - 2 Track (30' Avg. Exc Depth)</b>       |              |           |          |               |                | OC       | P | OC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010      | Reinforcing Steel  | 4,438.000    | lb        | 1.30     | 5,770         | 7,303          | 1.65     | P | OC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 2,663    | \$ 25,208      |                |
|                    | 03-30-53.40 | A145      | Structural Concrete, In Place, C&C Slab on Grade                 | 14.810       | cy        | 320.03   | 4,740         | 5,974          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 3,703    | \$ 17,089      |                |
|                    | 03-30-53.40 | A150      | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 14.780       | cy        | 395.18   | 5,841         | 7,365          | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 3,399    | \$ 10,376      |                |
|                    | 05-53-16.50 | A010      | Service/Safety Walkway   | 2.000        | lf        | 45.48    | 91            | 114            | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 460      | \$ 1,404       |                |
|                    | 07-13-53.10 | A010      | Sheet Waterproofing  | 202.500      | sf        | 6.19     | 1,253         | 1,576          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 820      | \$ 3,677       |                |
|                    | 07-17-13.10 | A010      | Composite Drainage Board   | 79.500       | sf        | 2.08     | 165           | 206            | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 318      | \$ 1,352       |                |
|                    | 31-23-19.20 | A010      | Dewatering Allowance   | 0.500        | day       | 219.96   | 110           | 141            | 281.56   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010      | Finish Grading   | 6.830        | sy        | 5.54     | 38            | 48             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 2        | \$ 41          |                |
|                    | 31-23-16.16 | A010      | Structural Excavation  | 90.540       | cy        | 21.83    | 1,977         | 2,530          | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 362      | \$ 16,750      |                |
|                    | 31-52-16.10 | A010      | Soldier Pile & Lagging   | 79.500       | sf        | 72.32    | 5,750         | 7,221          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 10,651   | \$ 27,649      |                |
|                    | 33-71-19.17 | A060      | Cable Duct, Underground Guideway                                 | 2.000        | lf        | 41.74    | 83            | 105            | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                |
|                    | 26-05-26.80 | A010      | Corrosion Control Allowance                                      | 1.000        | lf        | 3.35     | 3             | 4              | 4.20     | P | OC-Det |           |             |              | FP          | FP             |                |
|                    | 05-12-23.77 | A010      | Structural Steel (for Bracing)                                   | 0.300        | ton       | 2,103.47 | 631           | 792            | 2,639.23 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 180      | \$ 6,000       |                |
|                    | 05-52-13.50 | A010      | Safety Railing   | 2.000        | lf        | 27.19    | 54            | 68             | 34.03    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                |
|                    | 31-23-23.20 | A010      | Haul and Dispose of Excavated Material                           | 90.540       | cy        | 12.96    | 1,173         | 1,443          | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 204      | \$ 25,804      |                |
|                    | 32-06-10.10 | A100      | Site Restoration Allowance                                       | 0.220        | sy        | 49.77    | 11            | 14             | 61.91    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53          |                |
|                    | 33-41-13.60 | A020      | Trackway Drainage Allowance, Underground                         | 1.000        | lf        | 128.92   | 129           | 165            | 164.99   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 283      | \$ 1,484       |                |
|                    | 31-13-13.10 | A010      | Cleaning & Grubbing Allowance, Level 1                           | 6.830        | sy        | 0.49     | 3             | 4              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 12          |                |
|                    |             |           | <b>Retained Cut, Trench - 2 Track (30' Avg. Exc Depth)</b>       | <b>1.000</b> | <b>RF</b> |          | <b>27,823</b> | <b>35,074</b>  |          | P | OC-Det |           |             |              | Subtotal    | \$ 24,163      | \$ 142,690     |
|                    |             |           |  |              |           |          |               | \$ 190,000,000 | Per Mile |   |        |           |             |              | Fixed Price | \$ 4           | \$ 4           |
|                    |             |           |  |              |           |          |               |                |          |   |        |           |             |              | Total       | \$ 24,167      | \$ 142,694     |
|                    |             |           |  |              |           |          |               |                |          |   |        |           |             |              | Per Mile    | \$ 130,000,000 | \$ 760,000,000 |
| <b>10.08.241</b>   |             | <b>OC</b> | <b>Retained Cut, Trench - 4 Track (10' Avg. Exc Depth)</b>       |              |           |          |               |                | OC       | P | OC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010      | Reinforcing Steel  | 751.390      | lb        | 1.30     | 977           | 1,236          | 1.65     | P | OC-Det | 149 lb/cy | \$ 0.60     | \$ 5.68      | \$ 451      | \$ 4,268       |                |
|                    | 03-30-53.40 | A145      | Structural Concrete, In Place, C&C Slab on Grade                 | 4.030        | cy        | 320.03   | 1,290         | 1,626          | 403.38   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 1,008    | \$ 4,650       |                |
|                    | 03-30-53.40 | A150      | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 1.000        | cy        | 395.18   | 395           | 498            | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 230      | \$ 702         |                |
|                    | 05-53-16.50 | A010      | Service/Safety Walkway   | 4.000        | lf        | 45.48    | 182           | 228            | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                |
|                    | 07-13-53.10 | A010      | Sheet Waterproofing  | 174.500      | sf        | 6.19     | 1,080         | 1,358          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 707      | \$ 3,169       |                |
|                    | 07-17-13.10 | A010      | Composite Drainage Board   | 29.500       | sf        | 2.08     | 61            | 76             | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 118      | \$ 502         |                |
|                    | 31-23-19.20 | A010      | Dewatering Allowance   | 0.500        | day       | 219.96   | 110           | 141            | 281.54   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010      | Finish Grading   | 8.060        | sy        | 5.54     | 45            | 57             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 3        | \$ 48          |                |
|                    | 31-23-16.16 | A010      | Structural Excavation  | 39.610       | cy        | 21.83    | 865           | 1,107          | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 158      | \$ 7,328       |                |
|                    | 31-52-16.10 | A010      | Soldier Pile & Lagging   | 29.500       | sf        | 72.32    | 2,133         | 2,679          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 3,952    | \$ 10,260      |                |
|                    | 33-71-19.17 | A060      | Cable Duct, Underground Guideway                                 | 2.000        | lf        | 41.74    | 83            | 105            | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                |
|                    | 26-05-26.80 | A010      | Corrosion Control Allowance                                      | 2.000        | lf        | 3.35     | 7             | 8              | 4.21     | P | OC-Det |           |             |              | FP          | FP             |                |
|                    | 05-12-23.77 | A010      | Structural Steel (for Bracing)                                   | 0.170        | ton       | 2,103.47 | 358           | 449            | 2,639.35 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 102      | \$ 3,400       |                |
|                    | 05-52-13.50 | A010      | Safety Railing   | 2.000        | lf        | 27.19    | 54            | 68             | 34.01    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                |
|                    | 31-23-23.20 | A010      | Haul and Dispose of Excavated Material                           | 29.500       | cy        | 12.96    | 382           | 470            | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 66       | \$ 8,408       |                |
|                    | 32-06-10.10 | A100      | Site Restoration Allowance                                       | 0.220        | sy        | 49.77    | 11            | 14             | 62.00    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53          |                |
|                    | 33-41-13.60 | A020      | Trackway Drainage Allowance, Underground                         | 2.000        | lf        | 128.92   | 258           | 330            | 164.98   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 567      | \$ 2,968       |                |
|                    | 31-13-13.10 | A010      | Cleaning & Grubbing Allowance, Level 1                           | 8.060        | sy        | 0.49     | 4             | 5              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 15          |                |
|                    |             |           | <b>Retained Cut, Trench - 4 Track (10' Avg. Exc Depth)</b>       | <b>1.000</b> | <b>RF</b> |          | <b>8,295</b>  | <b>10,456</b>  |          | P | OC-Det |           |             |              | Subtotal    | \$ 9,408       | \$ 54,377      |
|                    |             |           |  |              |           |          |               | \$ 56,000,000  | Per Mile |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8           |
|                    |             |           |  |              |           |          |               |                |          |   |        |           |             |              | Total       | \$ 9,408       | \$ 54,377      |
|                    |             |           |  |              |           |          |               |                |          |   |        |           |             |              | Per Mile    | \$ 50,000,000  | \$ 290,000,000 |

Programmatic Unit Price Elements  
Los Angeles City Factor  
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| Unit Price Element | CSI No.     | Item | Description  | TO Qty    | Dir Un \$ | Dir \$   | Bid \$ | Bid Unit \$    | Code1    | P | Code2  | Notes     | Low \$'s    | High \$'s    | Low total   | Hi Total       |                |
|--------------------|-------------|------|--|-----------|-----------|----------|--------|----------------|----------|---|--------|-----------|-------------|--------------|-------------|----------------|----------------|
| 10.08.242          |             | OC   | Retained Cut, Trench - 4 Track (20' Avg. Exc Depth)              |           |           |          |        |                | OC       | P | OC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 2,626.390 | lb        | 1.30     | 3,415  | 4,322          | 1.65     | P | OC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 1,576    | \$ 14,918      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 11.480    | cy        | 320.03   | 3,674  | 4,631          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 2,870    | \$ 13,246      |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 6.030     | cy        | 395.18   | 2,383  | 3,005          | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 1,387    | \$ 4,233       |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 4.000     | lf        | 45.48    | 182    | 228            | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 209,500   | sf        | 6.19     | 1,297  | 1,631          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 848      | \$ 3,805       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 54,500    | sf        | 2.08     | 113    | 141            | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 218      | \$ 927         |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.56   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 8,610     | sy        | 5.54     | 48     | 61             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 3        | \$ 52          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 78,220    | cy        | 21.83    | 1,708  | 2,186          | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 313      | \$ 14,471      |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 54,500    | sf        | 72.32    | 3,942  | 4,950          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 7,301    | \$ 18,954      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2,000     | lf        | 41.74    | 83     | 105            | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2,000     | lf        | 3.35     | 7      | 8              | 4.21     | P | OC-Det |           |             |              | FP          | FP             |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.280     | ton       | 2,103.46 | 589    | 739            | 2,639.29 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 168      | \$ 5,600       |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2,000     | lf        | 27.19    | 54     | 68             | 34.02    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 78,220    | cy        | 12.96    | 1,014  | 1,247          | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 176      | \$ 22,293      |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.220     | sy        | 49.77    | 11     | 14             | 62.00    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53          |                |
|                    | 33-41-13.60 | A020 | Trackway Drainage Allowance, Underground                         | 2,000     | lf        | 128.92   | 258    | 330            | 164.98   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 567      | \$ 2,968       |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 8,610     | sy        | 0.49     | 4      | 5              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 16          |                |
|                    |             |      | Retained Cut, Trench - 4 Track (20' Avg. Exc Depth)              | 1,000     | RF        |          | 18,891 | 23,812         |          | P | OC-Det |           |             |              | Subtotal    | \$ 17,465      | \$ 110,134     |
|                    |             |      |  |           |           |          |        | \$ 130,000,000 | Per Mile |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 17,473      | \$ 110,142     |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 93,000,000  | \$ 590,000,000 |
| 10.08.243          |             | OC   | Retained Cut, Trench - 4 Track (30' Avg. Exc Depth)              |           |           |          |        |                | OC       | P | OC-Det |           |             |              |             |                |                |
|                    | 03-21-10.60 | A010 | Reinforcing Steel  | 5,195.830 | lb        | 1.30     | 6,755  | 8,550          | 1.65     | P | OC-Det | 150 lb/cy | \$ 0.60     | \$ 5.68      | \$ 3,117    | \$ 29,512      |                |
|                    | 03-30-53.40 | A145 | Structural Concrete, In Place, C&C Slab on Grade                 | 19,860    | cy        | 320.03   | 6,356  | 8,011          | 403.39   | P | OC-Det |           | \$ 250.00   | \$ 1,153.85  | \$ 4,965    | \$ 22,915      |                |
|                    | 03-30-53.40 | A150 | Structural Concrete, In Place, C&C Exterior Walls, Formed 1 Side | 14,780    | cy        | 395.18   | 5,841  | 7,365          | 498.33   | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 3,399    | \$ 10,376      |                |
|                    | 05-53-16.50 | A010 | Service/Safety Walkway   | 4,000     | lf        | 45.48    | 182    | 228            | 57.09    | P | OC-Det |           | \$ 230.00   | \$ 702.00    | \$ 920      | \$ 2,808       |                |
|                    | 07-13-53.10 | A010 | Sheet Waterproofing  | 244,500   | sf        | 6.19     | 1,513  | 1,903          | 7.78     | P | OC-Det |           | \$ 4.05     | \$ 18.16     | \$ 990      | \$ 4,440       |                |
|                    | 07-17-13.10 | A010 | Composite Drainage Board   | 79,500    | sf        | 2.08     | 165    | 206            | 2.59     | P | OC-Det |           | \$ 4.00     | \$ 17.00     | \$ 318      | \$ 1,352       |                |
|                    | 31-23-19.20 | A010 | Dewatering Allowance   | 0.500     | day       | 219.96   | 110    | 141            | 281.54   | P | OC-Det |           | \$ 2,180.85 | \$ 8,225.80  | \$ 1,090    | \$ 4,113       |                |
|                    | 31-22-16.10 | A010 | Finish Grading   | 9,170     | sy        | 5.54     | 51     | 65             | 7.09     | P | OC-Det |           | \$ 0.35     | \$ 6.00      | \$ 3        | \$ 55          |                |
|                    | 31-23-16.16 | A010 | Structural Excavation  | 121,460   | cy        | 21.83    | 2,652  | 3,394          | 27.95    | P | OC-Det |           | \$ 4.00     | \$ 185.00    | \$ 486      | \$ 22,470      |                |
|                    | 31-52-16.10 | A010 | Soldier Pile & Lagging   | 79,500    | sf        | 72.32    | 5,750  | 7,221          | 90.83    | P | OC-Det |           | \$ 133.97   | \$ 347.78    | \$ 10,651   | \$ 27,649      |                |
|                    | 33-71-19.17 | A060 | Cable Duct, Underground Guideway                                 | 2,000     | lf        | 41.74    | 83     | 105            | 52.27    | P | OC-Det |           | \$ 3.50     | \$ 615.00    | \$ 7        | \$ 1,230       |                |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                      | 2,000     | lf        | 3.35     | 7      | 8              | 4.22     | P | OC-Det |           |             |              | FP          | FP             |                |
|                    | 05-12-23.77 | A010 | Structural Steel (for Bracing)                                   | 0.370     | ton       | 2,103.46 | 778    | 977            | 2,639.22 | P | OC-Det |           | \$ 600.00   | \$ 20,000.00 | \$ 222      | \$ 7,400       |                |
|                    | 05-52-13.50 | A010 | Safety Railing   | 2,000     | lf        | 27.19    | 54     | 68             | 34.02    | P | OC-Det |           | \$ 9.00     | \$ 225.00    | \$ 18       | \$ 450         |                |
|                    | 31-23-23.20 | A010 | Haul and Dispose of Excavated Material                           | 121,460   | cy        | 12.96    | 1,574  | 1,936          | 15.94    | P | OC-Det |           | \$ 2.25     | \$ 285.00    | \$ 273      | \$ 34,616      |                |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                       | 0.220     | sy        | 49.77    | 11     | 14             | 62.00    | P | OC-Det |           | \$ 12.00    | \$ 238.80    | \$ 3        | \$ 53          |                |
|                    | 33-41-13.60 | A020 | Trackway Drainage Allowance, Underground                         | 2,000     | lf        | 128.92   | 258    | 330            | 164.98   | P | OC-Det |           | \$ 283.31   | \$ 1,483.80  | \$ 567      | \$ 2,968       |                |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                           | 9,170     | sy        | 0.49     | 5      | 6              | 0.63     | P | OC-Det |           | \$ 0.04     | \$ 1.83      | \$ 0        | \$ 17          |                |
|                    |             |      | Retained Cut, Trench - 4 Track (30' Avg. Exc Depth)              | 1,000     | RF        |          | 32,144 | 40,528         |          | P | OC-Det |           |             |              | Subtotal    | \$ 27,030      | \$ 172,423     |
|                    |             |      |  |           |           |          |        | \$ 220,000,000 | Per Mile |   |        |           |             |              | Fixed Price | \$ 8           | \$ 8           |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Total       | \$ 27,038      | \$ 172,431     |
|                    |             |      |  |           |           |          |        |                |          |   |        |           |             |              | Per Mile    | \$ 150,000,000 | \$ 920,000,000 |



