Chancellor Boulevard and East Mall Intersection Redesign

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EXECUTIVE SUMMARY

The Chancellor Blvd. East Mall intersection is a vital entrance and exit point from the University of British Columbia (UBC). Chancellor Blvd. was built during the period of highway development in Vancouver which occurred in the 1960's and 1970's. Despite the changes in nearby land use, the highway-style intersection has not changed over time. It does not accommodate active transportation modes which include walking, cycling, rolling, in-line skating and micro-mobility now, let alone the increased volume in the future.

The objectives for this redesign include:

- Reducing vehicle travel speeds approaching the campus.
- Accommodating all active modes of transportation.
- Minimizing land usage requirements and refraining from encroaching on preoccupied properties.
- Retaining all rainwater on-site to manage a 100-year storm event.
- Creating a gateway to welcome university faculty, students, residents and visitors to campus.

HEXALIGN followed relevant codes and standards in the geometric design of the intersection, analyzing it in PTV Vissim based on traffic flow data collected during the AM and PM peak hours of a regular weekday. AutoCAD, Civil 3D, and ArcGIS were used to develop drawings while SketchUp was used to develop the 3D renders of the final design.

The proposed intersection design includes a 33.5m diameter roundabout with a truck apron. Pedestrian crossings and cross rides will be installed at all four crossings, each equipped with Rectangular Rapid Flashing Beacons (RRFBs). Additionally, an underground stormwater detention tank located underground on East Chancellor Blvd., and an entry gateway structure located at the north-end of the roundabout will be incorporated.

The cost of the project is estimated to be $3.5 million, with a construction start date of May 2025 and completion date in August 2025. For detailed design drawings, refer to Appendix A.

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1. Introduction

1.1. Site Description

The University of British Columbia Point Grey Campus (UBC) is located within a forested area which is accessible by the remnants of three double-lane highways that were developed between the 1960’s and 1970’s. One of the highways is Chancellor Blvd. which intersects East Mall and Northwest Marine Dr. The intersection serves a vital entrance and exit point for university faculty, students and residents and is also part of a bus route for the TransLink bus route 68 – UBC Exchange / Wesbrook Village. The intersection is located on the northern end of campus and is at the border of Pacific Spirit Regional Park, the University Endowment Lands (UEL) and UBC; the intersection is circled in red.

Figure 1. Location of the Existing Intersection

(Photo Credit: UEL Boundary Map)

The intersection, shown in Figure 2, has not changed much despite the changes in nearby land uses and the increases in campus growth. The intersection possesses a variety of travel lanes for vehicles and does not accommodate the safety and accessibility of active modes. Active modes include walking, cycling, rolling, in-line skating and micro-mobility. Each road of the intersection, whether arterial or collector such as East Mall consists of one travel lane in each direction, however, there are instances where one travel lane turns into two travel lanes. Specifically, the NW Marine Dr. travel lane between Pacific Spirit Regional Park and the University Endowment Lands has the user to decide to turn right and continue on NW Marine Dr. or turn left and proceed onto Chancellor Blvd. Another instance is the East Mall travel lane; when the user is leaving UBC campus, they can either turn left onto NW Marine Dr. or turn right onto Chancellor Blvd. With all these vehicular movements, the intersection is not intuitive for motorists and there are a limited number of sidewalks, pedestrian crossings and bike lanes available for active modes to navigate around all these travel lanes. In addition, the posted speed limits of 50 km/h for Chancellor Blvd. and NW Marine Dr. present a challenge for active modes to comfortably and safely navigate the highway-style intersection.

Figure 2. Capture of the existing intersection

Figure 3 provides an overview of the utilities in the intersection and there is currently no gateway structure which welcomes the local community to campus.

