

**Strathcona County
Yellowhead North Arterial Road
Functional Design Study**

Final Report

113531005



1 December 2009



Stantec

Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB T5K 2L6
Tel: (780) 917-7000

December 02, 2009
File: 113531005

Strathcona County
2001 Sherwood Drive
Sherwood Park, Alberta T8A 3W7

Attention: Dave Friesen

Dear Sir:

**Reference: Yellowhead North Arterial Road
Functional Design Study
Final Report**

We are pleased to submit 5 copies of Final Report for the Yellowhead North Arterial Road Functional Design Study. We also have attached a PDF copy of the report and the drawing files for the Recommended Plans, Right-of-Way Drawings and Railway Crossing Drawings.

We thank you for the opportunity to have been of service on this project.

Sincerely,

STANTEC CONSULTING LTD.

Carl Clayton, P.Eng. P.E. PTOE
Senior Vice President
Tel: (780) 917-7188
Fax: (780) 969-2024
carl.clayton@stantec.com




Stantec

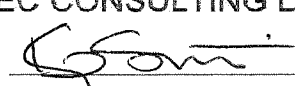
CORPORATE AUTHORIZATION

This document entitled "Strathcona County Yellowhead North Arterial Road – Functional Design Study" was prepared by Stantec Consulting Ltd. for the account of Sturgeon County. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

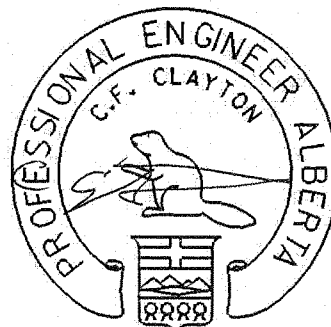
Prepared by:



Carl Clayton, P.Eng. P.E. PTOE

<p>PERMIT TO PRACTICE STANTEC CONSULTING LTD.</p> <p>Signature </p> <p>Date <u>2009 12 04</u></p> <p>PERMIT NUMBER: P 0258</p> <p>The Association of Professional Engineers, Geologists and Geophysicists of Alberta</p>
--

Corporate Permit



4 Dec 2009

Engineer: Carl Clayton, P.Eng. P.E. PTOE

Table of Contents

1.0 INTRODUCTION	1.1
1.1 STUDY AREA	1.1
1.2 EXISTING ROADWAY NETWORK CONDITIONS	1.1
2.0 TRAFFIC VOLUME PROJECTIONS	2.1
2.1 BACKGROUND	2.1
2.2 MODELING	2.5
2.3 ROADWAY CROSS-SECTION REQUIREMENTS	2.5
2.4 INTERSECTION REQUIREMENTS	2.6
2.4.1 Township Road 534	2.6
2.4.2 Range Road 231	2.6
2.5 RAIL CROSSINGS	2.6
2.5.1 Rail Crossing Warrants	2.6
2.5.2 CN Rail Crossings	2.7
2.5.3 CP Rail Crossings	2.7
3.0 DEVELOPMENT OF THE RECOMMENDED ROADWAY NETWORK	3.1
3.1 DESIGN CRITERIA AND CONSTRAINTS	3.1
3.2 OPTIONS	3.2
3.3 PUBLIC CONSULTATION	3.2
4.0 RECOMMENDED PLANS	4.1
4.1 TYPICAL CROSS-SECTION	4.1
4.2 RANGE ROAD 232	4.1
4.3 RANGE ROAD 231	4.2
4.4 TOWNSHIP ROAD 534	4.3
4.5 RAIL CROSSINGS	4.3
4.6 FUTURE WORK AND REGULATORY APPROVALS	4.4
5.0 UTILITIES	5.1
5.1 RANGE ROAD 232	5.1
5.2 RANGE ROAD 231	5.1
5.3 TOWNSHIP ROAD 534	5.1
5.4 HIGHWAY 21	5.2
6.0 STRUCTURES	6.1
6.1 OLDMAN CREEK	6.1
6.1.1 Alternatives	6.1
6.1.2 Township Road 534 Crossing	6.1
6.1.3 Range Road 231 Crossing	6.1
6.2 RAIL GRADE SEPARATIONS	6.2

YELLOWHEAD NORTH ARTERIAL ROAD FUNCTIONAL DESIGN STUDY

Table of Contents

6.2.1	Township Road 534 and the CP Rail Track.....	6.2
6.2.2	Range Road 231 and CN Track.....	6.3
6.2.3	Range Road 232 and CN Track.....	6.3
<hr/>		
7.0	STAGING.....	7.1
8.0	COST ESTIMATES	8.1
APPENDIX A – TRAFFIC VOLUME PROJECTIONS		
APPENDIX B – OVERALL NORTH OF YELLOWHEAD MASTER DRAINAGE PLAN		
APPENDIX C – GEOTECHNICAL REPORT		
APPENDIX D – ENVIRONMENTAL OVERVIEW UPDATE		
APPENDIX E – RAIL CROSSING PLANS		
APPENDIX F - COST ESTIMATES		
APPENDIX G - RIGHT-OF-WAY PLANS		

1.0 Introduction

1.1 STUDY AREA

The Yellowhead North area is bounded by Highway 16 on the south, Range Road 232 on the west, Highway 21 on the east and Township Road 534 on the north. Figure 1.1 illustrates the Study Area, surrounding context and plans for Highway 16 in this area.

The Study Area is mostly in agricultural use except for:

- Range Road 232 where there is a significant amount of industrial development along both sides of the roadway
- Industrial development along most of the west side of Range Road 231.
- Adjacent to Township Road 534 and in the vicinity of the Oldman Creek crossing there is a country residential development as well as some other dwellings scattered along the banks of the Oldman Creek.

Plans for the area envisage that, with the exception of the existing country residential development along Township Road 534 near the crossing of Oldman Creek, the area will be developed for industrial uses.

1.2 EXISTING ROADWAY NETWORK CONDITIONS

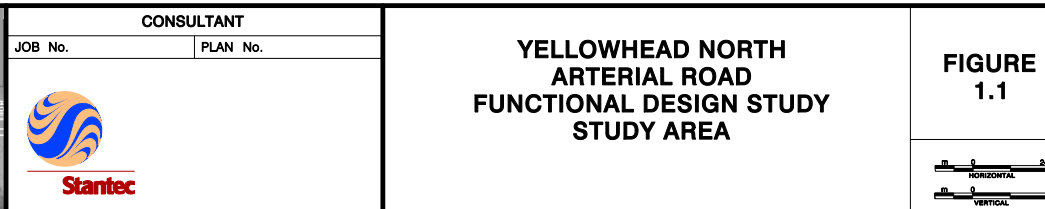
Highway 16 is a four lane divided highway with limited access. Within the Study area, all-directional access to Hwy 16 is available at Highway 21 and Range Road 231. Range Road 232 access currently exists as a right-in/right-out configuration in the eastbound direction and as a right-off facility in the westbound direction. Alberta Transportation will eventually upgrade the Range Road 232 / Highway 16 intersection to a diamond interchange as per the Highway 16 Functional planning Study completed in 2000.

Highway 21 is a two lane highway, which Alberta Transportation envisages will ultimately be a four lane divided highway with limited access. Within the Study Area there is currently all-directional access available at Highway 16 and at Township Road 534. Alberta Transportation does not envisage additional access points to Highway 21 between Highway 16 and the current intersection location of Township Road 534.

Within the Study Area, both Range Road 231 and Township Road 534 are 7 to 8 metres wide rural roads with a cold mix top. They are not designed to accommodate substantial traffic from both a volume and an axle loading perspective. They both currently need some level of upgrading to address current development in the area.

8/7/2009

8/7/2009 W:\active\113531005\3-planning\func\3-1-planning\Options\intc-cutsheet-overall.dq



Range Road 232 was rebuilt in 2000 to the first half of a four lane divided cross-section from Highway 16 to the CP Rail crossing. Upgrading of the next section of Range Road 232 to approximately 400 metres south of Township Road 534 in a similar manner is scheduled for the summer of 2009.

2.0 Traffic Volume Projections

2.1 BACKGROUND

The Edmonton Regional Model for the Year 2041 estimates that there will be 893 employment opportunities in the Study Area. However, more recent estimates provided by Strathcona County suggest there will be some 13,200 employment opportunities in the Study Area. Given the substantial differences in assumptions, use of the Edmonton Regional Model to develop a submodel for the Study Area was not considered to be a viable option.

The Strathcona County 2007/2008 Transportation Model Update was ongoing at the time of this study and was used as a source of base assumptions for the traffic volume predictions generated as part of this study. Specific relevant assumptions are as follows:

- Full build out of the area north of Highway 16 and east of Range Road 232 is based on a horizon year of approximately 2100 and includes a major new urban node in this area.
- Development of Strathcona County's new urban node will occur north of the Yellowhead North area (Northwest Node) and east of Highway 21 and north of Highway 16 (Northeast Node). The assumed population of the Northwest Node is approximately 25,700 with approximately 12,700 employment opportunities and the assumed population of the Northeast Node is 102,000 with approximately 51,000 employment opportunities.
- The Edmonton Regional model has some 31,000 employment opportunities in the Arum Industrial area to the west of the Study Area.
- Through traffic volumes on Highway 16 and Highway 21 are relatively low and will grow at a simple annual rate of 2.5% for the next 90 years.
- Distribution of traffic is:

City of Edmonton – 47%
Sherwood Park - 22%
North – 18%
East – 4%
South - 9%

Figure 2.1 summarizes the overall population and employment projections for the Study Area and surrounding areas. Tables 2.1, 2.2 and 2.3 summarize the assumed employment opportunities, the peak hour trip generation rates and inbound/outbound trip ratios used for the Study Area.

Table 2.1
Yellowhead North Area Land Uses and Trip Generation Totals

Land Use	Employment Opportunities	AM Peak Hour					PM Peak Hour				
		Original Trip Rate	Adjusted Trip Rate	In Trips	Out Trips	Total Trips	Original Trip Rate	Adjusted Trip Rate	In Trips	Out Trips	Total Trips
Retail	880	1.05	0.945	732	100	832	2.38	2.142	396	1,489	1,885
Service	1,760	0.90	0.810	1,255	171	1,426	0.90	0.810	300	1,126	1,426
Other	10,560	0.42	0.378	3,513	479	3,992	0.42	0.378	838	3,154	3,992
Total	13,200	-	-	5,500	750	6,250	-	-	1,534	5,769	7,303

Note: For this study, the original trip rates utilized in previous studies (i.e. 1.05 for retail, 0.9 for service and 0.42 for other jobs in AM) have been reduced by 10% to reflect anticipated higher shuttle bus users in the Long Term.

Table 2.2
City of Edmonton Aurum Industrial Area Land Uses and Trip Generation Totals

Land Use	Quantity	AM Peak Hour					PM Peak Hour				
		Original Trip Rate	Adjusted Trip Rate	In Trips	Out Trips	Total Trips	Original Trip Rate	Adjusted Trip Rate	In Trips	Out Trips	Total Trips
Population	12	0.28	0.25	1	2	3	0.31	0.28	2	1	3
Employment	31,000	0.42	0.378	10,312	1,406	11,718	0.42	0.378	9,257	2,461	11,718
Total	-	-	-	10,313	1,408	11,721	-	-	9,259	2,462	11,721

Note: In addition to the 10% trip rate reduction referenced in Table 2.1, all the employment positions are assumed as “other jobs” and the corresponding trip rate (0.378) was adopted. (The large amount of employment estimated for Aurum Industrial Area, suggested the use of the lower trip rate was likely reasonable).

Table 2.3 Strathcona County NE Future Urban Growth Node Land Uses and Trip Generation Totals

Land Use			Quantity	AM Peak Hour					PM Peak Hour				
				Orig. Rate	Adj. Rate	In Trips	Out Trips	Total Trips	Orig. Rate	Adj. Rate	In Trips	Out Trips	Total Trips
NE Node	Population		101,725	0.28	0.25	7,121	18,310	25,431	0.31	0.28	18,229	10,254	28,483
	Employment	Retail Jobs	15,951	1.05	0.998	8,910	7,001	15,911	2.38	2.261	18,033	18,033	36,066
		Service Jobs	9,348	0.90	0.855	6,873	1,120	7,993	0.90	0.855	1,359	6,634	7,992
		Other Jobs	25,673	0.42	0.399	9,015	1,229	10,244	0.42	0.399	2,152	8,092	10,244
		Sub Total	50,971	-	-	24,798	9,350	34,148	-	-	21,543	32,759	54,302
	Total Trips		-	-	-	31,919	27,660	59,579	-	-	39,772	43,013	82,785
NW Node	Population		25,660	0.28	0.25	1,796	4,619	6,415	0.31	0.28	4,598	2,587	7,185
	Employment	Retail Jobs	4,795	1.05	0.998	2,678	2,104	4,782	2.38	2.261	5,421	5,421	10,841
		Service Jobs	1,419	0.90	0.855	1,068	145	1,213	0.90	0.855	158	1,007	1,165
		Other Jobs	6,489	0.42	0.399	2,227	363	2,590	0.42	0.399	543	2,045	2,589
		Sub Total	12,703	-	-	5,973	2,613	8,585	-	-	6,122	8,473	14,595
	Total Trips		-	-	-	7,769	7,232	15,000	-	-	10,720	11,060	21,780

Note: During the study of the future urban growth node TIA, an assumed 10% and 5% trip rate reduction for residential and employment areas, respectively, was used to reflect higher transit (like LRT) and work-at-home users in the Long Term. Based on the land use concept plan/assumption that the employment-to-population ratios at the two future urban growth nodes are about 0.39 to 0.40, the residential trips are assumed 55% internal and 45% external trips, which brings the external trips for all combined land uses are about 32% of the total trips generated by the future urban growth nodes.

YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
POPULATION AND
EMPLOYMENT PROJECTIONS



2.2 MODELING

Modeling of traffic was done using the VISUM Version 10.03 model and was done concurrently with the Strathcona County 2007/2008 Transportation Model Update, which used the same modeling software. The model assigns traffic to the shortest route and is unconstrained by capacity limitations. There are a number of differences between this model and the Edmonton Regional Model. These include:

- The connection of Range Road 232 to the future Outer Ring Road.
- Connection of Township Road 533 across Highway 21 to Range Road 231 where it terminates. Township Road 533 from Range Road 231 to Range Road 232 is not envisaged as part of the plan.

Modeling was done in an iterative approach with four major components as follows:

- Background through traffic estimates for the Year 2100 (Full Build Out)
- Arum Industrial Area
- New Urban Node
- Yellowhead North Area

Projected Link and Intersection Turning Movement Volumes for the AM and PM Peak Hours for each of these components as well as the Background Traffic Volumes contained in Appendix A. Note that the Background Traffic Volumes are the volumes contained in the Regional Model and are not actual traffic count volumes. The PM traffic volumes are expected to represent approximately 10% of the daily traffic volume.

Figures 2.2 through 2.6 summarize the Daily, AM and PM Peak Hour Link Volumes and the AM and PM Peak Hour Turning Movement Volumes at key intersections.

2.3 ROADWAY CROSS-SECTION REQUIREMENTS

Basic roadway cross-section requirements were defined on the basis of projected AADTs and cross checked by a review of lane requirements at key intersections. It was assumed based on typical conditions in the metropolitan Edmonton area that a six-lane cross-section is adequate to accommodate AADTs up to a range of 50,000 to 60,000. Similarly a four-lane cross-section is adequate to accommodate AADTs up to a range of 35,000 to 40,000.

Long-term projected traffic volumes suggest that protection for an ultimate six-lane cross-section is advisable for the south half of Range Road 231 and Range Road 232 and for most of Township Road 534 within the Study Area. For the north portions of Range Road 231 and Range Road 232, a four-lane cross-section is likely adequate. The limits of these sections will

PLAN DESCRIPTION YELLOWHEAD NORTH ARTERIAL ROAD FUNCTIONAL DESIGN STUDY DAILY LINK VOLUMES										BAR CODE	
REVISION		BY	DATE	SURVEYED		BY	DATE	PHOTO No.		PLAN No.	INTERSECTION ID
				DESIGNED				TITLE SEARCH		CONTRACT No.	
				CHECKED				DATE		GRAPHICS FILE	

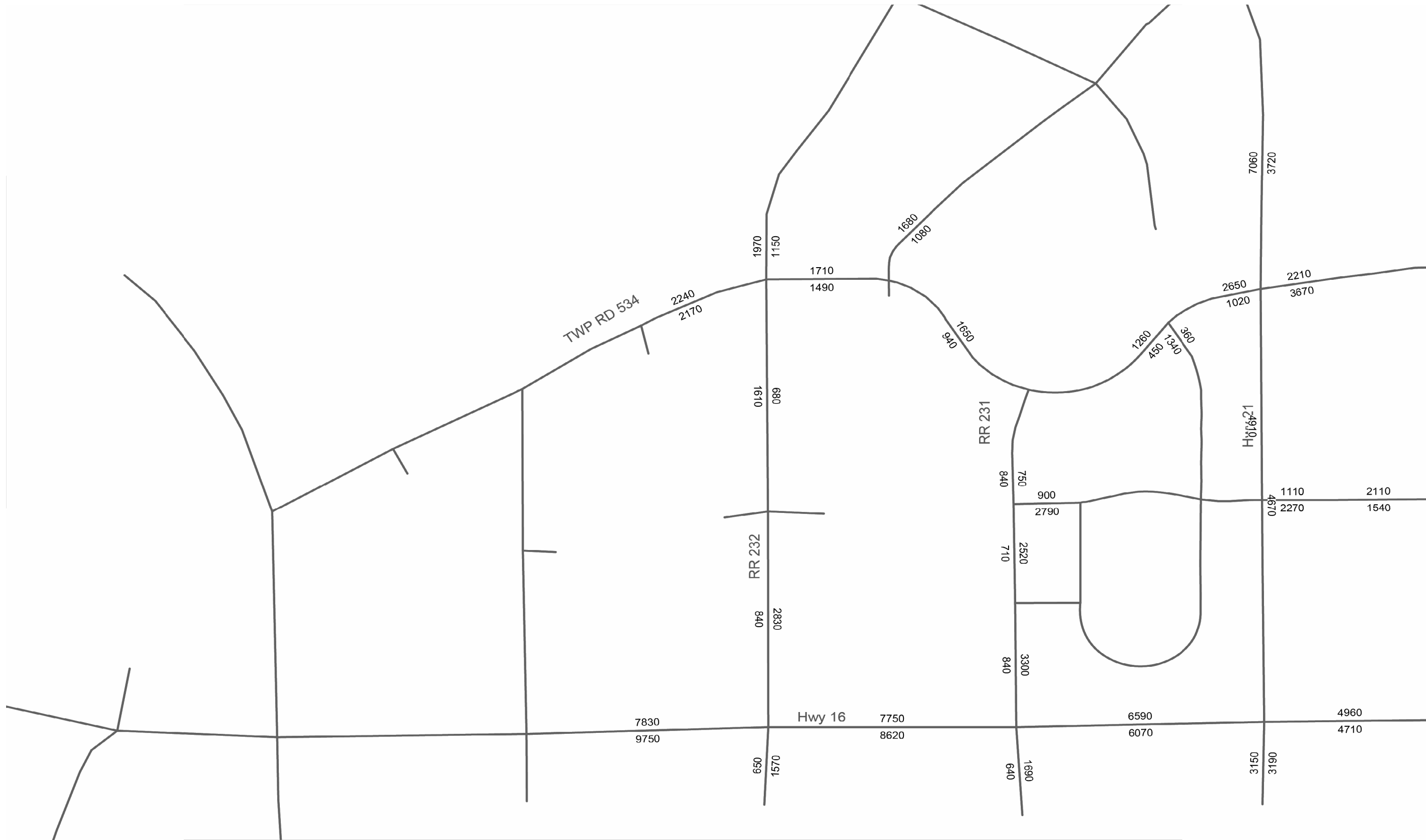
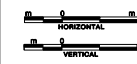
No.	REVISION	BY	DATE

**YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
AM PEAK HOUR
LINK VOLUMES**



FIGURE 2.3

JOB No. 113531005



No.	REVISION		BY	DATE	SURVEYED		BY	DATE	PHOTO No.	PLAN No.	BAR CODE		PLAN DESCRIPTION YELLOWHEAD NORTH ARTERIAL ROAD FUNCTIONAL DESIGN STUDY PM PEAK HOUR LINK VOLUMES
					DESIGNED				TITLE SEARCH	CONTRACT No.			
					CHECKED				DATE	INTERSECTION ID			
					DRAWN				GRAPHICS FILE				

YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
PM PEAK HOUR
LINK VOLUMES



FIGURE
2.4

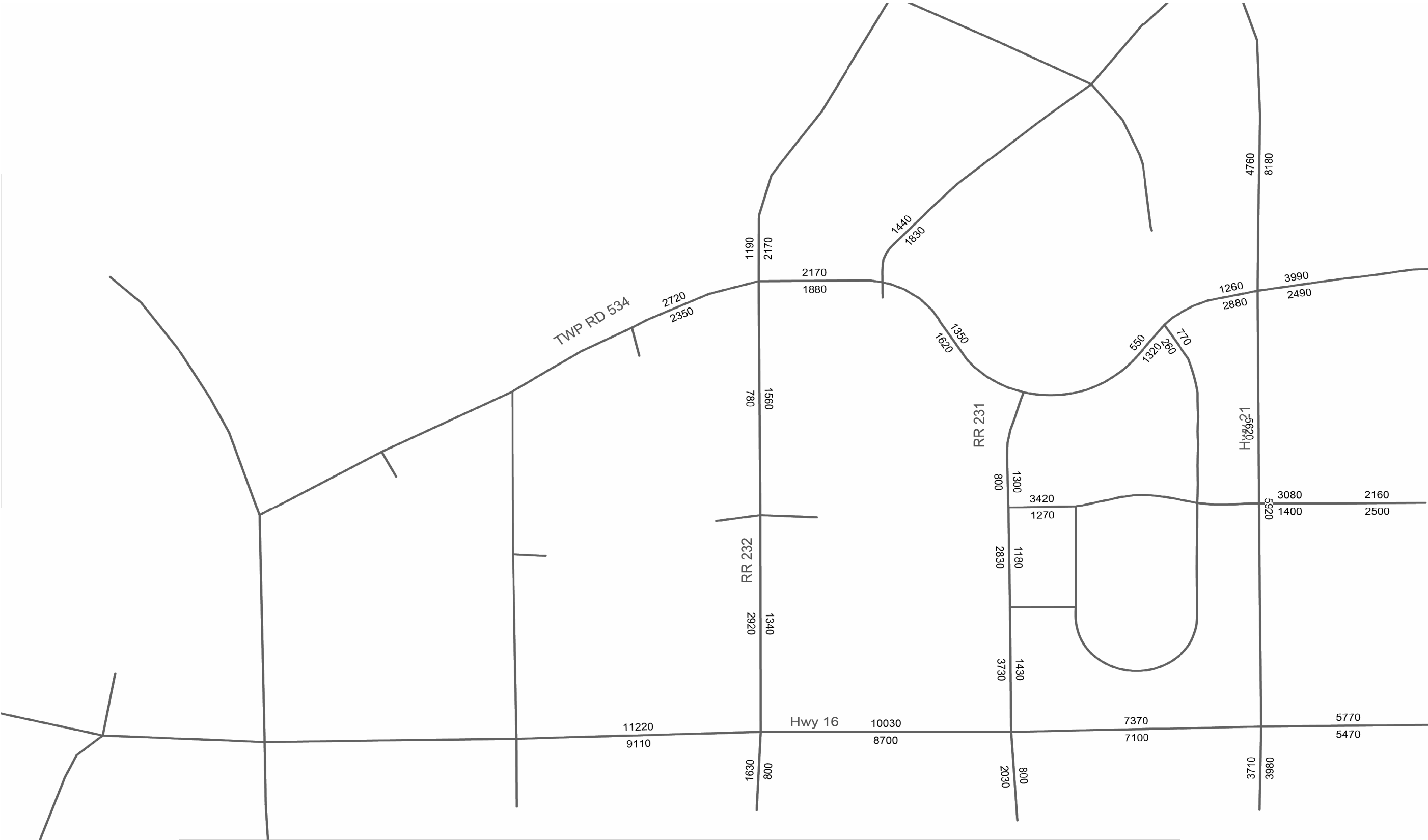
JOB No. 113531005

0 100 200

HORIZONTAL

0 100 200

VERTICAL



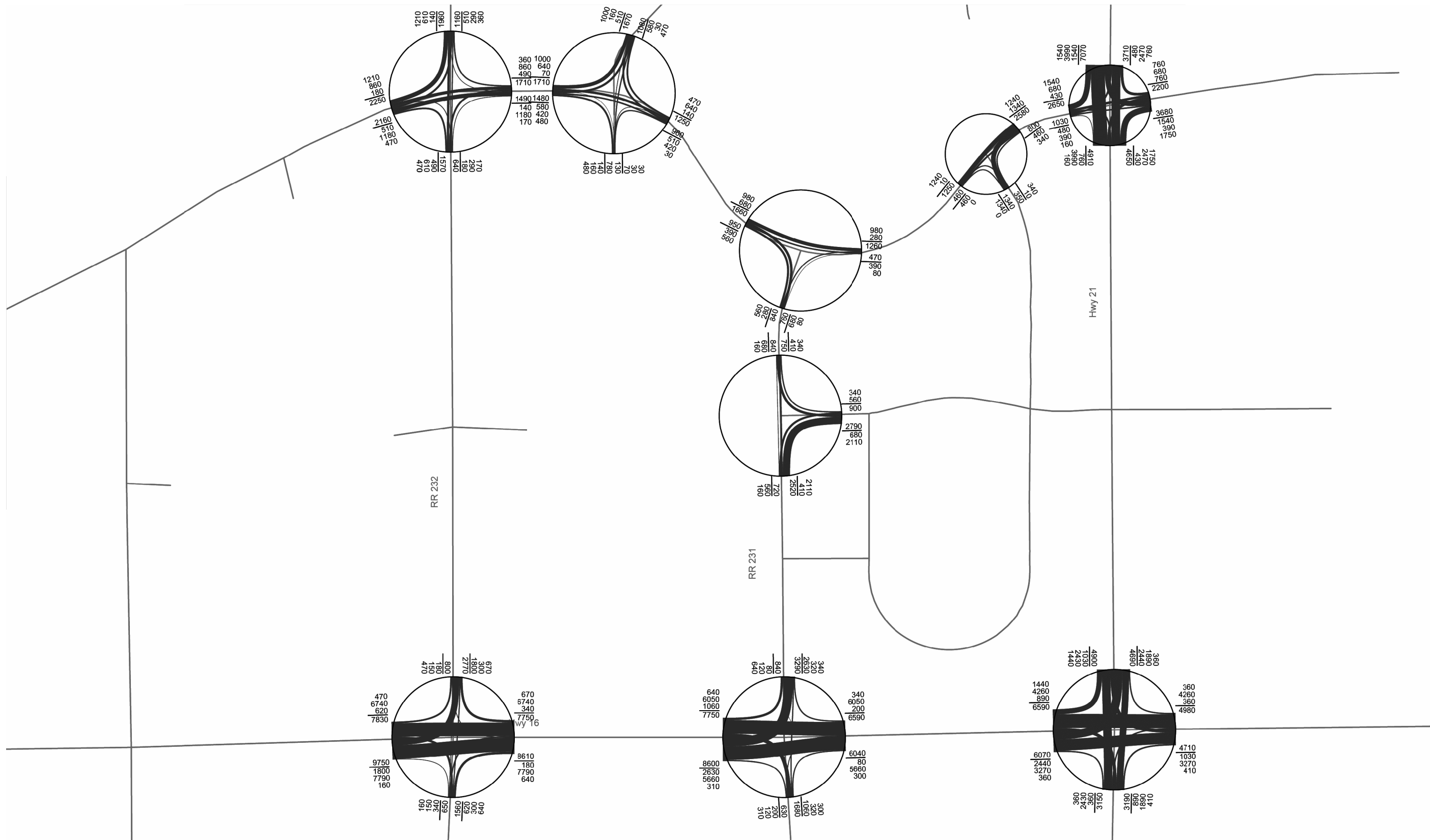
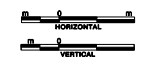
No.	REVISION	BY	DATE

**YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
AM PEAK HOUR
TURNING MOVEMENT VOLUMES**



FIGURE 2.5

JOB No. 113531005





depend on the location of intersections and access points to major employment generators. As noted below, the configuration requirements of the Range Road 231 and Township Road 533 intersection, suggest that the six-lane cross-section should start at this intersection and continue south to Highway 16.

Notwithstanding the recommended roadway cross-section requirements, given the uncertainty around future traffic projections, it is recommended that adequate right-of-way be acquired or protected for a six lane cross-section in all cases.

2.4 INTERSECTION REQUIREMENTS

2.4.1 Township Road 534

Turning movements onto and off of Township Road 534 are significant and as a basic premise dual left turn lanes will likely be required for one or more movements at each intersection. Particular attention will need to be paid to the Township Road 534 and Range Road 232 intersection. Even with a six-lane cross-section and dual left turn lanes in all directions there are several left turn movements that will be problematic, primarily due to the projected large eastbound to northbound movement in the PM Peak Hour. The desirable intersection configuration could potentially include a directional left turn ramp to accommodate this movement. However, this leg of the intersection is in the City of Edmonton and right-of-way is somewhat constrained and the directional left turn ramp option is not considered practical at this time.

2.4.2 Range Road 231

Township Road 533, which is proposed to cross over Highway 21 and connect with Range Road 231, is expected to attract significant traffic volumes entering and exiting the New Urban Node east of Highway 21. Very high right turn movements off of Range Road 231 onto Township Road 533 in the AM Peak Hour and left turn movements off of Township Road 533 onto Range Road 231 in the PM Peak Hour will necessitate triple left turns in the westbound direction and dual right turn lanes in the northbound direction to provide reasonable levels of service.

2.5 RAIL CROSSINGS

2.5.1 Rail Crossing Warrants

Where roadway vehicle and train traffic volumes (cross product of the volumes), sight lines and train speeds warrant, flashing lights and in most cases gates are provided as crossing protection.

Provision of grade-separated crossings is typically recommended when the cross product of the Average Annual Daily Traffic (AADT) and the number of trains exceeds 200,000.

2.5.2 CN Rail Crossings

Strathcona County is senior at both of the roadway crossings of the CN track. CN currently has 24 trains per day on its main line. Projected long-term traffic volumes on Range Road 231 and Range Road 232 (AADT of 40,000 to 50,000) clearly warrant the provision of grade-separated crossings. Even excluding traffic generated by the Aurum Industrial Area and the New Urban Node, development in the Study Area is sufficient in itself to generate traffic volumes that will warrant the provision of grade-separated crossings.

2.5.3 CP Rail Crossings

Strathcona County is senior at both of the roadway crossings of the CP Rail track. CP Rail currently has 6 to 8 trains per day on its line, but expects that to increase to 13 to 16 trains per day by 2012 as industrial development in the Fort Saskatchewan area continues. Long-term traffic volumes on Range Road 232 and Township Road 534 (AADT of 20,000 to 30,000) suggest that grade-separated crossings will be warranted, if the number of trains per day increases as projected. It should be noted that once roadway traffic volumes generated by the New Urban Node are excluded from the long-term traffic volumes, the AADT at the CP Rail crossings on both Range Road 232 and Township Road 534 drop to approximately 10,000. At this AADT, grade-separated crossings would not be warranted even with the projected growth in the number of trains per day.

3.0 Development of the Recommended Roadway Network

3.1 DESIGN CRITERIA AND CONSTRAINTS

In developing the Design Criteria and Recommended Plans the following studies were consulted:

- North of Yellowhead Engineering Design Brief by Morrison Hershfield, August 2006
- Range Road 232 Pre-Design Report by Infrastructure Systems Ltd., September 2000
- Highway 16 Functional Planning Study – West of 17 Street W. to East of SH 824 for Alberta Infrastructure by Infrastructure Systems Ltd., December 2000
- North of Yellowhead Master Drainage Plan by Sameng Inc., March 2006

The overall drainage plan for the study area prepared as part of the Sameng study is contained in Appendix B.

The following reports were prepared as part of this study to provide guidance on geotechnical and environmental issues:

- Preliminary Geotechnical Investigation for Proposed Yellowhead North Arterial Road Functional Design Study by Golder Associates, May, 2009
- An Environmental Update for the Yellowhead North Arterial Road Functional Design Study by Westworth Associates Environmental Ltd, May , 2009

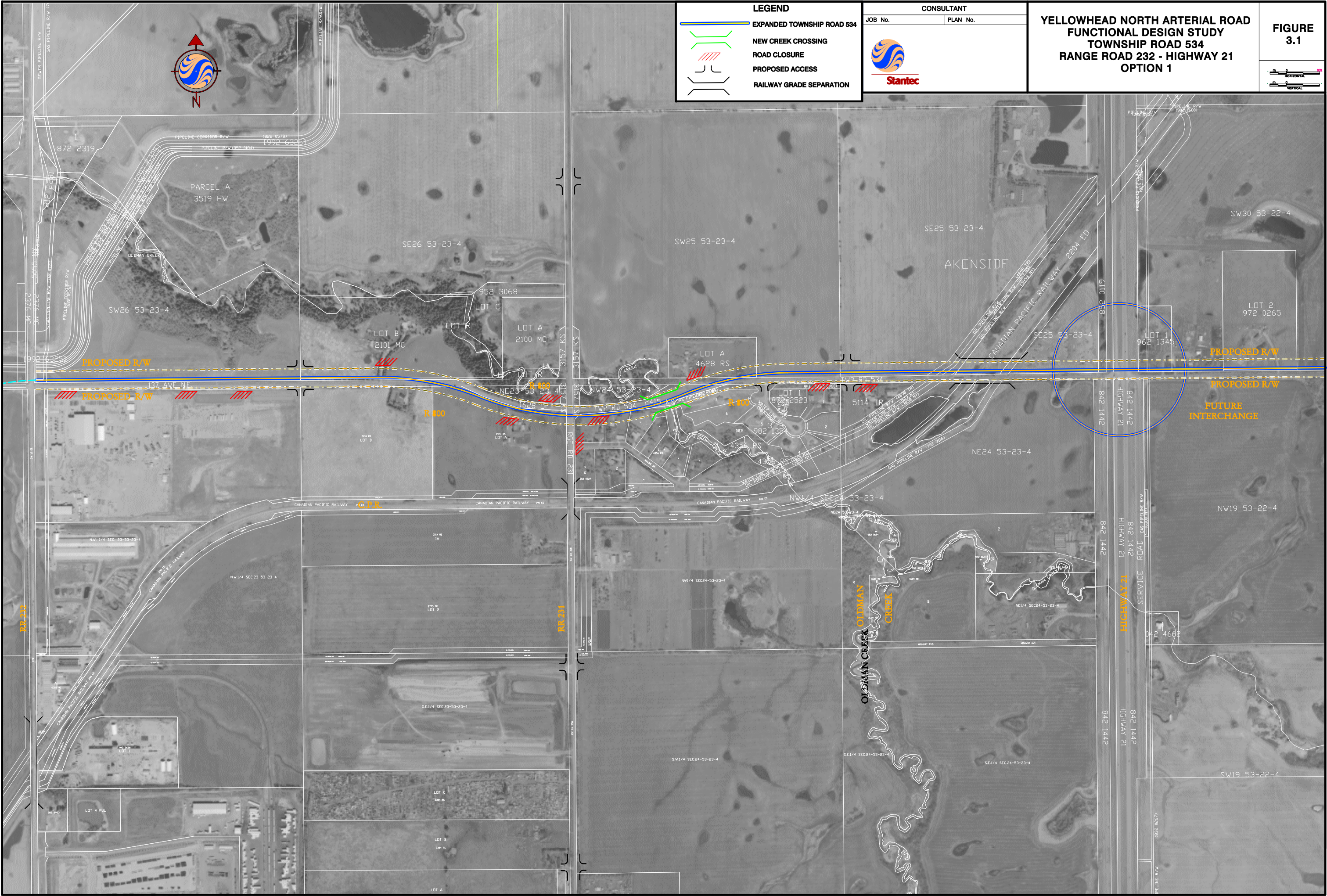
Copies of these reports are contained in Appendix C and D, respectively.

Specific constraints considered included:

- Existing right-of-ways recently established along Range Road 232
- The proposed alignment of Township Road 534 (137 Avenue) west of Range Road 232
- The existing industrial development along the south side of Township Road 534 immediately east of Range Road 232
- The existing residential development along Township Road 534 in the vicinity of Oldman Creek
- Existing developments along the west side of Range Road 231 between Hwy 16 and Township Road 534

No.	REVISION		BY	DATE	SURVEYED DESIGNED CHECKED DRAWN	BY	DATE	PHOTO No. TITLE SEARCH DATE GRAPHICS FILE	COORDINATE DATA			PLAN No. CONTRACT No. PLAN LOCATION	BAR CODE	PLAN DESCRIPTION	PROCESS TO IDMS TO GIS MICROFILMED	BY	DATE
										NAD 83	BASE LONGITUDE						

8/7/2009



LEGEND

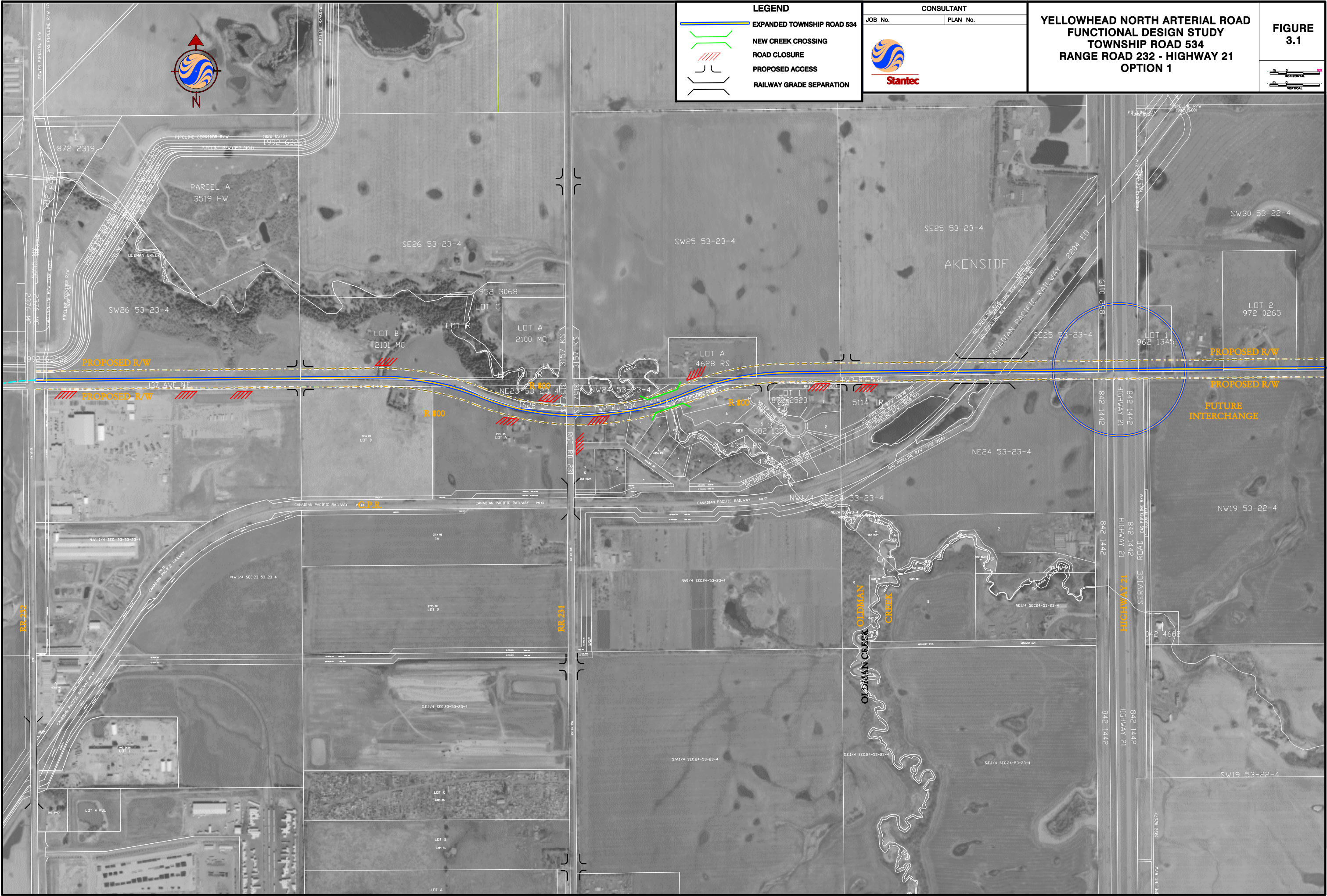
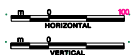
- EXPANDED TOWNSHIP ROAD 534
- NEW CREEK CROSSING
- ROAD CLOSURE
- PROPOSED ACCESS
- RAILWAY GRADE SEPARATION

CONSULTANT



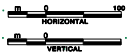
YELLOWHEAD NORTH ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
TOWNSHIP ROAD 534
RANGE ROAD 232 - HIGHWAY 21
OPTION 1

FIGURE
3.1



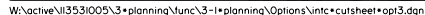
8/7/2009

8/7/2009 W:\active\113531005\3*planning\func\3-1*planning\Options\intc*cutsheet*opt2.dgn



8/7/2009

8/7/2009 W:\active\113531005\3-planning\func\3-1-planning\Options\intc-cutsheet-opt3.dgn



- Alberta Transportation's desire to limit access to Hwy 21 within the Study Area to one point within close proximity to the existing intersection of Township Road 534 with Hwy 21.
- A minimum all-directional intersection spacing of 800 metres and a minimum tee intersection spacing of 400 metres.
- A roadway design speed of 80 km/h combined with a maximum superelevation of 4% on curves to permit intersections to occur on the curves, thus limiting the minimum curve radius to 600 metres.

Discussions with Strathcona County staff resulted in the decision that left turn bays, right turn bays and acceleration lanes should have a 60 metres long taper and an 80 metres long bay.

3.2 OPTIONS

Three road network options were eventually developed based on the preceding criteria and constraints and are shown in Figure 3.1 through 3.3. All 3 options were considered acceptable from a road design perspective and had similar environmental impacts. The primary difference between the 3 options was the alignment of Township Road 534 and its impact on the existing residential development around the Oldman Creek area.

3.3 PUBLIC CONSULTATION

Options 1 and 2 were presented at an Open House at the County Building on 5 March 2008. While Option 2 was slightly preferred by the attendees at the Open House, there was concern that it did not adequately address land owner concerns. Option 3 was then developed and all 3 options presented at a second Open House at the County Building on 29 May 2008.

Based on input received at the Open Houses, there was landowner impacts associated with all 3 options, although Option 2, primarily because it provided the most separation of Township Road 534 and the existing residential development, was preferred by most stakeholders.

On 2 July 2008, Strathcona County Council was presented with the results of the two Open Houses. At that meeting, Council directed that planning to define the road right-of-way requirements be developed on the basis of Option 2. Figure 3.4 illustrates the recommended overall arterial roadway network based on Option 2 along with a possible conceptual road network for the undeveloped lands and how it could connect to the recommended arterial roadway network. A copy of this plan was provided via a mail-out to all stakeholders. Some minor revisions to alignments and access control were subsequently made to the recommended plan and are illustrated on the functional plans contained in Section 4.0.

8/7/2009

4.0 Recommended Plans

4.1 TYPICAL CROSS-SECTION

Figure 4.1 illustrates the basic right-of-way and roadway cross-section recommended for Range Road 231 and Township Road 534. It is based on the projected need to ultimately provide for up to six lanes with dual left turn lanes at major intersections and a bike path on one side. Where a service road is recommended, its location in relation to the arterial roadway is illustrated on the cross-section.

Cross section and right of way requirements for Range Road 232 were established in a study completed by Infrastructure Systems Ltd. in 2000. The recommendations outlined in this study appear appropriate, other than the possible long-term need for a six lane cross-section on Range Road 232 south of the CN Rail crossing.

