LOS ANGELES COUNTY

METROPOLITAN TRANSPORTATION AUTHORITY

Public-Private Partnership Program

SR 710 North Tunnel Cost Analysis

Prepared by

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Appendices

0. Introduction and Conclusions

This report is in response to Metro Task Order 4A-2(a) under Metro's Public-Private Partnership Advisory Services contract with InfraConsult, LLC. The Report presents a summary of a cost assessment for the SR 710 North Tunnel, as defined in the Strategic Assessment Report prepared previously. The primary conclusion to draw from this assessment is that the tunnel cost estimate for the representative SR 710 North alignment derived for the earlier strategic assessment work is reflective of current market pricing. The actual bids received for a generally similar project confirm the per-mile construction cost that Metro is using for its preliminary engineering and environmental work on the proposed tunnel.

It is very early in the planning and design process and clearly there are unknowns that could emerge as the planning and design process progresses. But given this early stage of analysis, the most likely construction cost (low bid price) for the Zone 3 alternative in 2011 dollars is $2.8B and can be reasonably assumed to fall between $2.3B and $3.0B. In terms of total project costs, it can reasonably be assumed that they will fall between $2.7B and $3.5B and most likely be $3.25B, in 2011 dollars.

1. Comparative Analysis with Seattle's Alaska Way Tunnel

In December 2010, the Washington State Department of Transportation (WSDOT) opened bids on the first large bore highway tunnel in North America using state-of-the-art tunnel boring machine (TBM) technology. The Alaskan Way Tunnel (AWT) in downtown Seattle will be built using design and technology similar to that proposed for the SR 710 North gap closure tunnel, should a tunnel be selected by the Metro Board as the Locally Preferred Alternative during the environmental process. This section of this report provides a summary comparison of the accepted bid price for the WSDOT tunnel to the proposed SR 710 North tunnel as defined conceptually by Metro and the InfraConsult Team. It should be noted that this comparative assessment has been prepared for the nominal tunnel alignment currently under study for a potential public-private partnership (PPP) for the SR 710 North project. The results of this study will represent a baseline with respect to the other alternatives that will be fully assessed in the pending environmental and engineering work. Section 4 of this report applies the results of this cost analysis to nominal alignments in the other four alternative zones to be studied in the pending environmental assessment work.

WSDOT received bids from ACS/Dragados and FCC, both major European contractors with large bore tunneling experience, a relatively recent technological advance in underground civil works. The bid prices were very close to one another, and both were below the WSDOT estimate. While ACS/Dragados' price was slightly higher (about $10M out of $1.1B), it was awarded the project on January 6, 2011 based on a comprehensive evaluation of best value. The contract is a design-build contract, with the contractor assuming substantial design and construction risk. The transference of risk from the public sector to the private sector is a key advantage of a design-build/PPP approach. This would also be the case with the SR 710 North tunnel under a PPP project delivery approach (Section 5 of this report presents a comparison of risk transference anticipated for the SR 710 North tunnel project under a PPP approach with that in the WSDOT AWT contract). The WSDOT requirement for such risk transference

assured that competition was effectively limited to those contractors with previous experience designing and constructing large bore tunnels and confident in their ability to meet the contractual and performance criteria.

1.1 Basis of Comparison

While there are many similarities between the Alaskan Way Tunnel and the proposed SR 710 North representative tunnel alignment, there are also key differences which must be taken into account in undertaking a comparative cost assessment. The most obvious difference is tunnel length. The Seattle tunnel is 9,500' long, while the proposed nominal SR 710 North tunnel alignment is 21,000' and currently anticipated to be a dual bore tunnel, creating a total center-line length of 42,000'. While this approach obviously increases the cost, it also provides for economies of scale, thus a reduction in the cost per mile of tunnel. For example, the purchase and placement of the TBMs – a substantial fixed cost – needs to be undertaken only once for each tunnel. Efficiencies also improve as tunneling progresses. Other key differences are as follows:

- The soils along the AWT tunnel alignment present a greater geotechnical challenge than the soils in the vicinity of the SR 710 North tunnel.
- The AWT alignment under downtown Seattle encounters numerous high rise buildings, as well as a number of historic buildings of substantial footprint. Certain special mitigation actions were therefore included in the AWT which are unlikely to be needed for SR 710 North. (One of the AWT bids included $36M for these costs, while the other bid carried $138M for such mitigation, as shown in Appendix A).
- The ventilation requirements for the AWT are less substantial than for the SR 710 North tunnel, owing to its shorter length. No interim vent stacks were necessary in Seattle, and horizontal ventilation is contained within the bore itself. For SR 710 North, this is not the case. For the purposes of this comparative analysis, the SR 710 North tunnel cost assessment incorporated $90 million for a parallel small bore tunnel to accommodate horizontal ventilation and to serve as a pilot bore and as an additional evacuation alternative.
- Both tunnels are in seismically vulnerable areas. The SR 710 North tunnel alternative considered here would dissect the Raymond Fault at nearly a perpendicular angle. While this is not considered particularly problematic, for the purposes of this assessment $50M has been included for special handling of the fault crossing.
- The portals in Seattle must be newly constructed in dense urban areas. For SR 710 North, there are stub freeway connections at both ends and the portal designs are relatively straight forward. The portal configurations and likely costs are considered in more detail in Section 2 of this report.

1.2 Results of Comparative Analysis

The primary conclusion to draw from this comparative analysis is that the tunnel cost estimate for the representative SR 710 North alignment derived for the earlier strategic assessment work is reflective of current market pricing. The actual bids received for a generally similar project confirm the per-mile construction cost that Metro is using for its preliminary engineering and environmental work on the

proposed tunnel. That is, the AWT tunnel construction cost, as bid, supports the value used in the earlier analysis of $332M per tunnel mile for the costs of the underground construction, but now including the $90M ventilation tunnel and the $50M seismic treatment at the Raymond fault. Also evaluated as part of this costing analysis were an alternative to build only a single bore as a first phase of the total project and building bores sequentially with a single tunnel boring machine (TBM) or simultaneously using two TBMs. Table 1 shows the top level results of this analysis and a detailed spreadsheet with more specific breakdowns is included with this report as Appendix A.

Table 1: Alaska Way Tunnel and SR 710 North Tunnel Cost Comparison

	Underground Cost per Tunnel Mile (million $/mile)	Total Construction Cost (million $)	Total Project Cost (million $)
SR 710 North Tunnel			
PB 2006 Estimate	-	2,514	2,891
Task 3 Cost Estimate	-	2,849	3,469
Current Estimate: Twin Bore - 2 TBMs	331	2,846	3,344
Current Estimate: Twin Bore - 1 TBM	321	2,761	3,244
Current Estimate: Single Bore	349	1,596	1,882
Alaska Way Tunnel			
WSDOT Estimate	428	1,365	2,155
FCC Bid	350	1,198	1,878
Dragados Bid	309	1,200	1,880

2. Portal Configuration and Estimate Adjustment

The portal design for SR 710 North is much simpler that AWT. The alignment being considered for the Zone 3 base case alternative ties into two stub freeways with no additional right of way required and favorable vertical alignment. For this study, we have extended and modified the previous assumptions with conceptual designs for both the north and south portals. The conceptual design retains the same access to city streets as currently exists. We have also segregated the cost by Phase 1 (first bore) and Phase 2 (second bore). These conceptual design drawings are included herewith as Appendix B. The cost estimate developed based on these conceptual designs, including contingency is shown in Table 2 below.

