City of Bellevue

East Link Light Rail B7/C9T to NE 2nd Portal (B7 – Revised) Alternative

TM14 – BNSF Corridor: Additional Freight Corridor Option

215382/TM14

Final | June 2011

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Job number 215382-00

ARUP

Document Verification

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Job title		East Link light rail B7/C9T to NE 2nd Portal (B7 – Revised) Alternative			**Job number** 215382-00
Document title		TM14 – BNSF Corridor: Additional Freight Corridor Option			**File reference**
Document ref		215382/TM14			
Revision	**Date**	**Filename**	TM14 - BNSF Corridor Trail Option (Review Draft 1).docx		
Review Draft 1	03/31/11	**Description**	Issued for review by City of Bellevue		
			Prepared by	Checked by	Approved by
		Name	Nathan Will	Richard Prust	Richard Prust
		Signature			
Final Draft	05/03/11	**Filename**	TM14 - BNSF Corridor Trail Option Final.docx		
		Description	Updated to address City of Bellevue and Sound Transit Comments		
			Prepared by	Checked by	Approved by
		Name	Nathan Will	Richard Prust	Richard Prust
		Signature			
Final	06/24/11	**Filename**	TM14 - BNSF Corridor Trail Option (Final).docx		
		Description	Revision status revised. No changes.		
			Prepared by	Checked by	Approved by
		Name	Nathan Will	Richard Prust	Richard Prust
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

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Appendix A

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1 Executive summary

The B7-Revised alternative being studied by the City of Bellevue as an alternative to the B7/C9T developed by Sound Transit for the East Link DEIS/SDEIS, passes through the now disused BNSF freight corridor to the west of the I-405, north of the I-90. This section of the alignment is 4750 feet long and passes through the railroad right of way which is generally 100 feet wide; with a section at the south end that is 50 ft wide.

When the freight rail line through the corridor was abandoned the corridor fell under a rail banking agreement which is intended to protect the corridor to allow freight operations to be reestablished should an operator be identified in the future. The B7-Revised alternative proposed by the City of Bellevue for study was originally planned to provide light rail tracks through this corridor which in the future could be shared by any future freight operation. This approach is rare in the US as it: provides technical and operational challenges; increases the risks associated with competing operations on the same track, and may not comply with the rail banking agreement. As such the City of Bellevue requested that a second option be developed which provides an 18 foot corridor alongside the light rail tracks which could be converted to a dedicated freight track.

This second option has been developed and the preferred alignment alternative comprises a cross section with a 27.5 feet spacing between the center line of the light rail east bound track and the center line of the freight rail track. This provides sufficient spacing, based on typical BNSF criteria, between the tracks to avoid the need for a corridor safety barrier throughout the majority of the corridor. At the south end of the corridor where the right of way width is 50 feet, the spacing is reduced to 20.5 feet to reduce the property impacts in the area. At this location a barrier is provided.

This alignment has been compared with the shared track alignment presented in the Early Concept Alignment Report (TM06) where there was no provision for a separate freight track and the future operator would utilize the LRT eastbound tracks in conjunction with Sound Transit.

Comparison of Shared Track

- The corridor for the additional freight corridor alternative is 61 feet against 32 feet for the shared track alternative
- The increased width requires the provision of 1100 feet of additional retaining walls to accommodate the topography
- To reduce property impacts a 800 foot long safety barrier is required at the south end of the corridor
- The additional right of way costs related to additional permanent easements at the south end of the corridor are on the order of $300k
- The additional project cost associated with the additional freight corridor is approximately $3m
- The alternative has no additional impacts on ecosystem resources
- The light rail alignment is approximately 25 feet closer to an apartment building on the west side at SE32nd Street which is likely to result in an increase in severity of some noise impacts in this area, however the mitigation through the provision of sound barriers will be similar to that for the Early Concept Alignment

2 Background

2.1 Project description

The East Link project is an extension to Sound Transit's Link light rail system that will provide light rail service across Lake Washington, linking Seattle, Bellevue, and Redmond (Overlake).

For the segment of East Link between the Lake Washington crossing and downtown Bellevue, Sound Transit has developed the B7 alternative to a conceptual engineering level of design (approximately five percent design) as part of the Draft Environmental Impact Statement (DEIS) for the project which was issued in December 2008.

A Supplemental Draft EIS, which analyzes new alternatives developed since the DEIS, was published in November 2010. That supplemental document includes updated conceptual engineering for the Sound Transit B7 alternative and a C9T alternative that could connect B7 to a station at the Bellevue Transit Center. A Final EIS is expected in the summer of 2011.

At the September 13, 2010, Bellevue City Council Study Session, the council discussed the need for design variations and for additional analysis of revised East Link B7 and C9T alternatives. The objectives of the additional analysis would be to improve performance, to reduce impacts, and to reduce costs, as compared with the Sound Transit B7 and C9T alternatives. As a result of that discussion the council initiated the development of a modified B7 alternative ("B7-Revised"). The council directed City staff to develop an "apples-to-apples" comparison of the Sound Transit B7 and C9T alternatives with a B7-Revised alternative. ARUP were commissioned by the City to develop the B7-Revised alternative.

The B7-Revised alternative begins at the transition from East Link Segment A to Segment B at the east shore of Lake Washington and connects with a new elevated station (A-2 Station) over south Bellevue Way/I-90 ramps. The alignment continues east from the station along the north side of I-90 and turns north into the BNSF corridor with an at-grade profile. The alignment transitions to elevated as it leaves the BNSF corridor, crosses over SE 8th Street, and transitions back to at-grade prior to a new station (East Main Station) just south of Main Street on the current Red Lion Hotel site. The alignment crosses under Main Street and turns west on the current Sheraton Hotel site before entering a tunnel portal at NE 2nd Street. The B7-Revised alternative is approximately three miles long with a combination of at-grade, elevated, and open-cut sections.

2.2 Technical memo scope

The Early Concept Alignment developed for the B7 Revised Alternative assumed that any future rail operator using the BNSF corridor would share the Sound Transit light rail tracks through the corridor. The scope of this memo is to develop a second alignment option which provides a freight corridor of 18 feet

width adjacent to the light rail tracks and compares the impacts of this with the first option of shared tracks.

2.3 Technical memo objectives

The objectives of this technical memo are to:

- describe the development of an alternative which provides an additional freight corridor through the BNSF RoW
- provides a comparison of the key factors which differentiate this alternative with the shared track alternative.

2.4 Key meetings and background documents

The meeting and documentation relevant to the development of this option and its analysis, are the same as described in the Early Concept Alignment Report (TM06).

3 Data, assumptions and methodology

Other than the objective of providing a separate freight corridor, the base data, key assumptions, and methodology used in the development of this option and its analysis are the same as described in the Early Concept Alignment Report (TM06).

4 BNSF corridor

The abandoned freight rail corridor runs on the west side of I-405 from SE 32nd Street in the south, to the site of the now removed Wilburton Tunnel in the north. This section is approximately 4750 ft long and the right of way is typically approximately 100' wide, with a narrowed section approximately 50' wide at the south end immediately north of SE 32nd Street.

On closure of the line this corridor became subject to a rail banking agreement which is intended to provide the opportunity to re-establish freight service in the future. The City of Bellevue has requested that this be addressed in two ways. Firstly to provide two tracks only, on the assumption that freight will run on the light rail tracks; and secondly that an alternative be developed which provides a dedicated corridor for an additional freight track alongside LRT in the future. The former is the basis of the alignment described in the Early Concept Alignment Report and the latter is the option developed in this technical memo.