Preliminary profiles developed as part of this study indicate that the roadway grading can be accommodated within the proposed right-of-way. For areas of large cut or fill, such as at water crossings and for railway grade separations, additional right-of-way will be required. The limit of these rights-of-way is shown on the recommended plan profiles. For those limited areas of minor cut and fill that cannot be accommodated within the proposed right-of-way, backsloping agreements or coordination of development grading plans are assumed to be possible and widening of the right-of-way will not be required.

4.2 RANGE ROAD 232

Strathcona County has been upgrading Range Road 232 over the last few years in a manner consistent with the plan prepared by Infrastructure Systems Ltd. in 2000. The recommended plan shown in Figures 4.2 through 4.4 is based on this plan from 2000 and ongoing construction to implement this plan. Significant recommended revisions to the plan developed in 2000 are:

- Based on the assumption that all-directional access to/from Highway 16 via an interchange will eventually be provided at this location, in the long-term, a six lane cross-section will likely be required from Turbo Drive (121 Avenue) to Highway 16. A shifting of the alignment of the centerline of Range Road 232 to the west will be required to avoid the need for right-of-way acquisition on the east side.
- A grade separation of the CNR tracks will present some conflicts with existing access points. Closure of some temporary or relocation of some existing access points will be required to avoid having intersections on steep grades.
- The configuration of the Range Road 232 / Township Road 534 (137 Avenue) intersection has been modified to reflect the City of Edmonton's current plans for 137 Avenue. In addition, the northbound to eastbound right turn cutoff has been modified to a

PLAN DESCRIPTION		BAR CODE		PLAN No.		CONTRACT No.		INTERSECTION ID		PHOTO No.		TITLE SEARCH		DATE		BY		SURVEYED		DESIGNED		CHECKED		DRAWN		REVISION		BY		DATE		No.	
YELLOWHEAD NORTH ARTERIAL ROAD ROAD FUNCTIONAL DESIGN STUDY TYPICAL SECTION																																	

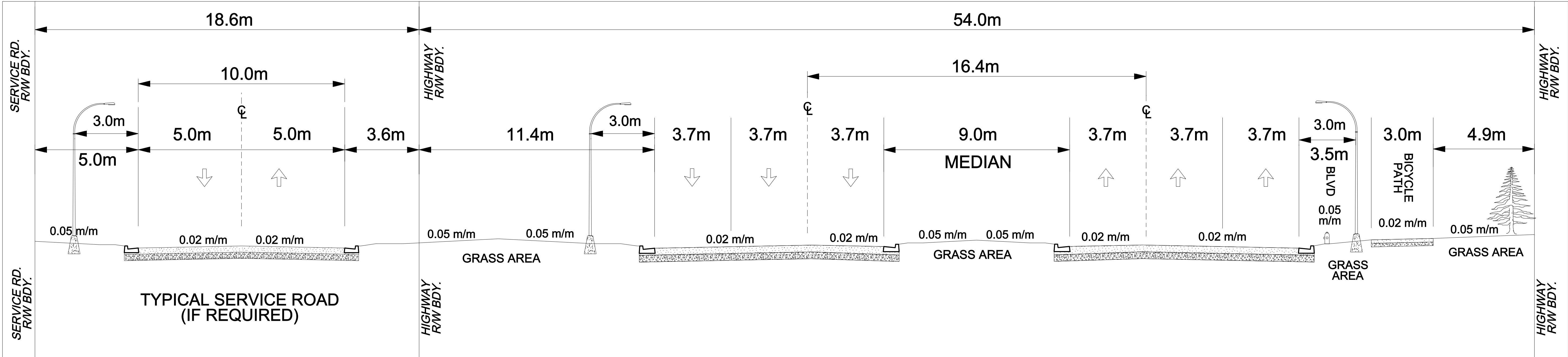
YELLOWHEAD NORTH ARTERIAL ROAD
ROAD FUNCTIONAL DESIGN STUDY
TYPICAL SECTION



FIGURE
4.1

JOB No. 113531005

1 m 0 2
HORIZONTAL 1:200



higher standard. This has minor right-of-way implications in the southeast quadrant of the intersection.

The overall drainage concept for Range Road 232 was defined in the plan prepared by Infrastructure Systems Ltd. in 2000, the North of Yellowhead Master Drainage Plan prepared by Sameng in 2006 and subsequent construction plans. No further work on drainage for Range Road 232 was done as part of this study.

4.3 RANGE ROAD 231

Figures 4.5 and 4.6 illustrate the recommended plan for Range Road 231 from Highway 16 to a realigned Township Road 534. Key features of the recommended plan include:

- The potential for a six lane cross-section from Highway 16 to Township Road 534.
- Two access points to the proposed light industrial development along the east side of Range Road 231 north of the CN tracks. The location of these access points is flexible within the design parameters described in Section 3.1 and the need to provide access to developments on the west side of Range Road 231.
- The location of the proposed intersection of the extension of Township Road 533 has been offset from the proposed access to the developments on the west side to create two tee intersections rather than one four legged intersection. Left turning movements from the extension of Township Road 533 onto Range Road 231 are projected to be quite high and the tee intersection approach will address this better than the four legged intersection approach.
- A service road is recommended along the west side of Range Road 231 from north of the CN tracks to Township Road 534. This service road will provide improved levels of access control, while maintaining access to the many existing developments along the west side of Range Road 231. Bulbing of the service roads to provide adequate storage for semi-trailers is required and does impact right-of-way requirements on some of the existing developments.

The overall drainage concept for Range Road 231 between Highway 16 and Township Road 534 was defined in the North of Yellowhead Master Drainage Plan prepared by Sameng in 2006. The Sameng plan appears to remain relevant with the proposed recommended plan and no further work on drainage for Range Road 231 was done as part of this study.

Figures 4.7 and 4.8 illustrate the recommended plan for Range Road 231 from Township Road 534 to the tie into the existing Range Road 231 north of Oldman Creek. Access to the existing residential developments to the east along Oldman creek is provided by retaining the existing Township Road 534 as a residential access with a connection to the relocated Range Road 231 at point just south of the structure crossing the Oldman Creek.

Existing property ownership, the close proximity of Oldman Creek to Township Road 534, desirable crossing locations of Oldman Creek in this area and the need to provide access along the south side of Township Road 534 and to the residential developments along Oldman Creek, placed significant constraints on the development of the recommended plan for how Range Road 231 to the north can connect to Township Road 534. While the radius and superelevation of the curve on Township Road 534 are such that they can accommodate a major intersection at the point it is illustrated, elimination of some of the constraints would allow for an improved recommended plan.

4.4 TOWNSHIP ROAD 534

Figures 4.9 to 4.12 illustrate the recommended plan for Township Road 534 from Range Road 232 to east of Highway 21. The recommended plan illustrates an at-grade intersection with the existing four lane divided cross-section of Highway 21 with service roads on both sides of Highway 21. The potential long-term interchange configuration for this intersection, including a westbound to southbound directional ramp, is also illustrated in Figure 4.13. While the interchange plan is believed to be conceptually acceptable to Alberta Transportation and likely adequate for defining right-of-way requirements and the location of access points to the east and west of the interchange ramps, it may be revised once Alberta Transportation prepares a functional plan for the interchange.

The recommended plan for Township Road 534 between Range Road 232 and Highway 21 reflects its need to be a high capacity arterial, while minimizing impacts on the existing residential development along Oldman Creek. The alignment reflects the design criteria outlined in Section 3.1 and provides a reasonable level of access control, while respecting the limits of the future grade separation over the CP Rail track and providing access to all adjacent lands in some manner.

The curvilinear alignment of Township Road 534 and constraints created by the desired design criteria, existing development, the desirable crossing location of Oldman Creek and the limits on the location of the intersection with Highway 21, results in a number of intersections occurring on curves. The illustrated intersection locations have been selected in an attempt to minimize the operational and safety impacts.

4.5 RAIL CROSSINGS

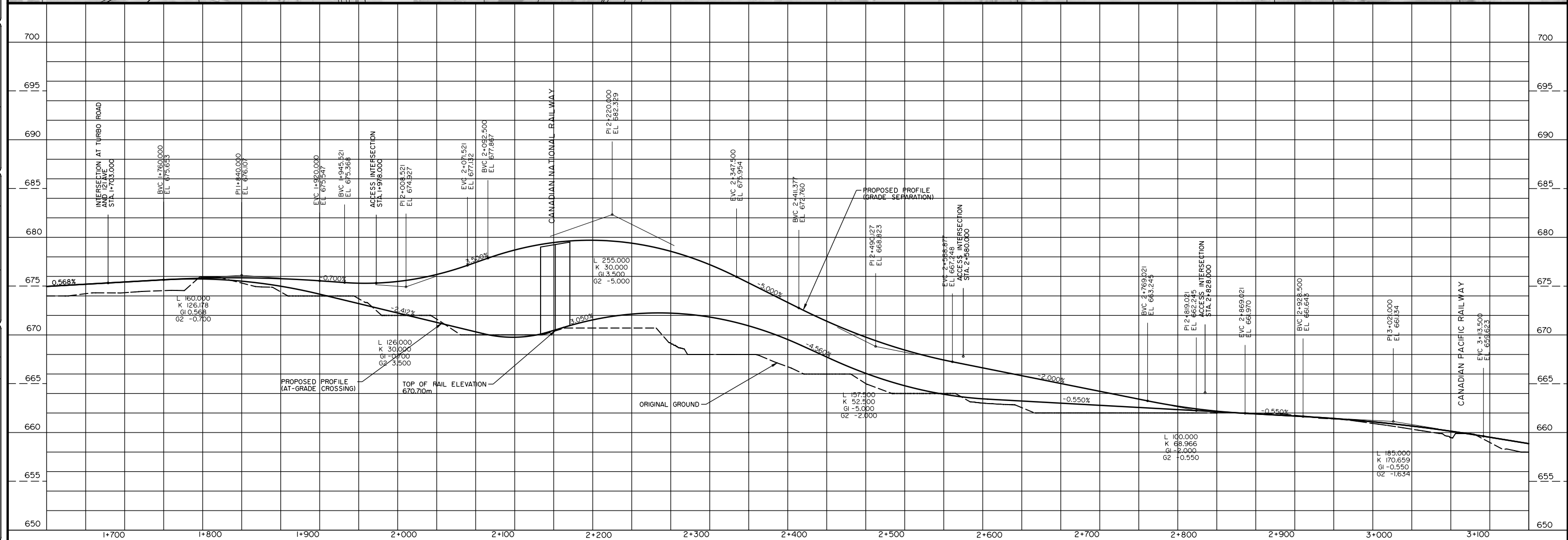
Upgrading of Range Road 232, Range Road 231 and Township Road 534 will all result in the need for new or improved at-grade railway crossings. Rail crossing application drawings, based on the ultimate roadway cross-section were developed as part of this study and are contained in Appendix E. They will need to be modified to address the particular requirements of any construction plans, but do provide the sight line, rail and road profile and road data relevant at the time they were completed.

4.6 FUTURE WORK AND REGULATORY APPROVALS

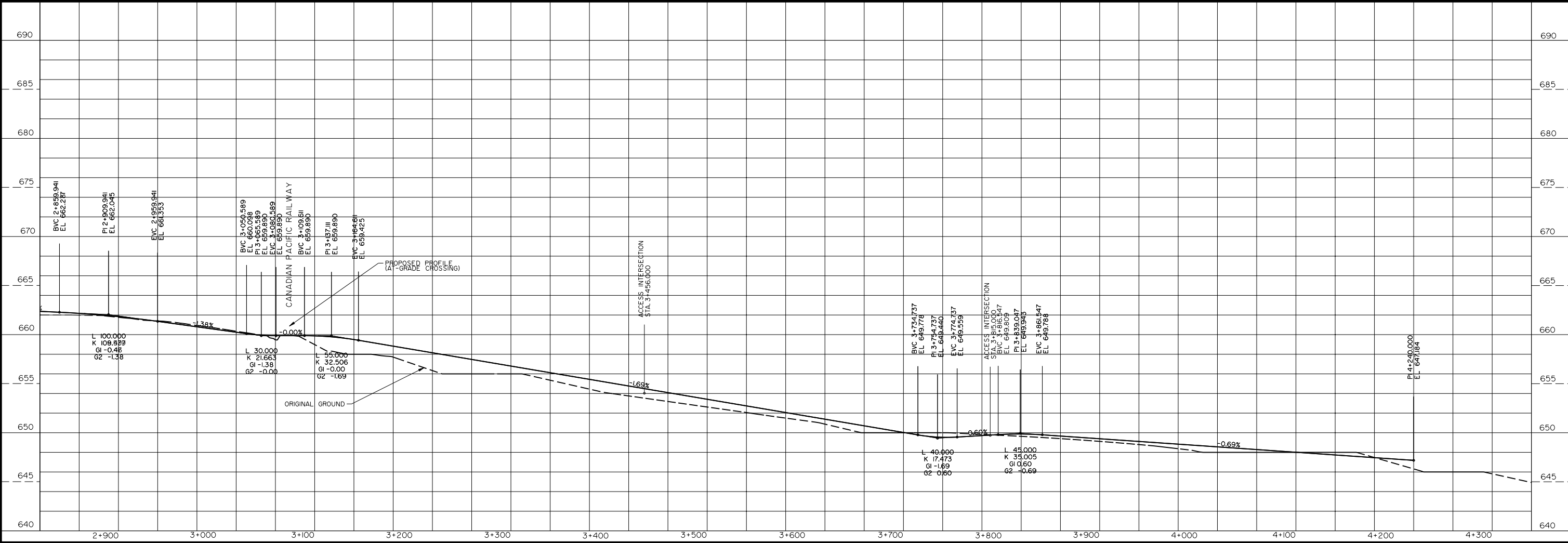
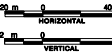
The recommended plans and background documentation prepared as part of this study provide overall guidance from a planning perspective, but more detailed investigations will be required during any subsequent detailed design phase to obtain required federal and provincial environmental approvals. For the crossings of Oldman Creek, the following steps will be required upon completing the detailed design of the structures and approach roadways:

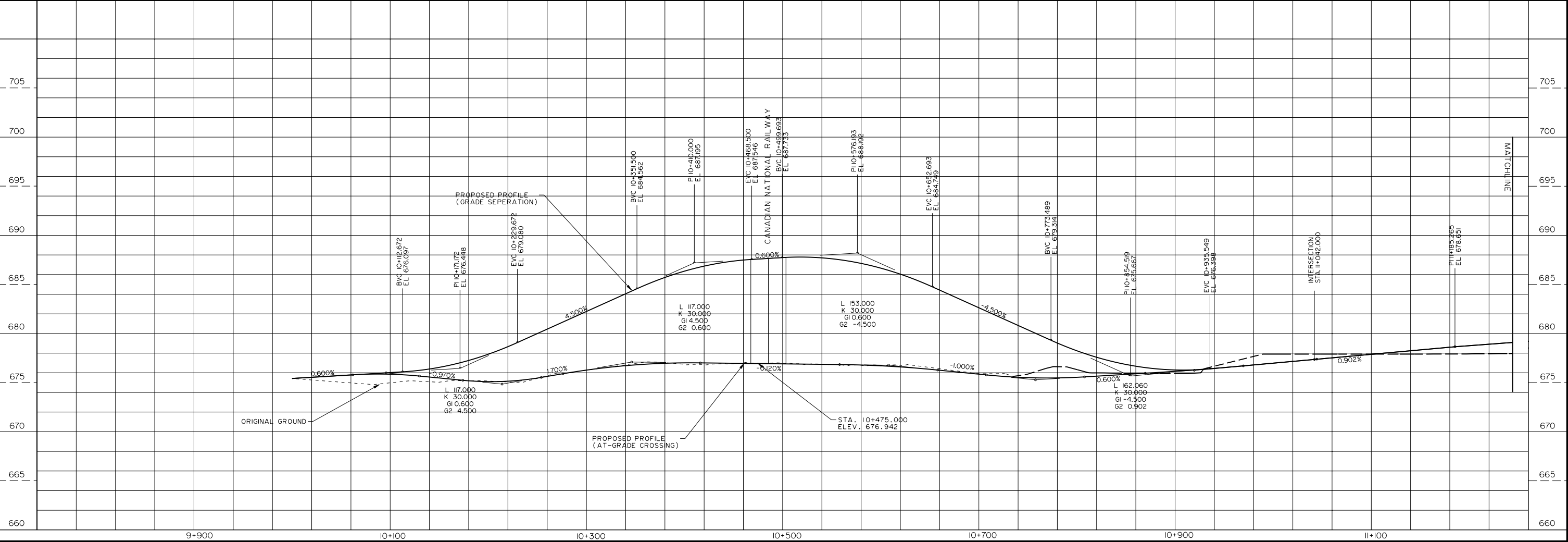
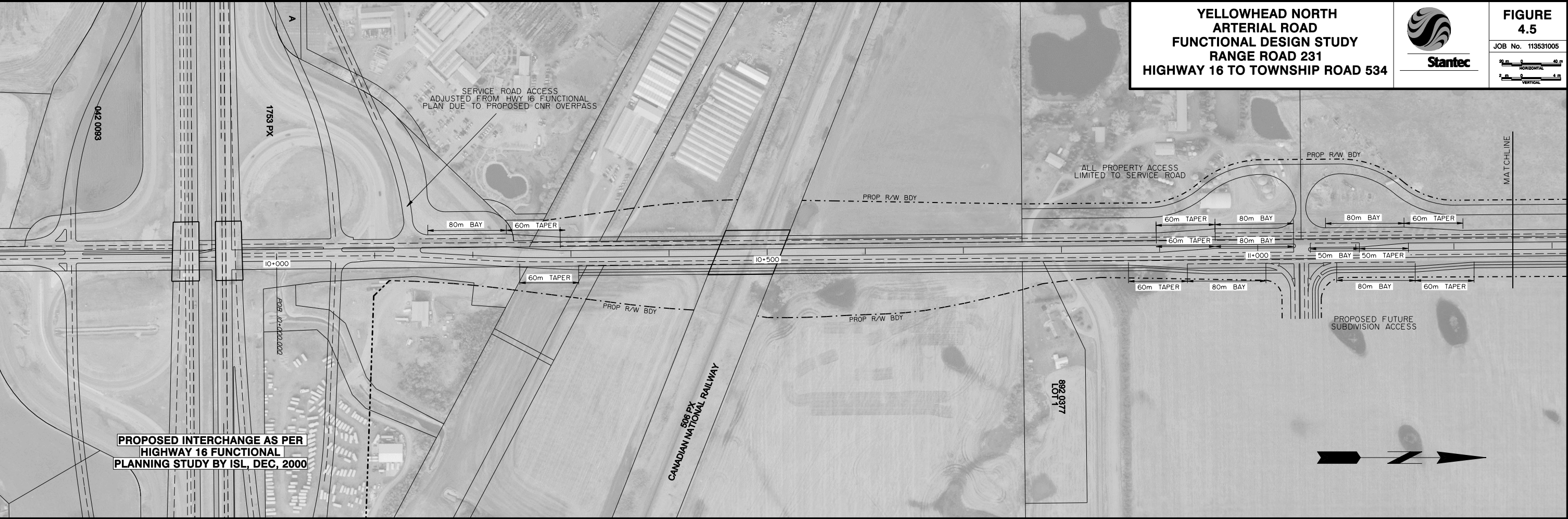
- Make application to Transport Canada under the Navigable Waters Protection Act to confirm that Oldman Creek is considered to be a non-navigable waterway
- Complete a desktop and a riparian and fish habitat field assessment to identify any lost habitat based on the detailed design and then make application to the Fisheries and Oceans Canada under the Fisheries Act with the results of this information for an approval for Works Affecting Fish Habitat.
- Undertake a desktop and visual review of the areas around Oldman Creek to be disturbed to confirm no archeological sites of significance are affected and make application to Alberta Environment to confirm that a Historical Resources Impact Assessment for the areas is not required under the Historical Resources Act.
- Make application to Alberta Environment for the approvals for the creek crossings with the detailed design drawings including any public lands affected, any impacts on the waterway and how wildlife passage is accommodated.

Although roadway drainage is primarily accommodated through the overall area drainage plan, any roadway drainage system and outfalls into Oldman Creek required as part of roadway construction will require application to Alberta Environment. This application will be for Authorization for Extension to a Waterworks, Wastewater or Storm Drainage System under the Environmental Protection and Enhancement Act and the Wastewater and Storm Drainage Regulation 119/93.



YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
RANGE ROAD 232
HIGHWAY 16 TO TOWNSHIP ROAD 534





PLAN DESCRIPTION
YELLOWHEAD NORTH ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
RANGE ROAD 231
HIGHWAY 16 TO TOWNSHIP ROAD 534

BAR CODE

PLAN No.

PHOTO No.

BY

DATE

REVISION

No.

CONTRACT No.

TITLE SEARCH
DATE

DESIGNED

CHECKED

DRAWN

INTERSECTION ID

GRAPHICS FILE

DATE

BY

DATE

REVISION

No.

YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
RANGE ROAD 231
HIGHWAY 16 TO TOWNSHIP ROAD 534



FIGURE
4.6
JOB No. 113531005
20 m 0 40 m
HORIZONTAL
2 m 0 4 m
VERTICAL



PLAN DESCRIPTION
YELLOWHEAD NORTH ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
RANGE ROAD 231
NORTH OF TOWNSHIP ROAD 534

BAR CODE

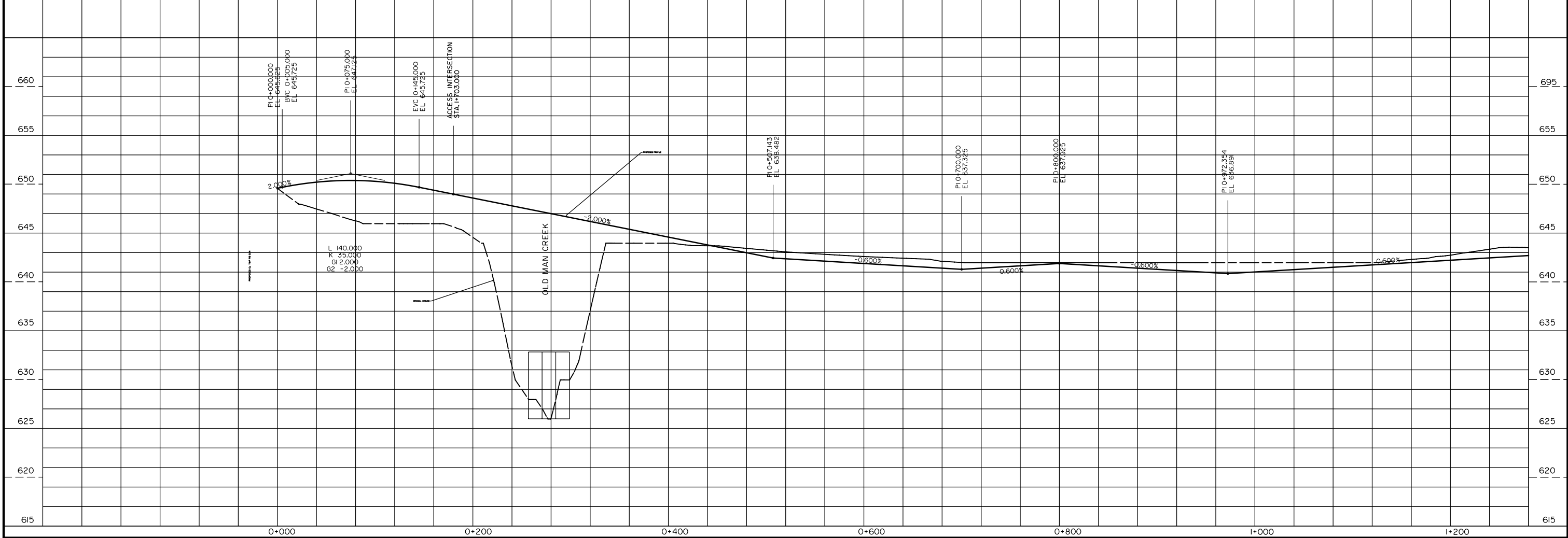
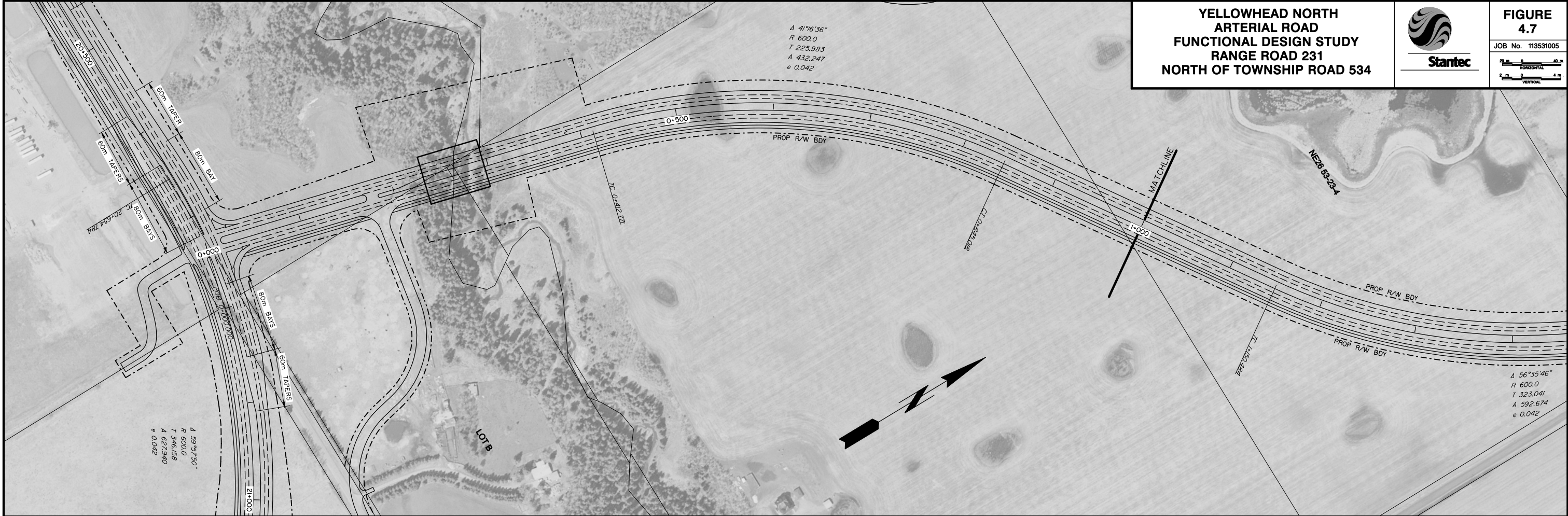
PLAN No.	CONTRACT No.	INTERSECTION ID

PHOTO No.	TITLE SEARCH DATE	GRAPHICS FILE

DATE	BY	SURVEYED	DESIGNED	CHECKED	DRAWN

REVISION	DATE	BY

8/2/2009



W:\active\113631005\3_planning\func\3-4_drawings\31005_FIG_4-7_FR231_NORTH_P1.dgn

PLAN DESCRIPTION
YELLOWHEAD NORTH ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
RANGE ROAD 231
NORTH OF TOWNSHIP ROAD 534

BAR CODE

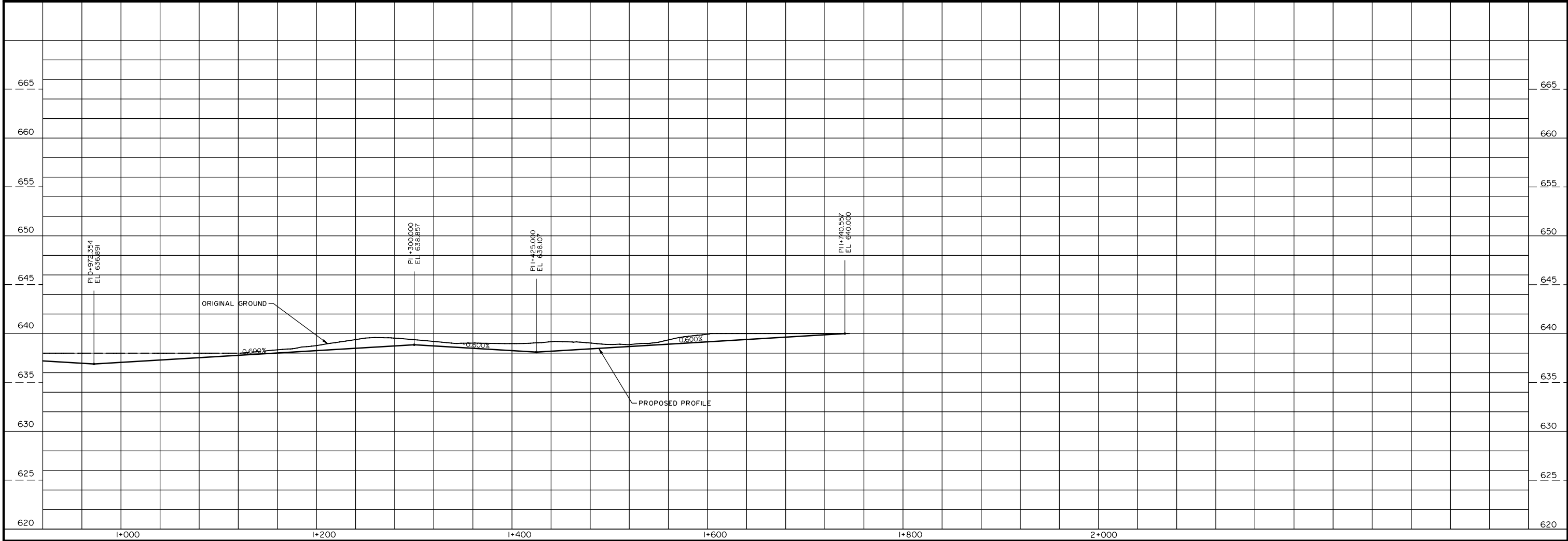
PLAN No.	CONTRACT No.	INTERSECTION ID

PHOTO No.	TITLE SEARCH DATE	GRAPHICS FILE

DATE	BY	SURVEYED	DESIGNED	CHECKED	DRAWN

REVISION	BY	DATE

8/2/2009

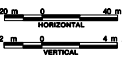


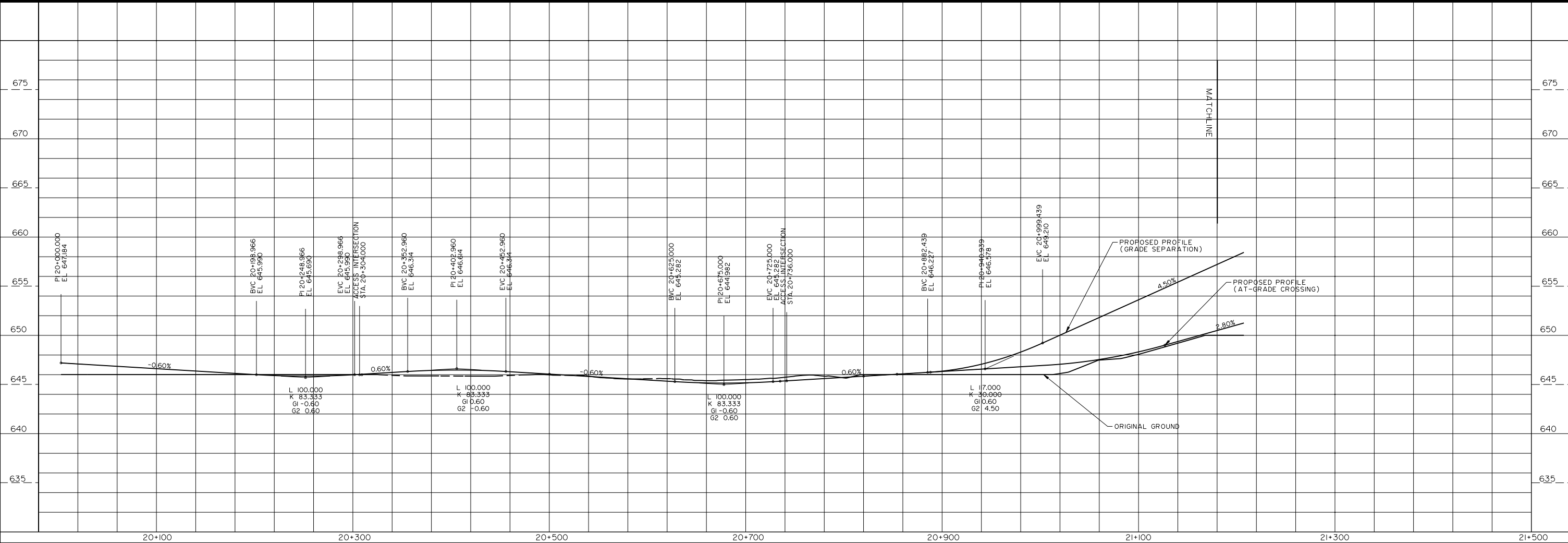
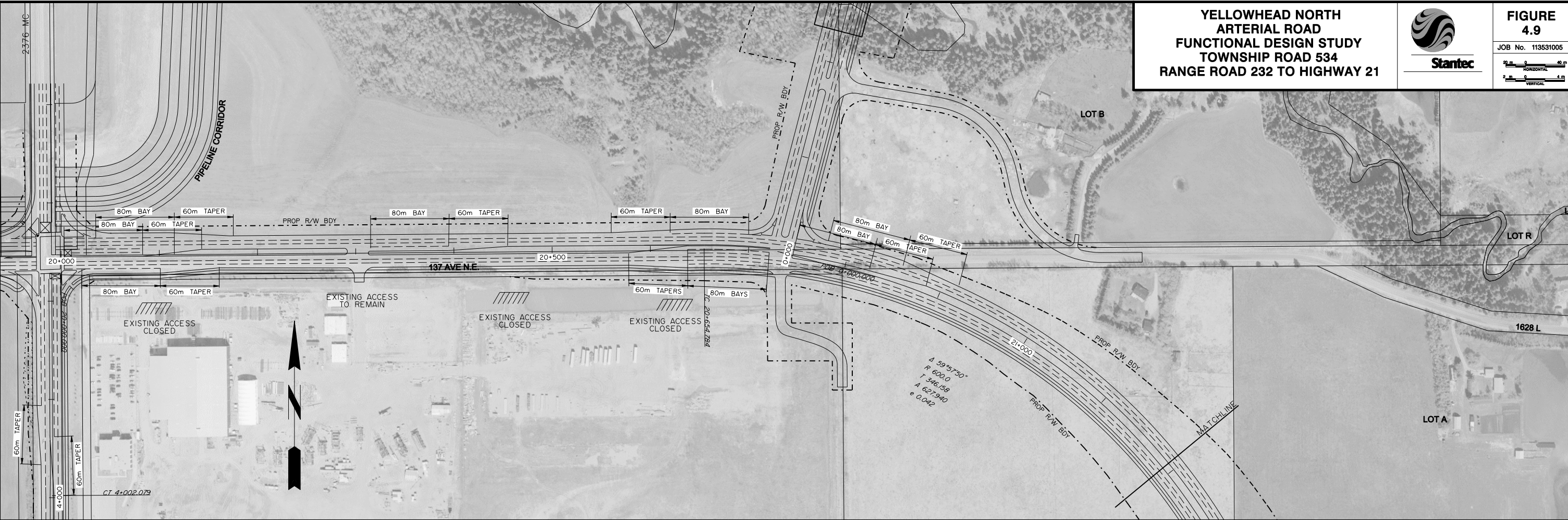
YELLOWHEAD NORTH
ARTERIAL ROAD
FUNCTIONAL DESIGN STUDY
RANGE ROAD 231
NORTH OF TOWNSHIP ROAD 534

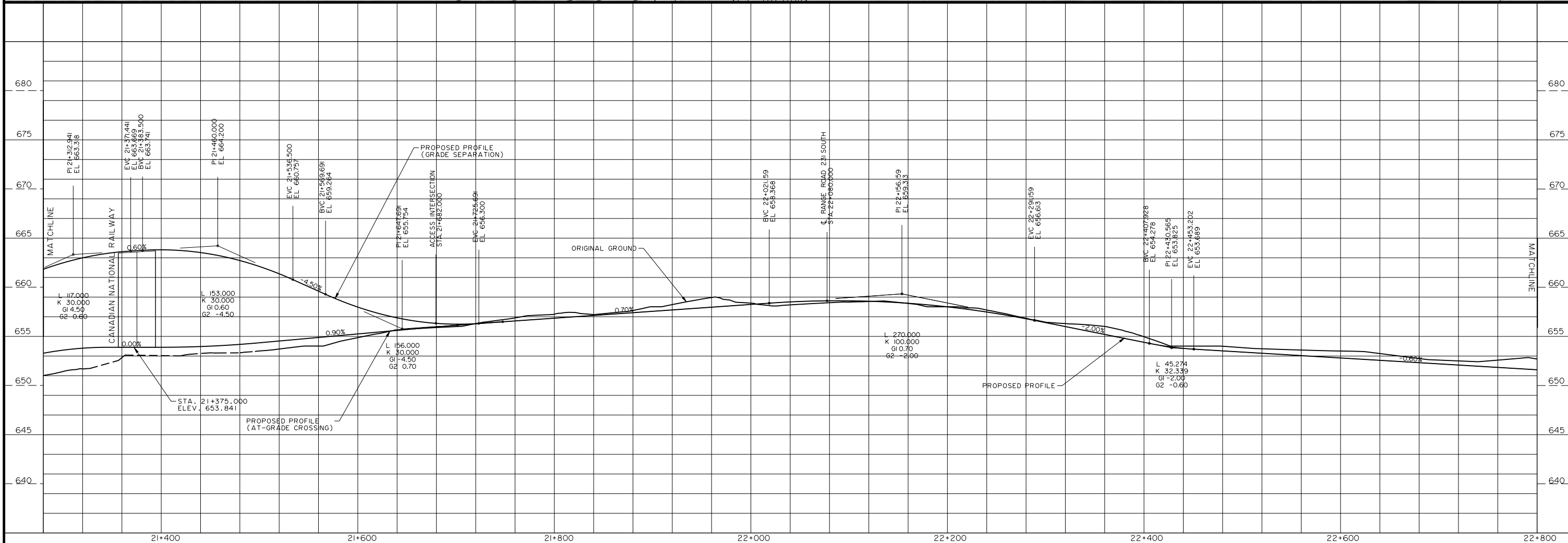


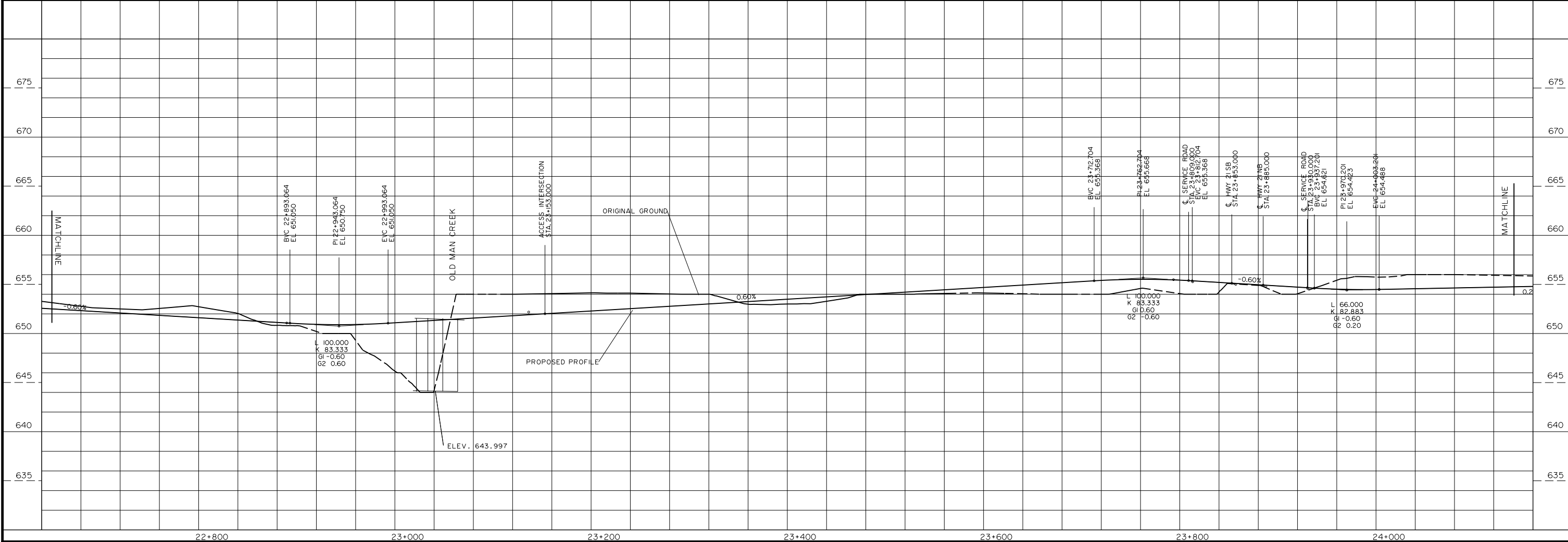
FIGURE
4.8

JOB No. 113631005









PLAN DESCRIPTION
NORTH OF YELLOWHEAD
AREA PLANNING STUDY
TOWNSHIP ROAD 534
RANGE ROAD 232 TO HIGHWAY 21

BAR CODE

PLAN No.

CONTRACT No.

INTERSECTION ID

PHOTO No.

TITLE SEARCH
DATE

GRAPHICS FILE

BY

DATE

DATE

SURVEYED
DESIGNED
CHECKED
DRAWN

REVISION

No.

12/4/2009

NORTH OF YELLOWHEAD
AREA PLANNING STUDY
TOWNSHIP ROAD 534
RANGE ROAD 232 TO HIGHWAY 21

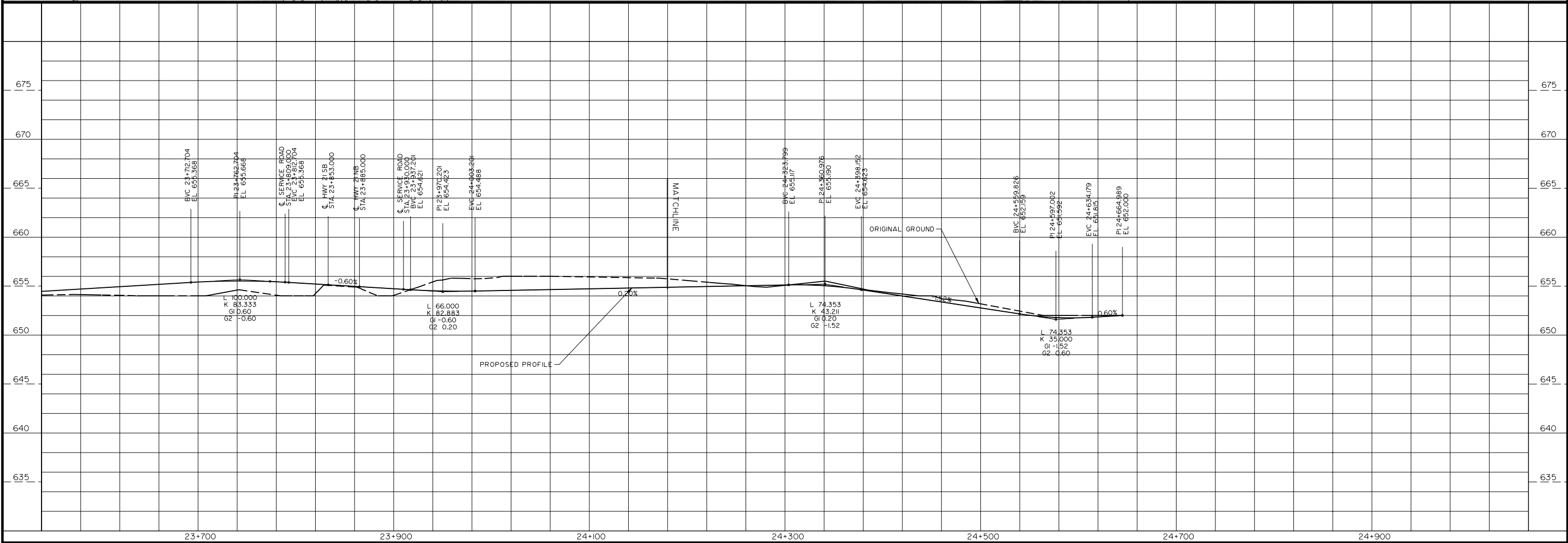


Stantec

FIGURE
4.12

JOB No. 113531005

20 m 0 40 m
HORIZONTAL
2 m 0 4 m
VERTICAL



5.0 Utilities

5.1 RANGE ROAD 232

Existing utilities along Range Road 232 were originally addressed in the Infrastructure Systems Ltd. report prepared in 2000 and subsequent construction works completed and planned since then. No further assessment of utilities was completed as part of this study.