| Unit Price Element | CSI No.     | Item | Description   | TO Qty  | Dir Un \$ | Dir \$ | Bid \$ | Bid Unit \$   | Code1    | P | Code2  | Notes    | Low \$'s  | High \$'s    | Low total     | Hi Total  |
|--------------------|-------------|------|---|---------|-----------|--------|--------|---------------|----------|---|--------|----------|-----------|--------------|---------------|-----------|
| 10.08.411          |             | OC   | Retained Fill, Walls Both Sides - 1 Tracks (10' Avg. Wall Ht) |         |           |        |        |               | OC       | P | OC-Det |          |           |              |               |           |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                        | 3.700   | sy        | 0.49   | 2      | 0.63          |          | P | OC-Det |          | \$ 0.04   | \$ 1.83      | \$ 0          | \$ 7      |
|                    | 31-14-13.23 | A010 | Rough Grading   | 3.700   | sy        | 4.31   | 16     | 20            | 5.52     | P | OC-Det |          | \$ 1.00   | \$ 28.00     | \$ 4          | \$ 104    |
|                    | 31-22-16.10 | A010 | Finish Grading  | 2.800   | sy        | 5.54   | 16     | 20            | 7.09     | P | OC-Det |          | \$ 0.35   | \$ 6.00      | \$ 1          | \$ 17     |
|                    | 31-23-16.16 | A010 | Structural Excavation   | 0.400   | cy        | 21.83  | 9      | 11            | 27.93    | P | OC-Det |          | \$ 4.00   | \$ 185.00    | \$ 2          | \$ 74     |
|                    | 31-23-23.14 | A010 | Structural Backfill   | 0.200   | cy        | 17.15  | 3      | 4             | 21.95    | P | OC-Det |          | \$ 10.00  | \$ 506.00    | \$ 2          | \$ 101    |
|                    | 31-23-23.13 | A010 | Embankment w/Haul & Compaction                                | 9.400   | cy        | 4.20   | 40     | 51            | 5.38     | P | OC-Det |          | \$ 10.00  | \$ 506.00    | \$ 94         | \$ 4,756  |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                                     | 1.000   | lf        | 2.47   | 2      | 3             | 3.14     | P | OC-Det |          |           |              | FP            | FP        |
|                    | 32-31-13.20 | A020 | 6 ft. Chain Link Fence, Wall Mounted                          | 2.000   | lf        | 26.77  | 54     | 67            | 33.51    | P | OC-Det |          | \$ 6.00   | \$ 140.00    | \$ 12         | \$ 280    |
|                    | 03-21-10.60 | A010 | Reinforcing Steel   | 114.910 | lb        | 1.30   | 149    | 189           | 1.65     | P | OC-Det | 60 lb/cy | \$ 0.60   | \$ 5.68      | \$ 69         | \$ 653    |
|                    | 03-30-53.40 | A110 | Structural Concrete, In Place, Footing                        | 1.000   | cy        | 361.82 | 362    | 457           | 456.87   | P | OC-Det |          | \$ 215.00 | \$ 700.00    | \$ 215        | \$ 700    |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls                          | 0.900   | cy        | 373.38 | 336    | 424           | 470.62   | P | OC-Det |          | \$ 230.00 | \$ 702.00    | \$ 207        | \$ 632    |
|                    | 33-41-13.60 | A010 | Trackway Drainage Allowance, Ballasted                        | 1.000   | lf        | 52.65  | 53     | 66            | 66.16    | P | OC-Det |          | \$ 283.31 | \$ 1,483.80  | \$ 283        | \$ 1,484  |
|                    | 33-71-19.17 | A050 | Cable Duct, At-Grade Guideway                                 | 1.000   | lf        | 36.17  | 36     | 46            | 45.59    | P | OC-Det |          | \$ 3.50   | \$ 615.00    | \$ 4          | \$ 615    |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                   | 1.000   | lf        | 3.35   | 3      | 4             | 4.20     | P | OC-Det |          |           |              | FP            | FP        |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                    | 0.890   | sy        | 49.76  | 44     | 55            | 61.97    | P | OC-Det |          | \$ 12.00  | \$ 238.80    | \$ 11         | \$ 213    |
|                    |             |      | Retained Fill, Walls Both Sides - 1 Tracks (10' Avg. Wall Ht) | 1.000   | RF        |        | 1,125  | 1,420         |          | P | OC-Det |          |           | Subtotal     | \$ 903        | \$ 9,635  |
|                    |             |      |   |         |           |        |        | \$ 7,000,000  | Per Mile |   |        |          |           | Fixed Price  | \$ 7          | \$ 7      |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Total     | \$ 910       | \$ 9,642      |           |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Per Mile  | \$ 5,000,000 | \$ 60,000,000 |           |
| 10.08.412          |             | OC   | Retained Fill, Walls Both Sides - 1 Tracks (20' Avg. Wall Ht) |         |           |        |        |               | OC       | P | OC-Det |          |           |              |               |           |
|                    | 31-13-13.10 | A010 | Clearing & Grubbing Allowance, Level 1                        | 3.700   | sy        | 0.49   | 2      | 0.63          |          | P | OC-Det |          | \$ 0.04   | \$ 1.83      | \$ 0          | \$ 7      |
|                    | 31-14-13.23 | A010 | Rough Grading   | 3.700   | sy        | 4.31   | 16     | 20            | 5.51     | P | OC-Det |          | \$ 1.00   | \$ 28.00     | \$ 4          | \$ 104    |
|                    | 31-22-16.10 | A010 | Finish Grading  | 2.800   | sy        | 5.54   | 16     | 20            | 7.09     | P | OC-Det |          | \$ 0.35   | \$ 6.00      | \$ 1          | \$ 17     |
|                    | 31-23-16.16 | A010 | Structural Excavation   | 0.400   | cy        | 21.83  | 9      | 11            | 27.95    | P | OC-Det |          | \$ 4.00   | \$ 185.00    | \$ 2          | \$ 74     |
|                    | 31-23-23.14 | A010 | Structural Backfill   | 0.200   | cy        | 17.15  | 3      | 4             | 21.95    | P | OC-Det |          | \$ 10.00  | \$ 506.00    | \$ 2          | \$ 101    |
|                    | 31-23-23.13 | A010 | Embankment w/Haul & Compaction                                | 18.900  | cy        | 4.20   | 79     | 102           | 5.38     | P | OC-Det |          | \$ 10.00  | \$ 506.00    | \$ 189        | \$ 9,563  |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                                     | 1.000   | lf        | 2.47   | 2      | 3             | 3.14     | P | OC-Det |          |           |              | FP            | FP        |
|                    | 32-31-13.20 | A020 | 6 ft. Chain Link Fence, Wall Mounted                          | 2.000   | lf        | 26.77  | 54     | 67            | 33.50    | P | OC-Det |          | \$ 6.00   | \$ 140.00    | \$ 12         | \$ 280    |
|                    | 03-21-10.60 | A010 | Reinforcing Steel   | 253.840 | lb        | 1.30   | 330    | 418           | 1.65     | P | OC-Det | 62 lb/cy | \$ 0.60   | \$ 5.68      | \$ 152        | \$ 1,442  |
|                    | 03-30-53.40 | A110 | Structural Concrete, In Place, Footing                        | 2.000   | cy        | 361.83 | 724    | 914           | 456.88   | P | OC-Det |          | \$ 215.00 | \$ 700.00    | \$ 430        | \$ 1,400  |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls                          | 2.100   | cy        | 373.37 | 784    | 988           | 470.61   | P | OC-Det |          | \$ 230.00 | \$ 702.00    | \$ 483        | \$ 1,474  |
|                    | 33-41-13.60 | A010 | Trackway Drainage Allowance, Ballasted                        | 1.000   | lf        | 52.65  | 53     | 66            | 66.15    | P | OC-Det |          | \$ 283.31 | \$ 1,483.80  | \$ 283        | \$ 1,484  |
|                    | 33-71-19.17 | A050 | Cable Duct, At-Grade Guideway                                 | 1.000   | lf        | 36.17  | 36     | 46            | 45.60    | P | OC-Det |          | \$ 3.50   | \$ 615.00    | \$ 4          | \$ 615    |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                   | 1.000   | lf        | 3.35   | 3      | 4             | 4.21     | P | OC-Det |          |           |              | FP            | FP        |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                    | 0.890   | sy        | 49.76  | 44     | 55            | 61.94    | P | OC-Det |          | \$ 12.00  | \$ 238.80    | \$ 11         | \$ 213    |
|                    |             |      | Retained Fill, Walls Both Sides - 1 Tracks (20' Avg. Wall Ht) | 1.000   | RF        |        | 2,155  | 2,721         |          | P | OC-Det |          |           | Subtotal     | \$ 1,572      | \$ 16,773 |
|                    |             |      |   |         |           |        |        | \$ 14,000,000 | Per Mile |   |        |          |           | Fixed Price  | \$ 7          | \$ 7      |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Total     | \$ 1,579     | \$ 16,780     |           |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Per Mile  | \$ 9,000,000 | \$ 90,000,000 |           |