Technical Memo TM12- Shared Running with Freight Rail should be considered in conjunction with this report as it discusses in greater detail the issues of light rail and freight sharing the same tracks.

5 Option development

5.1 General

The sharing of tracks by both freight and light rail trains is rare in North America and elsewhere in the world, primarily because the vehicles are not considered compatible when it comes to crash-worthiness. However, freight trains and light rail vehicles sharing corridors, where they have separate dedicated tracks and adequate horizontal clearance, is common.

In the case of the East Link light rail, the Sound Transit B7 alignment provided space for a future freight rail operator to occupy a portion of the BNSF Corridor, by planning for the wider formation and the retaining walls that would be required. This space could be developed to create a multi-use trail to be used until freight operations are implemented.

This report looks at optimizing the design of the freight option by looking at various horizontal spacing requirements between the light rail and the freight, as these impact the extent of retaining walls required along the corridor and consequently the construction cost of the option.

5.2 Alignment

The Early Concept Alignment provided a shared two track operation approximately centered in the 100-ft wide BNSF corridor, for approximately 5300 feet, to limit the extent of walls needed on either side of the alignment.

For the Additional Freight Corridor option a number of alignment alternatives were assessed including moving the LRT alignment to the west; however the analysis showed that leaving the LRT tracks on a similar alignment and providing the freight corridor on the east side was most effective in minimizing the increase in length of retaining wall required.

The same vertical alignment was utilized from the Early Concept Alignment as this is controlled by the clearance at the SE. 32nd Ave underpass at the south end of the corridor.

5.3 Running clearances

There are several running clearances that determine the cross-sections appropriate to the two rail systems (LRT and freight). The freight rail running clearances are less well defined than the light rail running clearances as the freight operator and the type of service that will be operated has not yet been identified. The East Link design criteria has been used to establish the light rail clearances.

5.3.1 Freight rail

Each freight rail operator can adopt differing criteria provided that they adhere to the American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual and the Federal Railroad Administration requirements.

As the future operator for this segment is not known, the legacy requirements of the BNSF have been applied for the purposes of this study.

5.3.1.1 Running clearances

The running clearance is the space required for the trains to operate safely, within which no other fixed items may be placed. The BNSF Engineering and Field Instructions (2001) generally require a minimum running clearance of 8 foot- 6 inches (Chapter 5.3.5). To allow for additional line-side infrastructure, an additional 6- inches should be allocated. This results in a running clearance to vertical obstructions (walls, poles, etc.) of 9 feet on each side of the track center line.

5.3.1.2 Track spacing (freight track to LRT track)

Typically, freight companies operate on their own dedicated right-of-way. However, due to the rapid expansion of transit facilities in the United States, the use of existing freight corridors for transit operations is growing. Light rail vehicles and freight trains have very different weights and construction and are not considered compliant with each other to operate on the same tracks safely without temporal separation (refer to TM12 for additional discussion). Safety considerations related to the appropriate distance to space the adjacent tracks is typically negotiated on a railroad specific basis. Some freight railroad companies require up to 50-feet between the tracks to limit the possible impacts of derailing freight cars impacting transit operations.

For this study, the requirements that BNSF has applied to other projects in the United States have been adopted, as there is not an active freight company operating in this corridor to negotiate with. BNSF has historically allowed the placement of transit rails as close as 25 feet, measured from the center of rails, without any additional protection. For areas where these cannot be met, a corridor safety barrier is installed between the tracks to prevent derailments from entering the transit corridor.

5.3.2 Light rail

Light rail clearances are dictated by the dynamic characteristics of the vehicles as they operate on the system. Clearances are entirely vehicle specific and are calculated in accordance with the Sound Transit design criteria.

Like all systems, there is a desired minimum clearance that allows for some flexibility, and an absolute minimum in confined areas that must be achieved.

5.3.2.1 Desirable Minimum

The desirable minimum running clearance for the Sound Transit light rail system is 8 foot – 6 inches according to Figure 4.9 of the Design Criteria. However, DCM Section 4.2.6.3.B.2.a states that if a cut retaining wall is use and an emergency walkway is needed, the desired minimum clearance is 9 feet. Any clearance less than this is calculated in accordance with Chapter 4 of the Criteria.

5.3.2.2 Absolute Minimum

To define how close to the light rail tracks the freight rail tracks can be placed, the absolute minimum clearance that would be needed for this particular section of the corridor is calculated below.

Clearance Envelope

The calculation of the Clearance Envelope (CE) is governed by Chapter 4 of the Sound Transit Design Criteria:

CE= VDE + OWF + RC

Where:

VDE = Vehicle Dynamic Envelope

OWF = Other Wayside Factors, and

RC = Running Clearance

The VDE is subject to the car-body effect and values are calculated for numerous hinge points of the actual vehicle. For this project, the point $WL4_{IN}$ in Figure 4.11 of the design criteria is adopted because of the location of the freight on the inside part of the curve (east side of LRT) in this corridor.

The VDE is also subject to the geometry of the track, superelevation of the tracks, and the design speed in that specific area. For this case, the Design Speed is 55 mph, the track is at a 3850-ft radius with a 1.5-inch super elevation (refer to Figure 4.2b in DCM). According to Table 10B, for a 2000 ft curve, the VDE is 67.6 inches; however, a tangent clearance of 67.8 inches is required, therefore the larger is used.

The OWF is calculated as follows:

OWF = CMT + CW

Where:

CMT = Sum of Certain Construction and Maintenance Tolerance

CW = Corded Wall Construction Factor

The CMT is a sum of the construction and maintenance tolerances identified in the table in Section 4.2.6.2.E.2. The tolerances of note are "Construction Tolerance along Other Proposed Structures" of two inches, and "Track Construction and Maintenance Tolerance Mainline, Ballasted Track" of 2.5 inches.

The CW factor is determined by the curved geometry of the track because curved walls are generally constructed as a series of straight cords. The factor for a 3000-ft radius curve, to be conservative, is 1 ¼ inches. The total for the OWF is 5.75 inches.

The RC is determined by the Table in 4.2.6.2.F. Due to uncertainty in the construction type, 6 inches has been used to allow for structures constructed with liberal construction tolerances.

The overall CE is then the sum of 67.8 inches, 5.75 inches and 6 inches. This results in a CE of 6 feet 7 ½ inches.

5.4 Typical section alternatives

Based on the clearance requirements described above, three typical sections have been developed that all include a provision for a future dedicated freight corridor:

- Absolute Minimum – Absolute minimum LRT running clearances with BNSF clearance and corridor safety barrier
- Preferred Minimum – Preferred minimum LRT running clearances with BNSF clearance and corridor safety barrier
- Freight Preferred Minimum – Preferred minimum LRT running clearances without BNSF clearance and corridor safety barrier

5.4.1 Absolute Minimum section (with corridor safety barrier)

The absolute minimum section maintains a side clearance of nine feet for the WB track and 6 foot 6.5 inches for the EB track as calculated above.

In accordance with Section 4.2.7 of the Sound Transit design criteria, minimum track centers shall be the greater of the minimum track center requirement from the two interfacing rail lines plus 30 inches. For this situation, the governing minimum center is 25 feet as required by the freight rail line. In order to reduce this spacing, a protection barrier in between tracks is required. Given a 3 foot wide barrier, the minimum EB track CE, and a 9 foot side clearance for freight, the track center is reduced to 18 feet 6.5 inches.