Table 2: Cost Estimates Based on Conceptual Designs

	South Portal	North Portal	Total
Phase 1	$68.2M	$27.3M	**$95M**
Phase 2	$42.9M	$18.3M	**$61.2M**
Total	**$111.1M**	**$45.5M**	
Grand Total:			**$156.6M**

The concept design is specifically based on the following:

Description

- Project Limits for South Portal: Hellman Avenue to Valley Road.
- Project Limits for North Portal: Palmetto Drive to Del Mar Boulevard.

Phase 1

- Construction of a single bored tunnel carrying 2 northbound (NBP1) and 2 southbound (SBP1) lanes in a stacked configuration.
- Includes construction of an off ramp from NBP1 to Valley Boulevard.
- Includes on ramp from Valley Boulevard to SBP1.
- Includes partial reconstruction of Valley Boulevard to allow for NBP1 and SBP1 underpass.
- Includes an off ramp from NBP1 to Pasadena Avenue.
- Includes an elevated on ramp from Del Mar Boulevard to SBP1.
- It is assumed that existing access from I-210 Foothill Freeway southbound to West California Boulevard to remain as is.

Phase 2

- Construction of a second single bored tunnel carrying 2 northbound (NBP2) and 2 southbound (SBP2) lanes in a stacked configuration.
- Includes partial reconstruction of on ramp from Valley Boulevard to SBP2.
- Includes partial reconstruction of Valley Boulevard to allow for NBP2 and SBP2 underpass.
- Includes partial reconstruction of on ramp from Del Mar Boulevard to SBP2.
- It is assumed that existing access from I-210 Foothill Freeway southbound to West California Boulevard to remain as is.

Assumptions

- The Cost Plan is based on Concept Engineering Design as shown in Appendix B.
- The Cost Plan is based at 1st Quarter 2011 prices.
- Drainage items are costed at 10% of Roadway Items 1 & 2.
- Minor Items are costed at 15% of Roadway Items 1 to 5.
- Mobilization is assumed to be 10% of Roadway Items 1 to 6.
- Utility Relocations are costed at 10% of Roadway Items.
- A Design Development/ Pricing Risk of 15% has been applied to the estimate.
- A Risk/Contingency of 20% has been applied to the estimate.

Exclusions

The Cost Plan excludes:

- All additional Taxes.
- Table 2 does not include any costs associated with land or property purchase. It appears that the portals can be constructed within existing right-of-way but $13M is included in the total project cost estimate to cover any such need that does emerge (see Appendix A).
- Any socio-environmental costs that may emerge.

- Any 3rd Party costs that may emerge.
- Project management and preliminary design costs are excluded from Table 2 but are covered in the total project cost estimate (see Appendix A).
- Price escalation and inflation beyond 1st Quarter 2011.
- All Maintenance and Operational Costs.
- No allowance has been made for any costs associated with Public Authorities.
- All finance or funding costs are excluded.

3. Range Estimate

At this level of analysis it is necessary to consider a range of possibilities related to costs and physical configurations. In determining the estimates presented in Sections 1 and 2 of this report we have selected the most reasonable assumptions with respect to each of the several cost components. It can be useful to assess the potential variability in these assumptions to place an upper and a lower bound on the numbers and assess the possible margin of error. That is the purpose of this section.

In addition to the "Best Estimate" presented in Sections 1 and 2, we assessed a reasonable low cost or best case estimate and a reasonable high cost estimate. The results of this analysis are shown in Table 3. The following can be concluded from this analysis:

- The most likely construction cost (low bid price) in 2011 dollars is $2.8B, but can be reasonably assumed to be between $2.3B and $3.0B.
- In terms of total project costs, it can reasonably be assumed that they will fall between $2.7B and $3.5B and most likely be $3.25B.

Table 3: Reasonable Low, Best, and High Estimates

Item Description	SR 710 North Revised Dual Bore - 1 TBM		
	Reasonable Low Estimate	Best Estimate	Reasonable High Estimate
	Millions, US$	Millions, US$	Millions, US$
Civils - Portals	122.4	156.0	156.0
Civils - Tunnels	2,059.0	2,413.5	2,495.1
TBM estimated fixed costs	55. 0	85. 0	85.0
Estimated Tunnel Variable costs: f(length)	2,004.0	2,328.5	2,410.1
Civils - Tunnel Ventilation Structures	90.0	90.0	150.0
Civils - Special Treatment at Raymond Fault	0	50.0	75.0
Toll Collection Systems	15.0	16.0	18.0
Socio-Environmental Works	4.0	5.0	6.0
Operational Control Centre / Building	25.0	28.0	60.0
Geological Surveys	1.8	2.0	2.2
Sub-total Construction Costs	**2,317.2**	**2,760.5**	**2,962.3**
Design Costs	69.5	82.8	88.9
Project Management Costs	23.2	27.6	29.6
Land Costs / Right of Way	0	13.0	18.0
Total Project Base Costs	**2,409.9**	**2,883.9**	**3,098.8**

Insurance	60.2	72.1	77.5
Risk / Contingency	241.0	288.4	309.9
Total Project Costs	**2,711.1**	**3,244.4**	**3,486.2**

4. Zonal Cost Estimates

The initial cost estimate developed for the "nominal" project, known as the Zone 3 generic alternative, was used to develop conceptual cost estimates for Zones 1, 2, 4, and 5. A number of construction components with fixed costs were held constant: cost of 2 TBMs and 2 portals, allocation for special seismic treatments, the cost of toll collections systems, an operational control center, and land costs/right-of-way. Variable costs primarily related to the length of the tunnel and/or geologic conditions varied between the zones: tunnel civil work costs, tunnel construction, ventilation structures, design costs, and project management costs.

Overall Project Costs varied from $3.4 billion for the generic alternative in Zone 3 to a high of $7.8 billion for the longest generic alternative in Zone 5. Construction costs varied from $2.8 billion to $6.6 billion. Longer alternatives in Zones 4 and 5 had the highest overall costs. Appendix C contains a spreadsheet with a more detailed breakdown of the costs.

Table 4: SR 710 North Generic Alternatives by Zone Comparison

	Zone 1 Generic Alt	Zone 2 Generic Alt	Zone 3 Generic Alt	Zone 4 Generic Alt	Zone 5 Generic Alt
Overall Length (miles)	10.80	10.42	7.96	12.88	20.45
Underground Cost per mile (million $/mile)	$324	$325	$331	$321	$315
Total Construction Costs (million $)	$3,752	$3,637	$2,847	$4,386	$6,689
Total Project Costs (million $)	$4,404	$4,270	$3,345	$5,146	$7,840

As a part of this study, the IC team reviewed the materials available on the geotechnical data for all the zones, primarily the CH2M Hill 2009 geotechnical report "Route 710 Tunnel Technical Feasibility Assessment." Our conclusion is that at this level of detail the cost per mile will not significantly vary based on geotechnical considerations. There is not much difference from one zone to the other for the tunnel itself based on the level of available design, geology and constructability/feasibility assumptions. Geologically speaking, there are comparable fault crossings in the various zones. The number of borings and geophysics did not provide any significant discriminators among the zonal alignments with respect to assignment of additional cost contributors.