| Unit Price Element | CSI No.     | Item | Description   | TO Qty  | Dir Un \$ | Dir \$ | Bid \$ | Bid Unit \$   | Code1    | P | Code2  | Notes    | Low \$'s  | High \$'s     | Low total      | Hi Total  |
|--------------------|-------------|------|---|---------|-----------|--------|--------|---------------|----------|---|--------|----------|-----------|---------------|----------------|-----------|
| 10.08.413          |             | OC   | Retained Fill, Walls Both Sides - 1 Tracks (30' Avg. Wall Ht) |         |           |        |        |               | OC       | P | OC-Det |          |           |               |                |           |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                        | 3.700   | sy        | 0.49   | 2      | 2             | 0.63     | P | OC-Det |          | \$ 0.04   | \$ 1.83       | \$ 0           | \$ 7      |
|                    | 31-14-13.23 | A010 | Rough Grading   | 3.700   | sy        | 4.31   | 16     | 20            | 5.52     | P | OC-Det |          | \$ 1.00   | \$ 28.00      | \$ 4           | \$ 104    |
|                    | 31-22-16.10 | A010 | Finish Grading  | 2.800   | sy        | 5.54   | 16     | 20            | 7.09     | P | OC-Det |          | \$ 0.35   | \$ 6.00       | \$ 1           | \$ 17     |
|                    | 31-23-16.16 | A010 | Structural Excavation   | 0.400   | cy        | 21.83  | 9      | 11            | 27.93    | P | OC-Det |          | \$ 4.00   | \$ 185.00     | \$ 2           | \$ 74     |
|                    | 31-23-23.14 | A010 | Structural Backfill   | 0.200   | cy        | 17.15  | 3      | 4             | 21.95    | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 2           | \$ 101    |
|                    | 31-23-23.13 | A010 | Embankment w/Haul & Compaction                                | 28.300  | cy        | 4.20   | 119    | 152           | 5.38     | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 283         | \$ 14,320 |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                                     | 1.000   | lf        | 2.47   | 2      | 3             | 3.15     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-31-13.20 | A020 | 6 ft. Chain Link Fence, Wall Mounted                          | 2.000   | lf        | 26.77  | 54     | 67            | 33.50    | P | OC-Det |          | \$ 6.00   | \$ 140.00     | \$ 12          | \$ 280    |
|                    | 03-21-10.60 | A010 | Reinforcing Steel   | 550.250 | lb        | 1.30   | 715    | 906           | 1.65     | P | OC-Det | 62 lb/cy | \$ 0.60   | \$ 5.68       | \$ 330         | \$ 3,125  |
|                    | 03-30-53.40 | A110 | Structural Concrete, In Place, Footing                        | 5.260   | cy        | 361.82 | 1,903  | 2,403         | 456.88   | P | OC-Det |          | \$ 215.00 | \$ 700.00     | \$ 1,131       | \$ 3,682  |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls                          | 3.610   | cy        | 373.37 | 1,348  | 1,699         | 470.61   | P | OC-Det |          | \$ 230.00 | \$ 702.00     | \$ 830         | \$ 2,534  |
|                    | 33-41-13.60 | A010 | Trackway Drainage Allowance, Ballasted                        | 1.000   | lf        | 52.65  | 53     | 66            | 66.15    | P | OC-Det |          | \$ 283.31 | \$ 1,483.80   | \$ 283         | \$ 1,484  |
|                    | 33-71-19.17 | A050 | Cable Duct, At-Grade Guideway                                 | 1.000   | lf        | 36.17  | 36     | 46            | 45.60    | P | OC-Det |          | \$ 3.50   | \$ 615.00     | \$ 4           | \$ 615    |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                   | 1.000   | lf        | 3.35   | 3      | 4             | 4.20     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                    | 0.890   | sy        | 49.76  | 44     | 55            | 61.97    | P | OC-Det |          | \$ 12.00  | \$ 238.80     | \$ 11          | \$ 213    |
|                    |             |      | Retained Fill, Walls Both Sides - 1 Tracks (30' Avg. Wall Ht) | 1.000   | RF        |        | 4,323  | 5,459         |          | P | OC-Det |          |           | Subtotal      | \$ 2,892       | \$ 26,555 |
|                    |             |      |   |         |           |        |        | \$ 29,000,000 | Per Mile |   |        |          |           | Fixed Price   | \$ 7           | \$ 7      |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Total     | \$ 2,899      | \$ 26,562      |           |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Per Mile  | \$ 16,000,000 | \$ 150,000,000 |           |
| 10.08.421          |             | OC   | Retained Fill, Walls Both Sides - 2 Tracks (10' Avg. Wall Ht) |         |           |        |        |               | OC       | P | OC-Det |          |           |               |                |           |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                        | 5.600   | sy        | 0.50   | 3      | 4             | 0.63     | P | OC-Det |          | \$ 0.04   | \$ 1.83       | \$ 0           | \$ 10     |
|                    | 31-14-13.23 | A010 | Rough Grading   | 5.600   | sy        | 4.31   | 24     | 31            | 5.52     | P | OC-Det |          | \$ 1.00   | \$ 28.00      | \$ 6           | \$ 157    |
|                    | 31-22-16.10 | A010 | Finish Grading  | 4.700   | sy        | 5.54   | 26     | 33            | 7.09     | P | OC-Det |          | \$ 0.35   | \$ 6.00       | \$ 2           | \$ 28     |
|                    | 31-23-16.16 | A010 | Structural Excavation   | 0.400   | cy        | 21.83  | 9      | 11            | 27.95    | P | OC-Det |          | \$ 4.00   | \$ 185.00     | \$ 2           | \$ 74     |
|                    | 31-23-23.14 | A010 | Structural Backfill   | 0.200   | cy        | 17.15  | 3      | 4             | 21.95    | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 2           | \$ 101    |
|                    | 31-23-23.13 | A010 | Embankment w/Haul & Compaction                                | 15.600  | cy        | 4.20   | 66     | 84            | 5.38     | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 156         | \$ 7,894  |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                                     | 1.000   | lf        | 2.47   | 2      | 3             | 3.13     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-31-13.20 | A020 | 6 ft. Chain Link Fence, Wall Mounted                          | 2.000   | lf        | 26.77  | 54     | 67            | 33.51    | P | OC-Det |          | \$ 6.00   | \$ 140.00     | \$ 12          | \$ 280    |
|                    | 03-21-10.60 | A010 | Reinforcing Steel   | 114.910 | lb        | 1.30   | 149    | 189           | 1.65     | P | OC-Det | 60 lb/cy | \$ 0.60   | \$ 5.68       | \$ 69          | \$ 653    |
|                    | 03-30-53.40 | A110 | Structural Concrete, In Place, Footing                        | 1.000   | cy        | 361.82 | 362    | 457           | 456.87   | P | OC-Det |          | \$ 215.00 | \$ 700.00     | \$ 215         | \$ 700    |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls                          | 0.900   | cy        | 373.38 | 336    | 424           | 470.64   | P | OC-Det |          | \$ 230.00 | \$ 702.00     | \$ 207         | \$ 632    |
|                    | 33-41-13.60 | A010 | Trackway Drainage Allowance, Ballasted                        | 1.000   | lf        | 52.65  | 53     | 66            | 66.13    | P | OC-Det |          | \$ 283.31 | \$ 1,483.80   | \$ 283         | \$ 1,484  |
|                    | 33-71-19.17 | A050 | Cable Duct, At-Grade Guideway                                 | 2.000   | lf        | 36.17  | 72     | 91            | 45.61    | P | OC-Det |          | \$ 3.50   | \$ 615.00     | \$ 7           | \$ 1,230  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                   | 1.000   | lf        | 3.35   | 3      | 4             | 4.21     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                    | 0.890   | sy        | 49.76  | 44     | 55            | 61.96    | P | OC-Det |          | \$ 12.00  | \$ 238.80     | \$ 11          | \$ 213    |
|                    |             |      | Retained Fill, Walls Both Sides - 2 Tracks (10' Avg. Wall Ht) | 1.000   | RF        |        | 1,207  | 1,524         |          | P | OC-Det |          |           | Subtotal      | \$ 971         | \$ 13,455 |
|                    |             |      |   |         |           |        |        | \$ 8,000,000  | Per Mile |   |        |          |           | Fixed Price   | \$ 7           | \$ 7      |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Total     | \$ 978        | \$ 13,462      |           |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Per Mile  | \$ 6,000,000  | \$ 80,000,000  |           |

| Unit Price Element | CSI No.     | Item | Description   | TO Qty  | Dir Un \$ | Dir \$ | Bid \$ | Bid Unit \$   | Code1    | P | Code2  | Notes    | Low \$'s  | High \$'s     | Low total      | Hi Total  |
|--------------------|-------------|------|---|---------|-----------|--------|--------|---------------|----------|---|--------|----------|-----------|---------------|----------------|-----------|
| 10.08.422          |             | OC   | Retained Fill, Walls Both Sides - 2 Tracks (20' Avg. Wall Ht) |         |           |        |        |               | OC       | P | OC-Det |          |           |               |                |           |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                        | 5.600   | sy        | 0.50   | 3      | 4             | 0.63     | P | OC-Det |          | \$ 0.04   | \$ 1.83       | \$ 0           | \$ 10     |
|                    | 31-14-13.23 | A010 | Rough Grading   | 5.600   | sy        | 4.31   | 24     | 31            | 5.52     | P | OC-Det |          | \$ 1.00   | \$ 28.00      | \$ 6           | \$ 157    |
|                    | 31-22-16.10 | A010 | Finish Grading  | 4.700   | sy        | 5.54   | 26     | 33            | 7.09     | P | OC-Det |          | \$ 0.35   | \$ 6.00       | \$ 2           | \$ 28     |
|                    | 31-23-16.16 | A010 | Structural Excavation   | 0.400   | cy        | 21.83  | 9      | 11            | 27.95    | P | OC-Det |          | \$ 4.00   | \$ 185.00     | \$ 2           | \$ 74     |
|                    | 31-23-23.14 | A010 | Structural Backfill   | 0.200   | cy        | 17.15  | 3      | 4             | 22.00    | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 2           | \$ 101    |
|                    | 31-23-23.13 | A010 | Embankment w/Haul & Compaction                                | 31.100  | cy        | 4.20   | 131    | 167           | 5.38     | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 311         | \$ 15,737 |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                                     | 1.000   | lf        | 2.47   | 2      | 3             | 3.14     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-31-13.20 | A020 | 6 ft. Chain Link Fence, Wall Mounted                          | 2.000   | lf        | 26.77  | 54     | 67            | 33.50    | P | OC-Det |          | \$ 6.00   | \$ 140.00     | \$ 12          | \$ 280    |
|                    | 03-21-10.60 | A010 | Reinforcing Steel   | 253.840 | lb        | 1.30   | 330    | 418           | 1.65     | P | OC-Det | 62 lb/cy | \$ 0.60   | \$ 5.68       | \$ 152         | \$ 1,442  |
|                    | 03-30-53.40 | A110 | Structural Concrete, In Place, Footing                        | 2.000   | cy        | 361.83 | 724    | 914           | 456.88   | P | OC-Det |          | \$ 215.00 | \$ 700.00     | \$ 430         | \$ 1,400  |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls                          | 2.100   | cy        | 373.37 | 784    | 988           | 470.61   | P | OC-Det |          | \$ 230.00 | \$ 702.00     | \$ 483         | \$ 1,474  |
|                    | 33-41-13.60 | A010 | Trackway Drainage Allowance, Ballasted                        | 1.000   | lf        | 52.65  | 53     | 66            | 66.16    | P | OC-Det |          | \$ 283.31 | \$ 1,483.80   | \$ 283         | \$ 1,484  |
|                    | 33-71-19.17 | A050 | Cable Duct, At-Grade Guideway                                 | 2.000   | lf        | 36.17  | 72     | 91            | 45.60    | P | OC-Det |          | \$ 3.50   | \$ 615.00     | \$ 7           | \$ 1,230  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                   | 1.000   | lf        | 3.35   | 3      | 4             | 4.20     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                    | 0.890   | sy        | 49.76  | 44     | 55            | 61.97    | P | OC-Det |          | \$ 12.00  | \$ 238.80     | \$ 11          | \$ 213    |
|                    |             |      | Retained Fill, Walls Both Sides - 2 Tracks (20' Avg. Wall Ht) | 1.000   | RF        |        | 2,262  | 2,857         |          | P | OC-Det |          |           | Subtotal      | \$ 1,700       | \$ 23,629 |
|                    |             |      |   |         |           |        |        | \$ 15,000,000 | Per Mile |   |        |          |           | Fixed Price   | \$ 7           | \$ 7      |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Total     | \$ 1,707      | \$ 23,636      |           |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Per Mile  | \$ 10,000,000 | \$ 130,000,000 |           |
| 10.08.423          |             | OC   | Retained Fill, Walls Both Sides - 2 Tracks (30' Avg. Wall Ht) |         |           |        |        |               | OC       | P | OC-Det |          |           |               |                |           |
|                    | 31-13-13.10 | A010 | Cleaning & Grubbing Allowance, Level 1                        | 5.600   | sy        | 0.50   | 3      | 4             | 0.64     | P | OC-Det |          | \$ 0.04   | \$ 1.83       | \$ 0           | \$ 10     |
|                    | 31-14-13.23 | A010 | Rough Grading   | 5.600   | sy        | 4.31   | 24     | 31            | 5.51     | P | OC-Det |          | \$ 1.00   | \$ 28.00      | \$ 6           | \$ 157    |
|                    | 31-22-16.10 | A010 | Finish Grading  | 4.700   | sy        | 5.54   | 26     | 33            | 7.09     | P | OC-Det |          | \$ 0.35   | \$ 6.00       | \$ 2           | \$ 28     |
|                    | 31-23-16.16 | A010 | Structural Excavation   | 0.400   | cy        | 21.83  | 9      | 11            | 27.95    | P | OC-Det |          | \$ 4.00   | \$ 185.00     | \$ 2           | \$ 74     |
|                    | 31-23-23.14 | A010 | Structural Backfill   | 0.200   | cy        | 17.15  | 3      | 4             | 21.90    | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 2           | \$ 101    |
|                    | 31-23-23.13 | A010 | Embankment w/Haul & Compaction                                | 46.700  | cy        | 4.20   | 196    | 251           | 5.38     | P | OC-Det |          | \$ 10.00  | \$ 506.00     | \$ 467         | \$ 23,630 |
|                    | 31-25-13.10 | A010 | Erosion Control Allowance                                     | 1.000   | lf        | 2.47   | 2      | 3             | 3.14     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-31-13.20 | A020 | 6 ft. Chain Link Fence, Wall Mounted                          | 2.000   | lf        | 26.77  | 54     | 67            | 33.50    | P | OC-Det |          | \$ 6.00   | \$ 140.00     | \$ 12          | \$ 280    |
|                    | 03-21-10.60 | A010 | Reinforcing Steel   | 550.250 | lb        | 1.30   | 715    | 905           | 1.65     | P | OC-Det | 62 lb/cy | \$ 0.60   | \$ 5.68       | \$ 330         | \$ 3,125  |
|                    | 03-30-53.40 | A110 | Structural Concrete, In Place, Footing                        | 5.260   | cy        | 361.82 | 1,903  | 2,403         | 456.88   | P | OC-Det |          | \$ 215.00 | \$ 700.00     | \$ 1,131       | \$ 3,682  |
|                    | 03-30-53.40 | A120 | Structural Concrete, In Place, Walls                          | 3.610   | cy        | 373.37 | 1,348  | 1,699         | 470.61   | P | OC-Det |          | \$ 230.00 | \$ 702.00     | \$ 830         | \$ 2,534  |
|                    | 33-41-13.60 | A010 | Trackway Drainage Allowance, Ballasted                        | 1.000   | lf        | 52.65  | 53     | 66            | 66.16    | P | OC-Det |          | \$ 283.31 | \$ 1,483.80   | \$ 283         | \$ 1,484  |
|                    | 33-71-19.17 | A050 | Cable Duct, At-Grade Guideway                                 | 2.000   | lf        | 36.17  | 72     | 91            | 45.60    | P | OC-Det |          | \$ 3.50   | \$ 615.00     | \$ 7           | \$ 1,230  |
|                    | 26-05-26.80 | A010 | Corrosion Control Allowance                                   | 1.000   | lf        | 3.35   | 3      | 4             | 4.20     | P | OC-Det |          |           |               | FP             | FP        |
|                    | 32-06-10.10 | A100 | Site Restoration Allowance                                    | 0.890   | sy        | 49.76  | 44     | 55            | 61.98    | P | OC-Det |          | \$ 12.00  | \$ 238.80     | \$ 11          | \$ 213    |
|                    |             |      | Retained Fill, Walls Both Sides - 2 Tracks (30' Avg. Wall Ht) | 1.000   | RF        |        | 4,456  | 5,629         |          | P | OC-Det |          |           | Subtotal      | \$ 3,082       | \$ 36,549 |
|                    |             |      |   |         |           |        |        | \$ 30,000,000 | Per Mile |   |        |          |           | Fixed Price   | \$ 7           | \$ 7      |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Total     | \$ 3,089      | \$ 36,556      |           |
|                    |             |      |   |         |           |        |        |               |          |   |        |          | Per Mile  | \$ 17,000,000 | \$ 200,000,000 |           |

## **ATTACHMENT 3**

Comments from AECOM Team



# California High-Speed Train Project Merced to Fresno Section Basis of Estimate Review

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|                  |  |
|------------------|--|
| Project Name:    | California High-Speed Rail                     |
| Class Estimate:  | Class 2  |
| Estimated By:    | John O'Reilly                                  |
| Reviewed By:     | Farid Nobari                                   |
| Estimator Phone: | 916.718.8916                                   |
| Estimate Date:   | 12.23.2010                                     |
| Produced by :    | John O'Reilly/SAC - CH2M HILL Senior Estimator |



## 1. Purpose of Estimate Review

The purpose of this task is to review the engineer's estimate provided by the Program Management Team (PMT), Parsons Brinckerhoff (PB) at 15% design and to provide comments (as applicable) on the scope, quantities, cost parameters, and methodology that were used.