5.2 RANGE ROAD 231

Range Road 231 crosses an ATCO pipeline south of the CN rail crossing. The roadway profile has taken the pipeline into consideration and relocation of the pipeline should not be required. Additional pipeline crossing protection may be required and will be determined once a crossing permit is applied for.

Ledcor Communications has buried fibre optic cables in the CN and CP rail rights-of-way. The fibre optic line is along the south side of the CN tracks and along the north side of the CP Rail tracks. In both cases the lines are located approximately 1.8 metres from the track at a depth of 1.2 to 1.5 metres.

AltaLink has a 700kv transmission line along the east property line of Range Road 231. This line will require relocation to accommodate the recommended plan. Costs for relocation would typically be the responsibility of Altalink as their line is within the County's road right-of-way.

Telus Communications has underground cables along the west side of Range Road 231. These cables are generally 1 metre below the existing groundline and will require relocation to accommodate the second stage of the recommended plan. There are a number of underground cable crossings of Range Road 231 to provide service to individual residents and businesses. These roadway crossings will likely require protection during the initial stage of construction.

From north of the CN rail crossing to Township Road 534, ATCO Gas has a smaller diameter gas line located in an easement east of the east property line of Range Road 231 to service existing developments in the area. This gas line and some service connections which cross Range Road 231 will likely conflict with the initial stage of construction. ATCO Gas is investigating the purchase of a right-of-way along the east side of Range Road 231 and the upgrading of the gas line to accommodate projected future demand in the area.

5.3 TOWNSHIP ROAD 534

The realigned Township Road 534 crosses a 400mm steel watermain on the north side of the proposed CP Rail crossing and four pipelines (Nova (2), BP and Keyera) on the south side of the proposed CP Rail crossing. The roadway profile has taken the watermain and pipelines into consideration and relocation of the watermain and pipelines should not be required.

Crossing protection for the watermain is not expected to be required. Crossing protection for the pipelines will be required and the extent of this protection will be determined once a crossing permit is applied for.

Just east of the existing Range Road 231, Township Road 534 will cross four (Keyera (3) and Nova) pipelines. The roadway profile has taken the pipelines into consideration and relocation of the pipelines should not be required. Some minor revisions to the roadway profile in this area to reduce possible impacts on the pipelines may prove desirable and they profile in this area can accommodate revisions. In any case, crossing protection for the pipelines will be required and the extent of this protection will be determined once a crossing permit is applied for.

Where the proposed Township Road 534 crosses the existing Range Road 231, there is an existing overhead powerline along the west side of the right-of-way. It provides service to the industrial site in the southwest quadrant of the Township Road 534 and Range Road 231 intersection. Some pole relocations and/or height adjustments to the powerline may be required to accommodate the proposed alignment of Township Road 534.

Along the existing alignment of Township Road 534 between Range Road 232 and Range Road 231 there is an overhead powerline on the north side and a buried Telus Communications line along the south side. Conflicts with the buried Telus Communications line may occur if substantial grading works are undertaken along the south property line. The overhead power line will require relocation to accommodate the ultimate construction works.

5.4 HIGHWAY 21

Along the east side of Highway 21 is an overhead powerline that provides service to residences south of Township Road 534. Some pole relocations and/or height adjustments to the powerline may be required to accommodate the proposed alignment of Township Road 534.

Shaw has a buried fibre optic cable in the west ditch line of the highway. It is in the order of 1 to 1.2 metres deep. Relocation of the line may be required if substantial undercutting is required in the vicinity of the cable.

Bell has a buried fibre optic cable in the east ditch line of the highway. It is in the order of 1 to 1.2 metres deep. Relocation of the line may be required if substantial undercutting is required in the vicinity of the cable.

Telus Communications has a buried line along the east property of the service road. It is in the order of 1 to 1.2 metres deep. Relocation of the line may be required if substantial undercutting is required in the vicinity of the cable.

6.0 Structures

6.1 OLDMAN CREEK

6.1.1 Alternatives

Both a bridge structure (single span and three span variants) and a large diameter (18 m arch span) culvert were reviewed as alternatives for crossing of the Oldman Creek. The bridge structure alternative was selected due to:

- The reduced environmental impact in terms of fish and wildlife passage
- The potential to minimize disruption to the native vegetation in the creek area
- The ease of staging the construction of the structure to meet interim roadway cross-section requirements and reduce the first stage capital costs

6.1.2 Township Road 534 Crossing

Figure 6.1 illustrates the recommended configuration for the Township Road 534 crossing of Oldman Creek. The recommended structure is a single-span 32 metre long bridge with integral abutments. The 32 metre span accommodates the high level water and will allow construction in dry ground as well as provide for a wildlife passage corridor. The superstructure consists of a 225 mm thick cast-in-place concrete deck slab supported on 1600 mm deep precast concrete NU girders. The substructure consists of cast-in-place concrete abutment seats supported by drilled cast-in-place concrete abutment seats supported by drilled cast-in-place concrete caissons of 900mm diameter. MSE walls are used to relieve lateral earth pressure load on the abutments.

Twin structures are recommended to accommodate the widening of the road in stages. The possible staging option illustrated is for an initial two lane cross section, a second stage to four lanes and the ultimate stage of six lanes. The illustrated first and second stages minimize initial construction costs, but do result in less than desirable shoulder widths before widening to the ultimate cross section.

6.1.3 Range Road 231 Crossing

Figure 6.2 illustrates the recommended configuration for the Range Road 231 crossing of Oldman Creek. The recommended structure is three-spans 24 metres each with integral abutments and piers. The 32 metre span accommodates the high level water and will allow construction in dry ground as well as provide for a wildlife passage corridor. The superstructure consists of a 225 mm thick cast-in-place concrete deck slab supported on 1200 mm deep precast concrete NU girders. The substructure consists of cast-in-place concrete abutment

seats supported by drilled cast-in-place concrete abutment seats supported by drilled cast-in-place concrete caissons of 900mm diameter and two cast-in-place reinforced concrete piers. The piers are supported by a buried concrete pilecap supported on steel piles. MSE walls are used to relieve lateral earth pressure load on the abutments.

Twin structures are recommended to accommodate the widening of the road in stages. The possible staging option illustrated is for an initial two lane cross section, a second stage to four lanes and the ultimate stage of six lanes. The illustrated first and second stages minimize initial construction costs, but do result in less than desirable shoulder widths before widening to the ultimate cross section.

6.2 RAIL GRADE SEPARATIONS

As noted in Section 2, grade separations of the CP Rail and CN lines are likely to be warranted at some point in the future as development continues in and around the Study Area at the following crossings:

- Township Road 534 and the CP Rail track
- Range Road 231 and CN track
- Range Road 232 and CN track

The Range Road 232 crossing of the CP Rail track is unlikely to warrant a rail grade separation. In addition, the proximity of existing development along with access constraints that a grade separation would impose on adjacent businesses, suggest a grade separation of the CP Rail track at this location would not be appropriate. Accordingly, a conceptual plan for this grade separation was not developed.

6.2.1 Township Road 534 and the CP Rail Track

Figure 6.3 illustrates the six lane cross-section of the ultimate grade separation, which is on a 30 degree LHF skew. The recommended structure configuration consists of a 24 metre long single-span bridge with integral abutments. This span provides for 5.49 metres clearance from the centre line of the existing track, provision of a future track 4.27 metres from the existing track centre and space for a maintenance road width of 7.93 metres. The single-span allows construction to occur with minimum disruption to rail traffic. The use of integral abutments eliminates the need for structural bearings and expansion joints, reducing capital and maintenance costs.

The superstructure consists of a 225mm deep cast-in-place concrete deck slab supported by 1200mm deep precast concrete NU girders. The substructure consists of cast-in-place concrete caissons of 900mm diameter. The fills on each side are retained by MSE walls set back adequately to avoid the need for crash walls.

6.2.2 Range Road 231 and CN Track

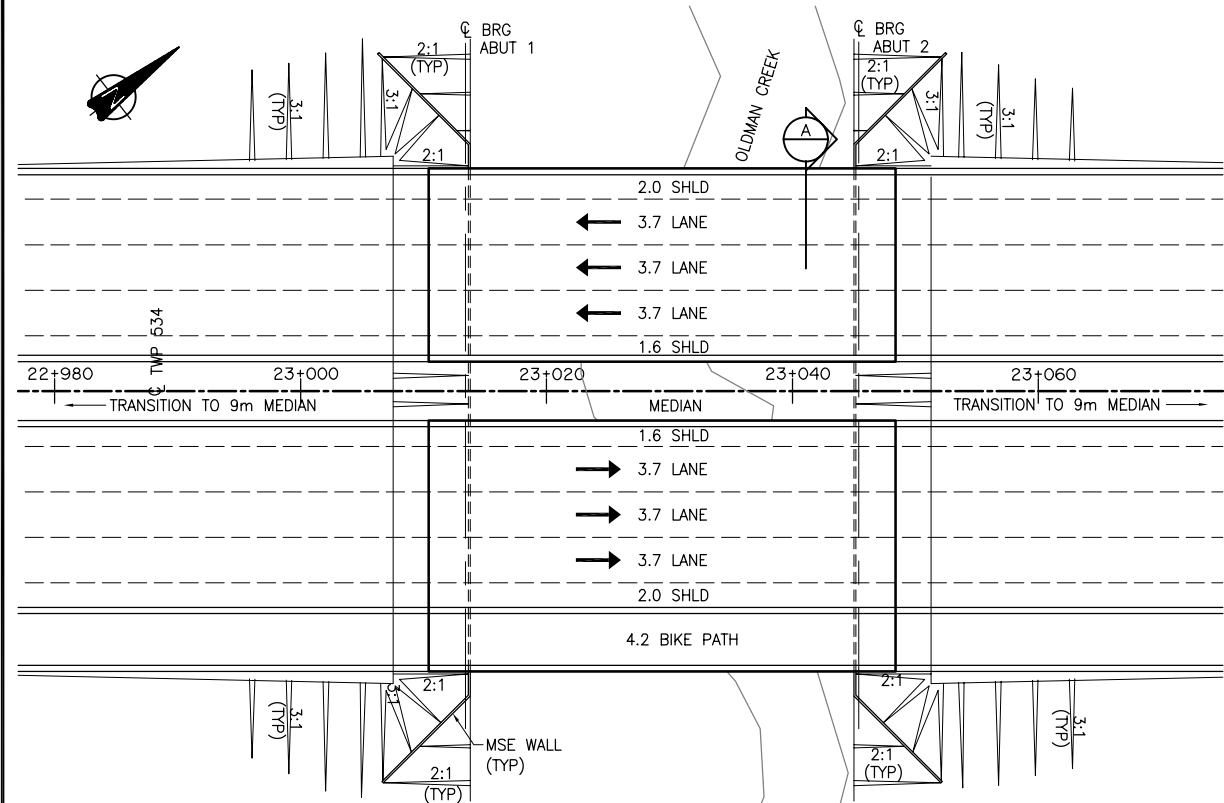
Figure 6.4 illustrates the six lane cross-section of the ultimate grade separation, which is on a 22 degree LHF skew. The recommended structure configuration consists of a 24 metre long single-span bridge with integral abutments. This span provides for 5.49 metres clearance from the centre line of the existing track, provision of a future track 4.27 metres from the existing track centre and space for a maintenance road width of 7.93 metres. The single-span allows construction to occur with minimum disruption to rail traffic. The use of integral abutments eliminates the need for structural bearings and expansion joints, reducing capital and maintenance costs.

The superstructure consists of a 225mm deep cast-in-place concrete deck slab supported by 1200mm deep precast concrete NU girders. The substructure consists of cast-in-place concrete caissons of 900mm diameter. The fills on each side are retained by MSE walls set back adequately to avoid the need for crash walls.

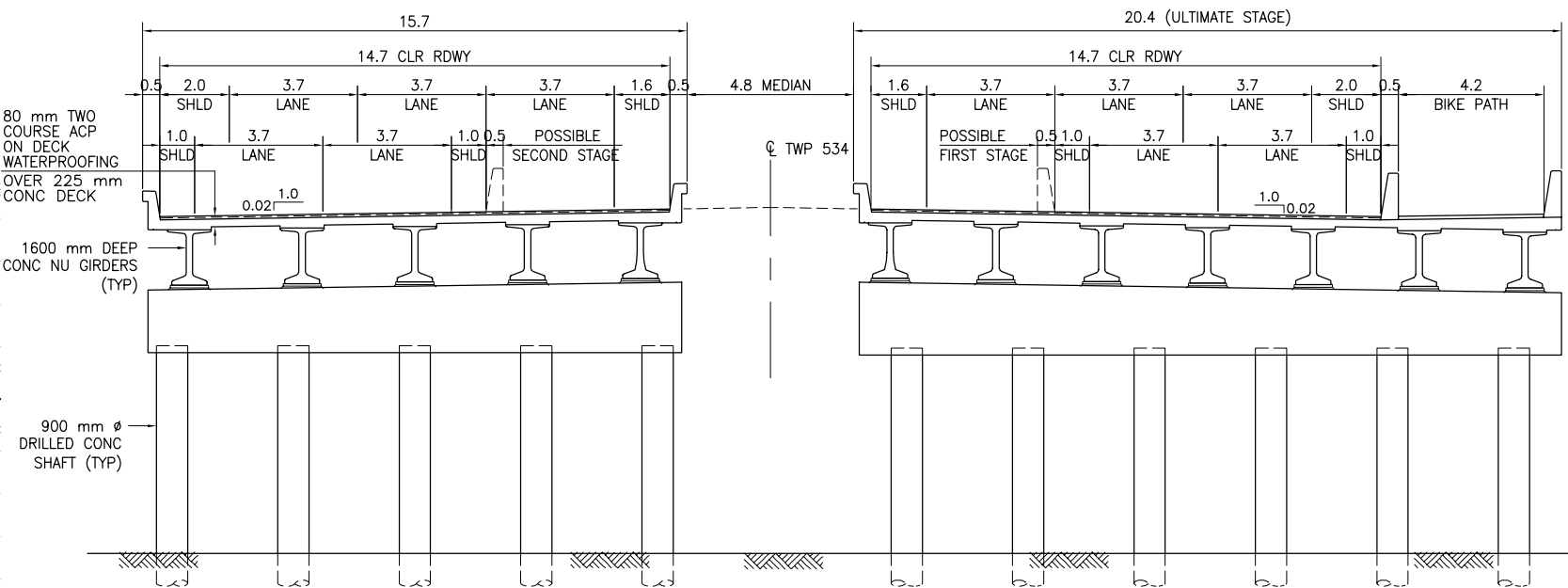
6.2.3 Range Road 232 and CN Track

Figure 6.5 illustrates the four lane cross-section of the ultimate grade separation, which is on a 10 degree LHF skew. The recommended structure configuration consists of a 21 metre long single-span bridge with integral abutments. This span provides for 5.49 metres clearance from the centre line of the existing track, provision of a future track 4.27 metres from the existing track centre and space for a maintenance road width of 7.93 metres. The single-span allows construction to occur with minimum disruption to rail traffic. The use of integral abutments eliminates the need for structural bearings and expansion joints, reducing capital and maintenance costs.

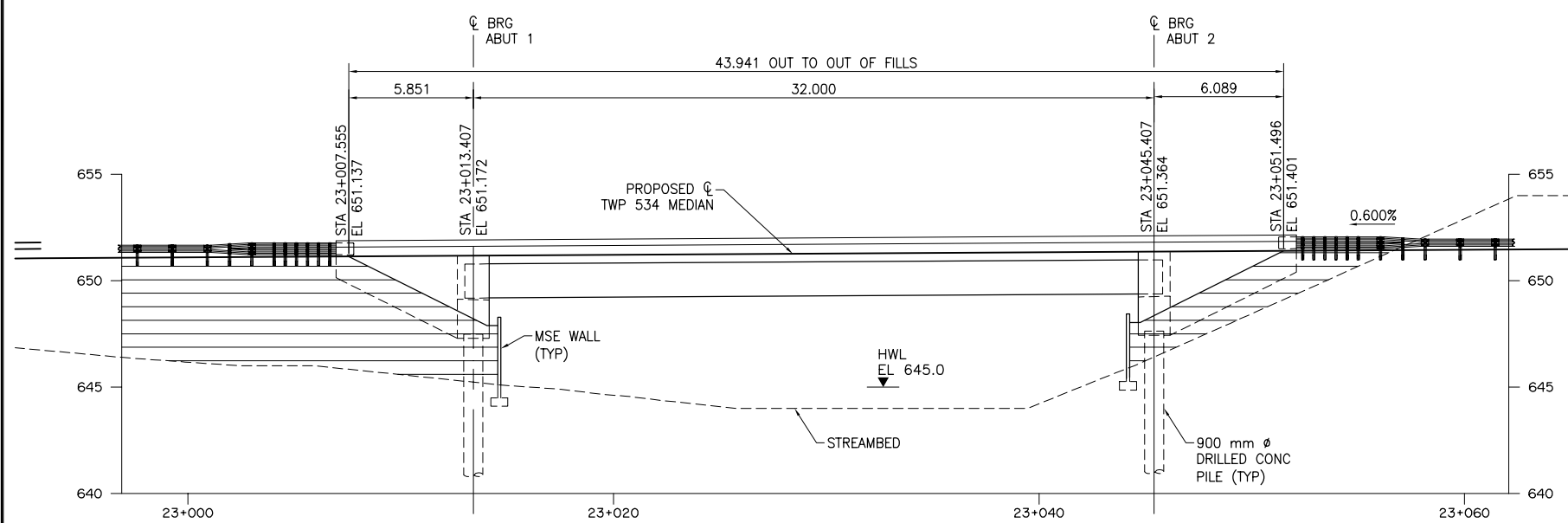
The superstructure consists of a 225mm deep cast-in-place concrete deck slab supported by 1200mm deep precast concrete NU girders. The substructure consists of cast-in-place concrete caissons of 900mm diameter. The fills on each side are retained by MSE walls set back adequately to avoid the need for crash walls.



PLAN
1:300



A SECTION
1:100



ELEVATION
1:150

LEGEND:

---	DESIGN FINISHED & TRAIL
---	DESIGN EDGE TRAIL
---	DESIGN BACK SLOPE LIMITS
---	ORIGINAL GROUND
---	ORIGINAL GROUND EDGE
---	PROPERTY LINE
---	SHAW CABLE
---	WATER MAIN
---	NUL/GAS LINE
---	TAU/POWER LINE
---	TRAFFIC CABLE
---	TELEPHONE CABLE
---	STORM MAIN
---	SANITARY MAIN

ABBREVIATIONS:

BTOT	BACK TOP OF CURB
BVC	BEGINNING OF VERTICAL CURVE
L	CENTRE LINE
ELEV	ELEVATION
EVC	END OF VERTICAL CURVE
N.T.S.	NOT TO SCALE
PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
PVI	POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER	PERMIT TO PRACTICE
--------------------	--------------------

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	3TM C.M. 114W		
SCALE FACTOR:	GRID		
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	09/04/03
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK9	REV. No.:	0
		SHEET No.:	1 OF 2

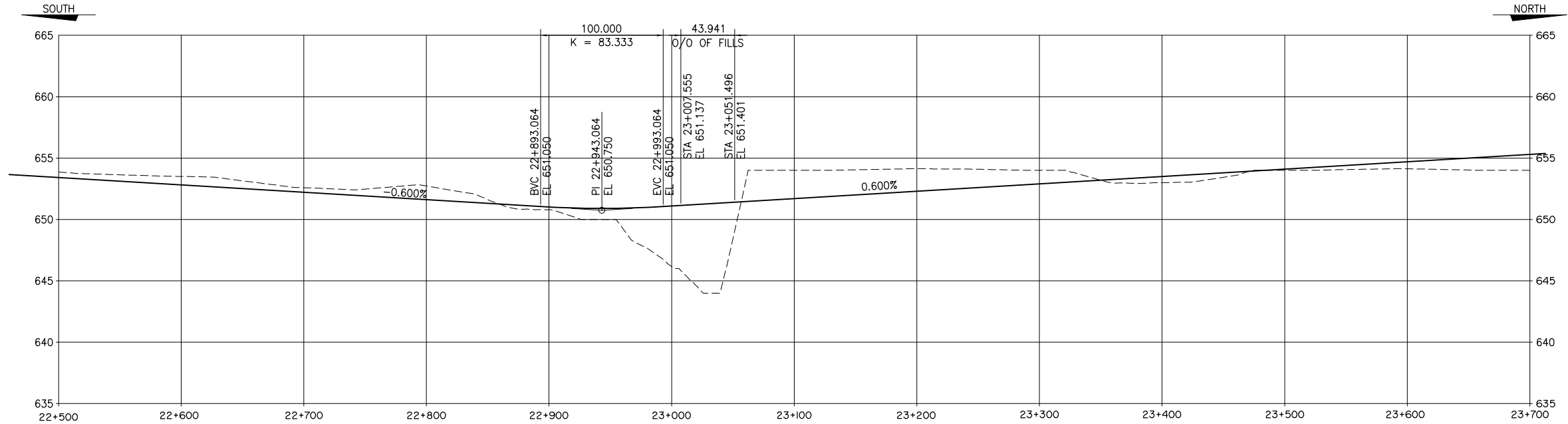
Strathcona County

Stantec

Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel. 780.917.7000
Fax. 780.917.7179
www.stantec.com