Drainage channels are provided for both cut and fill slopes with dimensions of 1.5 feet deep with 1V:3H side slopes, and a 2 foot bottom width. Appropriate to the geotechnical conditions in the corridor and consistent with Sound Transit criteria, maximum cut and fill slopes of 1V:2H have been utilized.

Retaining walls are used when the cut or fill slopes with drainage channels do not fall within the existing BNSF property or extent of the I-405 Master Plan. They

are located at nine feet from the track centerlines for the WB and future freight rail track. All walls are assumed to be cantilever retaining walls for estimating purposes.

Figure 1 below shows the absolute minimum section.

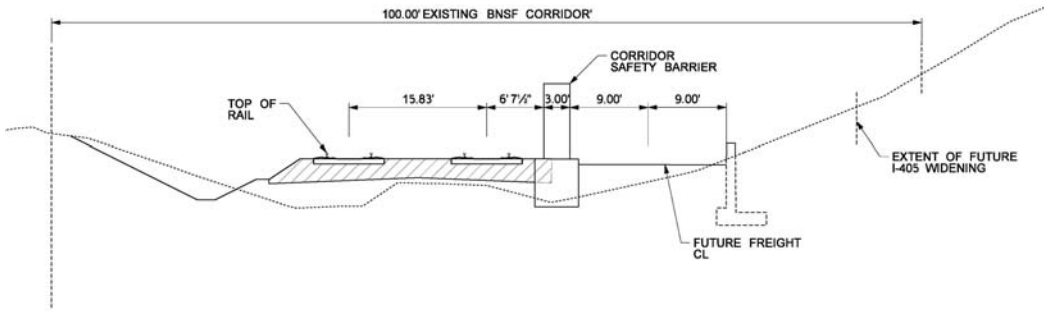


Figure 1 Absolute Minimum clearance typical section (STN 2066+00)

5.4.1.1 Retaining walls

The table overleaf indicates the location, length and height of retaining walls, and the location and length of corridor safety barrier required for this option.

Start STA	End STA	Length (ft)	Avg. Height (ft)
WB Side			
2053+99	2058+58	459	12
2063+50	2063+95	45	10
2064+65	2064+95	30	12
2066+45	2067+05	60	12
2067+55	2070+20	265	14
2072+60	2077+70	510	14
2078+50	2081+71	321	12
2083+45	2085+35	190	10
2090+55	2090+82	27	11
2092+80	2095+10	230	13
2100+00	2102+00	200	10
EB Side			
2054+02	2056+88	286	12
2058+68	2072+87	1319	11
2087+80	2089+90	210	10
2093+55	2095+55	200	10
	Total	4352	
Corridor Safety Barrier			
2054+00	2100+00	4600	
	Total	**8952**	

Table 1 – Retaining walls for Absolute Minimum clearances

A retained section is provided for the southern 280 feet where the right-of-way is only 50 feet to minimize the extent of additional property impacts.

5.4.1.2 Property impacts

Through the BNSF corridor this alignment is wholly within the BNSF right-of-way except at the south end where the corridor is limited to 50 feet wide. At this location a strip of land up to 25 feet wide will be required on the west side of the BNSF right of way. This is expected to require reconfiguring of parking in an existing commercial complex or may require a complete property take.

5.4.2 Preferred Minimum Section (with corridor safety barrier)

The preferred minimum section maintains a side clearance of nine feet for the WB track and nine feet for the EB track to provide the desirable running clearances for light rail.

As with the absolute minimum section, a corridor safety barrier in between tracks is provided to reduce the 25 foot offset freight requirement. Given a 3 foot wide barrier, the preferred minimum EB track CE and a 9 foot side clearance for freight, the track center is reduced to 21 feet.

Drainage channels have been provided for both cut and fill slopes with dimensions of 1.5 feet deep with 1V:3H side slopes, and a 2 foot bottom width. Appropriate to the geotechnical conditions in the corridor and consistent with Sound Transit criteria, maximum cut and fill slopes of 1V:2H have been utilized.

Retaining walls are used when the cut or fill slopes with drainage channels do not fall within the existing BNSF property or extent of the I-405 Master Plan. Drainage inlets and piping will be provided in the areas with retaining walls. They are located at nine feet from the track centerlines for the WB and future freight rail track. All walls are assumed to be cantilever retaining walls for estimating purposes.

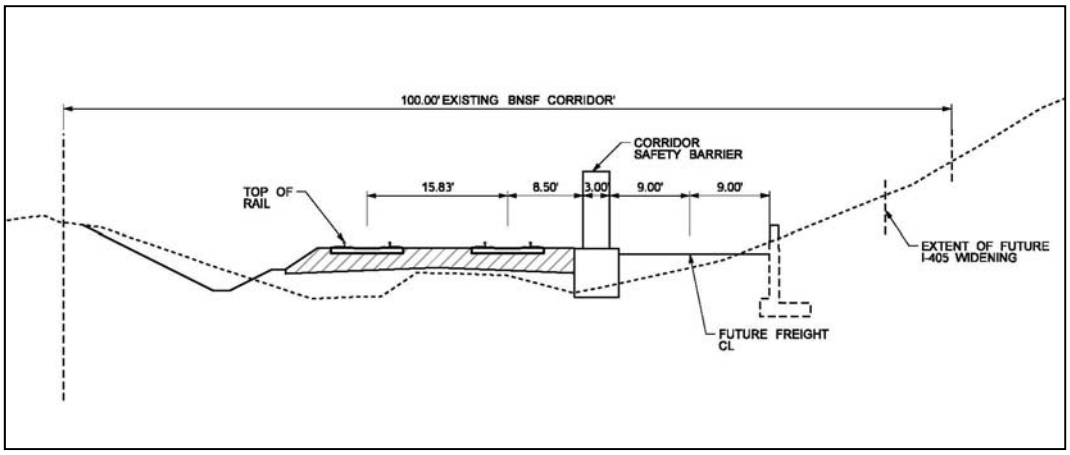


Figure 2 – Preferred Minimum Clearance typical section

5.4.2.1 Retaining walls

The following table indicates the location, length and height of retaining walls, and location and length of corridor safety barriers required for this option.

Start STA	End STA	Length (ft)	Avg. Height (ft)
WB Side			
2053+99	2058+58	459	12
2063+50	2063+95	45	10
2064+65	2064+95	30	12
2066+45	2067+05	60	12
2067+55	2070+20	265	14
2072+60	2077+70	510	14
2078+50	2081+71	321	12
2083+45	2085+35	190	10
2090+55	2090+82	27	11
2092+80	2095+10	230	13
2100+00	2102+00	200	10
EB Side			
2054+02	2056+88	286	12
2058+68	2072+35	1367	11
2087+50	2090+60	310	10
2093+55	2095+55	200	10
	Total	4500	
Corridor Safety Barrier			
2054+00	2100+00	4600	
	Total	**9100**	

Table 2 – Retaining walls for Freight Preferred Clearance

5.4.2.2 Property impacts

Through the BNSF corridor this alignment is wholly within the BNSF right-of-way except at the south end where the corridor is limited to 50 feet wide. At this

location a strip of land up to 25 feet wide will be required on the west side of the BNSF right of way. This is expected to require reconfiguring of parking in an existing apartment complex.