## 2. General Project Description

The California High-Speed Train (HST) System, is planned to provide intercity, high-speed service on more than 800 miles of tracks throughout California, connecting the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego.

The draft cost estimate under review, covers Merced to Fresno section of the system, which is part of the Phase 1 projects, connecting San Francisco to Los Angeles via the Pacheco Pass and the Central Valley.

## 3. Items Reviewed

The cost estimate review is based on the following information provided by the PMT:

- Draft Unit Price Estimates - Aerial Structures - October 2010
- Draft Unit Price Estimates - Track and Maintenance - Facilities
- Supportive unit price listings dated 10-01-10

The following sub-section numbering corresponds to the unit price estimate report section of the above documents.

### 1.0 N/A

### 2.0 General Methodology

**Scope** – The Scope has been properly identified into unit price elements (UPEs) with the use of typical drawings and in some cases past rail experience. The cost elements have been defined by the Federal Transit Administration's (FTA's) standards. This approach is a standard basis of identifying the cost elements for the scope of work.

**Quantities** – The quantities have been generated and aligned with the UPEs from the typical drawings and dimensional information from the drawings. This approach is a standard cost estimating practice at 15% design.

**Cost** – The UPEs have been incorporated into the Timberline Estimating Software in a well-thought-out manner. The approach being used is standard practice with bottoms-up estimating. The unit cost have been review and appear to be reasonable.

### **3.0 Report Format**

The report format was well thought out and highlights the general methodology of the project scope, quantities, cost, and general assumptions. The estimate backup has been provided with the appropriate assumptions documented in developing the scope, quantities, and cost estimate.

### **4.0 Unit Price Element Parameters**

**Quantities** – As mentioned in the general methodology section of the report, the quantities have been generated by standard practices and means.

**Unit Costs** – The unit costs have been developed utilizing the Timberline Estimating Software, which is tied to a national means cost database. This estimating software allows estimating to be done using a bottoms-up method. Typically, the national means database does run +/- of a typical contractor's bottoms-up estimates where material, equipment, and labor have been crewed up. Our estimation practice applies an estimate accuracy range based on the amount of design that has been completed. In this case, the estimate is based on 15% design and would have an accuracy range of -10% to +15%.

**Labor Rates** – Craft labor rates have been used using standard practices. The raw labor rates, fringe benefits, insurance, and taxes have been combined into a composite labor rate for union work in the Los Angeles area. The actual composite labor rate that is being used was not referenced in the report and cannot be confirmed for accuracy. For Merced-Fresno section, more locally representative labor rate may be considered. Note that some crafts will be imported from more urbanized regions.

**Equipment Rates** – Hourly equipment rental and operating rates were estimated using commercially available equipment rates published by R.S. Means. Typically, these rates are going to be +/- of a typical contractor's inside and outside rental rates. The industry standard is to use 80% of the blue book equipment rental rates. This can be covered with the estimate accuracy range that is mentioned in the Recommendations section below.

**Material Prices** – Permanent and consumable materials were estimated using commercially available equipment rates published by R.S. Means. Typically, these rates are going to be +/- of a typical contractor's quoted materials during the closing process of an estimate. Significant implications can result on a project of this size if material pricing methods are not consistent. Potential discrepancies in pricing the material can be covered with the estimate accuracy range that is mentioned in the Recommendations section below.

### **Contractor's Overhead, Indirect, and Profit**

The list of markup allowances and taxes have been reviewed and seem to be reasonable except for the Markup Allowance for profit. Typically, a range exists from 10% to 18%

for major design-build projects of this type with a mean average of 13%. See Recommendations below for further details.

## 4. Assumptions and Reference Drawings

All documented assumptions appear to be reasonable except for the work-week schedule and embankment material. Our recommendation is to schedule the work week based on 5/10's as the typical work week. The embankment material assumptions are aggressive in nature with some risk. The risks rise from assuming that the excavated material would be of good engineering quality to be used for new embankments. Our recommendation would be to assume much lower supply of embankment fills to be from excavated material, and that a majority of the fill (up to 60 to 70%) will be import material. See Recommendations below for more details.

## 5. Escalation Rate

The current estimate does not include any escalation. We recommend the following **escalation factors** for the first quarter of 2011:

- Subcontractors – 4 % per year
- Composite rate – 3.85 % per year
- Labor – 3 % per year
- Materials and Equipment – 4 % per year
- Diesel Fuel – \$3.25 per gallon
- Gasoline – \$3.00 per gallon

## 6. Market Conditions

The current market conditions are drastically impacting the construction market across the country. This is based upon recent bids and comparisons with Engineer's Estimates. Bids are coming in between 10% to 20%, and even 30%, lower than the current engineer's estimates. Despite the estimator's best practices and adjustments, bids are being driven by current market conditions. A detailed analysis of local market conditions should be made; this could be performed by a review of upcoming and current similar projects around the region of this project site. Market conditions include the following:

- Busy contractors
- Contractors selectively bidding jobs
- Contractors selectively choosing which owners they want to work for
- Premium wages to keep skilled workers and management staff
- Availability of crafts/trades
- Immigration impacts and uncertainty
- Abnormal fuel impacts and uncertainty (Oil = \$88/barrel; gas = \$3.20/gal)
- Abnormal material impacts of the last two years; inflation is already starting to trend upward and will impact major projects in the next several years

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## 7. Estimate Classification

This cost estimate is considered a Budget Level or Class 3 estimate as defined by the American Association of Cost Engineering (AACE). It is considered to be accurate to +15% to -10%, based upon a 15% design deliverable.

The cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project costs, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. The client should be cautioned that such prices are highly subject to variation as a result of market conditions.

## 8. Cost Resources

The following is a list of the various cost resources used in developing the cost estimate that we agree was a good basis of estimate:

- R.S. Means
- Vendor quotes on equipment and materials where appropriate
- Estimator's judgment

Labor unit prices reflect a burdened rate, including workers' compensation, unemployment taxes, fringe benefits, and medical insurance.

## 9. Sales Tax

Sales tax has been reviewed and confirmed at 9.25%.

## 10. Recommendations

Our recommendations are as follows:

- Contingency should be included for quantity creep, design change, parametrical calculated quantities, and assumed quantities based on past rail experience. Our recommended percentage to capture the quantity risk is a range from 8% to 15% contingency, with 10% being recommended for this project for quantity risk.
- A composite labor rate should be included within the assumptions for reference and to confirm the accuracy of the rate being used. A disconnect of only a few dollars can add up to tens of millions of dollars being associated with the project cost.
- An estimated accuracy range should be included after all direct, indirect, markups, contingency, and escalation have been completed. Our estimation policy for a project of this size at 15% design would be to insert a -10% to 15% accuracy range.
- The recommendation for contractor profit would be a mean average of 13%.
- A craft work week should be estimated using 5/10's.
- The embankment material assumption is a little aggressive. We recommend using 60% as import material for the embankment in lieu of all embankment material coming from excavated material onsite.

| Low Range       | Estimate Range               | High Range      |
|-----------------|------------------------------|-----------------|
| -10%            |                              | +15%            |
| \$4,639,429,039 | <b>Total \$5,154,921,155</b> | \$5,928,159,328 |

## **ATTACHMENT 4**

Comments from HMM Team



# California High-Speed Train Project



## Palmdale to Los Angeles

# PEER REVIEW OF PROTOTYPICAL TUNNEL UNIT COSTS

Prepared by: \_\_\_\_\_  
Ken Fiorentino \_\_\_\_\_ Date \_\_\_\_\_

Checked by: \_\_\_\_\_  
Mike Wongkaew, PhD, PE, SE \_\_\_\_\_ Date \_\_\_\_\_

Reviewed by: \_\_\_\_\_  
John Hawley, PE \_\_\_\_\_ Date \_\_\_\_\_

Approved by: \_\_\_\_\_  
Dan Tempelis, PE \_\_\_\_\_ Date \_\_\_\_\_

| Revision | Date          | Description |
|----------|---------------|-------------|
| 0        | November 2010 | Issued      |
|          |               |             |
|          |               |             |

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## **ABBREVIATIONS / ACRONYMS**

Authority ..... California High-Speed Rail Authority  
D&B ..... Drill and Blast  
EPB ..... Earth Pressure Balance tunnel boring machine  
HMM ..... Hatch Mott MacDonald  
HST ..... High-Speed Train  
ID ..... Internal Diameter  
LF ..... Linear Foot  
OD ..... Outer Diameter  
RF ..... Route Foot  
RH ..... Roadheader  
SEM ..... Sequential Excavation Method  
TBM ..... Tunnel Boring Machine  
UCC..... Unit Cost Category

## 1.0 EXECUTIVE SUMMARY

The purpose of this memorandum is to provide a limited peer review of Unit Price Estimates (\$/Route Foot and \$/Route Mile) for 27 categories of prototypical tunnels for the California High-Speed Train Project (CHSTP) summarized in Table 1 below.

Thirty two documents were provided for our review on November 3, 2010, including 31 HeavyBid® Cost Reports along and Prototypical Tunnel Unit Costs Memorandum. We reviewed these documents as provided; no independent estimates were performed as part of this review. General and specific comments are provided in the body of this memorandum.

Our aim is to provide a brief note giving general opinion on the cost estimating methodology and rates of various tunnel unit cost categories, identifying particularly rates where we see issues and suggesting adjustments, redefinitions and recommendations for future work.

It is our general opinion that the proposed Unit Price Estimates quoted in Table 1 below are in the reasonable ranges, given the exclusions and assumptions adopted in the cost estimating approach and despite the pluses and minuses to be reconciled as a result of incorporation of our comments

The only exceptions are the high costs of Drill & Blast Tunnels with Type IV Support (UCC #8, #12 and #16), which more than double the costs of Drill & Blast Tunnels of the same size but with Type I Support (UCC #5, #9 and #13, respectively). We recommend further examination to identify the cause of this high contrast, which we did not find when examining the cost differentials for SEM or RH tunnels with Type IV versus Type I support.

**Table 1: Summary of Unit Price Estimates for Prototypical Tunnels**

| Unit Cost Categories                 |   | \$/Route Foot <sup>1</sup><br>(\$/Route Mile or<br>\$/Cross Passage) | Our General<br>Opinion on Unit<br>Price |
|--------------------------------------|---|--|---|
| <b>TBM Single-Track Twin Tunnels</b> |   |  |   |
| 1                                    | TBM Single Track, Twin Tunnel, 30-ft ID, Unpressurized Machine in Hard Rock | \$23,000<br>(\$121,440,000)  | Within reasonable range                 |
| 2                                    | TBM Single Track, Twin Tunnel, 30-ft ID, Slurry Machine in Hard Rock        | \$34,000<br>(\$179,520,000)  | Within reasonable range                 |
| 3                                    | TBM Single Track, Twin Tunnel, 30-ft ID, EPB in Soft Ground                 | \$30,000<br>(\$158,400,000)  | Within reasonable range                 |