5. Comparative Risk Assessment: SR 710 North to AWT

The purpose of this section is to compare the current SR 710 North risk register prepared in the strategic assessment phase of this study with the recently submitted proposals for the WSDOT Alaskan Way Tunnel. Both bidders for the AWT (Seattle Tunnel Partners (STP), the Dragados team, and Seattle Tunneling Group (STG), the FCC team) submitted risk registers as part of their technical proposals. The risk registers are prepared from the perspective of the bidding parties and primarily identify and assess the technical risks associated with the construction contract.

As part of this task, we have reviewed both STP's and STG's risk registers in direct comparison with the risk register prepared previously as part of the strategic assessment phase (Task 3) of the P3 Analysis contract.

It should be noted that while it is possible to carry out a comparative study between these projects of a similar nature, as noted earlier, each project has its own specific risks related to such things as geotechnical ground conditions, degree of urbanization, proximity of buildings and other structures, political environment, contract terms and conditions, technical design solutions and project objectives including expected volumes of traffic.

Table 5 below summaries the risks, by topic, that have been included in the SR 710 North Task 3 risk register compared to the Contractor's risks registers for the AWT.

Table 5: Risk Comparison between the SR 710 North and the Bids for AWT

Risk Topic	SR 710 North Risk Register	Seattle Tunnelling Group (STG)	Seattle Tunnel Partners (STP)
Permits and Approvals	Risks included to cover Local, Regional and State approvals – LACMTA risk	N/A – permits and approvals already obtained	N/A – permits and approvals already obtained
Political support	Risks identified to cover a change in political environment or a change in political support – LACMTA risk	N/A – would be considered a WSDOT risk	N/A – would be considered a WSDOT risk
Security Provisions	Risks identified to cover a change in security requirements – LACMTA risk	N/A – would be considered a WSDOT risk as Contract awarded	N/A – would be considered a WSDOT risk as Contract awarded
Design of TBM and tunnel lining	Numerous design and technical risks included – identified as Contractor's risk	Numerous design and technical risks included – accepted as Contractor's risk	Numerous design and technical risks included – accepted as Contractor's risk

Risk Topic	SR 710 North Risk Register	Seattle Tunnelling Group (STG)	Seattle Tunnel Partners (STP)
Operation of TBM during construction	Numerous construction, operational and technical risks included – identified as Contractor's risk	Numerous construction, operational and technical risks included – accepted as Contractor's risk	Numerous construction, operational and technical risks included – accepted as Contractor's risk
Ground conditions and contaminated material	Risks identified for inaccuracy of ground conditions as a shared risk between LACMTA and Contractor	Risks included for varying ground conditions as a shared risk between WSDOT and STG	Risks included for varying ground conditions as a STP risk
Change in Scope	Risks identified to cover a change in scope of works – LACMTA risk	N/A – would be considered a WSDOT risk as Contract awarded	N/A – would be considered a WSDOT risk as Contract awarded
Unforeseen Utilities	Risks identified covering discovery of unforeseen utilities – Contractor risk	Risk identified as a shared risk	No risks identified
Subcontractor/ material supplier performance	Risks included for subcontractor / material supplier poor performance as a Contractor risk	Risks included as a STG risk	Risks included as a STP risk
Insufficient drainage leading to flooding	Risks identified as a Contractor's risk	Risks included as a STG risk	Risks included as a STP risk
Fire / Explosion damage in tunnel	Risks identified as a Contractor's risk	Risks included as a STG risk	Risks included as a STP risk
Operations and Maintenance	Numerous risks identified for the O&M phase of the project – both LACMTA and Contractor risk	N/A – as O&M not part of the Contract	N/A – as O&M not part of the Contract
Inaccuracies in Cost Estimate	Risks identified for the inaccuracy in quantities and pricing – Contractor's risk	Risks included as a STG risk	Risks included as a STP risk
Cost escalation / inflation	Risks identified for the increase in construction costs due to inflation / price escalation – Contractor's risk	Risks included as a STG risk	No risks identified

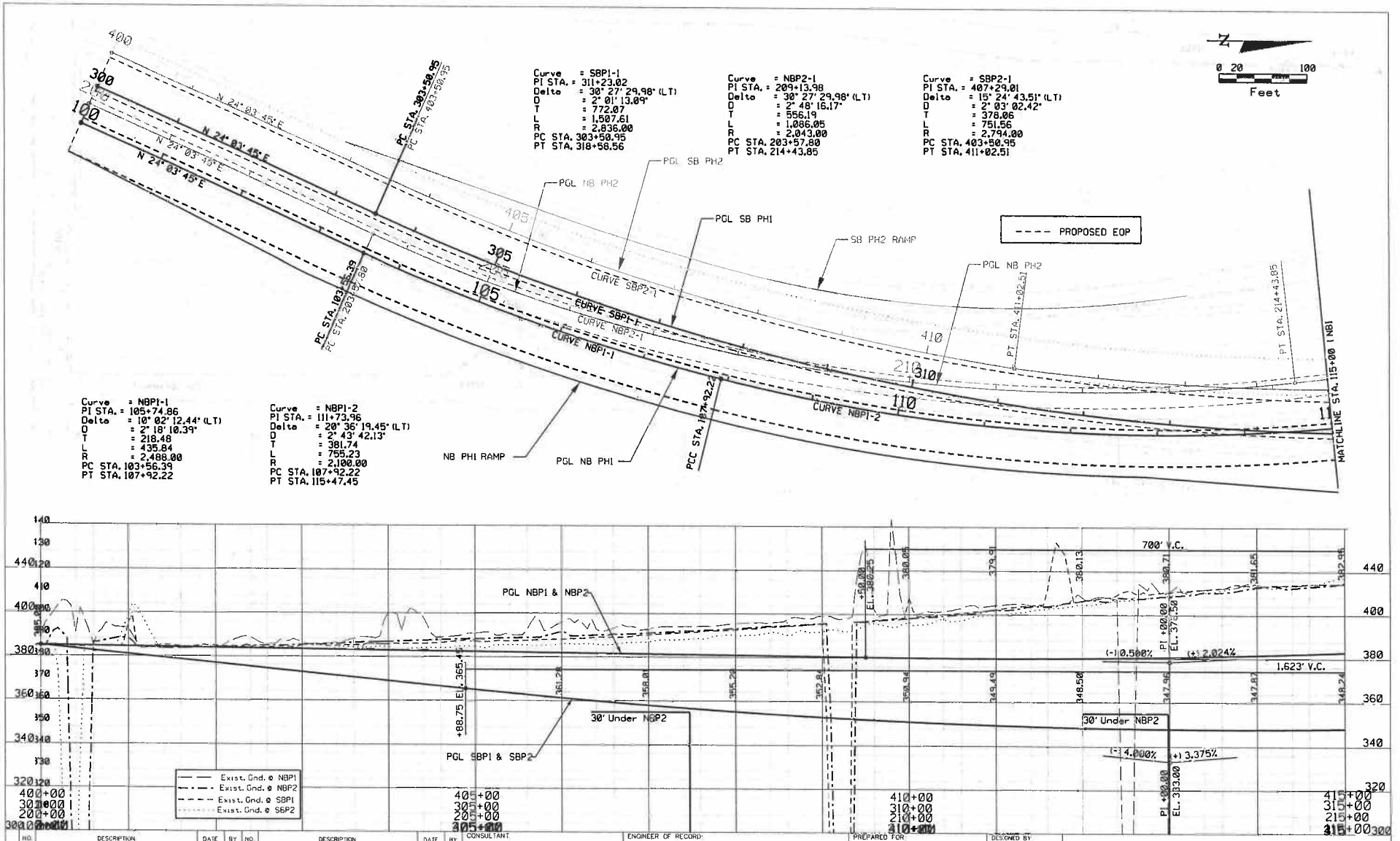
Risk Topic	SR 710 North Risk Register	Seattle Tunnelling Group (STG)	Seattle Tunnel Partners (STP)
Delays to public / state funding	Risks included for delays to public / state funding – LACMTA risk	No risks identified	No risks identified
Availability of Performance Securities / Bonds	Risks included for the availability and premium cost for Performance Securities / Bonds	No risks identified	No risks identified