TOWNSHIP ROAD 534
OVER OLDMAN CREEK

FIGURE 6.1A



TWP 534 PROFILE
OVER OLDMAN CREEK
H 1:2000
V 1:200

LEGEND:	
	DESIGN FINISHED & TRAIL
	DESIGN EDGE TRAIL
	DESIGN BACK SLOPE LIMITS
	ORIGINAL GROUND
	ORIGINAL GROUND EDGE
	PROPERTY LINE
	SHAW CABLE
	WATER MAIN
	NUL/GAS LINE
	TAU/POWER LINE
	TRAFFIC CABLE
	TELEPHONE CABLE
	STORM MAIN
	SANITARY MAIN

ABBREVIATIONS:	
BTOC	BACK TOP OF CURB
BVC	BEGINNING OF VERTICAL CURVE
L	CENTRE LINE
ELEV	ELEVATION
EVC	END OF VERTICAL CURVE
N.T.S.	NOT TO SCALE
PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
PVI	POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER

PERMIT TO PRACTICE

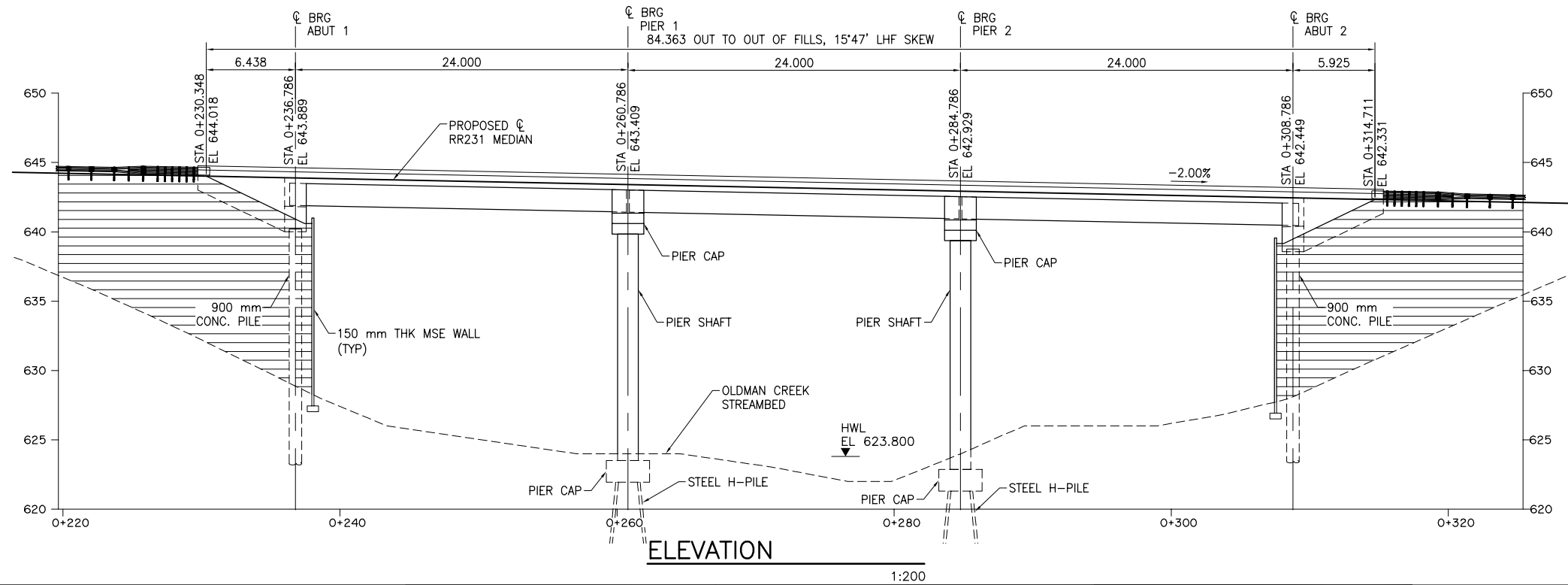
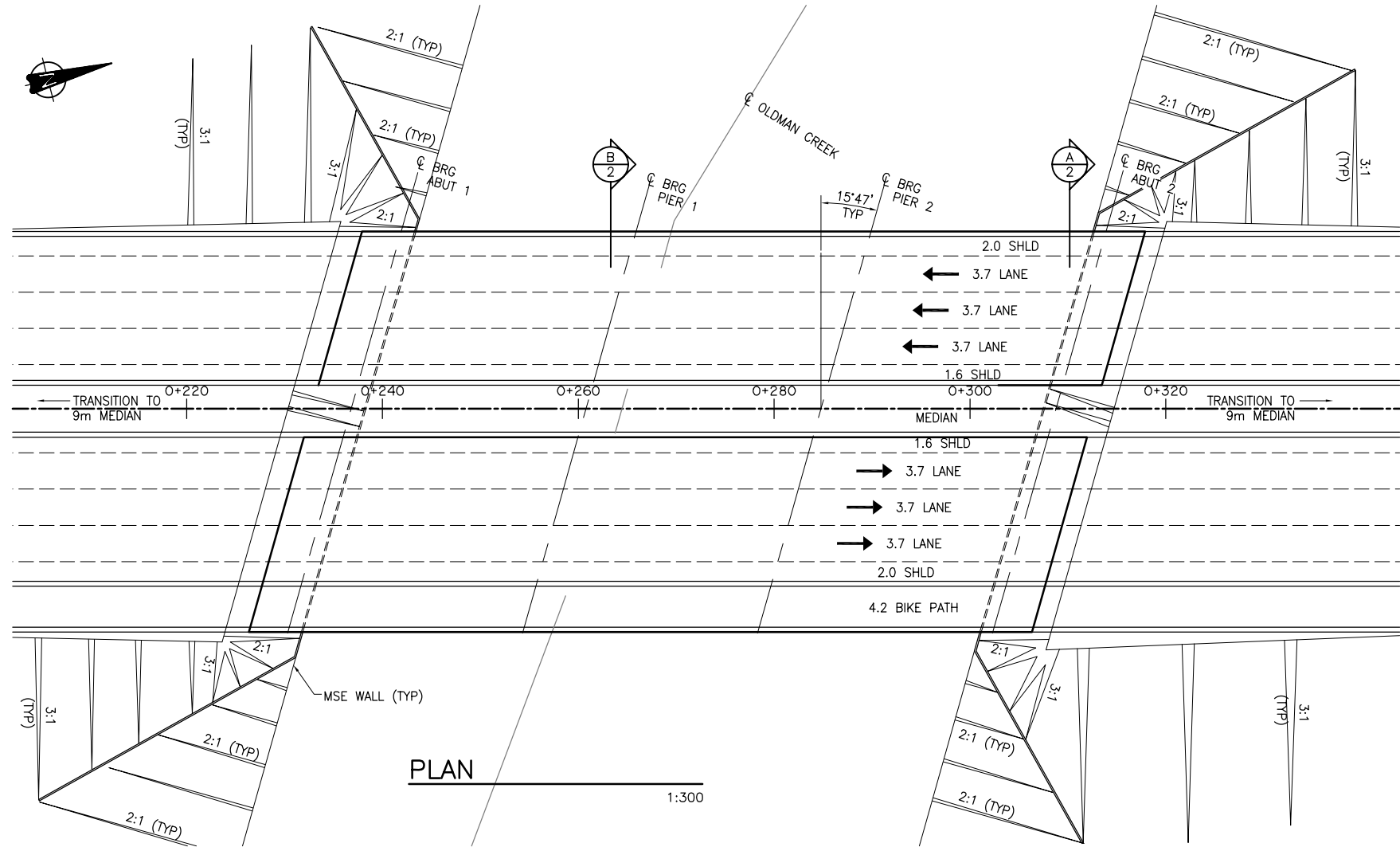
DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	UTM C.M. 114W		
SCALE FACTOR:			
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	09/04/03
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK10	REV. No.:	0
		SHEET No.:	2 OF 2



Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel. 780.917.7000
Fax. 780.917.7179
www.stantec.com

TOWNSHIP ROAD 534
OVER OLDMAN CREEK

FIGURE 6.1B



LEGEND:

- DESIGN FINISHED & TRAIL
- DESIGN EDGE TRAIL
- DESIGN BACK SLOPE LIMITS
- ORIGINAL GROUND
- ORIGINAL GROUND EDGE
- PROPERTY LINE
- SHAW CABLE
- WATER MAIN
- NUL/GAS LINE
- TAU/POWER LINE
- TRAFFIC CABLE
- TELEPHONE CABLE
- STORM MAIN
- SANITARY MAIN

ABBREVIATIONS:

- BTOC BACK TOP OF CURB
- BVC BEGINNING OF VERTICAL CURVE
- L CENTRE LINE
- ELEV ELEVATION
- EVC END OF VERTICAL CURVE
- N.T.S. NOT TO SCALE
- PC POINT OF CURVATURE
- PT POINT OF TANGENCY
- PVI POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER

PERMIT TO PRACTICE

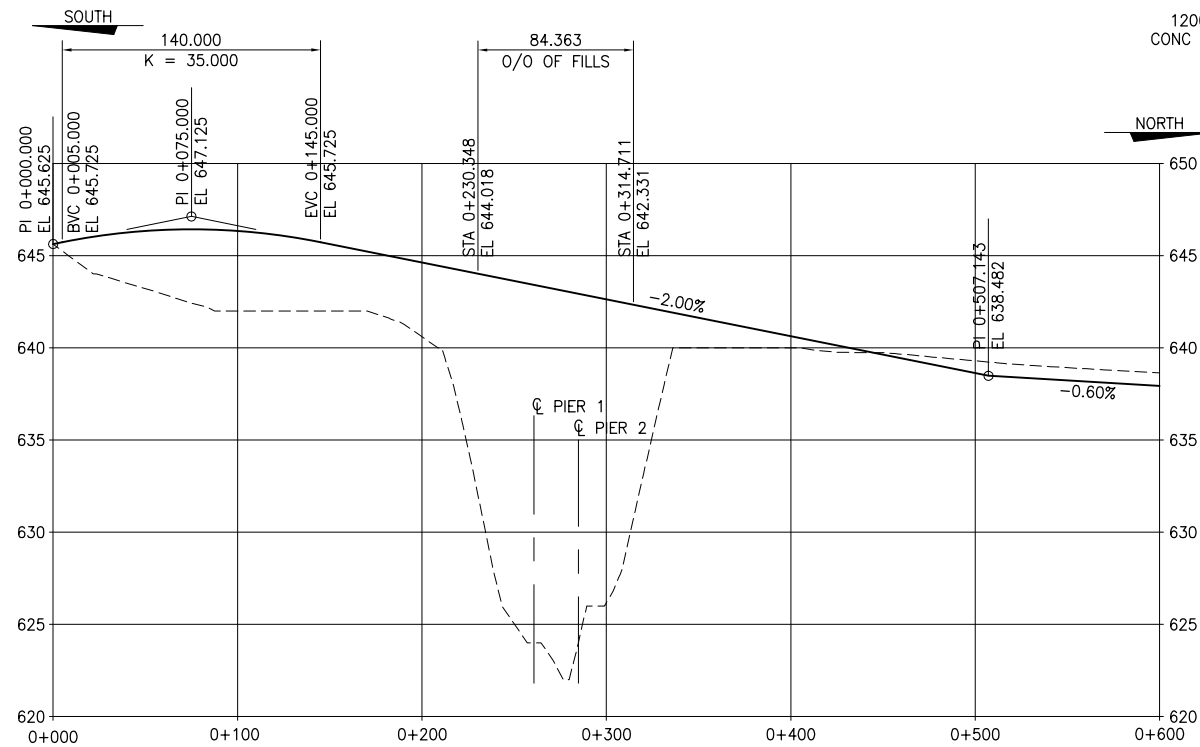
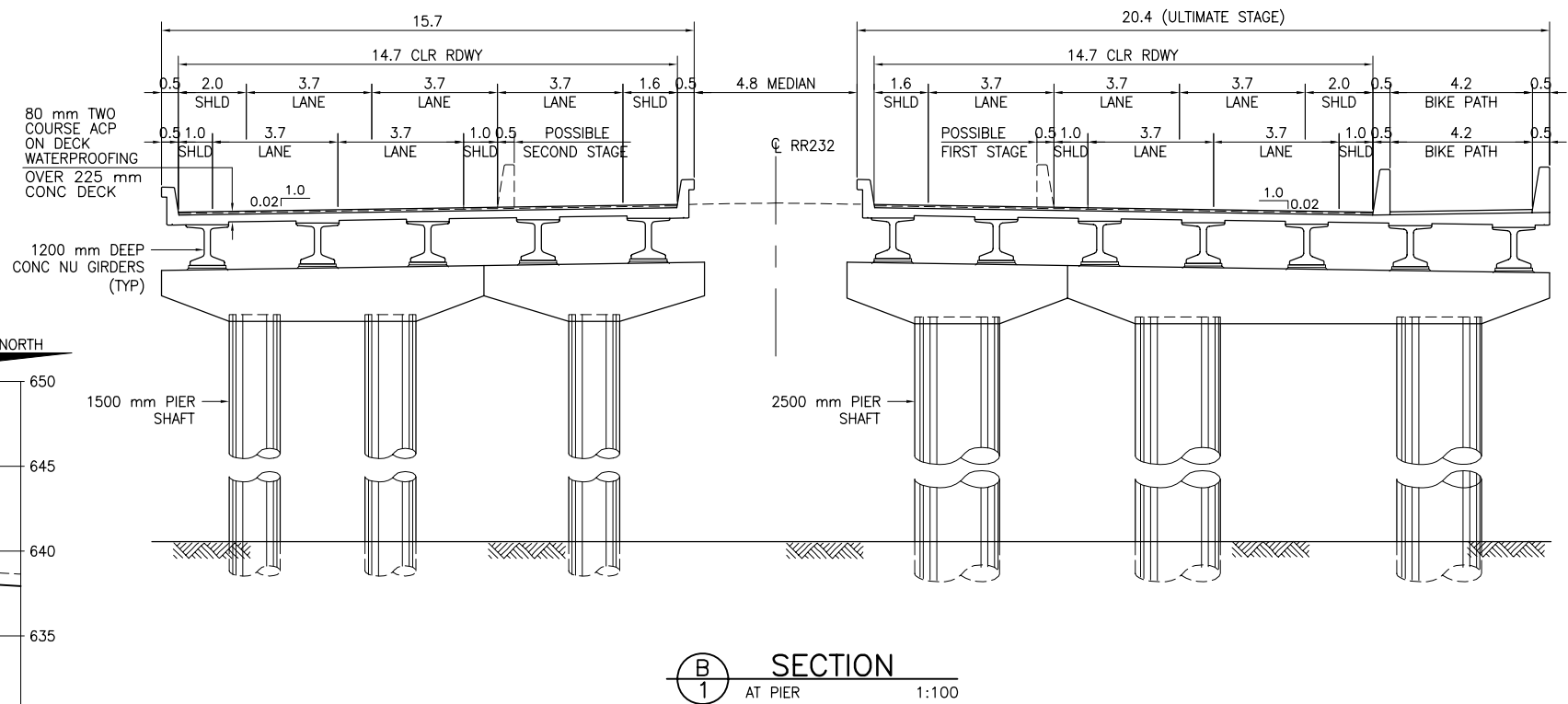
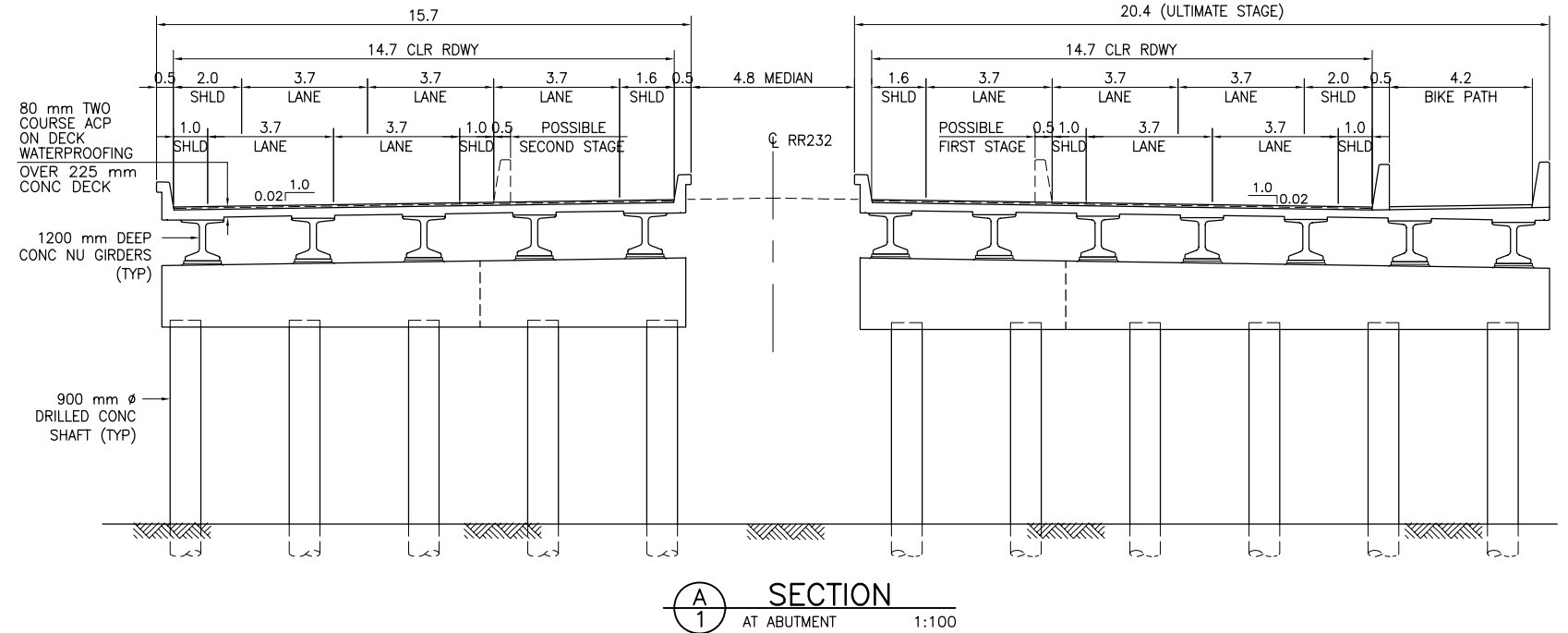
DATUM: NAD 83
PROJECTION: 3TM C.M. 114W
SCALE FACTOR: GRID
COORDINATES: N/A
SCALE (m): AS SHOWN
CONTOUR INTERVAL: N/A
LDD PROJECT: N/A
DATE: 09/04/03
SURVEY BY: STANTEC
DESIGN BY: VK
APPROVED BY: SK3
DRAWN BY: CL
CHECKED BY: CC
REV. No.: 0
SHEET No.: 1 OF 2



Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

RANGE ROAD 231
OVER OLDMAN CREEK

FIGURE 6.2A



RR 231 N PROFILE
NORTH OF TWP 534
H 1:2000
V 1:200

LEGEND:	
	DESIGN FINISHED & TRAIL
	DESIGN EDGE TRAIL
	DESIGN BACK SLOPE LIMITS
	ORIGINAL GROUND
	ORIGINAL GROUND EDGE
	PROPERTY LINE
	SHAW CABLE
	WATER MAIN
	NUL/GAS LINE
	TAU/POWER LINE
	TRAFFIC CABLE
	TELEPHONE CABLE
	STORM MAIN
	SANITARY MAIN

ABBREVIATIONS:	
BTOT	BACK TOP OF CURB
BVC	BEGINNING OF VERTICAL CURVE
L	CENTRE LINE
ELEV	ELEVATION
EVC	END OF VERTICAL CURVE
N.T.S.	NOT TO SCALE
PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
PVI	POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER

PERMIT TO PRACTICE

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	3TM C.M. 114W		
SCALE FACTOR:	GRID		
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	09/04/03
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK4	REV. No.:	0
		SHEET No.:	2 OF 2

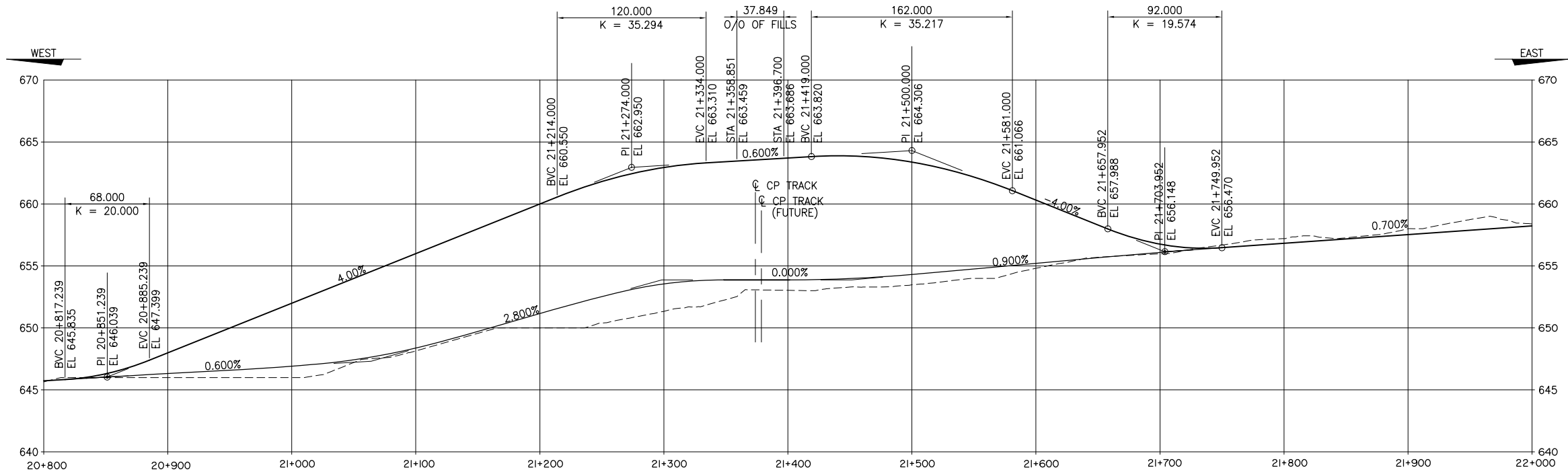


Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

RANGE ROAD 231
OVER OLDMAN CREEK
FIGURE 6.2B

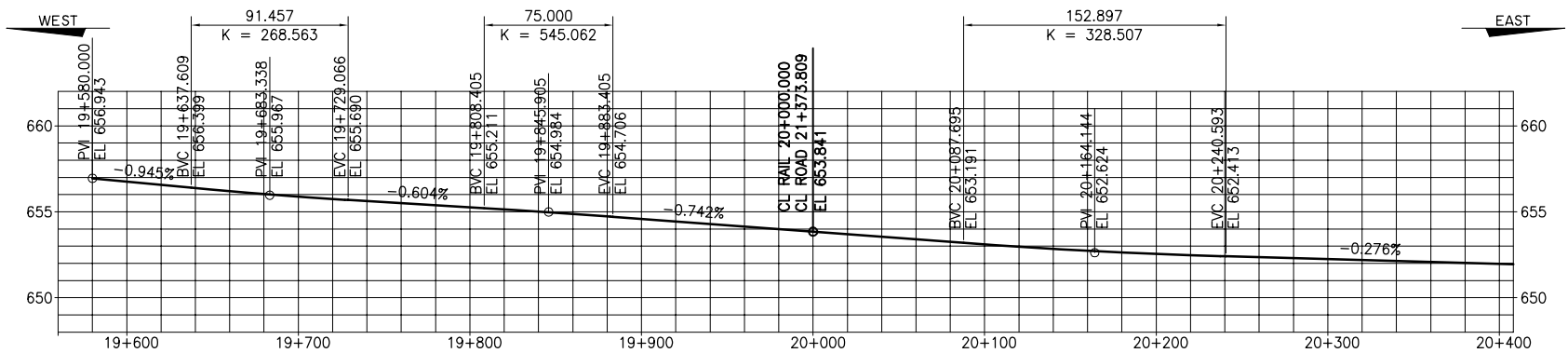


TOWNSHIP ROAD 534
OVER CP RAIL
GRADE SEPERATION
FIGURE 6.3A



TWP 534 PROFILE

H 1:2000
V 1:200



RAIL PROFILE

H 1:2000
V 1:200

LEGEND:

---	DESIGN FINISHED & TRAIL
---	DESIGN EDGE TRAIL
---	DESIGN BACK SLOPE LIMITS
---	ORIGINAL GROUND
---	ORIGINAL GROUND EDGE
---	PROPERTY LINE
---	SHAW CABLE
---	WATER MAIN
---	NUL/GAS LINE
---	TAU/POWER LINE
---	TRAFFIC CABLE
---	TELEPHONE CABLE
---	STORM MAIN
---	SANITARY MAIN

ABBREVIATIONS:

BTOT	BACK TOP OF CURB
BVC	BEGINNING OF VERTICAL CURVE
CL	CENTRE LINE
ELEV	ELEVATION
EVC	END OF VERTICAL CURVE
N.T.S.	NOT TO SCALE
PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
PVI	POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER

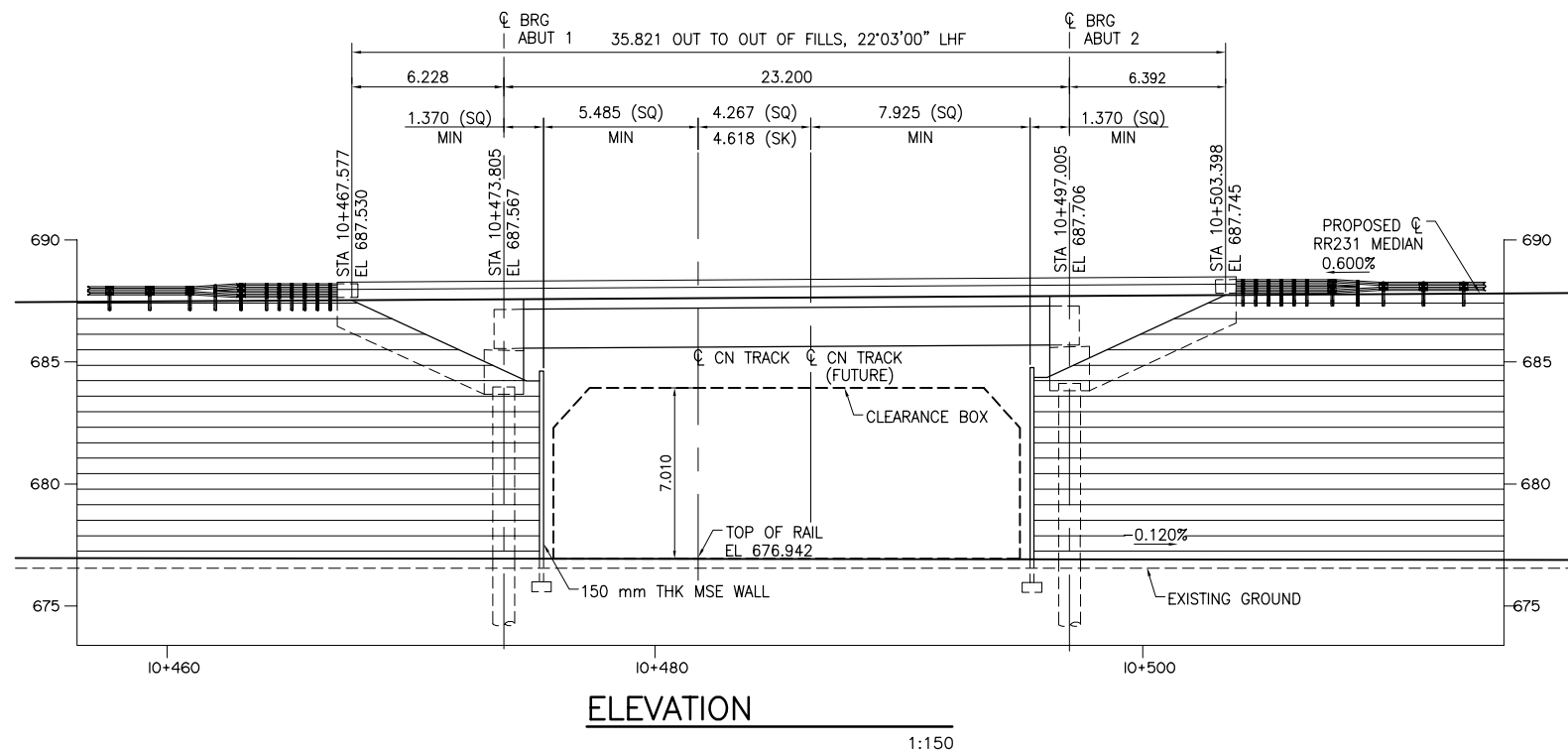
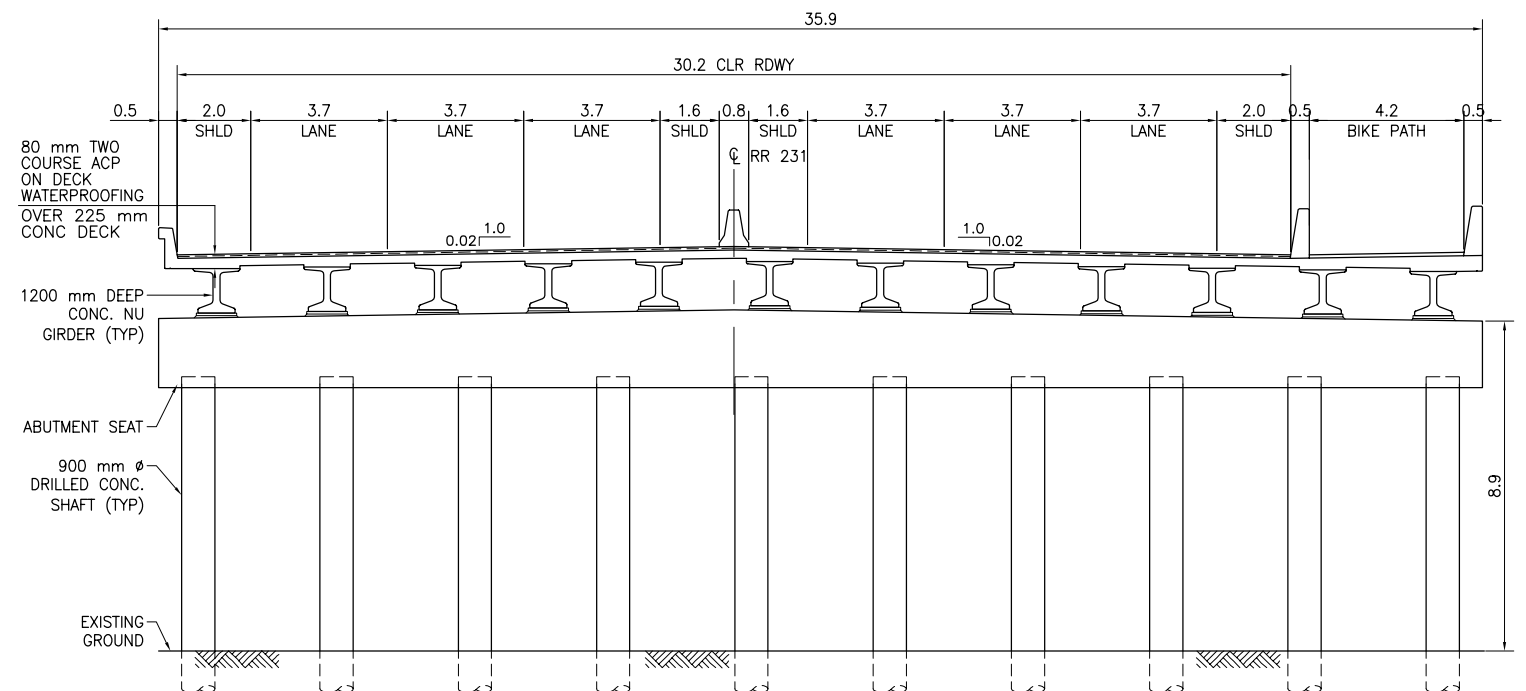
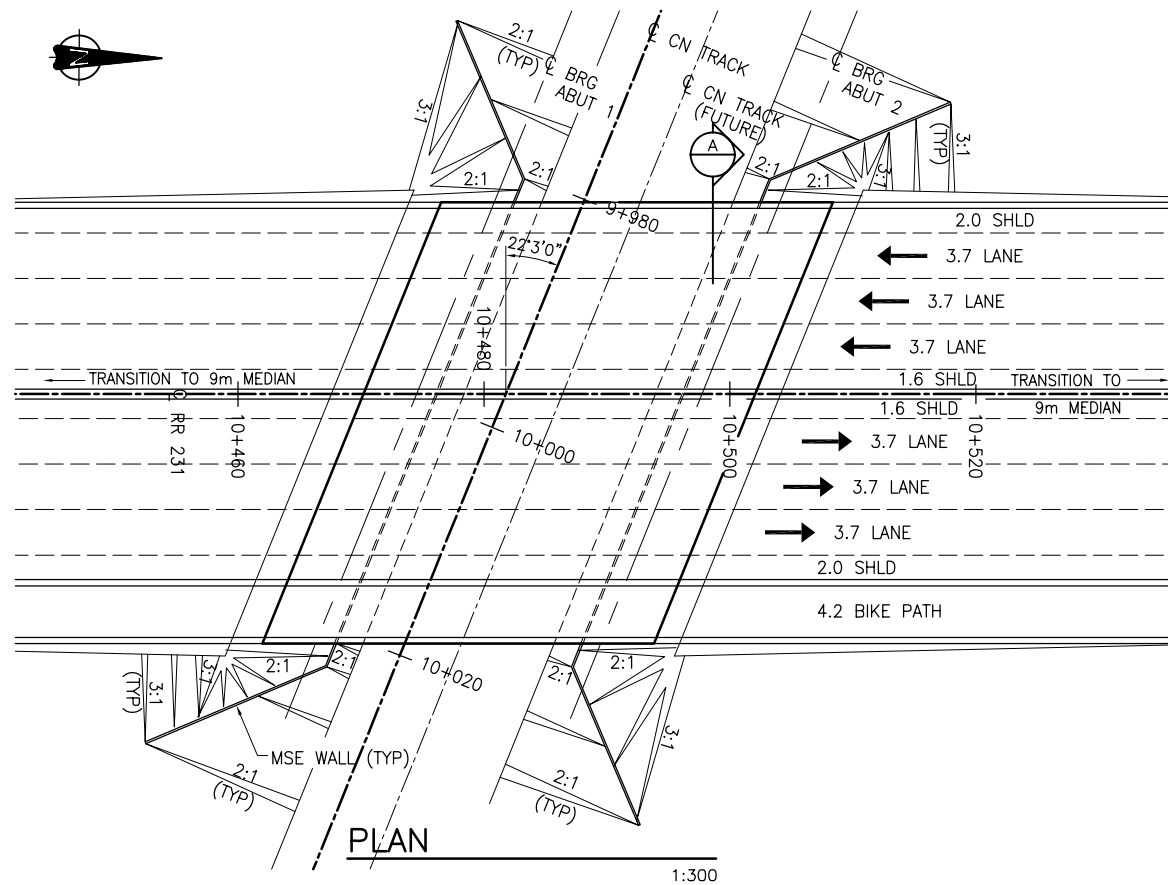
PERMIT TO PRACTICE

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	UTM	C.M.	114W
SCALE FACTOR:	GRID		
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	08/02/08
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK6	REV. No.:	0
		SHEET No.:	2 OF 2



Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

TOWNSHIP ROAD 534
OVER CP RAIL
GRADE SEPERATION
FIGURE 6.3B



LEGEND:

- DESIGN FINISHED & TRAIL
- DESIGN EDGE TRAIL
- DESIGN BACK SLOPE LIMITS
- ORIGINAL GROUND
- ORIGINAL GROUND EDGE
- PROPERTY LINE
- SHAW CABLE
- WATER MAIN
- NUL/GAS LINE
- TAU/POWER LINE
- TRAFFIC CABLE
- TELEPHONE CABLE
- STORM MAIN
- SANITARY MAIN

ABBREVIATIONS:

- BTOC: BACK TOP OF CURB
- BVC: BEGINNING OF VERTICAL CURVE
- L: CENTRE LINE
- ELEV: ELEVATION
- EVC: END OF VERTICAL CURVE
- N.T.S.: NOT TO SCALE
- PC: POINT OF CURVATURE
- PT: POINT OF TANGENCY
- PVI: POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER

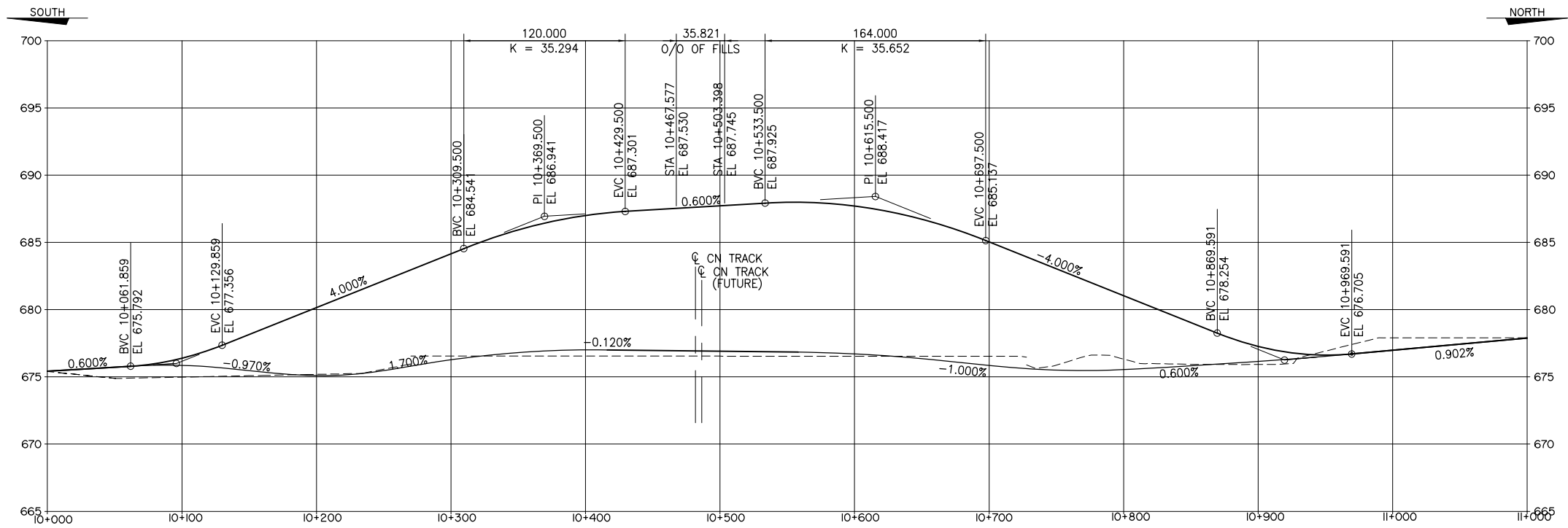
PERMIT TO PRACTICE

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	3TM C.M. 114W		
SCALE FACTOR:	GRID		
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	08/02/08
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK7	REV. No.:	0
		SHEET No.:	1 OF 2

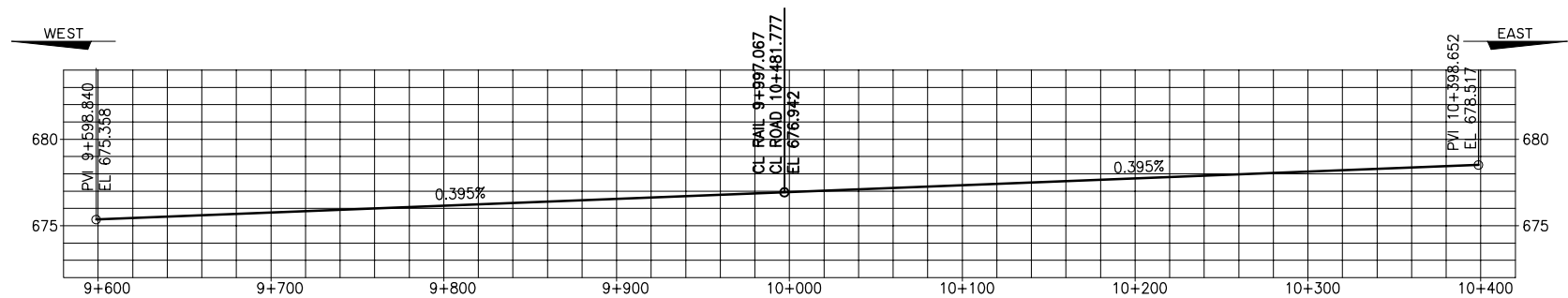


Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

RANGE ROAD 231
OVER CN RAIL
GRADE SEPERATION
FIGURE 6.4A



RR231 PROFILE
H 1:2000
V 1:200



RAIL PROFILE
H 1:2000
V 1:200

FILENAME: \\vestia\13031005\4_preliminary\structures\4-4_not_applicable\Working\31005_6_4.dwg
PLOT DATE: Apr 21, 2009 - 8:55 am

LEGEND:	
	DESIGN FINISHED & TRAIL
	DESIGN EDGE TRAIL
	DESIGN BACK SLOPE LIMITS
	ORIGINAL GROUND
	ORIGINAL GROUND EDGE
	PROPERTY LINE
	SHAW CABLE
	WATER MAIN
	NUL/GAS LINE
	TAU/POWER LINE
	TRAFFIC CABLE
	TELEPHONE CABLE
	STORM MAIN
	SANITARY MAIN

ABBREVIATIONS:	
BTOC	BACK TOP OF CURB
BVC	BEGINNING OF VERTICAL CURVE
E	CENTRE LINE
ELEV	ELEVATION
EVC	END OF VERTICAL CURVE
N.T.S.	NOT TO SCALE
PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
PVI	POINT OF VERTICAL INTERSECTION