<sup>1</sup> Source: Table 6 of Prototypical Tunnel Unit Costs Memorandum, Final Draft, October 2010 prepared by PMT

| <b>Unit Cost Categories</b>                          |   | <b>\$/Route Foot<sup>1</sup></b><br><b>(\$/Route Mile or</b><br><b>\$/Cross Passage)</b> | <b>Our General</b><br><b>Opinion on Unit</b><br><b>Price</b> |
|--|---|--|--|
| <b>TBM Double-Track Tunnel</b>                       |   |  |  |
| 4  | TBM Double Track Tunnel, 50-ft ID, Slurry Machine in Soft Ground        | \$57,000<br>(\$300,960,000)  | Within reasonable range                                      |
| 4B   | TBM Double Track Tunnel, 40-ft ID, Slurry Machine in Soft Ground        | \$43,000<br>(\$227,040,000)  | Within reasonable range                                      |
| <b>Hard Rock - D&amp;B Single-Track Twin Tunnels</b> |   |  |  |
| 5  | D&B Single Track, Twin Tunnel, 30-ft ID in Hard Rock, Support Type I    | \$39,000<br>(\$205,920,000)  | Within reasonable range                                      |
| 8  | D&B Single Track, Twin Tunnel, 30-ft ID in Hard Rock, Support Type IV   | \$88,000<br>(\$464,640,000)  | High, as compared to UCC #5                                  |
| <b>Hard Rock - D&amp;B Double-Track Tunnel</b>       |   |  |  |
| 9  | D&B Double Track Tunnel, 40-ft ID in Hard Rock, Support Type I          | \$28,000<br>(\$147,840,000)  | Within reasonable range                                      |
| 12   | D&B Double Track Tunnel, 40-ft ID in Hard Rock, Support Type IV         | \$69,000<br>(\$364,320,000)  | High, as compared to UCC #9                                  |
| 13   | D&B Double Track Tunnel, 50-ft ID in Hard Rock, Support Type I          | \$44,000<br>(\$232,320,000)  | Within reasonable range                                      |
| 16   | D&B Double Track Tunnel, 50-ft ID in Hard Rock, Support Type IV         | \$92,000<br>(\$485,760,000)  | High, as compared to UCC #13                                 |
| <b>Soft Ground - SEM Single-Track Twin Tunnels</b>   |   |  |  |
| 17   | SEM Single Track, Twin Tunnel, 30-ft ID in Soft Ground, Support Type I  | \$71,000<br>(\$374,880,000)  | Within reasonable range; a bit conservative                  |
| 20   | SEM Single Track, Twin Tunnel, 30-ft ID in Soft Ground, Support Type IV | \$86,000<br>(\$454,080,000)  | Within reasonable range                                      |

| <b>Unit Cost Categories</b>                     |  | <b>\$/Route Foot<sup>1</sup><br/>(\$/Route Mile or<br/>\$/Cross Passage)</b> | <b>Our General<br/>Opinion on Unit<br/>Price</b> |
|---|--|--|--|
| <b>Soft Ground - SEM Double-Track Tunnel</b>    |  |  |  |
| 21  | SEM Double Track Tunnel, 40-ft ID in Soft Ground, Support Type I     | \$51,000<br>(\$269,280,000)  | Within reasonable range                          |
| 24  | SEM Double Track Tunnel, 40-ft ID in Soft Ground, Support Type IV    | \$58,000<br>(\$306,240,000)  | Within reasonable range                          |
| 25  | SEM Double Track Tunnel, 50-ft ID in Soft Ground, Support Type I     | \$75,000<br>(\$396,000,000)  | Within reasonable range                          |
| 28  | SEM Double Track Tunnel, 50-ft ID in Soft Ground, Support Type IV    | \$85,000<br>(\$448,800,000)  | Within reasonable range                          |
| <b>Soft Rock - RH Single-Track Twin Tunnels</b> |  |  |  |
| 29  | RH Single Track, Twin Tunnel, 30-ft ID in Soft Rock, Support Type I  | \$45,000<br>(\$237,600,000)  | Within reasonable range                          |
| 32  | RH Single Track, Twin Tunnel, 30-ft ID in Soft Rock, Support Type IV | \$52,000<br>(\$274,560,000)  | Within reasonable range                          |
| <b>Soft Rock - RH Double-Track Tunnel</b>       |  |  |  |
| 33  | RH Double Track Tunnel, 40-ft ID in Soft Rock, Support Type I        | \$34,000<br>(\$179,520,000)  | Within reasonable range                          |
| 36  | RH Double Track Tunnel, 40-ft ID in Soft Rock, Support Type IV       | \$47,000<br>(\$248,160,000)  | Within reasonable range                          |
| 37  | RH Double Track Tunnel, 50-ft ID in Soft Rock, Support Type I        | \$55,000<br>(\$290,400,000)  | Within reasonable range                          |
| 40  | RH Double Track Tunnel, 50-ft ID in Soft Rock, Support Type IV       | \$76,000<br>(\$401,280,000)  | Within reasonable range                          |

| Unit Cost Categories |  | \$/Route Foot <sup>1</sup><br>(\$/Route Mile or<br>\$/Cross Passage) | Our General<br>Opinion on Unit<br>Price |
|----------------------|--|--|---|
| <b>Cross Passage</b> |  |  |   |
| 41                   | D&B Cross Passage in Rock                                | \$28,000<br>(\$924,000 EA)   | Within reasonable<br>range              |
| 43                   | RH Cross Passage in Soft Rock                            | \$25,000<br>(\$825,000 EA)   | Within reasonable<br>range              |
| 44                   | SEM Cross Passage in Soft Ground                         | \$33,000<br>(\$1,089,000 EA)   | Within reasonable<br>range              |
| 45                   | SEM Cross Passage in Soft Ground, Including Jet<br>Grout | \$84,000<br>(\$2,772,000 EA)   | Within reasonable<br>range              |

## 2.0 REVIEW METHODOLOGY

Thirty two documents identified in Table 2 below were provided for our review on November 3, 2010. These include the memorandum summarizing the prototypical tunnel unit costs and 31 HeavyBid® cost reports for various direct and indirect cost categories.

Considering the large volume of documents to be reviewed (1020 pages total), diversity of tunnel construction methods and tunnel sizes (27 categories total) and short time given to perform this task, only a limited review of the documents could be performed. We reviewed the documents as provided, and no independent estimates were performed as part of this review.

**Table 2: List of Documents Reviewed**

| No.   | Title  | Date     | Pages |
|---|--|----------|-------|
| <b>Memorandum</b>                                       |  |          |       |
| 1   | Prototypical Tunnel Unit Costs Memorandum – Final Draft  | 10/27/10 | 56    |
| <b>HeavyBid® Direct Cost Report for TBM Tunnels</b>     |  |          |       |
| 2   | HeavyBid® Direct Cost Report for Unit Cost Category #1 – TBM Single Track, Twin Tunnel, 30-ft ID, Unpressurized Machine in Hard Rock | 5/21/10  | 71    |
| 3   | HeavyBid® Direct Cost Report for Unit Cost Category #2 – TBM Single Track, Twin Tunnel, 30-ft ID, Slurry Machine in Hard Rock        | 5/21/10  | 57    |
| 4   | HeavyBid® Direct Cost Report for Unit Cost Category #3 – TBM Single Track, Twin Tunnel, 30-ft ID, EPB in Soft Ground                 | 5/21/10  | 53    |
| 5   | HeavyBid® Direct Cost Report for Unit Cost Category #4 – TBM Double Track Tunnel, 50-ft ID, Slurry Machine in Soft Ground            | 5/21/10  | 37    |
| 6   | HeavyBid® Direct Cost Report for Unit Cost Category #4B – TBM Double Track Tunnel, 40-ft ID, Slurry Machine in Soft Ground           | 5/21/10  | 24    |
| <b>HeavyBid® Direct Cost Report for D&amp;B Tunnels</b> |  |          |       |
| 7   | HeavyBid® Direct Cost Report for Unit Cost Category #5 – D&B Single Track, Twin Tunnel, 30-ft ID in Hard Rock, Support Type I        | 10/5/10  | 18    |
| 8   | HeavyBid® Direct Cost Report for Unit Cost Category #8 – D&B Single Track, Twin Tunnel, 30-ft ID in Hard Rock, Support Type IV       | 10/6/10  | 78    |
| 9   | HeavyBid® Direct Cost Report for Unit Cost Category #9 – D&B Double Track Tunnel, 40-ft ID in Hard Rock, Support Type I              | 10/5/10  | 17    |



| No.   | Title   | Date    | Pages |
|---|---|---------|-------|
| 10  | HeavyBid® Direct Cost Report for Unit Cost Category #12 – D&B Double Track Tunnel, 40-ft ID in Hard Rock, Support Type IV         | 10/6/10 | 41    |
| 11  | HeavyBid® Direct Cost Report for Unit Cost Category #13 – D&B Double Track Tunnel, 50-ft ID in Hard Rock, Support Type I          | 10/6/10 | 19    |
| 12  | HeavyBid® Direct Cost Report for Unit Cost Category #16 – D&B Double Track Tunnel, 50-ft ID in Hard Rock, Support Type IV         | 10/6/10 | 45    |
| <b>HeavyBid® Direct Cost Report for SEM Soft Ground Tunnels</b> |   |         |       |
| 13  | HeavyBid® Direct Cost Report for Unit Cost Category #17 – SEM Single Track, Twin Tunnel, 30-ft ID in Soft Ground, Support Type I  | 10/6/10 | 36    |
| 14  | HeavyBid® Direct Cost Report for Unit Cost Category #20 – SEM Single Track, Twin Tunnel, 30-ft ID in Soft Ground, Support Type IV | 10/6/10 | 72    |
| 15  | HeavyBid® Direct Cost Report for Unit Cost Category #21 – SEM Double Track Tunnel, 40-ft ID in Soft Ground, Support Type I        | 10/6/10 | 35    |
| 16  | HeavyBid® Direct Cost Report for Unit Cost Category #24 – SEM Double Track Tunnel, 40-ft ID in Soft Ground, Support Type IV       | 10/6/10 | 36    |
| 17  | HeavyBid® Direct Cost Report for Unit Cost Category #25 – SEM Double Track Tunnel, 50-ft ID in Soft Ground, Support Type I        | 10/6/10 | 36    |
| 18  | HeavyBid® Direct Cost Report for Unit Cost Category #28 – SEM Double Track Tunnel, 50-ft ID in Soft Ground, Support Type IV       | 10/6/10 | 40    |
| <b>HeavyBid® Direct Cost Report for RH Soft Rock Tunnels</b>    |   |         |       |
| 19  | HeavyBid® Direct Cost Report for Unit Cost Category #29 – RH Single Track, Twin Tunnel, 30-ft ID in Soft Rock, Support Type I     | 10/6/10 | 22    |
| 20  | HeavyBid® Direct Cost Report for Unit Cost Category #32 – RH Single Track, Twin Tunnel, 30-ft ID in Soft Rock, Support Type IV    | 10/6/10 | 38    |
| 21  | HeavyBid® Direct Cost Report for Unit Cost Category #33 – RH Double Track Tunnel, 40-ft ID in Soft Rock, Support Type I           | 10/6/10 | 26    |
| 22  | HeavyBid® Direct Cost Report for Unit Cost Category #36 – RH Double Track Tunnel, 40-ft ID in Soft Rock, Support Type IV          | 10/6/10 | 23    |
| 23  | HeavyBid® Direct Cost Report for Unit Cost Category #37 – RH Double Track Tunnel, 50-ft ID in Soft Rock, Support Type I           | 10/6/10 | 26    |

| No.  | Title  | Date     | Pages       |
|--|--|----------|-------------|
| 24   | HeavyBid® Direct Cost Report for Unit Cost Category #40 – RH Double Track Tunnel, 50-ft ID in Soft Rock, Support Type IV | 10/6/10  | 23          |
| <b>HeavyBid® Direct Cost Report for Cross Passages</b> |  |          |             |
| 25   | HeavyBid® Direct Cost Report for Unit Cost Category #41 – D&B Cross Passage in Rock                                      | 10/12/10 | 12          |
| 26   | HeavyBid® Direct Cost Report for Unit Cost Category #43 – RH Cross Passage in Soft Rock                                  | 10/12/10 | 12          |
| 27   | HeavyBid® Direct Cost Report for Unit Cost Category #44 – SEM Cross Passage in Soft Ground                               | 10/12/10 | 13          |
| 28   | HeavyBid® Direct Cost Report for Unit Cost Category #45 – SEM Cross Passage in Soft Ground, Including Jet Grout          | 10/12/10 | 14          |
| <b>HeavyBid® Indirect Cost Report</b>                  |  |          |             |
| 29   | HeavyBid® Indirect Cost Report for TBM Tunnel  | 10/20/10 | 10          |
| 30   | HeavyBid® Indirect Cost Report for Drill & Blast Tunnel  | 10/21/10 | 10          |
| 31   | HeavyBid® Indirect Cost Report for SEM Tunnel  | 10/21/10 | 10          |
| 32   | HeavyBid® Indirect Cost Report for Road Header Tunnel  | 10/21/10 | 10          |
| <b>Total</b>   |  |          | <b>1020</b> |

### 3.0 OUR UNDERSTANDING OF UNIT COST ESTIMATING APPROACH

It is our understanding that the prototypical unit costs were prepared by the CHSTP Program management Team (PMT) and are intended for use in the development of programmatic-level cost estimates and to support future detail cost estimates at a regional level for California High-Speed Train Project. Some general assumptions behind the unit costs include:

- All the TBM Tunnel Estimates were developed assuming 10,560 LF (2 mi) long tunnel
- All the Conventional Tunnel Estimates (Drill & Blast for hard rock, SEM for soft ground, or Road Header for soft rock) were developed assuming 1,000 LF (0.19 mi) long tunnel

- Due to the absence of specific geotechnical information, two support classes, Class I and Class IV, were assumed for Conventional Tunnel Estimates; Class I was considered for Good Ground and Class IV was considered for Poor Ground
- All estimates are for the excavation, temporary support of excavation, final tunnel lining. For double-track tunnels, the estimates include reinforced concrete center wall separating the two tracks. First-stage track concrete and walkway are included only in UCCs #1, #4, #4B and #5.<sup>2</sup>
- Estimates exclude site work, utilities, mobilization, demobilization, financing, bonds, escalation, contingencies, surveying and personnel mobilization (Source: Section 4.0 of the Prototypical Tunnel Unit Costs Memorandum)

## 4.0 GENERAL OPINION AND RECOMMENDATION

1. With the exception of utilities and contingencies, which are accounted for separately in the cost estimating spreadsheet used by PMT, the exclusions identified in the last bullet above represent major components that contractors would have included in their cost. These costs further depend on the method of tunneling. As such, we caution that the proposed Programmatic Unit Price Elements do not directly relate to contractor's bid price. Adjustments, which could be significant, to the proposed unit prices to account for these excluded items will be required prior to incorporation of unit prices into Programmatic Level Cost Estimates. Further, there is a risk that these unit prices could be misinterpreted by casual users who may not be familiar with the assumptions, exclusions and limitations inherent in these numbers.
2. Nevertheless, we find the proposed Unit Price Elements very useful for the purpose of comparing relative costs of various tunnel construction methods, subject to general and detail comments below.
3. We understand the absence of geotechnical information at specific tunnel sites, and as such recognize that it was necessary to assume conservative productivity rates. Due to this difficulty, we refrain generally from commenting on productivity at this stage of project development, unless we find the rates to be too optimistic or too conservative.
4. We recommend the following adjustments, which would increase equipment and labor costs:
  - a. Plant and equipment hourly rates used in the estimates are somewhat low. (For comparison, we used the ownership and operating costs data in EquipmentWatch® Cost Reference Guide.)
  - b. Recommend adding a Plant & Equipment purchase / salvage / assembly spreadsheet for all major equipment and plants.
  - c. Travel time within the tunnels from the dry house to the heading and back should be added, a union requirement.