From this review of the three difference project risk registers, it is apparent that that they are comparable and a cost comparison is valid from a comparable risk transference point of view. Certain differences do exist however, primarily as follows:

1. The SR 710 North risk register includes some specific risks for Permitting and Approvals which have already been obtained for the AWT.
2. The SR 710 North risk register includes Operations and Maintenance risks which are not applicable to the AWT project.
3. All three risk registers include some detailed risks associated with the specific project geography, geotechnical, technical and design constraints.

Appendix A, Detailed Breakdown of Comparative Cost Analysis

Item Description	SR 710 North Single Bore US$	SR 710 North Revised Dual Bore - 2 TBMs US$	SR 710 North Revised Dual Bore - 1 TBM US$	Alaskan Way WSDoT Estimate US$	Alaskan Way Seattle Tunneling Group (FCC) Bid US$	Alaskan Way Seattle Tunnel Partners (Dragados) Bid US$
Civils - Portals	95,000,000	156,000,000	156,000,000	INCL	324,000,000	340,000,000
Civils - Tunnels	1,249,233,613	2,498,467,227	2,413,467,227	770,000,000	630,000,000	557,000,000
TBM estimated fixed costs	85,000,000	170,000,000	85,000,000	85,000,000	85,000,000	85,000,000
Estimated Tunnel Variable costs: f(length)	1,164,233,613	2,328,467,227	2,328,467,227		545,000,000	472,000,000
Civils - Tunnel Ventilation Structures	90,000,000	90,000,000	90,000,000	NA	NA	NA
Civils - Special Treatment at Raymond Fault	50,000,000	50,000,000	50,000,000	NA	NA	NA
Civils - Roadworks	INCL	INCL	INCL	100,000,000	INCL	INCL
Mechanical and Electrical systems	INCL	INCL	INCL	180,000,000	INCL	INCL
Toll Collection Systems	16,000,000	16,000,000	16,000,000			0
Socio-Environmental Works	5,000,000	5,000,000	5,000,000	0	0	0
Operational Control Centre / Building	28,000,000	28,000,000	28,000,000	60,000,000	98,500,000	55,000,000
Geological Surveys	2,000,000	2,000,000	2,000,000	0	0	0
Utility Diversions	INCL	INCL	INCL	60,000,000	INCL	INCL
Sub-total Construction Costs	**1,535,233,613**	**2,845,467,227**	**2,760,467,227**	**1,255,000,000**	**1,052,500,000**	**952,000,000**
Special Building Settlement Mitigation	NA	NA	NA	INCL	35,802,000	137,700,000
Inflation / Price Escalation	NA	NA	NA	110,000,000	110,000,000	110,000,000
Total Construction Costs	**1,535,233,613**	**2,845,467,227**	**2,760,467,227**	**1,365,000,000**	**1,198,302,000**	**1,199,700,000**
Design Costs	46,057,008	85,364,017	82,814,017	169,000,000	169,000,000	169,000,000
Project Management Costs	15,352,336	28,454,672	27,604,672	54,000,000	54,000,000	54,000,000
Land Costs / Right of Way	13,000,000	13,000,000	13,000,000	152,000,000	152,000,000	152,000,000
Total Project Base Costs	**1,609,642,958**	**2,972,285,916**	**2,883,885,916**	**1,740,000,000**	**1,573,302,000**	**1,574,700,000**
Insurance	40,241,074	74,307,148	72,097,148	100,000,000	100,000,000	100,000,000
Design Development / Pricing Risk	0	0	0	0	0	0
Risk / Contingency	160,964,296	297,228,592	288,388,592	205,000,000	205,000,000	205,000,000
Total Project Costs	**1,810,848,328**	**3,343,821,655**	**3,244,371,655**	**2,155,000,000**	**1,878,302,000**	**1,879,700,000**
Total other costs	275,614,714	498,354,429	483,904,429	790,000,000	790,000,000	790,000,000
% Additive due to Inflation LS added by WSDOT	NA			8.76%	10.45%	11.55%
Facts and Figures						
Overall Length	3.98	7.96	7.96	1.8	1.8	1.8
Excavation diameter	57.40	57.40	57.40	54.00	54.00	57.40
Internal liner diameter	52.00	52.00	52.00	50.00	50.00	52.00
Underground Cost per mile (millions $)	**349**	**331**	**321**	**428**	**350**	**309**
Overall Cost per mile (millions $)	**455**	**420**	**408**	**1197**	**1044**	**1044**



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MARCH 2011

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ROUTE 710 TUNNEL

PLAN/PROFILE (SOUTH END) (PHASE 1)