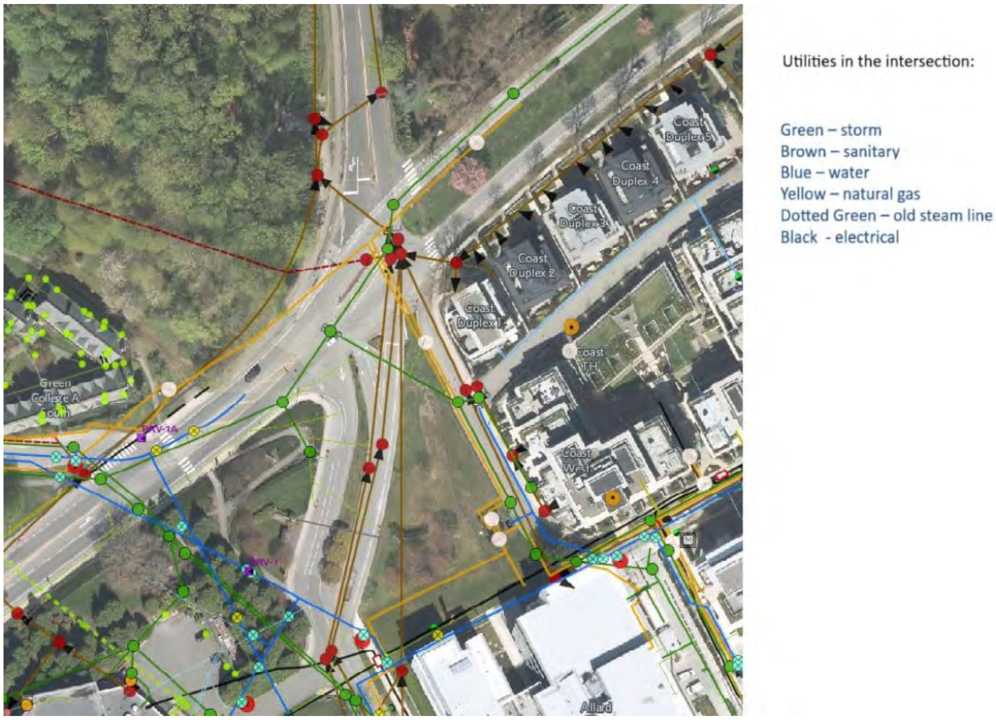

Figure 3. Utilities in the intersection

1.2. Project Scope

The primary objective is to redesign the intersection to the future year of 2050 for active modes of all ages and abilities to comfortably and safely navigate. Please note that Iona Dr. is not part of the scope of this intersection redesign.

HEXALIGN's scope of work includes the following:

- Gather and review the information given by the client and research additional information relating to property lines, future land use changes, existing infrastructure and traffic counts.
- Carry out site investigations to understand the current conditions and the issues of the intersection.
- Collect AM and PM peak period intersection counts at the intersection.
- Create a base file in AutoCAD by using provided LiDAR, orthophotos and/or GIS.
- Select and refine the most suitable intersection design by listening to the client's needs.

- Model the most suitable intersection design on PTV Vissim.
- Prepare a 3D model of the most suitable intersection design.
- Create a pavement design for the intersection.
- Create an 8m ground-mounted UBC gateway sign structure.
- Prepare a stakeholder engagement, consultation and communication plan.
- Provide a draft plan of construction work along with the anticipated issues resulting during construction.
- Prepare a schedule of milestones concerning the undertaking of the construction and completion of the project.
- Prepare a Class A cost estimate of the most suitable intersection design.
- Develop detailed design drawings to be "Issued for Construction" (IFC).
- Develop construction specifications and service life maintenance plan to include with the set of IFC drawings.

1.3. Governing Policies and Documents

All design work is based on the following governing policies and documents. They include:

- CSA S16 / CISC Handbook (2024)
- The University of British Columbia Campus Vision 2050 (2021)
- National Building Code of Canada (2020)
- CSA A23.3 Design of Concrete Structures (2019)
- BC MoTI Standard Specifications for Highway Construction (2020)
- BC MoTI B.C. Supplement to TAC Geometric Design Guide for Canadian Roads (2019)
- BC MoTI British Columbia Active Transportation Design Guide (2019)
- BC MoTI PAVEMENT STRUCTURE DESIGN GUIDELINES Technical Circular T-01/15 (2015)
- Piteau Associates UBC Properties Trust Hydrogeological and Geotechnical Assessment of Northwest Area UBC Campus, Vancouver (2002)

Additionally, HEXALIGN utilized the following supplemental documents:

- Government of Canada Transportation 2030 (2019)
- City of Vancouver Engineering Design Manual (2019)
- Heavy Truck Weight and Dimension Limits for Interprovincial Operations in Canada (2019)
- Transportation Association of Canada (TAC) Canadian Roundabout Design Guide (2017)
- UBC Integrated Stormwater Management Plan (2017)
- City of Vancouver Elevation contour lines - 1 metre contours (2002)
- BC Stormwater Management Guidebook (2002)