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<sup>2</sup> It is unclear how the cost of first-stage track concrete and walkway will be captured for other UCCs. The accompanying sketches in Appendix B of Prototypical Tunnel Unit Costs Memorandum do not show these elements and the HeavyBid® Cost Reports do not appear to include these elements.

- d. Should add cost for working through lunch and eating on the fly
  - e. Should add cost for major maintenance days or shifts at least once each week
  - f. Should adjust the pay hours and rates to reflect the travel time and working through lunch, all that time is overtime.
5. The documents would benefit from additional coordination and QA/QC review. As illustrated by examples in the section that follows, mining rates and conceptual excavation support designs stated in the Prototypical Tunnel Unit Costs Memorandum should be reconciled with those used in HeavyBid® Direct Cost Reports. Also, there are elements, such as crews or equipments, inserted in HeavyBid® Direct Cost Reports that may not be compatible with the tunneling method or construction activity being estimated. While we recognize that most of the items to be reconciled may not result in a significant change in the unit prices, which is our ultimate objective, eliminating these minor inconsistencies would strengthen the defensibility of the Unit Price Estimates.
  6. Overall, given the exclusions and assumptions adopted in the cost estimating approach, and despite the pluses and minuses to be reconciled as a result of additional QA/QC review of the cost estimates and incorporation of our comments, it is our general opinion that the individual Unit Price Estimates (\$/Route Foot) shown in Table 6 of the Prototypical Tunnel Unit Costs Memorandum are in the reasonable ranges. The only exceptions are the high costs of Drill & Blast Tunnels with Type IV Support (UCC #8, #12 and #16), which more than double the costs of Drill & Blast Tunnels of the same size but with Type I Support (UCC #5, #9 and #13, respectively). We recommend further examination to identify the cause of this high contrast, which we did not find in when looking at the cost differentials for SEM or RH tunnels with Type IV versus Type I support.
  7. Due to limited time, we did not review the cross passage cost estimates (UCCs #41, #43, #44 and #45) in detail. Cross passages generally represent a small fraction of overall tunnel cost. Nevertheless, based on our experience on similar projects, it is our general opinion that the Unit Price Estimates (\$/LF) for cross passages shown in Table 6 of the Prototypical Tunnel Unit Costs Memorandum are in the reasonable range. For 33-ft long by 14 ft ID typical cross passage dimensions, the cost per foot translates to \$0.8 to \$2.8 millions for cross passage in rock and in soft ground requiring jet grouting for ground improvement, respectively.

## 5.0 SPECIFIC RECOMMENDATION

Due to the short time frame, we were unable to review all 31 HeavyBid® cost reports. We focused our effort on reviewing the Prototypical Tunnel Unit Costs Memorandum and at least one HeavyBid® cost report for each tunneling method (TBM, D&B, SEM, and RH). The recommendations below are intended to help with the QA/QC process suggested above and with future improvement of the estimates as the project further develops.

## 5.1 Prototypical Tunnel Unit Costs Memorandum

We find the Memo to be clearly written, and the advance rates and conceptual design of tunnel excavation sequence and supports to be reasonable given the limited geotechnical data and considering the early stage of project development. Below are minor suggestions for consideration:

1. Page 5, Second Para.: The reference to European experience, while may be viewed as factual by some, seems out of context and it is unclear whether this has been a consideration in the Unit Price Estimates. Suggest omitting the sentence.
2. Page 9, Section 6.5, Line 2: Agree that TBM delivery cost should be included; however, this has not been consistently applied to all HeavyBid® Direct Cost Reports for all TBM tunnels.
3. Page 9, Section 6.5, Table 5: TBM Supply Costs for UCC 1 through 3 are for single TBM while Unit Price Estimates were based on two TBMs. Suggest reporting the TBM Supply Costs for two TBMs for consistency and for comparison with UCC 4 and 4B.
4. Page 9, Section 6.7, Line 4: Please check the excavation method of UCC 41 and 43 as they may have been switched.
5. Page 12, Table 6: Advance rate of UCC 2 (30-ft ID Slurry TBM in hard rock) of 20 ft/day seems too conservative.
6. Page 15: The backfill below the concrete invert slab has not been identified and does not appear to be included in the HeavyBid® Direct Cost Report.
7. Page 38, Appendix B, UCC 1: Mining rate of 26 LF/day and lining rate of 20 LF/day are too conservative and not coordinated with Table 6 on Page 12.
8. Page 38, Appendix B, UCC 1: Swell factor of 1.5 is somewhat low. Suggest 1.8 (Source: Robbins)
9. Page 51, Appendix C: TBM utilization seems a bit conservative. It is unclear how this information is reflected in the HeavyBid® estimates.
10. Page 51, Appendix C: Tunnel outside diameters seems to refer to the concrete lining. The TBM excavated diameters will be larger.
11. Page 51, Appendix C: For UCC 1 through 3, quantities appear to be for one tunnel instead of two.
12. Page 51, Appendix C: For UCC 4, the concrete and reinforcement quantities do not coordinate with HeavyBid® estimate.
13. Page 51, Appendix C: the cost of concrete liner for UCC 2 and 3 seems high, almost twice of UCC 1 which we feel is a more reasonable number. Since the liners for UCC 1 through 3 have similar thickness and reinforcement ratios, the difference seems too drastic and warrants a closer examination.

## 5.2 UCC#1 – TBM Single Track, Twin Tunnel, 30-ft ID, Unpressurized Machine in Hard Rock

1. Bid Item 20021:
  - a. Page 3 Activity ASMTBM is for a 21 FT TBM. This should be 33.5 ft OD TBM.
  - b. Page 25, Activity 20215B, tail shield and erector ring disassembly are included; however, these are not applicable to main beam TBM and cast-in-place concrete lining assumed for this UCC.
2. Bid Item 20031, Page 26: 21FT TBM was noted, instead of 33.5 ft OD for this UCC. Also, it is unclear why the total crew hours for disassembling the TBM is the same as that used for assembling the TBM in Activity 20215B.
3. Bid Item 20225 on Page 32
  - a. Robbins 24'-6" shown instead of 33.5 ft TBM; and at 38 % the math does not calculate.
  - b. Suggest verifying the validity of applying the same cutter replacement unit cost of \$4.50 per loose cubic yard of excavated material for all TBM tunnel UCCs (hard rock and soft ground). Also, please verify whether the unit cost data should be per bank cubic yard or loose cubic yard.
  - c. There is no allowance for Travel Time from the Dry House to the Tunnel Heading.
  - d. 22.5 working hours shown, meaning there is no one at the tunnel heading for 0.5 hours per shift and 1.5 hours per day. There should always be a crew at the tunnel heading during a standard work day. These hours should be adjusted to reflect a 24 hour work day plus travel time.
4. No line item for muck disposal; not consistent with other UCCs.
5. Bid Item 20235 on Pages 45-46: including both steel fibers (at about 80#/CY) and rebars (at about 200#/CY) seems redundant. Bid Item 20240 on Page 48: 938,667 LB of rebars represent about 270#/CY of concrete, which seems high and not coordinated with the assumptions in Appendix B of Prototypical Tunnel Unit Costs Memorandum.

## 5.3 UCC #2 -- TBM Single Track, Twin Tunnel, 30-ft ID, Slurry Machine in Hard Rock

1. Bid Item 20011, Page 1: Should include cost of slurry pipe.
2. Bid Item 20021, Page 3-4:
  - a. Front support, side supports, rear supports, gripper and main beam are not applicable for slurry TBM. Activities associated with these items should be removed.
  - b. 21 ft TBM noted, instead of 33.5 ft.
  - c. The crew hours for assembling slurry TBM (568 hours) should be different than the crew hours for assembling a main beam TBM in UCC #1.
3. Activity 20215C, Page 3-6: Gripper walls are not applicable for slurry TBM.
4. Activity 20215H, Page 8: D&B Tunnel Service Crew shown; not applicable for Slurry TBM.
5. Activity 20220A, Page 9: Conveyor shown; unclear how this is applicable to slurry TBM.
6. Activity 20220B, Page 10: Unclear where pea gravel ballast is used for slurry TBM with precast concrete segmental tunnel lining.
7. Activity 20220G, Page 12 and Activity 20021, Page 14: Muck hopper and muck transfer belt shown; not applicable for slurry TBM where muck is transported in slurry return pipe.

8. Activity 20220A, Page 36: PCC lining cost of \$58 Millions seems too high when compared to \$29.9 cast-in-place lining for UCC #1, which seems reasonable. Please check.
9. No line item for muck disposal; not consistent with other UCCs.
10. Activities 20240D and 20240F, Page 43: quantities of haunch concrete and rebars not coordinated with those shown on Appendix C of Prototypical Tunnel Unit Costs Memorandum.

#### **5.4 UCC #3 – TBM Single Track, Twin Tunnel, 30-ft ID, EPB in Soft Ground**

1. Bid Item 20021:
  - a. Front support, side supports, rear supports, gripper and main beam are not applicable for EPB TBM and activities associated with these items should be removed.
  - b. Page 4 ASMTBM is for a 21 FT TBM for Tunnel #1. This should be 33.5 ft OD TBM.
  - c. Page 5 FMGRIP crew has a Drill Jumbo & a Wagner ST 3.5 LHD. These are not applicable for EPB TBM.
  - d. Page 8 Activity 20215H and Page 20220M, Drill & Blast Shaft Service Crew was noted. This is not applicable for EPB TBM operation.
2. Page 35 Bid Item 20225
  - a. Activity 20225B shows 33.5' TBM; however, the crew has a 24'-6" Robbins TBM at 38%. The value of \$301,777 for the Robbins at 38% does not calculate. It is unclear what 38% is for. Take 38% of 6,050.67 Hrs = 2,299.25 x \$375 = \$862,220.47 not \$301,777. This is repeated on page 44 for Tunnel #2.
  - b. The major equipment operating hours should be less than the crew hours due to the loss of efficiency with the TBM.
  - c. There is no allowance for travel time from the dry house to the heading.
3. Page 38 Activity 20235A
  - a. Concrete Crew shown with a Wagner ST3.5 and a concrete pump for 150 CY pour of Invert. Suggest instead: using 5" slick line and pump 5280 LF from each end of the tunnel portals; setting 2 each invert screeds at the center of the tunnel and pour out to each portal; setup a concrete screed attached to the precast segments with rail brackets and run light rail on these brackets to hang the screed from.
  - b. This concrete crew has Crane Oiler and Electricians. There is no crane in the operation and it is unclear why the crane or the electricians are required. There are Concrete Forms for the Cavern Walls in Activity 20240B, however, we could not locate the invert screed or invert forming system.

#### **5.5 UCC #4 – TBM Double Track Tunnel, 50-ft ID, Slurry Machine in Soft Ground**

1. Activity 20210, Page 1:
  - a. Based on the sketch shown on Page 15 of Prototypical Tunnel Unit Costs Memorandum, the TBM outside diameter will be 55.33 ft. 54 ft is OD of lining.
  - b. No Freight cost in this item. Freight cost is included in TBM Purchase items for other UCCs. Should be consistent.

2. Activity 20215A, Page 2: Unclear why the cost to receive and offload 54 ft TBM is less than that for one 33.5 ft TBM in UCC #2.
3. Activity 20215B, Pages 2-3:
  - a. Front support, side supports, rear supports, gripper and main beam are not applicable for slurry TBM and activities associated with these items should be removed.
  - b. Unclear why the cost to assemble 54 ft slurry TBM is less than that for one 33.5 ft TBM in UCC #2.
4. Activity 20215C, Pages 3-5: Gripper walls are not applicable for slurry TBM.
5. Activity 20215D, Page 5: Invert mud slab for 54 ft slurry TBM should be larger than that for one 33.5 ft TBM in UCC #2.
6. Activity 20215H, Page 7: D&B Tunnel Service Crew shown; not applicable for slurry TBM.
7. Activities 20217A-C, Page 8: These activities are related to conveyor belt, which is not applicable for slurry TBM.
8. Activities 20220A and 20220C-F, Pages 9-11: Unclear why the costs for these activities, which are for 54 ft slurry TBM are less than those shown for one 33.5 ft TBM in UCC #2.
9. Activity 20220B, Page 9: Unclear where pea gravel ballast is used for slurry TBM with precast concrete segmental tunnel lining.
10. Activity 20220G, Pages 11-12 and Activity 20220H, Page 12: Muck hopper and muck transfer belt shown; not applicable for slurry TBM where muck is transported in slurry return pipe.
11. Activity 20225B, Page 17 shows mining rate of 5.86 ft per shift. This is low, and inconsistent with 36 LF/Day assumed in Table 6 of Prototypical Tunnel Unit Costs Memorandum. We feel 36 LF/Day is achievable, based on our experience with planning for 56 ft TBM in Seattle.
12. No line item for muck disposal; not consistent with other UCCs.
13. Activity 20235D on Pages 20: inclusion of steel fibers seems redundant with rebars in Activity 20235A.
14. Activities 20235A and 20235L: Rebars are included in both activities, please confirm that we need both.
15. Activities 20240A and 20240D on Pages 24-25: inclusion of both steel fibers (8.1 million pounds) and rebars (4.4 million pounds) seems redundant.
16. Activity 20215B, Pages 32-33: Front support, side supports, rear supports, gripper and main beam are not applicable for slurry TBM and activities associated with these items should be removed.
17. Activity 20125B, Page 33: Unclear why
18. Activity 20215B, Page 33: Unclear why the cost to disassemble and load 54 ft TBM is less than that shown for 33.5 ft TBM in UCC #2.