5.4.3 Freight Preferred Section (no corridor safety barrier)

The preferred freight section maintains a side clearance of nine feet for each track and a 27.5 feet track spacing between the future freight and EB track as discussed above.

Drainage channels have been provided for both cut and fill slopes with dimensions of 1.5 feet deep with 1V:3H side slopes, and a 2 foot bottom width. Appropriate to the geotechnical conditions in the corridor and consistent with Sound Transit criteria, maximum cut and fill slopes of 1V:2H have been utilized.

The 27.5 feet spacing provides addition space in between to allow for a drainage channel. Therefore, the second option for the cut or fill on the eastern side is to utilize a 1:2 slope without channels. This solution reduces the retaining wall length required on the EB side. The center channel is about 1'deep with 1H:4V side slopes in between the freight and the light rail tracks.

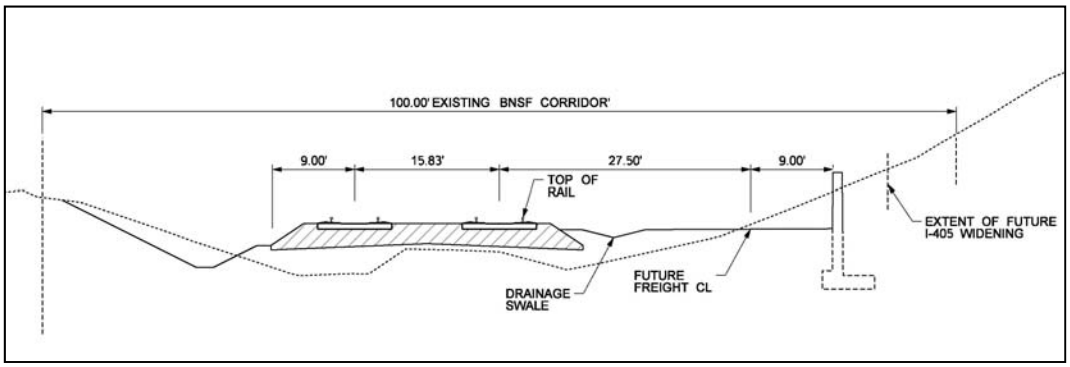


Figure 3 – Preferred Freight Clearance section

Retaining walls are used when the cut or fill slopes do not fall within the existing BNSF property or extent of future I-405 widening. They are located at nine feet from the track centerlines for the WB and future freight rail track. All walls are assumed to be cantilever retaining walls for estimating purposes.

5.4.3.1 Retaining walls

The following table indicates the location, length and height of retaining walls required for this option.

Start Sta.	End Sta.	Length (ft)	Avg Height (ft)
WB Side			
2053+99	2058+58	459	12
2063+50	2063+95	45	10
2064+65	2064+95	30	12
2066+45	2067+05	60	12
2067+55	2070+20	265	14
2072+60	2077+70	510	14
2078+50	2081+71	321	12
2083+45	2085+35	190	10
2090+55	2090+82	27	11
2092+80	2095+10	230	13
2100+00	2102+00	200	10
EB Side			
2054+02	2056+88	286	12
2058+65	2072+31	1366	15
2087+45	2090+65	320	10
2093+50	2095+60	210	10
	Total	**4519**	

Table 3 – Retaining Walls for Freight Preferred Clearance

5.4.3.2 Property impacts

This alignment falls within the BNSF right of way except at the south end where the additional width of this option would likely require the full taking of either the property on the east or west side of the right-of-way on the north side of SE32nd Street.

5.5 Preferred alignment

The Freight Preferred Section requires a relatively modest increase in corridor width and retaining wall length over the others sections and removes the need for a corridor protection barrier along the length of the corridor, and is therefore considered the preferred section. However, at the south end this section would have a substantial property impact on one of the properties at SE32nd Street on either side of the alignment. To mitigate these impacts the preferred minimum section is adopted at the south end with a 900 ft transition between the two. A corridor protection barrier approximately 800 feet long is then required at the south end.

This approach reduces the property impacts to a strip of land up to 25 feet wide on the west side of the BNSF right of way. This is expected to require reconfiguring of parking in an existing apartment complex.

The length of retaining wall and corridor safety barrier for this alignment are then:

EB and WB retaining walls		
	Total	4519
Corridor Safety Barrier		
2054+00	2061+00	800
	Total	**5319**

Table 4 - Total walls (Preferred Option) with corridor safety barrier

The drawings in Appendix A show this preferred alignment.

5.5.1 Environmental impacts

The alignment of the additional freight corridor alternative is within the BNSF right of way and the light rail tracks are in nearly the same location as for the shared track alternative. Impacts to ecosystem resources would be similar to those for the shared track alternative.

The light rail alignment is approximately 25 feet closer to an apartment building on the west side at SE32nd Street which will be likely to result in an increase in severity of some noise impact in this area, however the mitigation through the provision of sound barriers will be similar to that for the Early Concept Alignment.

5.5.2 Project cost

The wider corridor and greater extent of retaining walls will increase the cost of this preferred section above the cost of the shared track option.

Following are the cost elements that are different between the two options:

BNSF Corridor	Unit cost	Qty	Shared Rail	Qty	Rail and trail	Delta
Fill (CY)	$ 25	21,632	$ 540,809	29,795	$ 744,885	
Excavation (CY)	$ 32	6,422	$ 205,495	10,523	$ 336,741	
Retaining walls (10ft high, avg ht)	$ 757	3391	$ 2,567,471	3,153	$ 2,387,271	
Retaining walls (15ft high, avg ht)	$ 945	800	$ 756,000	2,166	$ 2,046,870	
			$ 4,069,776		$ 5,515,768	$ 1,445,992

Table 5 - Cost delta comparison with Shared Track option

Given the aforementioned elements, additional costs above cost of the shared track option are as follows:

Construction cost = $1.45m

Right-of Way = $0.3m

Soft costs (includes change order and unallocated contingency, management, design costs) = $0.85m

Project cost = $2.6m

5.6 Operations and Maintenance

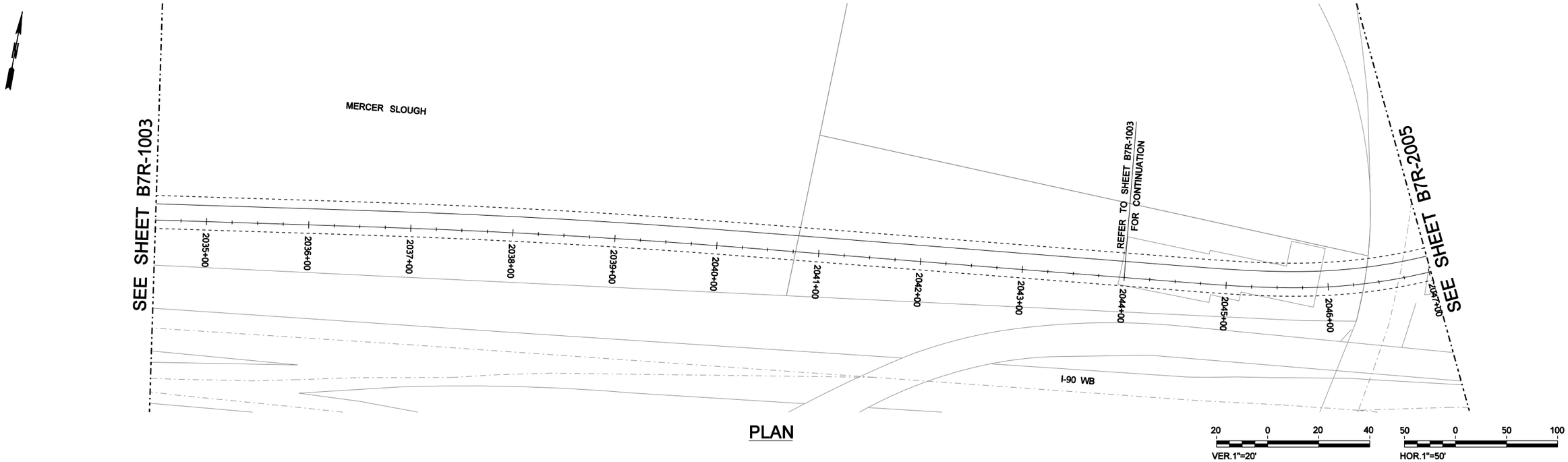
The provision of a freight corridor immediately alongside the LRT tracks would require cooperation between Sound Transit and the freight operator regarding emergency and safety planning, maintenance and access. However, the significant operational and maintenance constraints associated with this option are significantly less than those for the shared track option as described in TM 12.