1.4. Limitations

There is limited access to as-built drawings, therefore, assumptions are required concerning much of the existing civil infrastructure. Minimal information regarding underground utilities was provided, therefore, multiple assumptions were made to design the gateway structure and water retention system. Given that BC MoTI has old design standards for active transportation, HEXALIGN will address any gaps between the ministry requirements predictions made in this report. Limitations in grades and space will affect the allocation towards active transportation modes. Lastly, limited traffic data provided will require the use of data from other nearby intersections to calculate the average annual daily traffic (AADT) and analysis of the compounding growth rate.

1.5. Task Register and Computer Modelling Software

Table 1. Project Team Contributions to the Detailed Design and Report

Report Component	Primary Contributor	Secondary Contributor	Reviewer
Executive Summary			
1. Introduction			
2. Design Criteria			
3. Detailed Design – Key Components & Selection Rationale			
4. Construction Plan			
5. Construction Schedule			
6. Class A Cost Estimation			
7. Conclusion			
8. References			
Appendix A – Detailed Drawings			
Appendix B – Traffic Analysis			

Appendix C - Structural Calculations			
Appendix D – Stormwater Calculations			
Appendix E - TMPs			
Appendix F – Construction Schedule			
Appendix G – Class A Cost Estimation			
Appendix H – Construction Specifications			
Project Component	**Primary Contributor**	**Secondary Contributor**	**Reviewer**
Traffic Counts – Morning Traffic Counts Traffic Counts – Afternoon Traffic Counts Traffic Counts – Evening Traffic Counts			
Roadway Design – Geometric Design Roadway Design – Traffic Analysis Roadway Design – Collision and Safety Assessment Roadway Design – Active Transportation Infrastructure Roadway Design – Signage and Pavement Markings Roadway Design – 3D Model Roadway Design – Drafting			
Pavement Design – Pavement Structure Pavement Design – Drafting			
Gateway Design – Structural Layout Gateway Design – Structural Analysis and Calculations Gateway Design – Drafting			
Stormwater Design – LiDAR Analysis Stormwater Design – EPANET Analysis Stormwater Design – Catchment Basin Analysis Stormwater Design – Drafting			
Additional Infrastructure			
Construction Plan – Anticipated Site Issues and Risk Analysis Construction Plan – Maintenance Plan Construction Plan – Construction Phasing Construction Plan – Traffic Management Plan (TMPs) Construction Plan – Construction Specifications			
Construction Schedule			
Class A Cost Estimation			

The table below presents a summary of the computer modelling software utilized.

Table 2. Computer Modelling Software Utilized

Software	Utilization
PTV Vissim	Feasibility and Traffic Analysis
SketchUp	3D Model
Autodesk Civil 3D	Geometric Design and Detailed Design Drawings
Autodesk AutoCAD	Detailed Design Drawings

ArcGIS	LiDAR Data
Bluebeam	Construction and Traffic Management Plan
Microsoft Excel	Geometric Elements and Gateway Design Calculations

2. Design Criteria

UBC Campus and Community Planning (CCP) is interested in understanding the work required to redesign the current intersection to current BC MoTI standards and address other issues with the intersection. As mentioned previously, HEXALIGN will redesign the intersection to a future year of 2050 with a design life of 25 years for active modes of all ages and abilities to comfortably and safely navigate; active travel modes will be prioritized over single occupant vehicles. The following issues will also be addressed:

- Reduce vehicle travel speeds approaching the campus.
- Minimize land usage requirements and refrain from encroaching on preoccupied properties.
- Retain all rainwater on-site to manage a 100-year storm event.
- Create a gateway to welcome university faculty, students, residents and visitors to campus.

The following sections highlight key design and evaluation criteria that were considered when developing and refining the proposed intersection redesign.

2.1. Regulatory Aspects

To undertake the roadway design, gateway design and stormwater design, HEXALIGN will follow all the relevant codes and standards listed in Section 1.3 - Governing Policies and Documents.