## 5.6 UCC #4B – TBM Double Track Tunnel, 40-ft ID, Slurry Machine in Soft Ground

1. Bid Item 20210 page 1 to Item 20215 page 7
  - a. 54 FT TBM shown instead of 40 FT for this UCC. Should adjust purchase price, etc. from a 54-ft TBM to a 40 ft TBM.
  - b. Should purchase 42,240 LF of Slurry Pipe. It will wear out and need to be replaced at least once. On the Brightwater Tunnel in Seattle, as an example, the abrasive material wore out pipe, pumps and the TBM Drag Teeth and Gage Ring on the face.



- c. No Freight cost in this item. Freight cost is included in TBM Purchase items for other UCCs. Should be consistent.
  - d. General note for all TBM Bid Items: there is no Plant & Equipment purchases of any equipment or major plant items other than the TBM purchase shown in the estimates. The purchase price for Locomotives, Flat Cars, Mancars, California Switches, Fanline, Utility lines, track, rail, ties, almost everything required to do the work is not shown purchased.
  - e. Currently, the equipment rates shown appear to be rental rate as there is no purchase salvage plant & equipment sheet. Recommend that this be adjusted to reflect purchase and salvage of all major plant & equipment. A tunnel contractor pricing these tunnels would not be renting the major equipments required to build these tunnels.
  - f. There is no indication in any of the HeavyBid® Direct Cost Reports stating the number of shifts worked per day. We can only find a 7.5 hour working day with no mention of shifts; this is not typical for tunnel estimates and could be misinterpreted with respect to the production and cost.
  - g. Typical 3 shift tunnel operation includes Day Shift (work 8 hours pay 8 hours), Swing Shift (work 7.5 Hours pay 8 hours), and Graveyard Shift (work 7 Hours pay 8 hours). This means Work 22.5 Hours Pay for 24 Hours per day. In addition to this the crew gets paid for travel time from the Dry House to the Heading and Back again. The crew also gets paid to work through lunch, they eat of the fly at the heading. There is none of this in any of the estimates that we reviewed.
  - h. There is no Major Maintenance day such as Saturday for a 5 day work week or Sunday for a 6 day work week or any other method identified as a Major Maintenance day of shift.
  - i. Items relating to gripper pads and main beams shown. These are not applicable to Slurry TBM.
  - j. Quantities for invert mud slab are the same as other UCC where 30-ft TBM is used. 40-ft TBM should require different quantities.
  - k. Item 20215H – drill and blast tunnel service crew shown, which is not applicable to Slurry TBM.
2. Bid Item 20225 page 14.
- a. Locomotives missing (3 Loco Operators included but no Locomotives)
  - b. No Walking Boss in Crew
  - c. No Shifter in Crew
  - d. No Lead Miner in Crew
  - e. No Tunnel Travel Time in Item (Have to pay from Dry House to Tunnel Heading & Back plus working through lunch. All this is at O.T. rate)
  - f. TBM efficiency hours should use average at 60% of time (Source: various RETC articles relating to TBM utilization from various rock tunnel projects). Operating hours for major equipment should be reduced to 60% of the crew time to match the TBM drive.
  - g. Suggest carrying Walking Boss in the Indirect Items (Time Spanned) not in the Direct items as it may be overlooked.
  - h. The production for the tunnel drive is shown as 19.54 LF/Day. Page 40 of the Prototypical Tunnel Unit Cost Memorandum shows the average rate at 40 LF/Day. It is

also shown as 40 LF / Day on page 12 in Table 6 under Unit Cost Categories 4B. If the 40 LF/Day is correct, there will be a major cost impact to this bid item.

3. Bid Item 20220, Page 14
  - I. Price for 30FTID PCC Segment of \$8000 / LF is high. Based on our experience in Seattle for a 56 Foot OD PCC Segment, we received a quote for \$5730 / LF. Note also that this Bid Item is for a 40 Foot Slurry TBM not a 30 Foot.

## 5.7 UCC #8 – D&B Single Track, Twin Tunnel, 30-ft ID in Hard Rock, Support Type IV

1. General note for all Drill & Blast operations:
  - a. Unclear why various bolt grade, length and pricing are used.
  - b. "Install Resin and Bolt" are shown in crew hours, but no cost listed for resin. Please verify that resin cost was included in unit price for bolts. Resin Cartridges are used for the bolts which I would guess are Dywidag bars.
  - c. In every D & B item there is a 4" Submersible Pump for some reason but there is no line item for pipe line or hose for this pump to discharge into.
  - d. No fans nor fanline for ventilation in the cost
  - e. No tunnel lights, light line, air line or water line listed as well as no track or utilities.
2. General note for the Shotcrete operations:
  - a. The crew does not have an Air Compressor listed and the 4" Submersible pump is shown for some reason.
  - b. The ST&S amount looks OK as it would cover the 2" Shotcrete hose, extra nozzles, face shield, gloves etc. However, does the concrete quantity in the shotcrete items include a rebound waste factor of 2? If not it should be adjusted for that factor.
3. For mucking out the heading:
  - a. There is a Wagner ST3.5 that trams from the face to outside and dumps on the ground. This ST3.5 is too small to load a truck without a ramp as the bucket can't get up high enough to do that. The estimate states the muck is dumped on the ground. There needs to be a loader like a 966 or 988 pick this muck up and load it into the truck. Also need to add a truck spotter and loader operator.
  - b. Unclear why the 4" Submersible pump and Burner/Weld Operator are in most all of the bid items, not sure what this person does.
4. Bid Item 30105 Page 56: Clean Tunnel Invert Crew has 2 each Nozzle men and 1 each Burner / Welder. Unclear why these are needed.
5. Bid Item 30105B Page 56 Set & Strip Invert Bulkheads has a Cat 950 Loader, 2 Each Crane Operators but only 1 Crane, 1 Each Burner / Welder, and no Operator for the 950 Loader. Please check.
6. Bid Item 30105 Page 57: Invert Conc. Sngl. Trk. Tnl., unclear why there is a shaft service crew activity
7. Bid Item 30105D Place Tunnel Invert Concrete, unclear why there are a Wagner ST3.5 LHD and a Crane Oiler and Electrician in the crew. There should be Invert Screed in the crew.

8. Bid Item 30105G Service Crew for the invert concrete has a Roadheader Service Crew in this item. This crew includes a 3900 Crawler Crane, a Grove RT 640 E Crane, Oiler, Change House Man and a Top Man. Unclear why these are needed for invert concrete.
9. General Note about the concrete Crews and Activities for this D & B Tunnel. Please review the crew makeup including equipment and personnel and adjust as needed.

### **5.8 UCC #20 – SEM Single Track, Twin Tunnel, 30-ft ID in Soft Ground, Support Type IV**

1. Activity 20200AA, Page 1: the D&SHD1 Crew should be modified to eliminate the Blaster, the Burner Welder and the Powderman. These crew members are not required to drill and install the fore poling rebar.
2. Unclear why all the crews have 4" Submersible Pump in them; what does it do and what does it pump to for discharge.

### **5.9 UCC #24 – SEM Double Track Tunnel, 40-ft iD in Soft Ground, Support Type IV**

1. We like the idea of using Gradall for excavation of this tunnel due to its long reach, attachment to the boom and rotation of the boom; however, we prefer a model with a track instead of rubber tires.
2. For Mucking out heading operations there should be a 966 or 988 FEL and Operator to load the truck for dump disposal. The ST3.5 will not reach high enough to load out a truck without a loading ramp and there is no ramp in the estimate.
3. Unclear why all the crews have 4" Submersible Pump in them; what does it do and what does it pump to for discharge.
4. Activity 20205A4 F & I 9" Shotcrete:
  - a. Unclear why the crew has a 953 Track Loader and no Compressor for shotcrete operations.
  - b. The shotcrete crew also has a Burner / Welder; unclear what this person does in this crew.
5. Unclear why the Welded Wire crew and the Lattice Girder Crew have a TBM Mechanic in them.
6. Unclear why the Fore Poling crew has a blaster and 2 powdermen in it plus the Burner / Welder.

## **6.0 UNREVIEWED HEAVYBID® COST REPORTS**

Due to the limited time available to conduct the peer review, we were unable to review in detail all tunnel Unit Cost Categories. The general and specific recommendations for HeavyBid® Cost Reports for other tunnel of similar excavation method may serve as a guideline for QA/QC review of these un-reviewed reports:

- D&B Tunnels: please refer to our recommendations for UCC #8
- SEM and RH Tunnels: please refer to our recommendations for UCCs #20 and #24

We did not review the cross passage cost estimates (UCCs #41, #43, #44 and #45) in detail as cross passages represent a small fraction of overall tunnel cost. Nevertheless, based on our experience on similar projects, it is our general opinion that the Unit Price Estimates (\$/LF) for cross passages shown in Table 6 of the Prototypical Tunnel Unit Costs Memorandum are in the reasonable range. For 33-ft long by 14 ft ID typical cross passage dimensions, the cost per foot translates to \$0.8 to \$2.8 millions for cross passage in rock and in soft ground requiring jet grouting for ground improvement, respectively.

# Memorandum

# ARUP

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|                |   |                         |                   |
|----------------|---|-------------------------|-------------------|
| <b>To</b>      | John Hawley, Timothy Fawcett, Michael Witt    | <b>Date</b>             | November 23, 2010 |
| <b>Copies</b>  | Neil Carstairs                                | <b>Reference number</b> |                   |
| <b>From</b>    | Bill Maddex<br>Colm Tully, Amruta Deshpande   | <b>File reference</b>   |                   |
| <b>Subject</b> | Peer Review of 15% Design Unit Price Elements | <b>Page 1 of 6</b>      |                   |

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## PEER REVIEW- UNIT COSTS FOR HIGH SPEED RAIL PROJECT

### EXECUTIVE SUMMARY

The analysis below yields a divergence on some significant components of the costs. A cursory view of approximately 75% of the total cost assembly set for trenches and retaining walls could result in significant variance from current market prices (all comparative values are stated in fourth quarter 2010). In general, the overall unit costs/pricing appear to be higher than expected for a project of this enormity.

### PURPOSE AND SCOPE

The purpose of this memorandum is to provide a limited peer review of Unit Price Estimates (\$/Route Foot and \$/Route Mile) for prototypical walls and trenches for the California High Speed Rail Project. Three documents were provided for review:

1. Draft-Unit price estimates - Walls and trenches (*Binder3.pdf*)
2. Prototypical Unit Price Elements (*PrototypicalUPES(REV2).xlsx*)
3. Unit Price Details Report (*Unit Price Detail\_10-01-10.pdf*)

The prototypical unit UPE spreadsheet includes detail on all sections of the cost estimate breakdown but this review has concentrated solely on cost elements in Section C3. Structures – Walls.

### UNDERSTANDING OF UNIT COST ESTIMATING APPROACH

It is our understanding that the prototypical unit costs have been prepared by the CHSTP Program management Team (PMT) and will be used in the development of programmatic-level cost estimates and to support future detail cost estimates at a regional level for California High-Speed Train Project.

The walls and trenches unit costs were developed using a commercial cost estimating database software called Timberline. The report has been developed using cost categories as defined by the Federal Transit Administration (FTA) in their Standard Cost Category (SCC) workbook. The industry standard Construction Specification Institute (CSI) MasterFormat 2004 coding structure has been utilized and this coding structure can be used to compare the unit price details report from Timberline with the Prototypical Unit Price spreadsheet.

Some general assumptions and exclusions have been documented in the draft report including:

- UPE's are based on preliminary drawings and quantities
- All costs are in 3<sup>rd</sup> quarter 2009 dollars
- Typical construction contracting methods will be used and project development costs such as engineering, project or construction management, agency staffing, or project start-up are excluded
- Normal workweek schedule assumed
- Material for general embankment and backfilling assumed to be available from excavated on-site soil
- Temporary support of excavation for cut and cover construction using internally braced soldier pile and lagging
- Right-of-Way costs excluded
- Design or construction contingencies excluded
- Financing costs excluded

The direct unit costs have been factored to include mark-up on labor, equipment, material and subcontractor costs as well as state sales tax and contractor profit. The resultant cost is the bid total and is described in the report as *"the bid level unit pricing that would typically be expected utilizing a competitive bid contracting method"*.