6 Conclusions

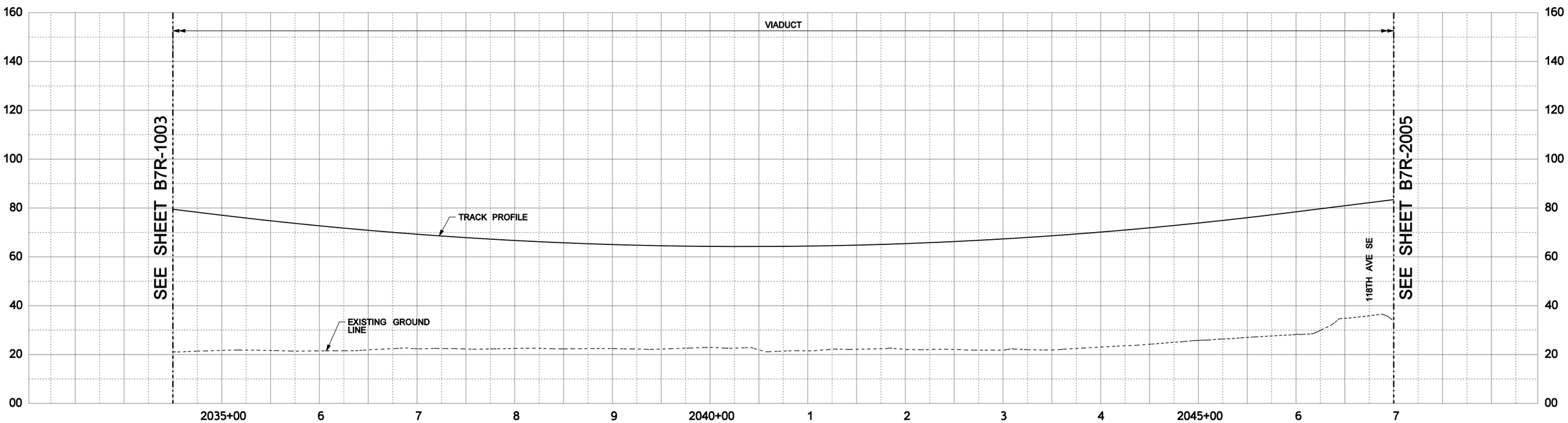
- For the majority of the corridor the preferred option, with light rail and freight separated such that there is no requirement for a central barrier, is the most cost effective. At the south end a closer track spacing and a safety barrier is required to reduce property impacts.
- There is a relatively small cost differential between the shared track and the additional freight corridor option as the length of barrier has been minimized and the length of retaining walls and extent of earthworks are not greatly increased.
- The additional freight corridor option has no additional impacts on ecosystem resources.
- The provision of a separate freight corridor alongside the light rail tracks will significantly reduce the operational and maintenance constraints that would be imposed for the shared track alternative.

Appendix A

Alignment plans with Additional Freight Corridor



PLAN



PROFILE

REV	DATE	BY	CHK	APP	DESCRIPTION
A	03/22/11	PT	DH	RP	EARLY CONCEPT ALIGNMENT SUBMITTAL

DESIGNED BY T. NATWICK
DRAWN BY P. TONKIN
CHECKED BY D. HUNT
IN CHARGE R. PRUST
DATE 03/22/11

REVISED 1% SUBMITTAL

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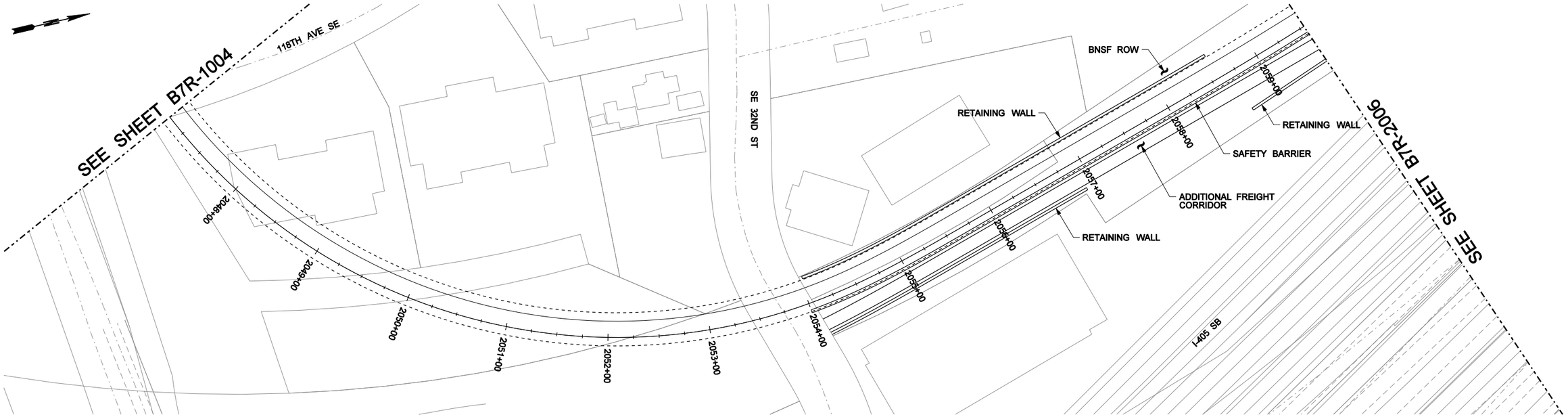
CITY OF BELLEVUE WASHINGTON