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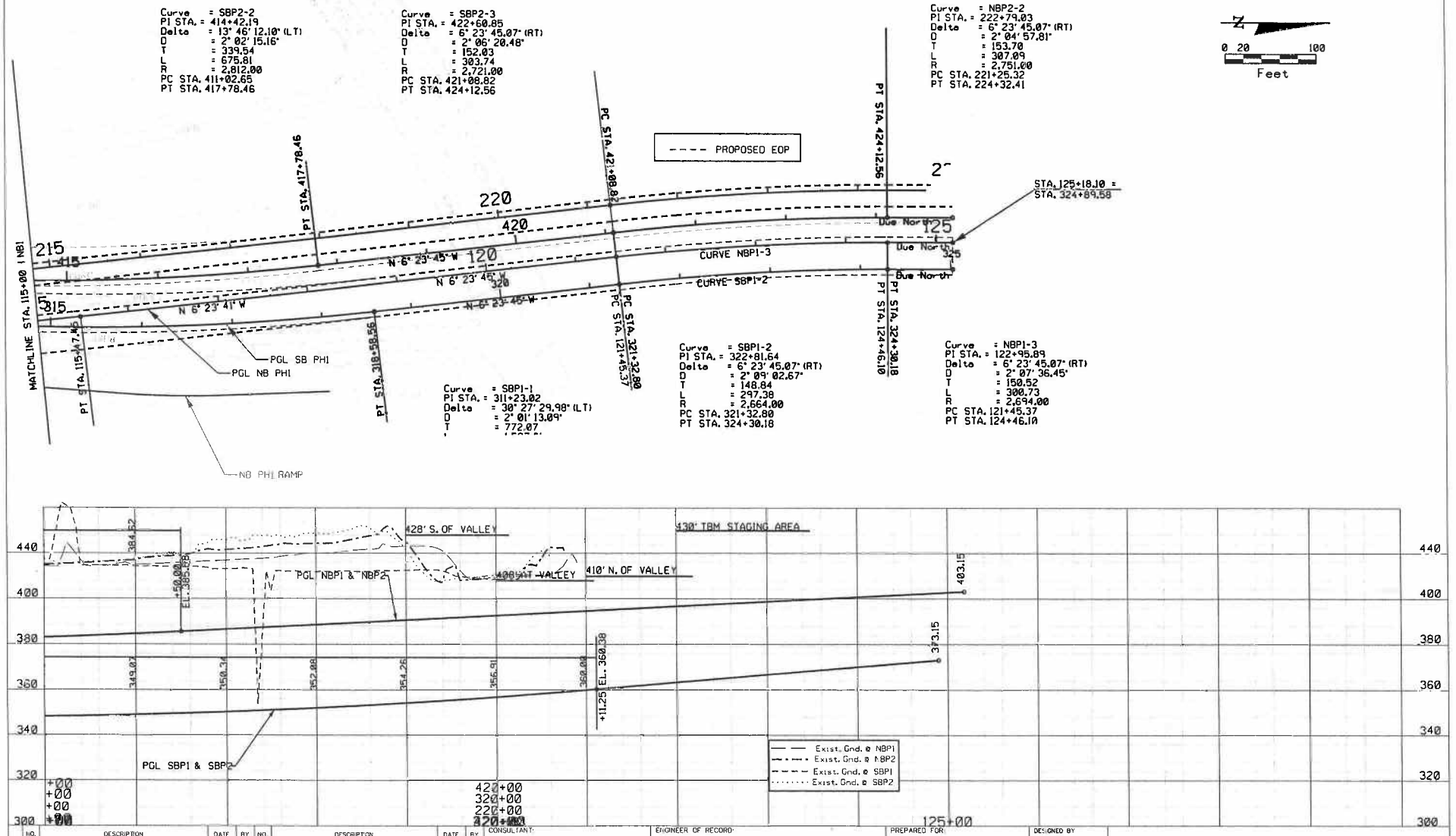

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ROUTE 710 TUNNEL

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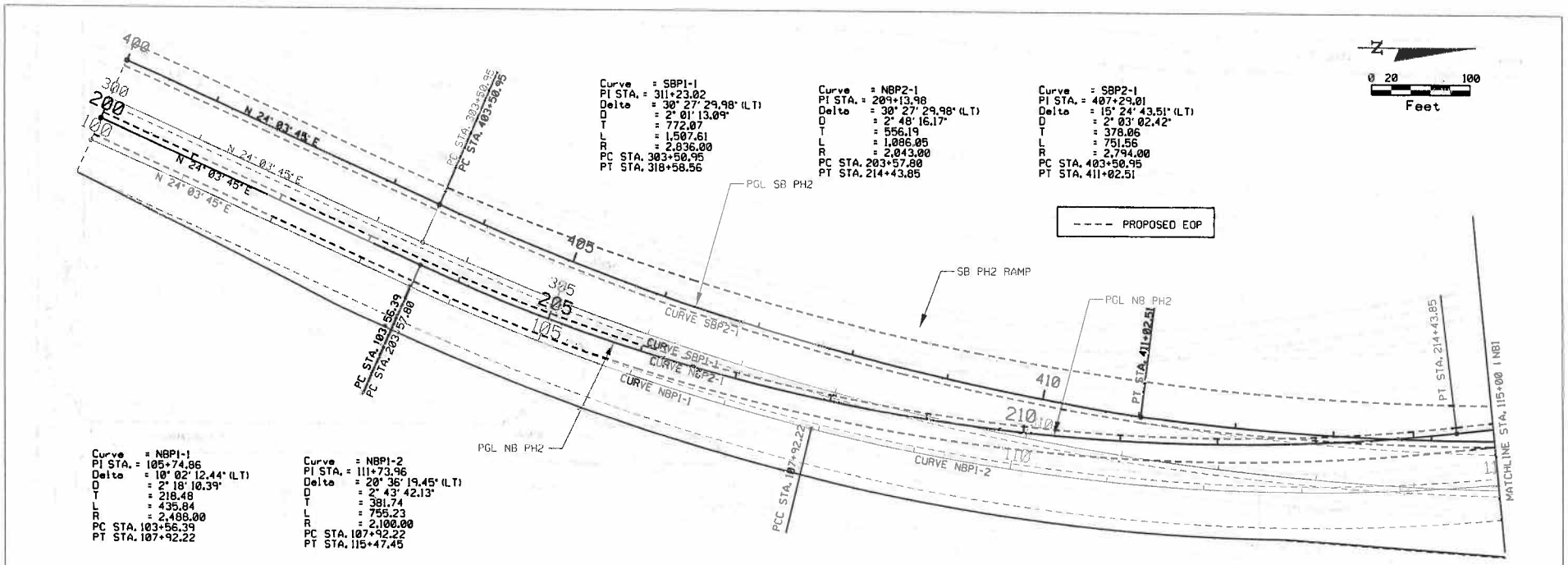