2.2. Technical Aspects

To undertake the roadway design, gateway design and stormwater design, HEXALIGN will comply with all technical design criterions outlined in Table 3. In addition, all design assumptions must be stated.

Table 3. Technical Aspects of the Chancellor Blvd./East Mall Intersection Redesign

Roadway Design	Gateway Design	Stormwater Design
Meet current design standards and operational requirements to an appropriate future year scenario; consider safe and efficient	Meet current codes and standards when designing the 8m tall gateway structure.	Create a retention system to manage a 100-year storm event with no changes to underground utilities

maintenance of the design. The more active mode design elements incorporated into the design, the better. Include a pavement design appropriate for the vehicle composition of the intersection and anticipated future year volumes at the intersection. Account for additional information researched relating to the project objectives which include: - Property lines. - Future land use changes. - Existing infrastructure usage. - Traffic counts. - Orthophotos, GIS. - CAD files. - Site visits. Identify where lighting and street furnishings go.		but with assumptions for the following: - Existing civil infrastructure. - Existing utility information. - Existing soil conditions. Ensure that all rainwater is retained and reused on site for the whole catchment area around the intersection.

2.1 Economical Aspects

To ensure that HEXALIGN demonstrates fiscal responsibility despite not having a specific budget constraint, the proposed intersection redesign will:

- Incorporate sustainable practices to reduce costs associated with environmental degradation and compliance.
- Incorporate features that reduce ongoing maintenance and operational expenses.
- Utilize affordable construction materials.
- Explore innovative traffic management solutions.

2.3. Environmental Aspects

To ensure HEXALIGN exemplifies commitment to sustainable development, the proposed intersection redesign will:

- Minimize tree loss and overall vegetation in the design, construction and maintenance of the proposed intersection. If at any point in the design process a tree is removed, one tree will be planted.

Specifically, construction of the proposed intersection redesign will:

- Minimize disturbance to Pacific Spirit Regional Park and surrounding animals.
- Minimize space occupied within the project area.

Two evaluation criteria related to environmental aspects have been proposed.

1. The easier it is to provide safe and efficient maintenance of the intersection, the better.
2. The lower the emissions and fuel consumption used by motorists – the more walking, cycling, rolling, in-line skating and micro-mobility transportation carried out – the better.

2.4. Societal Aspects

The proposed intersection redesign will:

- Prioritize the safety of pedestrians, cyclists, and motorists by providing a clear and intuitive path of travel for everyone.
- Align with the cultural and visual identity of UBC and its surrounding environment.
- Account for and incorporate community feedback to address local needs and expectations.
- Encourage walking, cycling, rolling, in-line skating and micro-mobility over single occupancy vehicles.
- Minimize the disruption of traffic flow during construction.

2.5. Construction Planning Aspects

To ensure that the construction schedule does not get disrupted, HEXALIGN recognizes that an effective construction staging plan is required. The proposed intersection redesign will:

- Ensure the work zone does not encroach on preoccupied properties; boundaries will be respected.

3. Detailed Design – Key Components & Design Rationale

3.1. Geometric Design

The proposed roundabout at the Chancellor Blvd. and East Mall intersection has been designed in accordance with the BC TAC Geometric Design Guide (2019), incorporating key principles of compact, single-lane urban roundabouts that support all users. The roundabout features one entry and exit lane on all approaches, with a consistent circulating lane width of 5.1 meters to balance vehicle flow and safety. The design includes a truck apron to accommodate WB-20 trucks, the largest design vehicle expected to use the intersection regularly. To further support safe and intuitive navigation, the design incorporates splitter islands, medians, and seamless transitions to existing infrastructure, all of which help calm traffic and enhance comfort for pedestrians, cyclists, and drivers. Figure 4 below is an overview of our roundabout and Table 4 is a summary of key components.