EAST LINK LIGHT RAIL

B7/C9T TO NE 2nd PORTAL
(B7 REVISED) ALTERNATIVE
TRACK PLAN & PROFILE
STA. 2034+50 TO 2047+00

CONTRACT NO. 215382
DRAWING NO. B7R-1004
SCALE AS SHOWN
SHEET NO. 2004

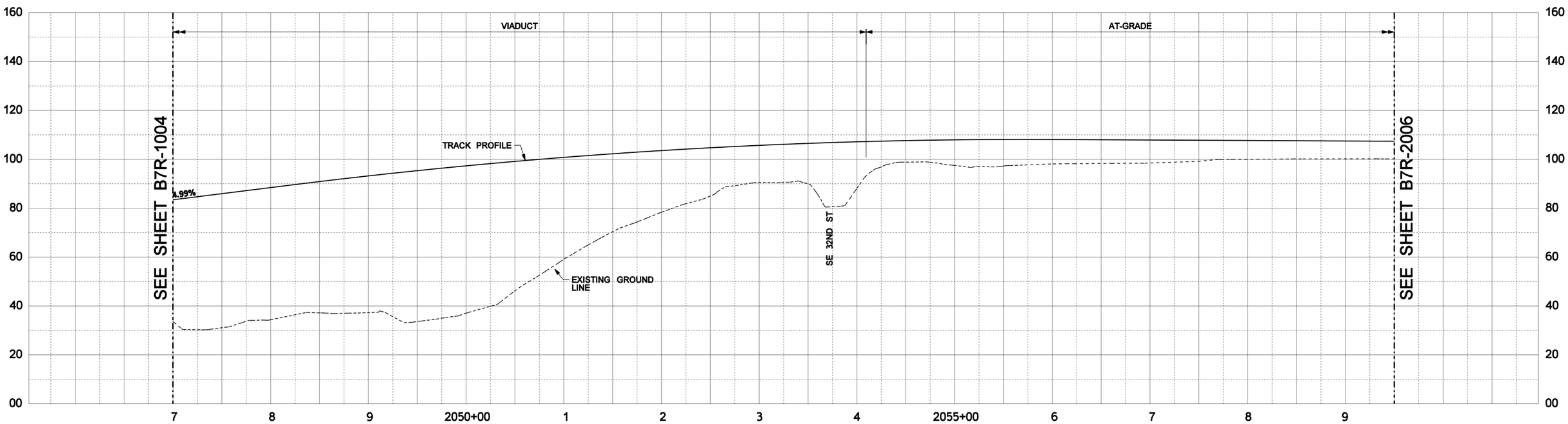
paul.tonkin 3/28/2011 2:00:33 PM Q:\215382-00\4 Internal Project Data\4-03 Drawings\Rail\Drawing Sheets\B7R-2004.dgn



PLAN

VER.1"=20' (20 0 20 40)

HOR.1"=50' (50 0 50 100)



PROFILE

REV	DATE	BY	CHK	APP	DESCRIPTION
A	03/22/11	PT	DH	RP	EARLY CONCEPT ALIGNMENT SUBMITTAL

DESIGNED BY T. NATWICK
DRAWN BY P. TONKIN
CHECKED BY D. HUNT
IN CHARGE R. PRUST
DATE 03/22/11

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CONTRACT NO. 215382
DRAWING NO. B7R-2005
SCALE AS SHOWN
SHEET NO. 2005

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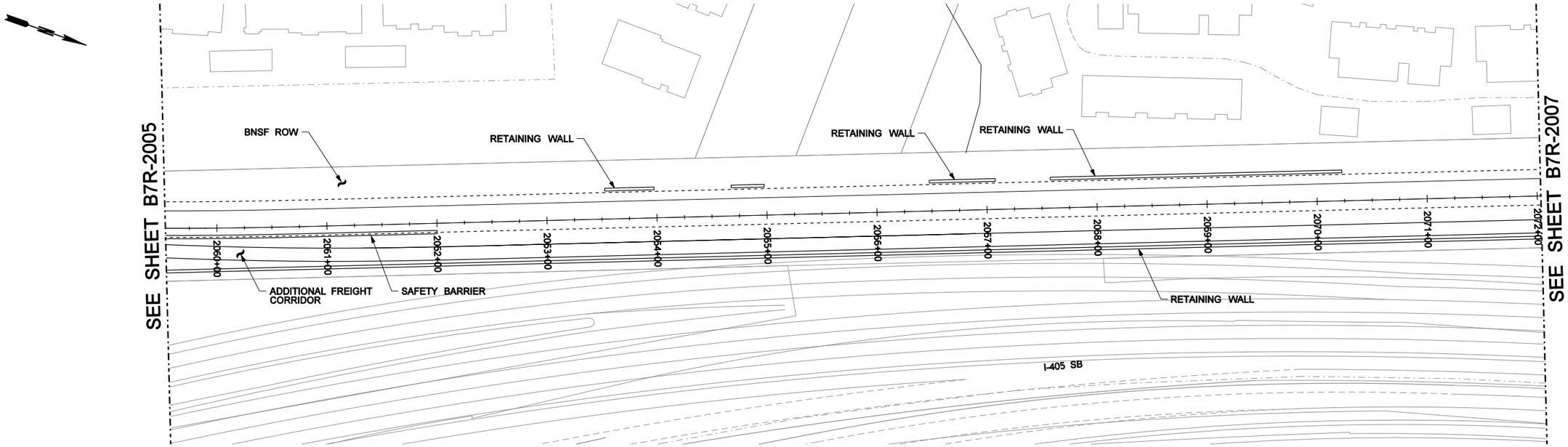
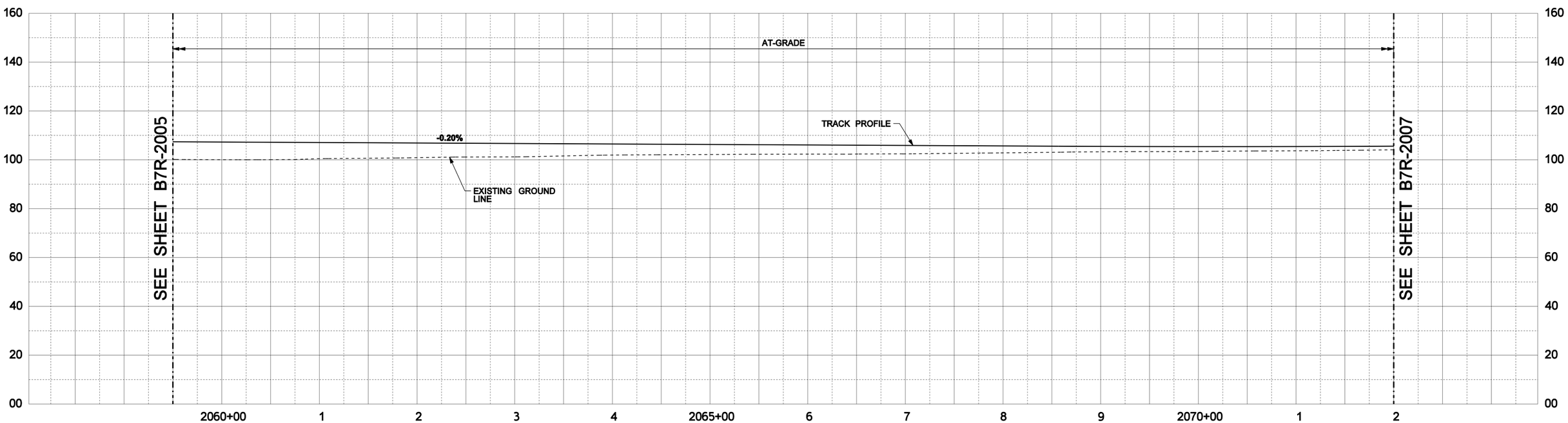


PLAN

VER. 1"=20' (20 0 20 40) HOR. 1"=50' (50 0 50 100)



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CONTRACT NO. 215382
DRAWING NO. B7R-2006
SCALE AS SHOWN
SHEET NO. 2006