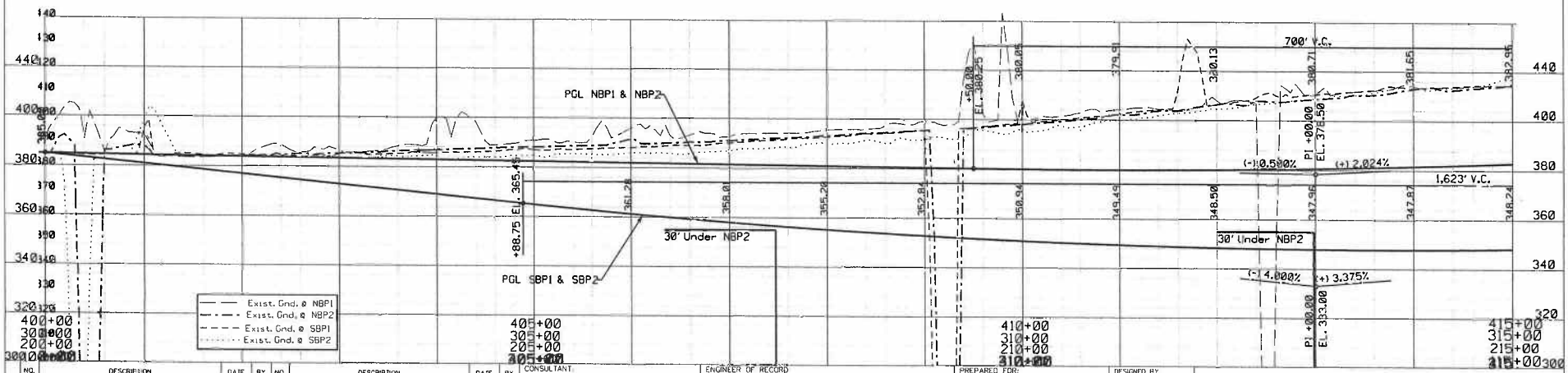

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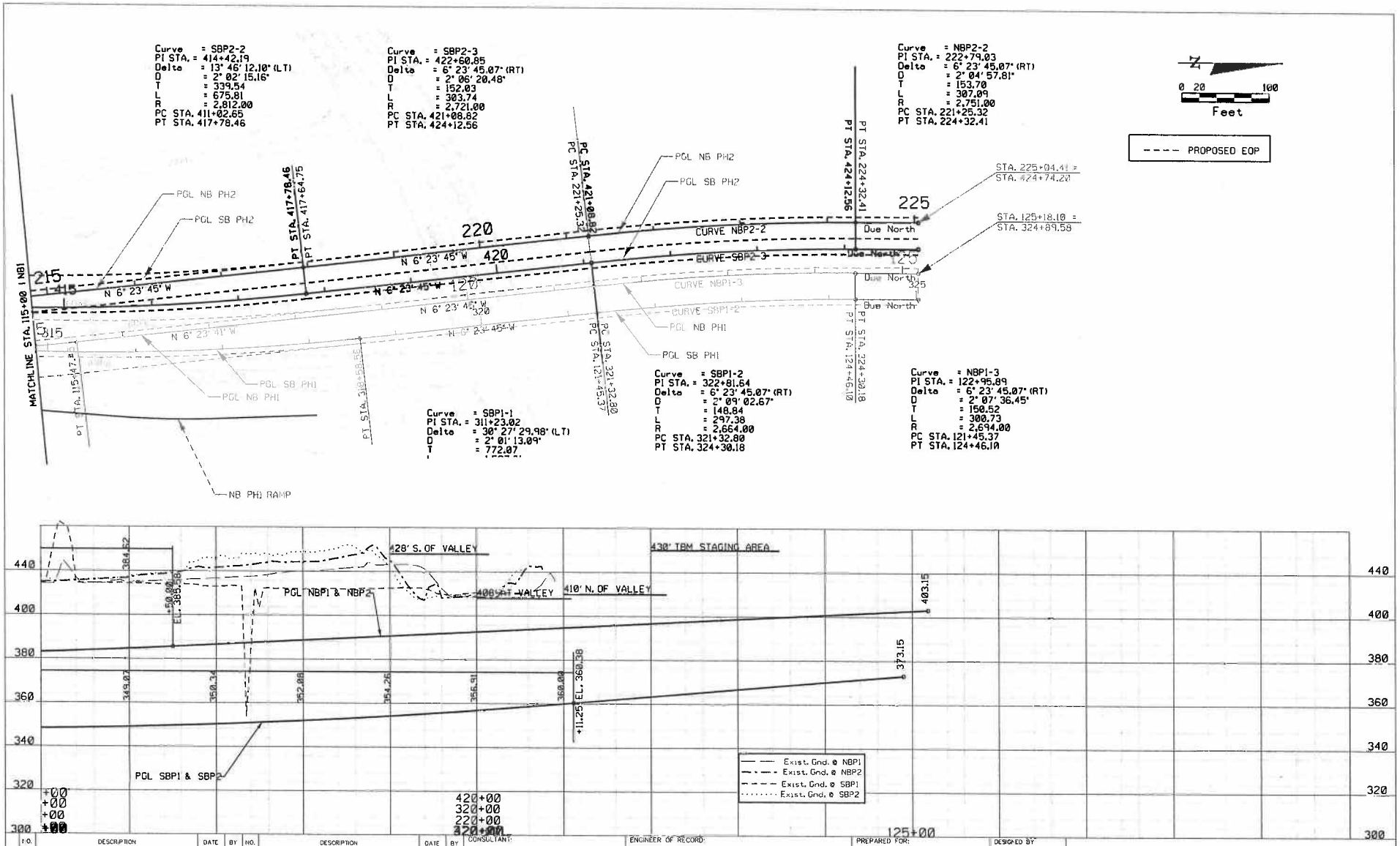

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

CONSULTANT:
Halcrow
Halcrow Inc.
6700 E. Pacific Coast Highway, Suite 180
Long Beach, CA 90803 (562) 493-8300
CERTIFICATE OF AUTHORIZAT ON: 26480

ENGINEER OF RECORD:

MARCH 2011

PREPARED FOR:
Metro
InfraConsult

DESIGNED BY	OO
DRAWN BY	KS
CHECKED BY	
PROJECT ENGR	

ROUTE 710 TUNNEL

PLAN/PROFILE (SOUTH END) (PHASE 2)

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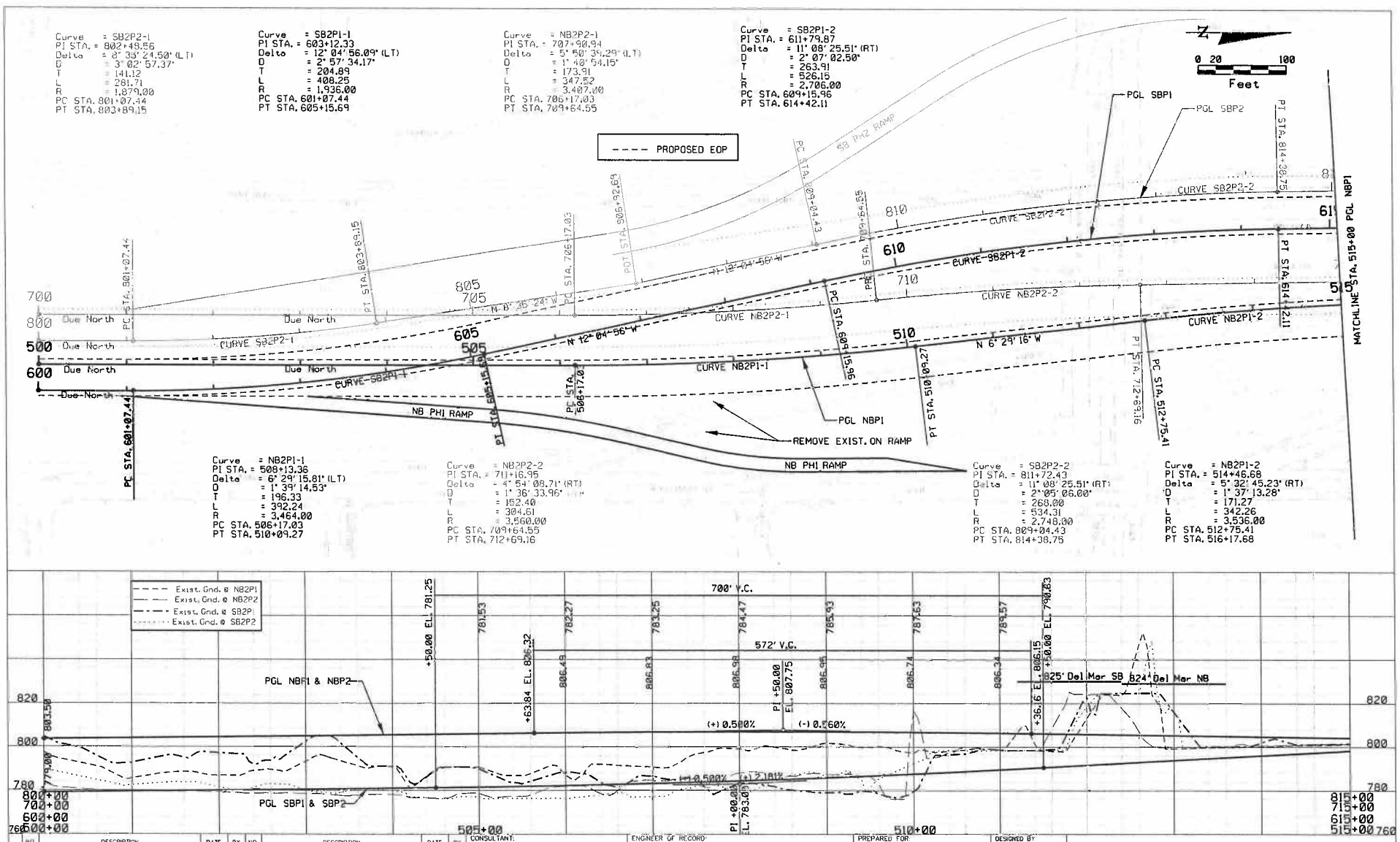