## **APPROACH FOR REVIEW**

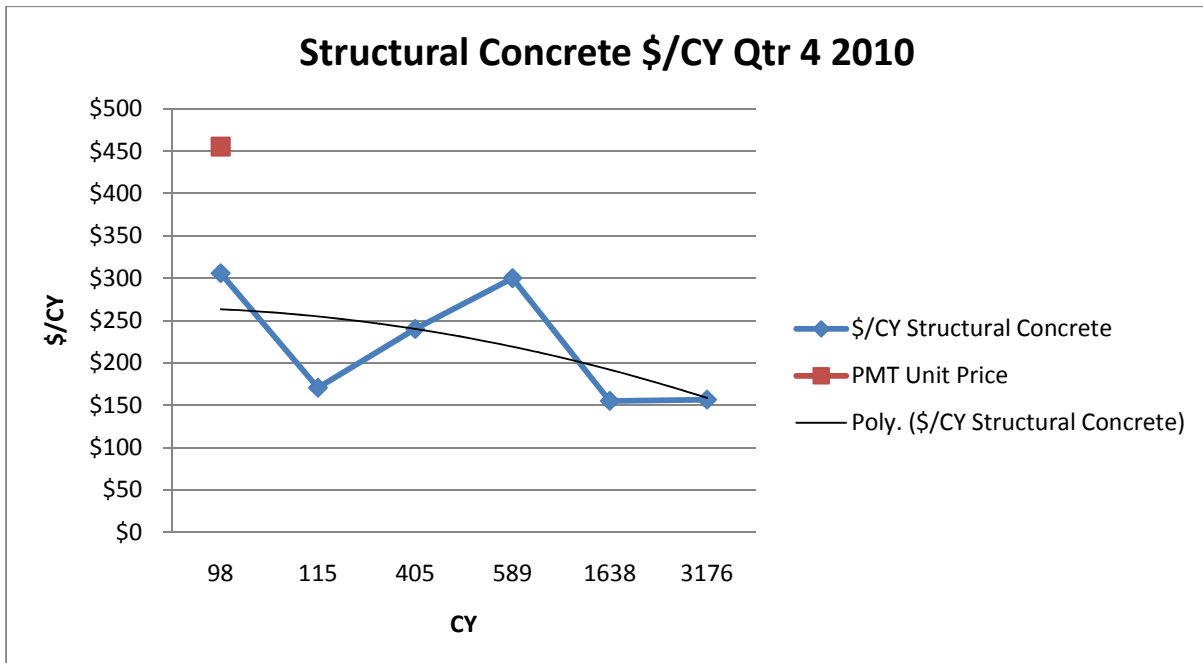
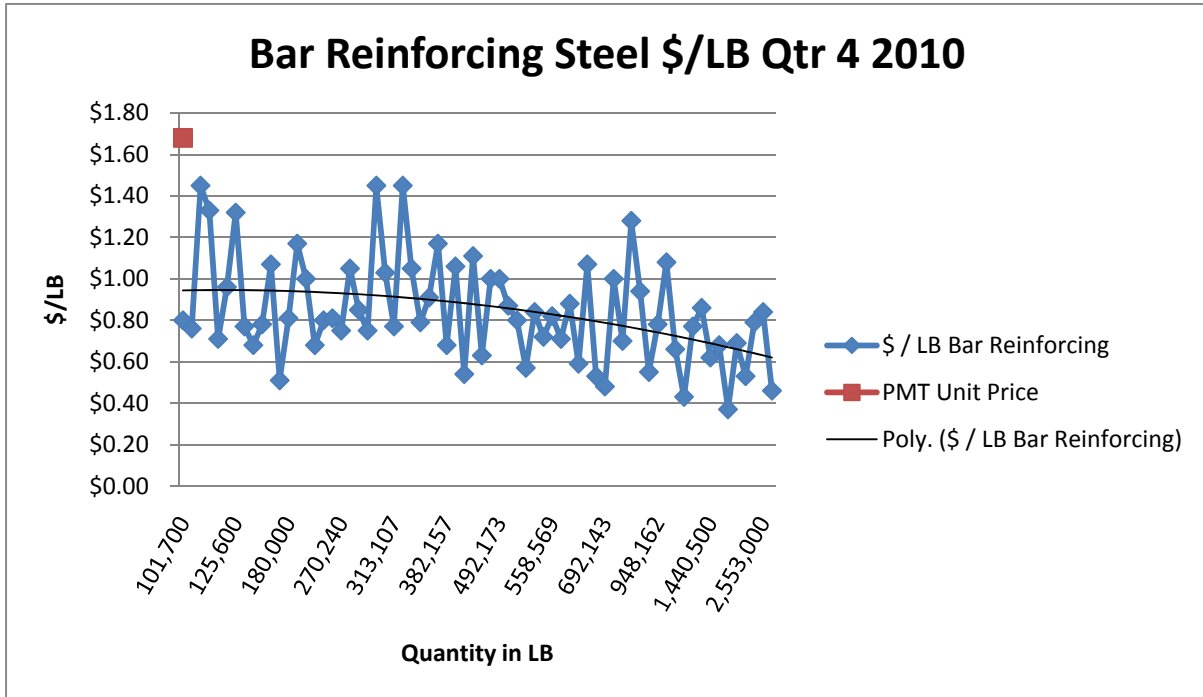
The unit costs from the PMT were analyzed using market analysis, categorical cost model and unit cost data methods. Market analysis was done by plotting unit costs with market trends to find their position in terms of the market trend and scale of economy.

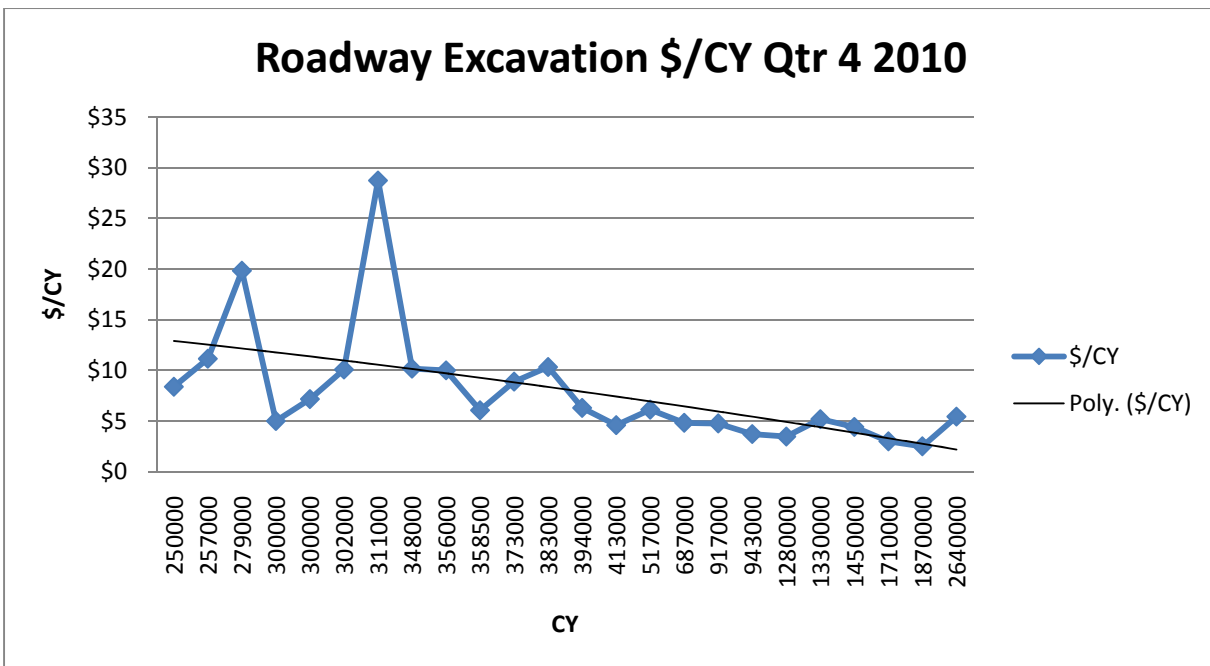
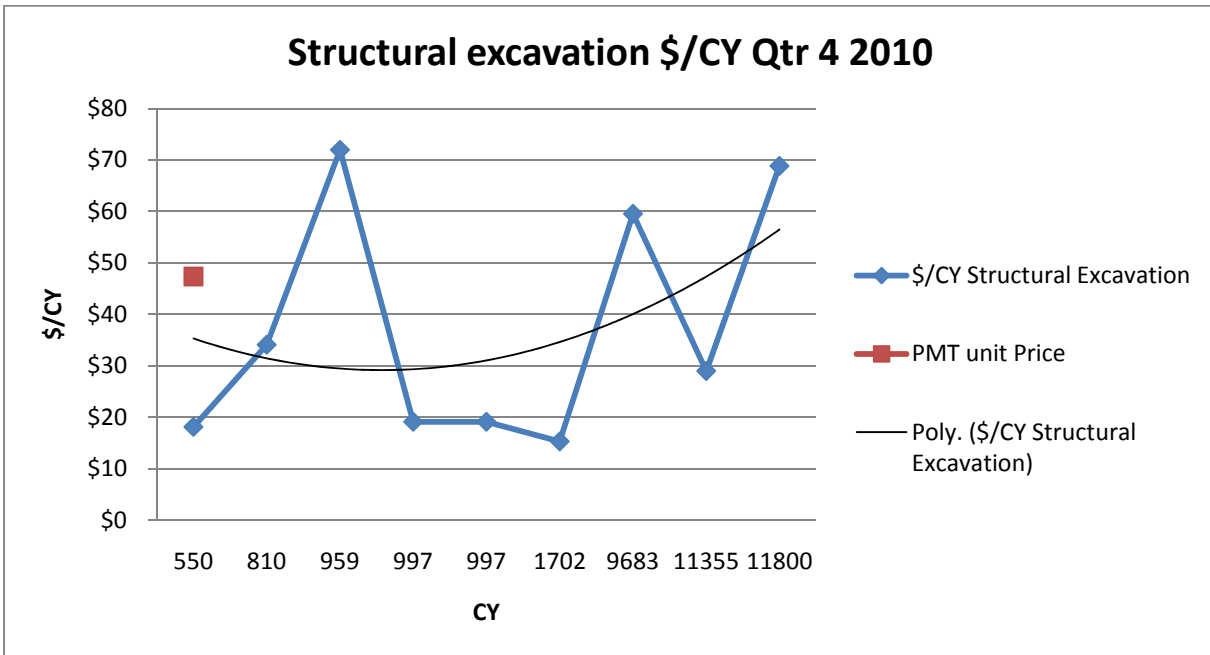
The major sources of reference for review are as follows;

- Caltrans District 8 Cost Data website
- ENR
- Construction E-bid board
- Arup project database
- Heuristics

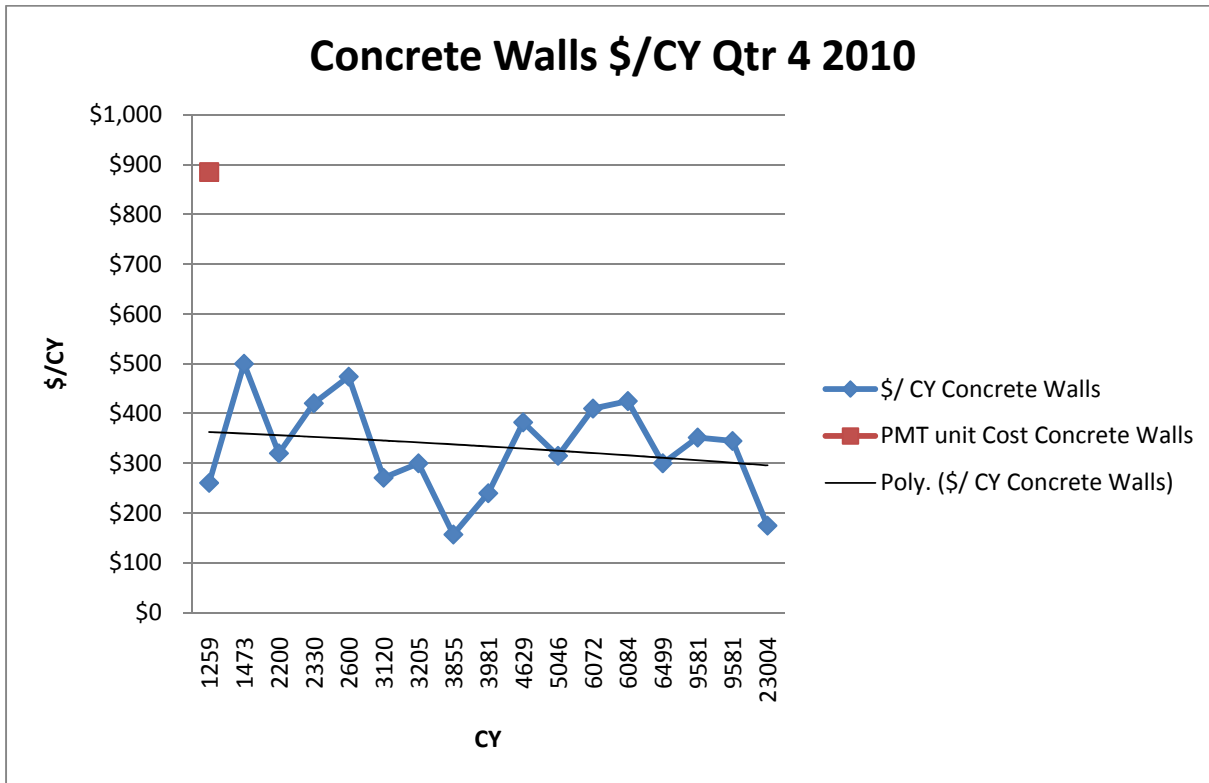
**ANALYSIS**

The plots below show some specific significant variance from norms.









The figures above show project cost information throughout California from the past four years and have been normalized to 4<sup>th</sup> quarter 2010. This approach varies from that of the report reviewed and is considered more representative of the project geography. This may vary from what can be seen if only focusing on San Francisco (District 4) or Los Angeles (District 7).

The unit prices analysed are documented in the report as being 3<sup>rd</sup> quarter 2009 dollars. This would be another reason for higher than expected unit costs. The unit price details report is dated 10/01/10. It is assumed that this is the date of printing and that the costs are 3<sup>rd</sup> quarter 2009 as indicated. Clarification on this issue is requested.

The economies of scale that could be realized due to the significant size of this project may not have been factored into the unit prices under review. Section 6 of the report contains a qualification outlining this issue where it states that the unit prices are “prototypical” and that “there are any number of factors which could affect the applicability to these UPE’s to an actual project and the use of this information should be subject to this understanding”. Although the final economy of scale is indeterminate at this point, it will certainly involve multi-miles of work within a given scope/segment. The data reviewed appeared to focus on much smaller scope/segments than will ultimately be built under any one contract.

# Memorandum

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Basic parameters such as the bid factor (the total price divided by the direct cost) are outside the norm and lower than expected for a project of this size. The PMT has used a bid factor between 1.25 and 1.3 while the norm for large scale construction projects ranges between 1.5 and 1.7.

## CONCLUSION

The variances detailed in the analysis will yield large variances of price/cost when applied to the large quantities of work that are required to build the CHSTP and thus are extremely elastic in nature.

The data supplied reveals a limited view of unit cost build-up and results in a limited review of the unit costs/price. Further examination should be undertaken in order to gain a better understanding of the PMT values represented.

In general, it appears that the overall unit costs/pricing appears to be higher than expected for a project of this enormity.