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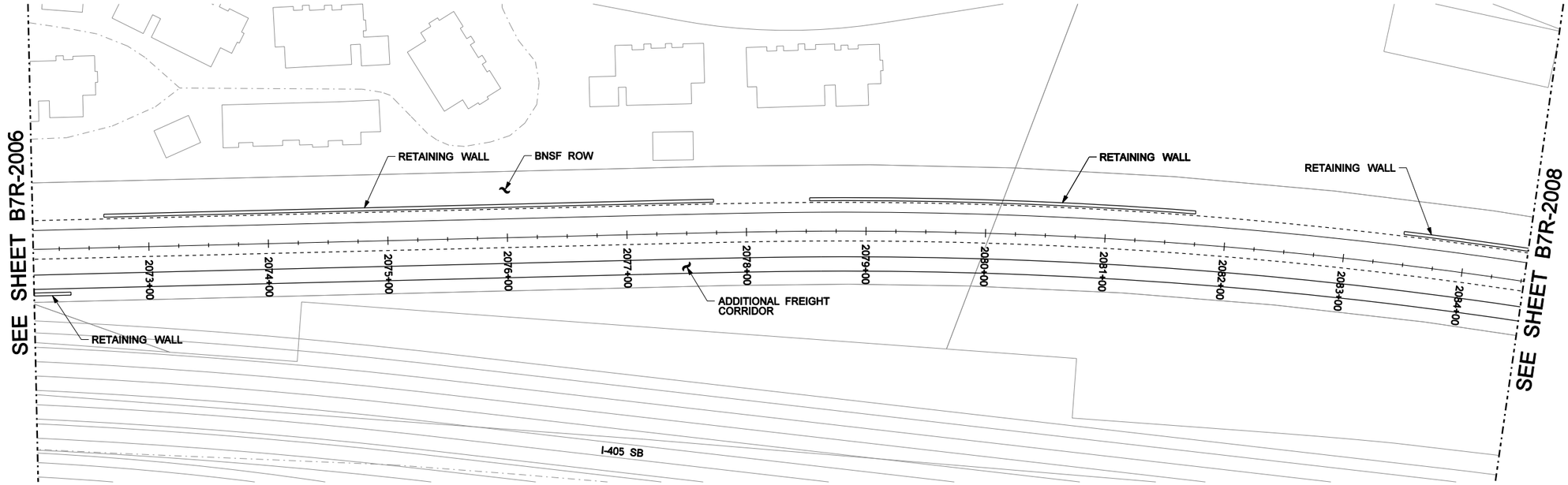
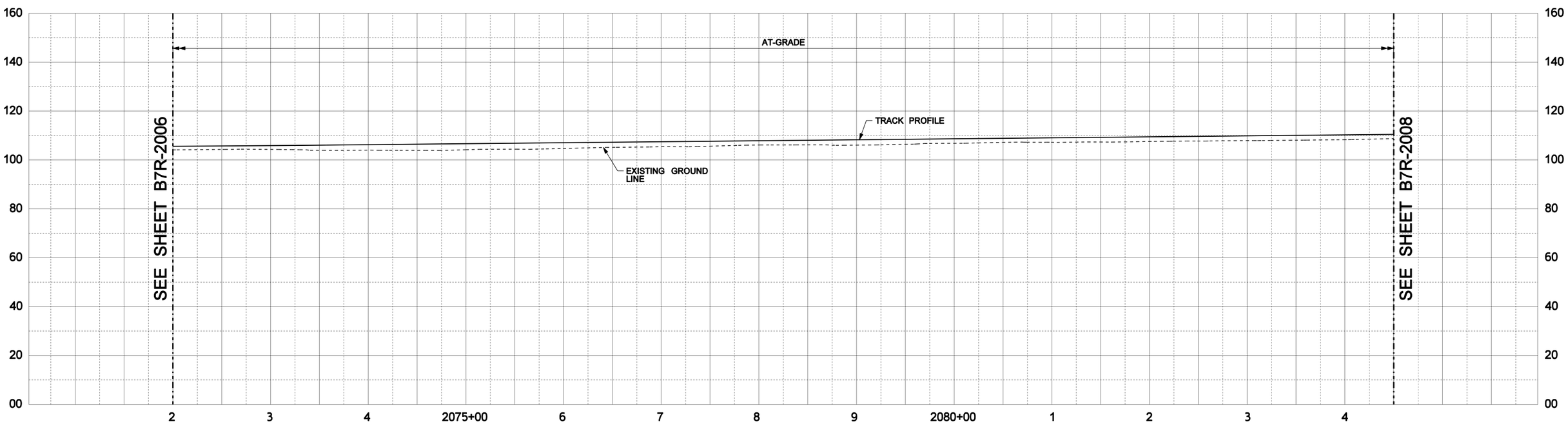


PLAN

VER. 1"=20' (20 0 20 40)

HOR. 1"=50' (50 0 50 100)



PROFILE

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CONTRACT NO. 215382
DRAWING NO. B7R-2007
SCALE AS SHOWN
SHEET NO. 2007

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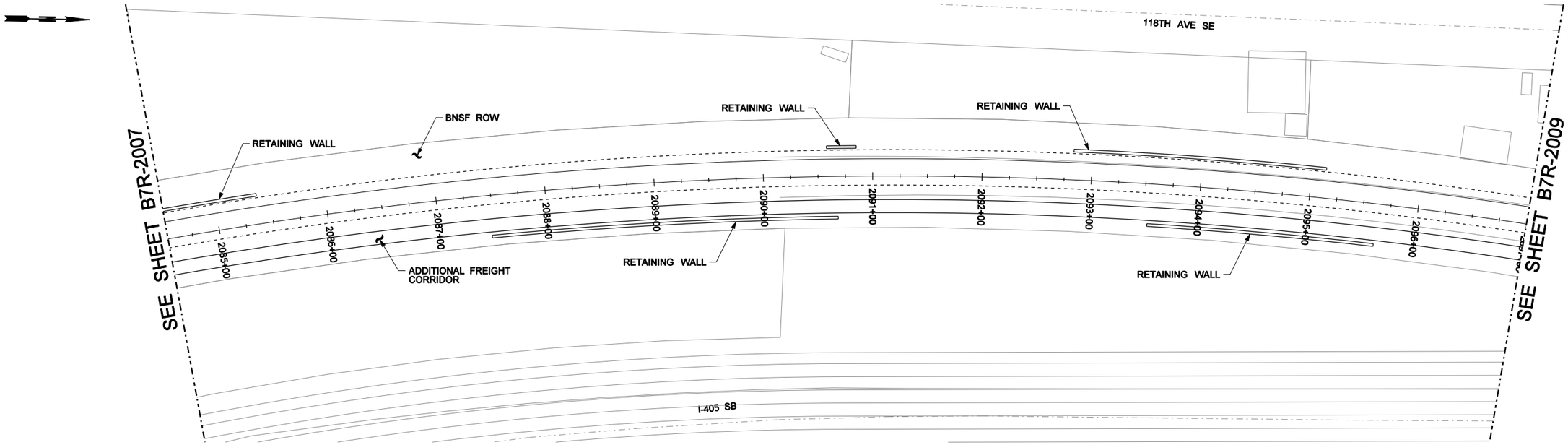
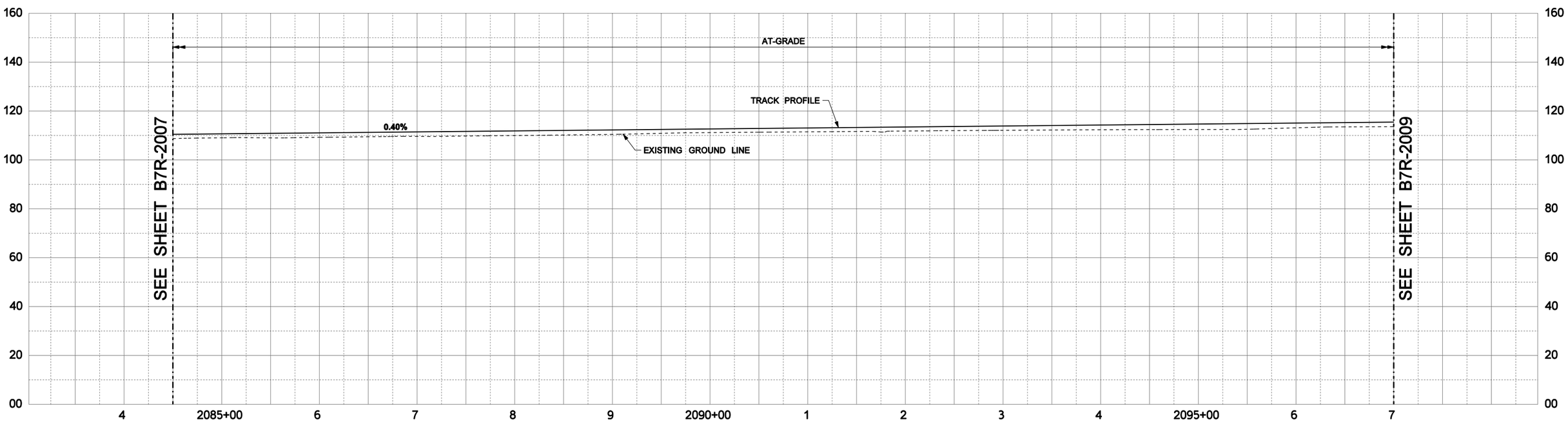