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

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ENGINEER OF RECORD:

MARCH 2011

PREPARED FOR:
Metro
InfraConsult

DESIGNED BY: OG
DRAWN BY: KS
CHECKED BY:
PROJECT ENGR:

ROUTE 710 TUNNEL

PLAN/PROFILE (NORTH END) (PHASE 1)

DRAWING NO: C5

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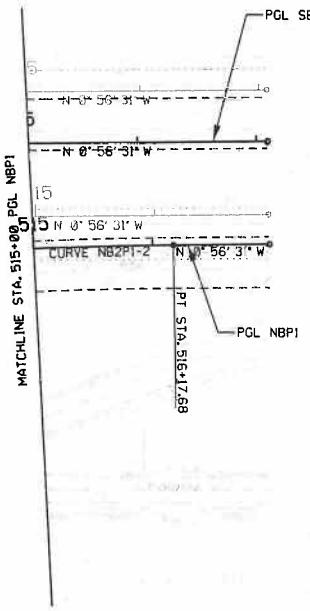


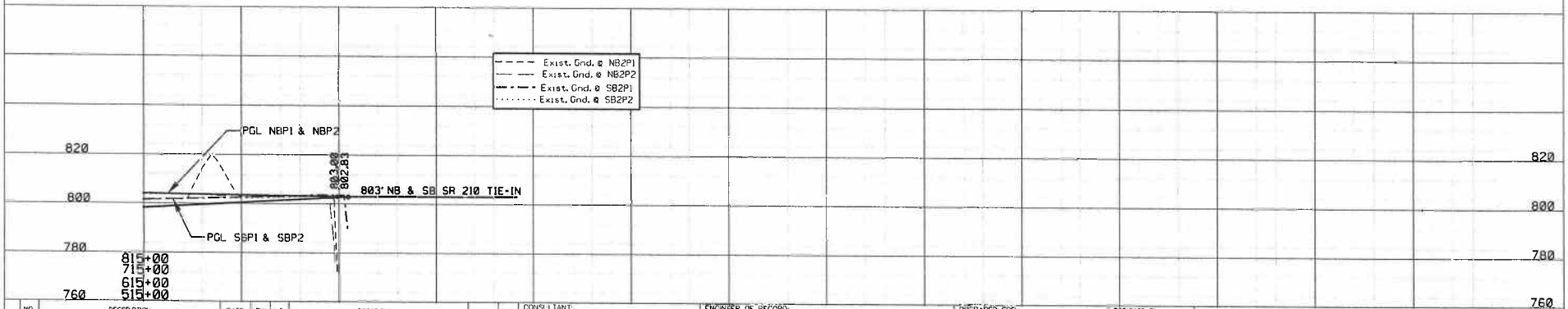
PROPOSED EOP

N

0 20 100

Feet

Curve = NB2P1-2
PI STA. = 514+46.68
Delta = 5° 32' 45.23" (RT)
D = 1° 37' 13.28"
T = 171.27
L = 342.26
R = 3,536.00
PC STA. 512+75.41
PT STA. 516+17.68



REVISIONS	NO	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

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CERTIFICATE OF AUTHORIZATION: 26480

ENGINEER OF RECORD:

MARCH 2011

PREPARED FOR:
Metro
InfraConsult

DESIGNED BY	OG
DRAWN BY	KS
CHECKED BY	
PROJECT ENGR	

ROUTE 710 TUNNEL

PLAN/PROFILE (NORTH END) (PHASE 1)

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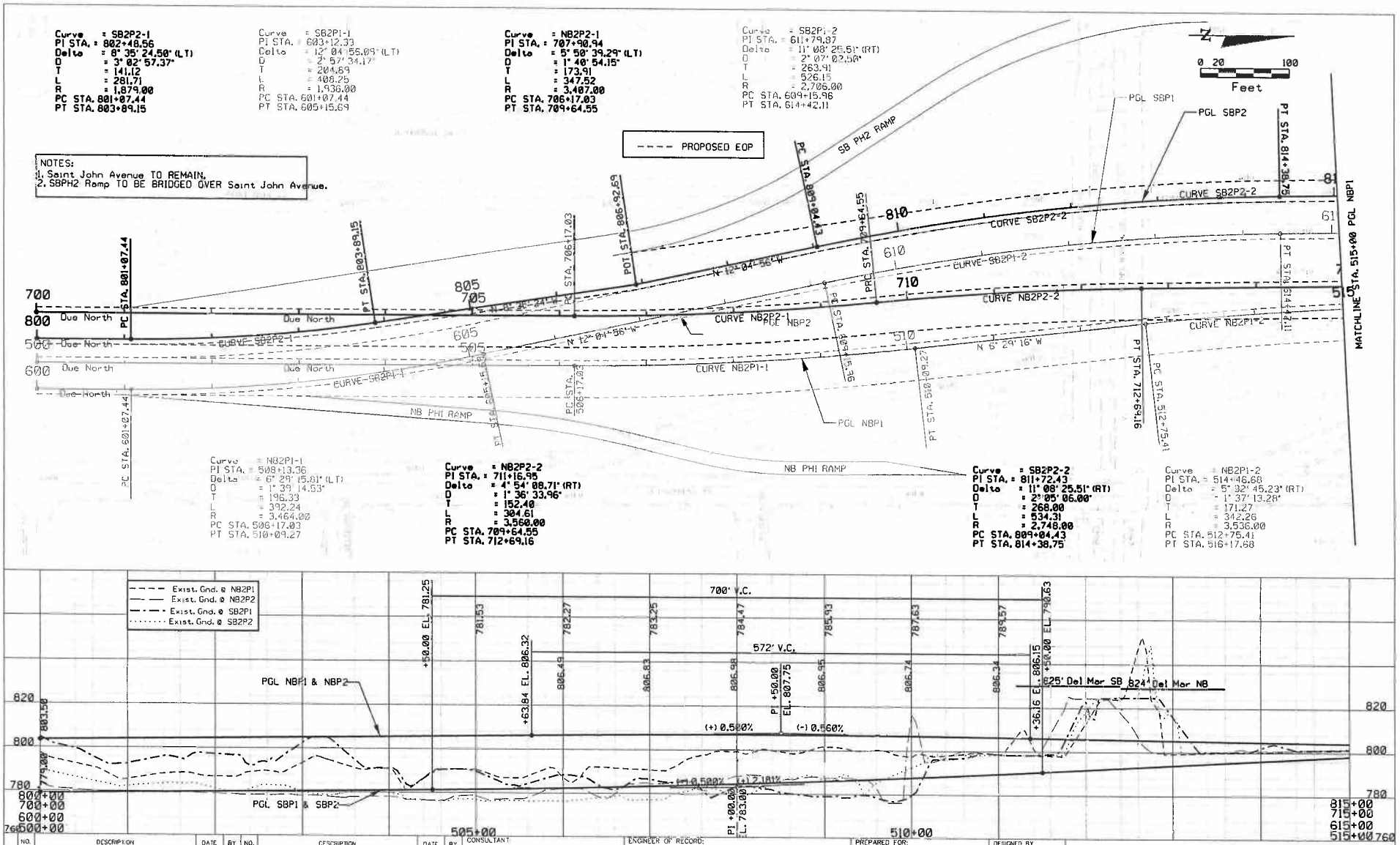