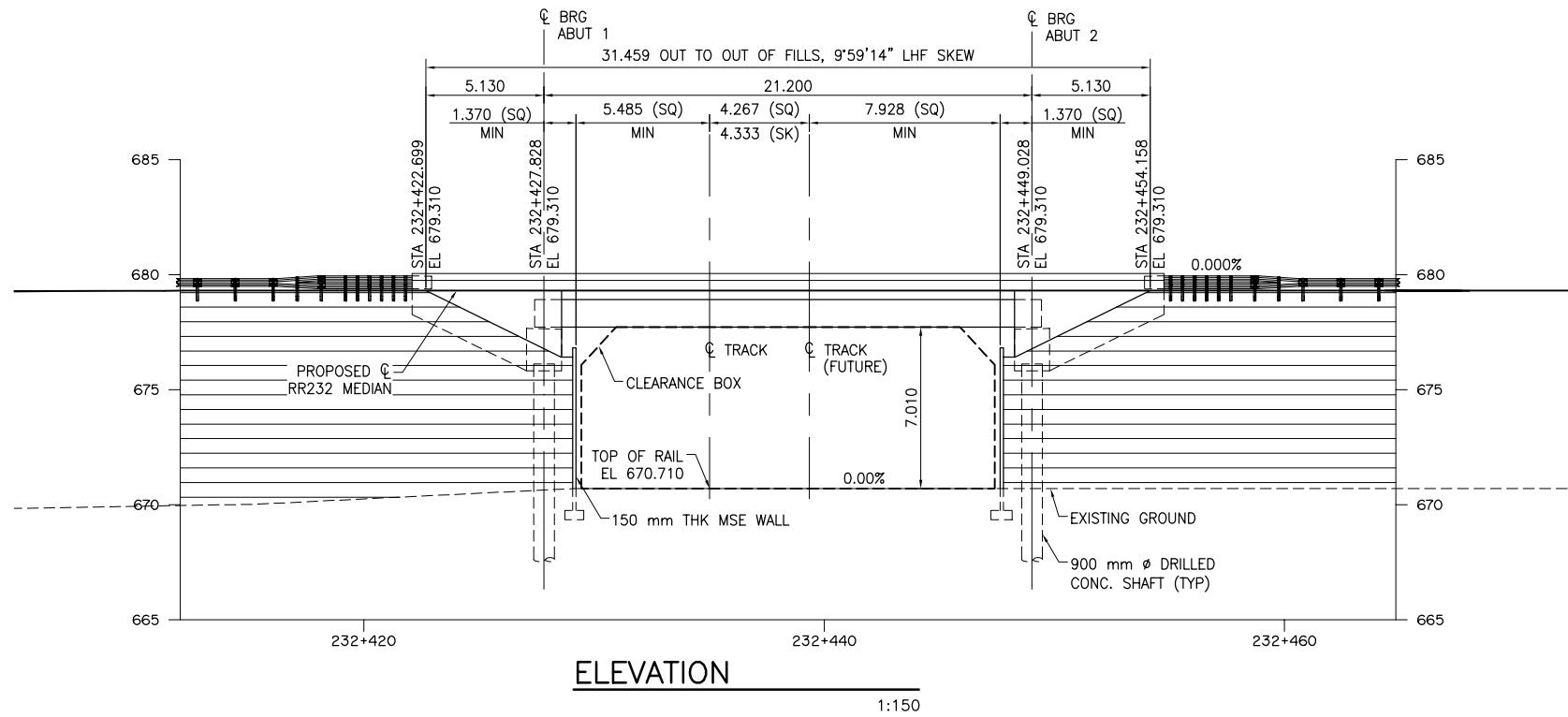
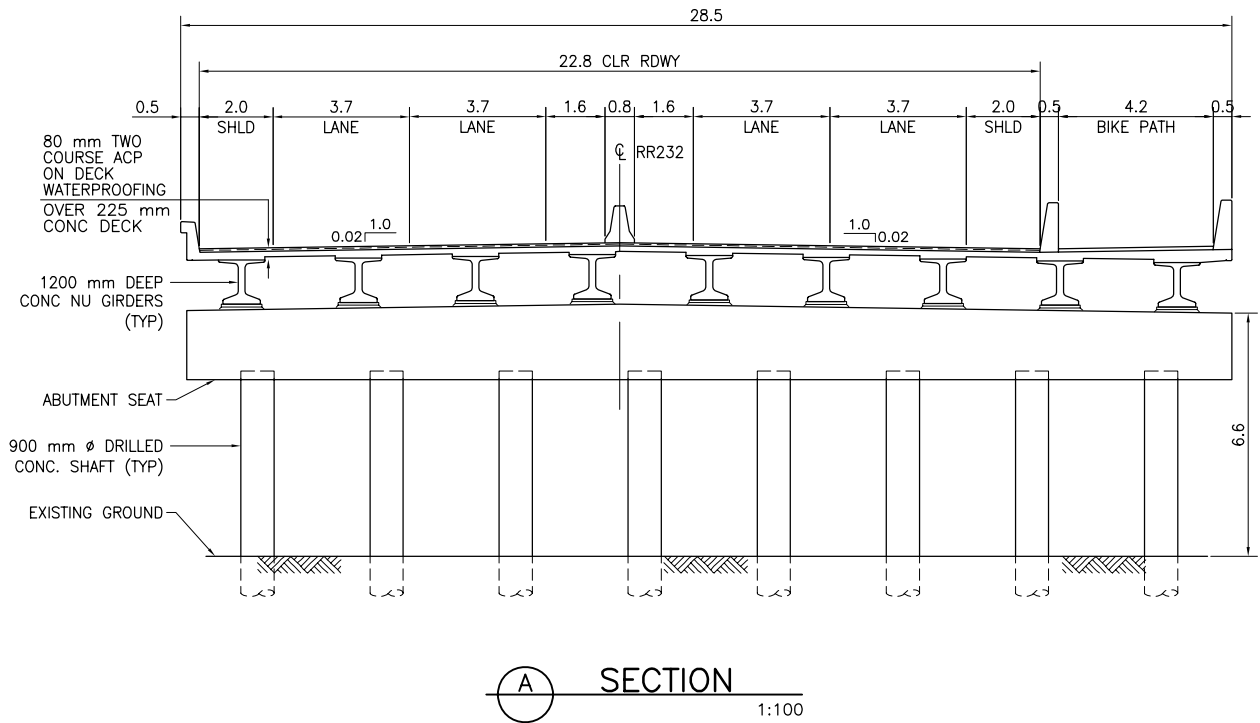
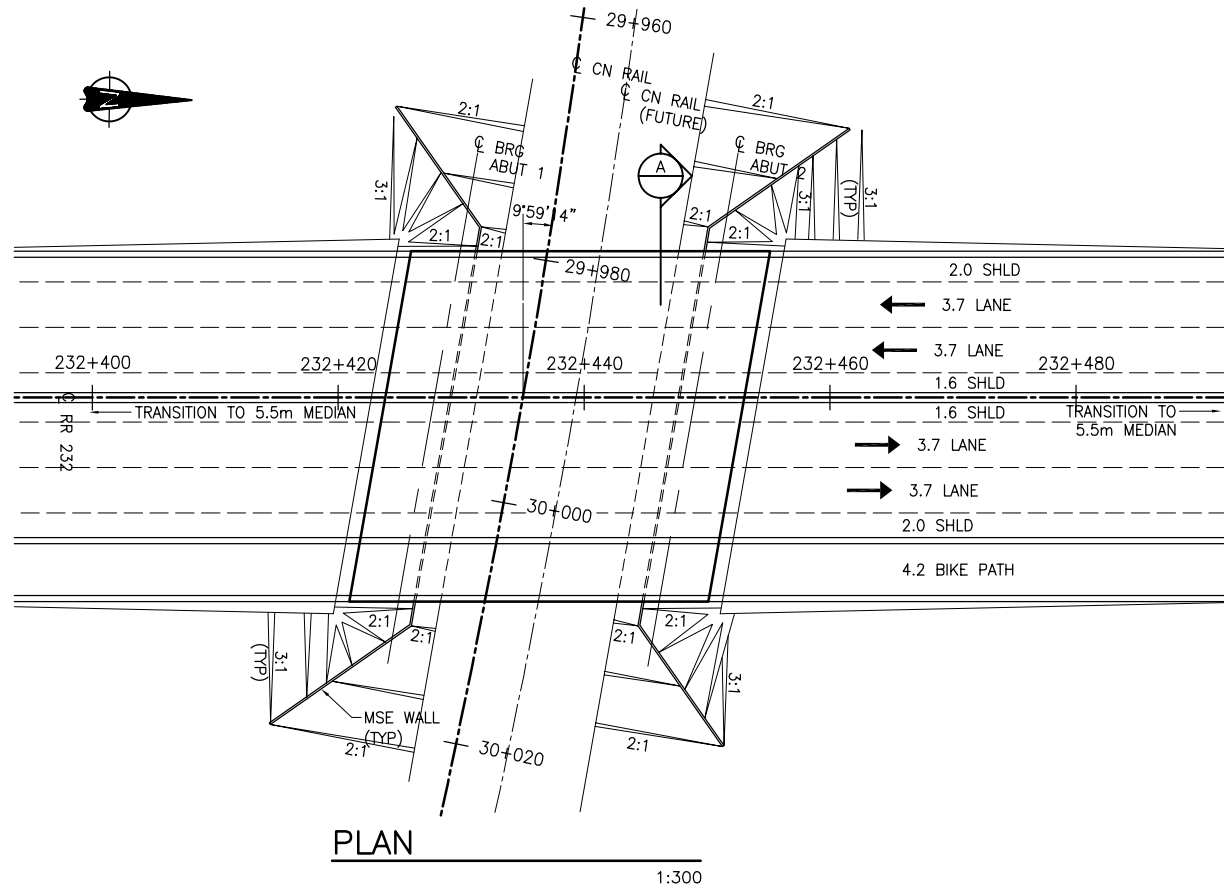
#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER	PERMIT TO PRACTICE

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	3TM C.M. 114W		
SCALE FACTOR:			
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A	DATE:	08/02/08
LDD PROJECT:	N/A		
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK8	REV. No.:	0
		SHEET No.:	2 OF 2

Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

RANGE ROAD 231
OVER CN RAIL
GRADE SEPERATION
FIGURE 6.4B



LEGEND:

- DESIGN FINISHED & TRAIL
- DESIGN EDGE TRAIL
- DESIGN BACK SLOPE LIMITS
- ORIGINAL GROUND
- ORIGINAL GROUND EDGE
- PROPERTY LINE
- SHAW CABLE
- WATER MAIN
- NUL/GAS LINE
- TAU/POWER LINE
- TRAFFIC CABLE
- TELEPHONE CABLE
- STORM MAIN
- SANITARY MAIN

ABBREVIATIONS:

- BTOC BACK TOP OF CURB
- BVC BEGINNING OF VERTICAL CURVE
- L CENTRE LINE
- ELEV ELEVATION
- EVC END OF VERTICAL CURVE
- N.T.S. NOT TO SCALE
- PC POINT OF CURVATURE
- PT POINT OF TANGENCY
- PVI POINT OF VERTICAL INTERSECTION

#	DATE	BY	ENG	SUBJECT
1	09/04/03	EDM	VK	ISSUED FOR REVIEW
REVISIONS				

RESPONSIBLE MEMBER

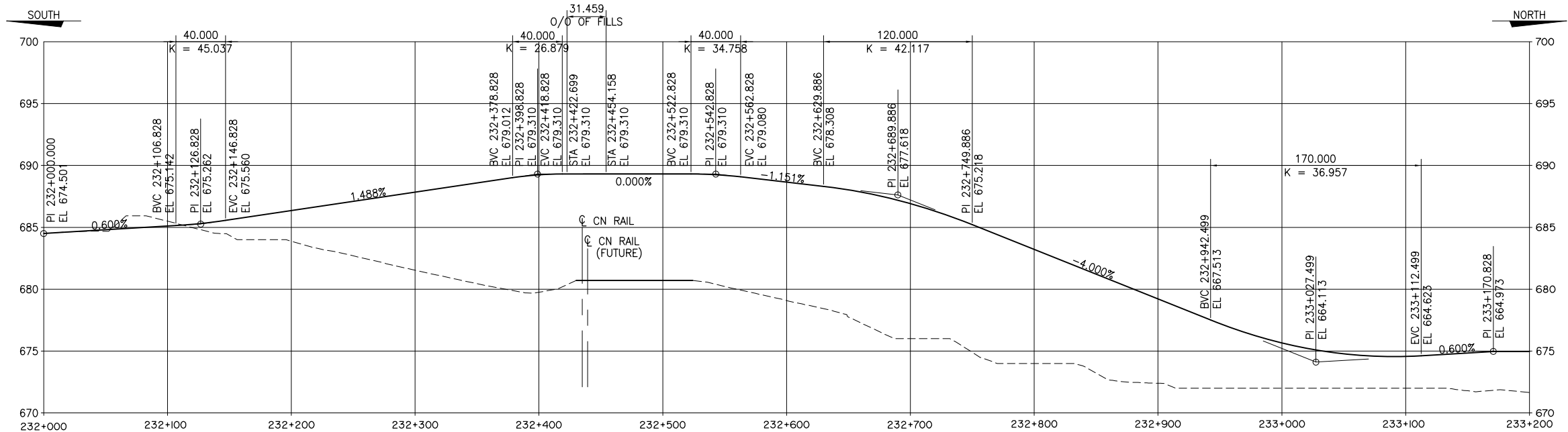
PERMIT TO PRACTICE

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	3TM C.M. 114W		
SCALE FACTOR:	GRID		
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	08/02/08
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK1	REV. No.:	0
		SHEET No.:	1 OF 2

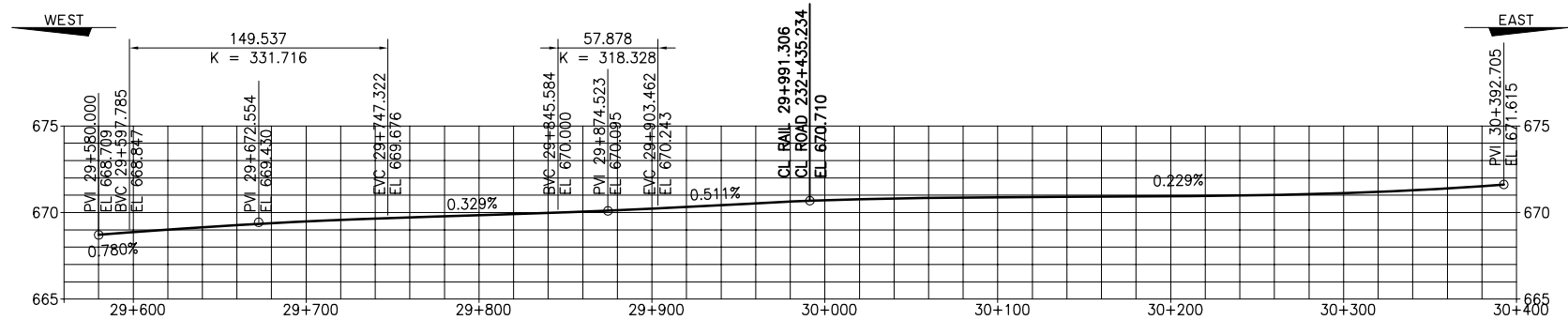


Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

RANGE ROAD 232
OVER CN RAIL
GRADE SEPERATION
FIGURE 6.5A



RR 232 PROFILE
H 1:2000
V 1:200



RAIL PROFILE
H 1:2000
V 1:200

FILENAME\\w:\active\13031005\4_preliminary\structures\4-4_not_applicable\working\31005_6.5.dwg
PLOTDATE Apr 21, 2009 - 10:10am

LEGEND:

---	DESIGN FINISHED & TRAIL
---	DESIGN EDGE TRAIL
---	DESIGN BACK SLOPE LIMITS
---	ORIGINAL GROUND
---	ORIGINAL GROUND EDGE
---	PROPERTY LINE
---	SHAW CABLE
---	WATER MAIN
---	NUL/GAS LINE
---	TAU/POWER LINE
---	TRAFFIC CABLE
---	TELEPHONE CABLE
---	STORM MAIN
---	SANITARY MAIN

ABBREVIATIONS:

BTOT	BACK TOP OF CURB
BVC	BEGINNING OF VERTICAL CURVE
E	ELEVATION
EVC	END OF VERTICAL CURVE
N.T.S.	NOT TO SCALE
PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
PVI	POINT OF VERTICAL INTERSECTION

--	--	--	--		--
					--
1	09/04/03	EDM	VK	ISSUED FOR REVIEW	
#	DATE	BY	ENG	SUBJECT	
REVISIONS					

RESPONSIBLE MEMBER

PERMIT TO PRACTICE

DATUM:	NAD 83	AIR PHOTO:	N/A
PROJECTION:	UTM	C.M.	114W
SCALE FACTOR:			
COORDINATES:	GRID		
SCALE (m):	AS SHOWN		
CONTOUR INTERVAL:	N/A		
LDD PROJECT:	N/A	DATE:	08/02/08
SURVEY BY:	STANTEC	DRAWN BY:	CL
DESIGN BY:	VK	CHECKED BY:	CC
APPROVED BY:			
DRAWING No.:	SK2	REV. No.:	0
		SHEET No.:	2 OF 2



Stantec Consulting Ltd.
10160 - 112 Street
Edmonton AB Canada
T5K 2L6
Tel: 780.917.7000
Fax: 780.917.7179
www.stantec.com

RANGE ROAD 232
OVER CN RAIL
GRADE SEPERATION
FIGURE 6.5B

7.0 Staging

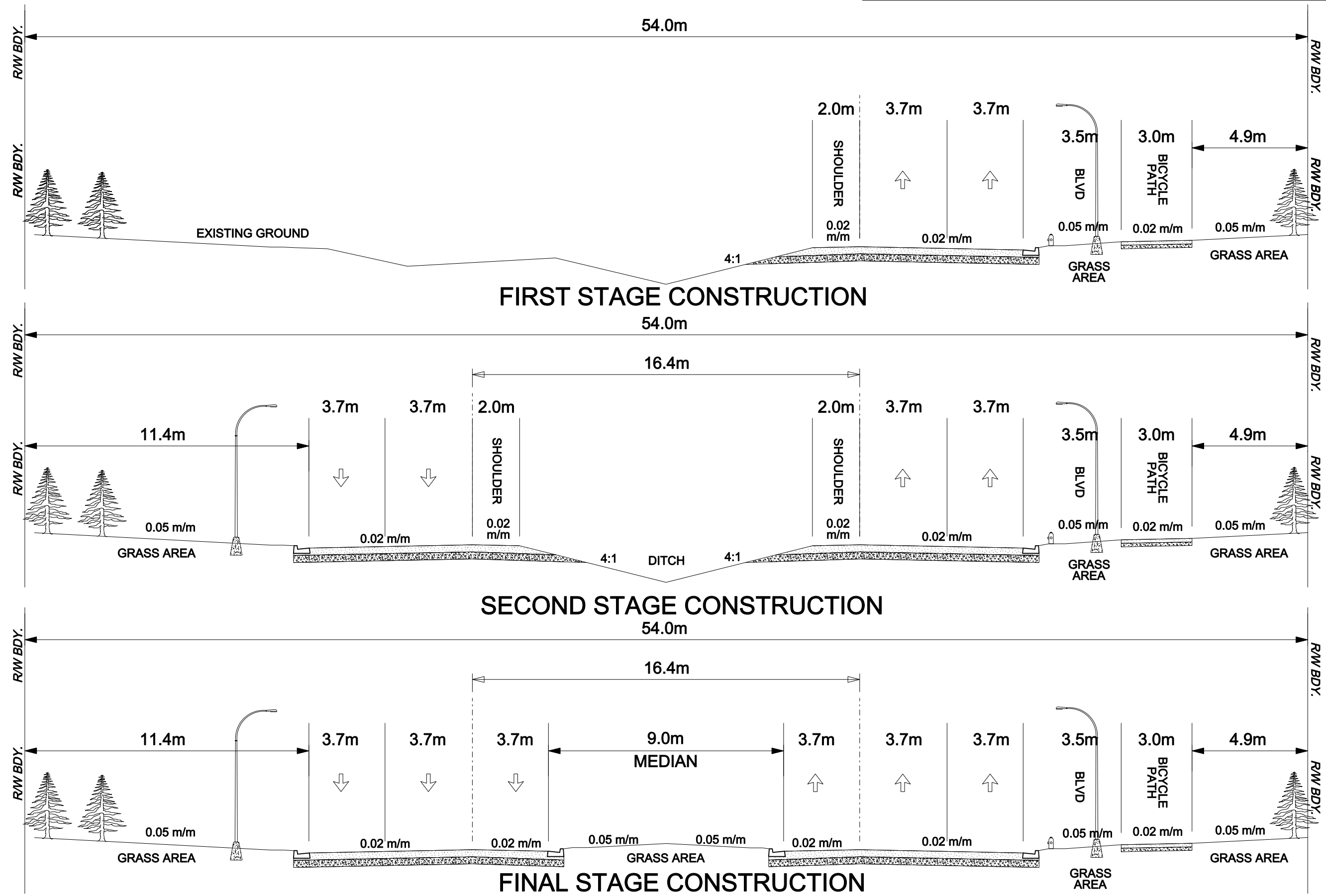
As traffic volumes and development warrant, it is proposed that the typical roadway cross-section for Range Road 231 and Township Road 534 will be developed in a staged manner as shown in Figure 7.1. This is similar to how Range Road 232 is being developed.

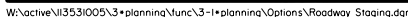
A variation of the illustrated staging approach would be to urbanize the median side of the cross-section in addition to urbanizing the boulevard side of the cross-section in the initial stage. Right-of-way and constructability constraints should be reviewed during preliminary design to confirm which approach is most effective.

Figure 7.2 illustrates the likely staging of Range Road 231 and Township Road 534 to their initial two lane upgraded cross-section as well as further upgrading of Range Road 232 to its four lane urban cross-section over the next 5 to 10 years.

The need for widening of Range Road 231 and Township Road 534 to a four lane cross-section will be dependant on the rate of development in the Yellowhead North Area, but will likely occur in the 10 to 20 year period. Further widening to six lanes of Range Road 231, Township Road 534 and possibly Range Road 232 south of Turbo Drive is expected to be required eventually. However, the timing of these six laning requirements is projected to be well beyond the 20 year horizon and is primarily driven by the potential new urban node proposed by Strathcona County to the east of Hwy 21.

YELLOWHEAD NORTH ARTERIAL ROAD
ROAD FUNCTIONAL DESIGN STUDY
CROSS-SECTION STAGING PLAN



8/7/2009

8.0 Cost Estimates

Cost estimates for each stage of construction were developed based on construction pricing from 2008, an estimate of expected pricing in 2009, which was expected to be substantially lower than 2008 costs, and planning level estimates of quantities. Table 8.1 summarizes the estimated overall cost of the arterial roadway network exclusive of right-of-way costs. The tables in Appendix F provide a breakdown of the how the cost of each stage of construction was calculated. Right-of-way requirements are identified in the plans contained in Appendix G.

Table 8.1
Summary of Costs

Road	Section	Cost (\$2009)
Range Road 231 – Hwy 16 to Township Road 534	Initial Stage – East half	\$7,600,000
Township Road 534 – Range Road 232 to Hwy 21	Initial Stage – South half	\$23,700,000
Range Road 232 – Turbo Drive to Township Road 534	Second Stage – East half and urbanization of west half	\$10,100,000
Range Road 231 – Township Road 534 to Existing Range Road 231	Initial Stage – East half	\$15,800,000
Range Road 231 – Hwy 16 to Township Road 534	Second Stage – West half	\$10,600,000
Township Road 534 – Range Road 232 to Hwy 21	Second Stage – North Half	\$14,400,000
Range Road 231 – Township Road 534 to Existing Range Road 231	Second Stage – West Half	\$9,700,000
Range Road 231 Hwy 16 to Township Road 534	Six Lanes	\$3,900,000
Township Road 534 – Range Road 232 to Hwy 21	Six Lanes	\$10,800,000
Range Road 231 – Township Road 534 to	Six Lanes	\$6,900,000

Existing Range Road 231		
Road	Section	Cost (\$2009)
Range Road 232	CN Grade Separation	\$19,500,000
Range Road 231	CN Grade Separation	\$16,700,000
Township Road 534	CP Grade Separation	\$16,900,000
Total		\$166,600,000