PLAN

VER. 1"=20' (20 0 20 40) HOR. 1"=50' (50 0 50 100)



PROFILE

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STA. 2084+50 TO 2097+00

CONTRACT NO. 215382
DRAWING NO. B7R-2008
SCALE AS SHOWN
SHEET NO. 2008

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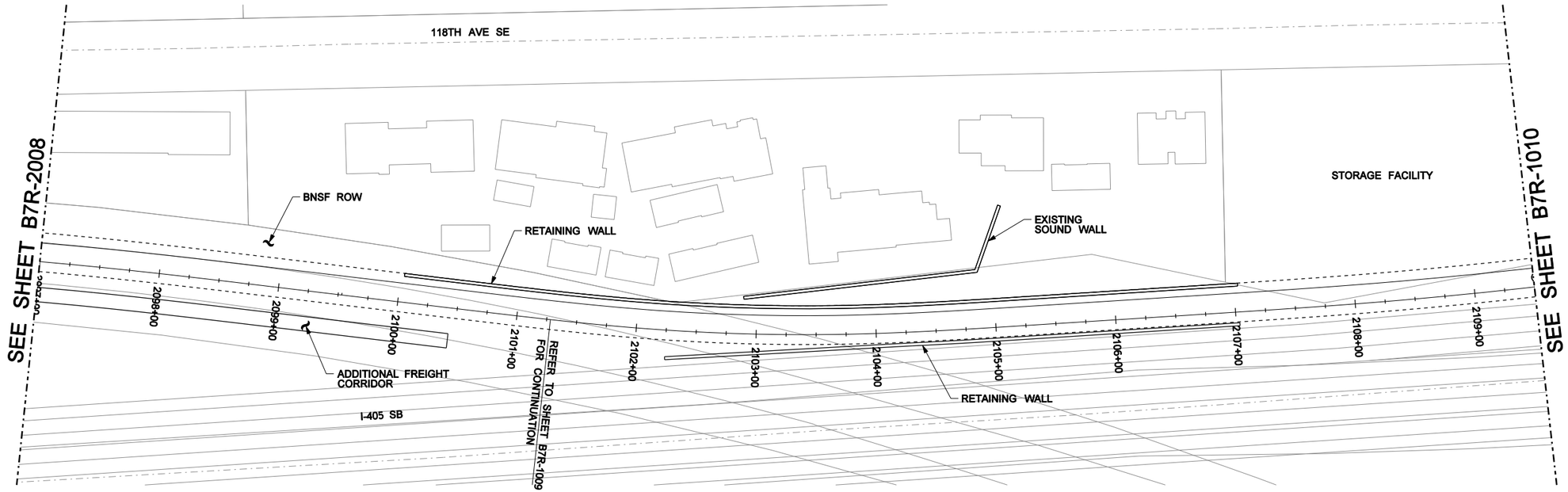
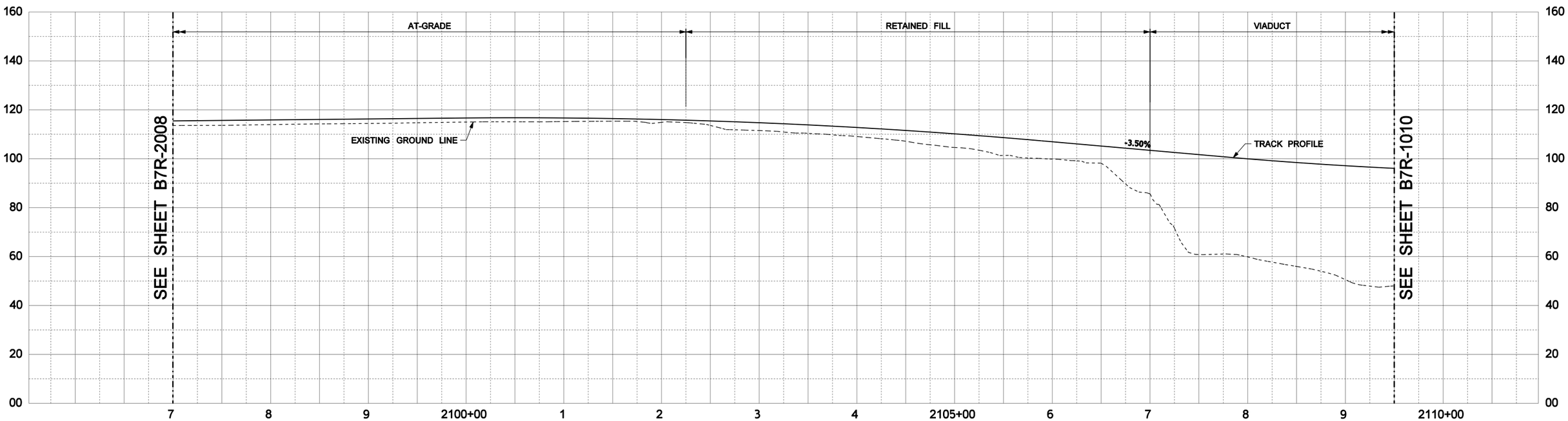


PLAN

VER.1"=20' (20 0 20 40) HOR.1"=50' (50 0 50 100)



PROFILE

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CONTRACT NO. 215382
DRAWING NO. B7R-2009
SCALE AS SHOWN
SHEET NO. 2009

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