REVISIONS								
NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY	

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6700 E. Pacific Coast Highway, Suite 180
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CERTIFICATE OF AUTHORIZATION: 26480

ENGINEER OF RECORD:

MARCH 2011

PREPARED FOR: Metro / InfraConsult

DESIGNED BY	OC
DRAWN BY	KS
CHECKED BY	
PROJECT ENGR	

ROUTE 710 TUNNEL

PLAN/PROFILE (NORTH END) (PHASE 2)

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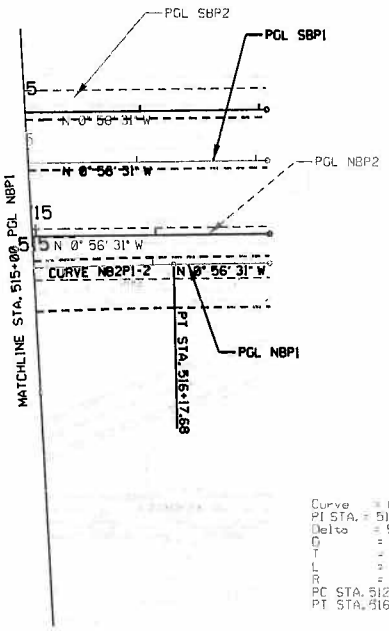
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT. SCALE ACCORDINGLY



PROPOSED EOP

0 20 100
Feet

Curve = NB2P1-2
PI STA. = 514+46.68
Delta = 5° 32' 45.23" (RT)
D = 1° 37' 13.28"
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R = 3,536.00
PC STA. 512+75.41
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Exist. Grd. @ NB2P1
Exist. Grd. @ NB2P2
Exist. Grd. @ SB2P1
Exist. Grd. @ SB2P2

PGL NBP1 & NBP2
PGL SBP1 & SBP2
803.00
802.83
803' NB & SB SR 210 TIE-IN
820
800
780
760
815+00
715+00
615+00
515+00

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

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ENGINEER OF RECORD

MARCH 2011

PREPARED FOR:
Metro
InfraConsult

DESIGNED BY DC
DRAWN BY KS
CHECKED BY
PROJECT ENGR

ROUTE 710 TUNNEL

PLAN/PROFILE (NORTH END) (PHASE 2)

DRAWING NO. C8

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Appendix C, SR 710 North Generic Alternatives by Zone vs. Alaskan Way Cost Plan Summary

Item Description	SR 710 North Zone 3 generic alternative (2 TBMs) US$	SR 710 North Zone 1 generic alternative US$	SR 710 North Zone 2 generic alternative US$	SR 710 North Zone 4 generic alternative US$	SR 710 North Zone 5 generic alternative US$	Alaskan Way Seattle Tunnel Partners (Dragados) Bid US$
Civils - Portals	157,000,000	200,000,000	200,000,000	200,000,000	200,000,000	340,000,000
Civils - Tunnels	2,498,467,227	3,328,056,807	3,217,483,866	3,937,670,588	6,153,224,706	557,000,000
TBM estimated fixed costs	170,000,000	170,000,000	170,000,000	170,000,000	170,000,000	85,000,000
Estimated Tunnel Variable costs: f(length)	2,328,467,227	3,158,056,807	3,047,483,866	3,767,670,588	5,983,224,706	472,000,000
Civils - Tunnel Ventilation Structures	90,000,000	122,065,327	117,791,457	145,628,141	231,263,819	NA
Civils - Special Seismic Treatment	50,000,000	50,000,000	50,000,000	50,000,000	50,000,000	INCL
Toll Collection Systems	16,000,000	16,000,000	16,000,000	16,000,000	16,000,000	0
Socio-Environmental Works	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	0
Operational Control Centre / Building	28,000,000	28,000,000	28,000,000	28,000,000	28,000,000	55,000,000
Geological Surveys	2,000,000	2,712,563	2,617,588	3,236,181	5,139,196	0
Sub-total Construction Costs	**2,846,467,227**	**3,751,834,696**	**3,636,892,911**	**4,385,534,910**	**6,688,627,721**	**952,000,000**
Special Building Settlement Mitigation	0	0	0	0	0	**137,700,000**
Inflation / Price Escalation	0	0	0	0	0	110,000,000
Total Construction Costs	**2,846,467,227**	**3,751,834,696**	**3,636,892,911**	**4,385,534,910**	**6,688,627,721**	**1,199,700,000**
Design Costs	85,394,017	112,555,041	109,106,787	131,566,047	200,658,832	169,000,000
Project Management Costs	28,464,672	37,518,347	36,368,929	43,855,349	66,886,277	54,000,000
Land Costs / Right of Way	13,000,000	13,000,000	13,000,000	13,000,000	13,000,000	152,000,000
Total Project Base Costs	**2,973,325,916**	**3,914,908,084**	**3,795,368,627**	**4,573,956,306**	**6,969,172,830**	**1,574,700,000**
Insurance	74,333,148	97,872,702	94,884,216	114,348,908	174,229,321	100,000,000
Design Development / Pricing Risk	0	0	0	0	0	0
Risk / Contingency	297,332,592	391,490,808	379,536,863	457,395,631	696,917,283	205,000,000
Total Project Costs	**3,344,991,655**	**4,404,271,595**	**4,269,789,706**	**5,145,700,845**	**7,840,319,434**	**1,879,700,000**
Total other costs	498,524,429	652,436,898	632,896,795	760,165,935	1,151,691,713	790,000,000
% Additive due to Inflation LS added by WSDOT						11.55%
Facts and Figures						
Overall Length	7.96	10.80	10.42	12.88	20.45	1.8
Excavation diameter	57.40	57.40	57.40	57.40	57.40	57.40
Internal liner diameter	52.00	52.00	52.00	52.00	52.00	52.00
Underground Cost per mile (millions $)	**331**	**324**	**325**	**321**	**315**	**309**
Overall Cost per mile (millions $)	**420**	**408**	**410**	**400**	**383**	**1044**