Figure 4. Overview of the Detailed Design Peanut-Shaped Roundabout

Key Components

Table 4. Technical Key Components of the Main Roundabout

Geometric Design Elements	East Mall N/B Approach	NW Marine Dr. S/B Approach	Chancellor Blvd. W/B Approach	NW Marine Dr. E/B Approach
Functional Classification of Approach Road	Collector Road	Collector Road	Major Arterial Road	Major Arterial Road
Design Classification of Approach Road	Urban Collector Road	Urban Collector Road	Primary Urban Arterial Road	Primary Urban Arterial Road
Posted Speed of Approach Road	50 km/h	50 km/h	50 km/h	50 km/h
Speed Inside the Roundabout	30 km/h	30 km/h	30 km/h	30 km/h
Angle of Intersecting Roads	105 degrees	80 degrees	83 degrees	89 degrees
Approach Grade	8.5%	4.5%	5.4%	6%
Apron Width	11.6 m	11.6 m	11.6 m	11.6 m
Inscribed Circle Diameter	33.5 m	33.5 m	33.5 m	33.5 m
Circulating Lane Width	5.1 m	5.1 m	5.1 m	5.1 m
Entry Width	4.5 m	4.8 m	6.0 m	5.7 m
Entry Radius	16.75 m	16.75 m	11.21 m	16.75 m
Exit Width	4.5 m	5.5 m	5.2 m	5.6 m
Exit Radius	16.75 m	11.21 m	16.75 m	16.75 m
Bypass Lane	No	No	No	No
Number of Lanes	1	1	1	1
Current Traffic Volume (SADT)	557	663	3620	3315
Design Hour Approach Volume (Year 2050)	49	50	625	274
Truck Volume %	0.5%	0%	3%	2%
Level of Service	A	A	C	B
Design Vehicle	WB-20	WB-20	WB-20	WB-20

No Right Turning for Large Vehicles; Truck and buses cannot turn right from Chancellor Blvd. to NW Marine Dr. due to radius constraints(NE Approach). If needed, they must perform a "slingshot" maneuver around the roundabout. During HEXALIGN's site visits and traffic counts, a total of 3 trucks turned right from Chancellor Blvd. to NW Marine Dr., accounting for AM and PM peak hours. After conducting analyses on PTV Vissim, the collected data also indicates that there is currently a low volume of vehicles turning right from Chancellor Blvd. Thus, the low volume, combined with an emphasis on accessibility, enabled the removal of the existing right turn movement on Chancellor Blvd. All other movements will remain operating as normal.

Multi-Use Pathway (MUP): All approaches to the roundabout include a 4.0m wide MUP to accommodate travel space for all modes of transportation within the roundabout zone. The MUP will be composed of a 75mm overlay of asphalt with adequate gravel support.

Crossrides: With the special permission from BC MoTI, crossrides are proposed within each pedestrian crossing zone. Crossrides provide a clearly marked space for cyclists, reducing conflicts with pedestrians and motor vehicles. The presence of specific markings and signage enhances driver awareness, lowering the risk of accidents.

Design Vehicle: As outlined by Section 720 in the BC Supplement to TAC Geometric Design Guide 2019, the recommended design vehicle of the roundabout is a WB-20 truck. This implies that all smaller vehicles, such as articulated buses, can traverse the intersection.

Truck Apron: Truck aprons are specially designed sections of roadway, typically found at roundabouts and intersections, that provide additional space for the rear wheels of large trucks such as the WB-20 truck to navigate turns without encroaching on adjacent lanes. The truck apron will be constructed using concrete to accommodate the weight of the heavy trucks.

Inscribed Circle Diameter (ICD): The recommended ICD of this roundabout is 33.5m for both North-East and South-West circles. This ensures that the largest design vehicle (WB-20) will have enough turning radius to complete the turns within the roundabout.

Circulatory Roadway Width: According to Section 740.04 in the BC Supplement to TAC Geometric Design Guide 2019, single lanes are recommended for both entry and exit legs of the roundabout in all directions, based on an analysis of traffic volumes and turning movements.

A camel back design was used within the roadway of the roundabout. This refers to a type of humped road profile that features a rising and falling curve, like the shape of a camel's back. This design is used primarily to slow down vehicles, improve traffic safety, and enhance road aesthetics.

Medians: Concrete medians help define lanes and guide vehicles through the roundabout, ensuring that traffic flows in an orderly manner. By clearly delineating lanes, these medians reduce the risk of lane encroachment and prevent vehicles from cutting across traffic. This leads to smoother and more predictable movement of vehicles, reducing the likelihood of accidents. The width of the median at least is 3.0m and 2.0m long, according to the TAC guidelines. On East Chancellor Boulevard, the new medians will tie into the existing median, which is wider than the newly proposed ones, ensuring a smooth transition and visual consistency along the corridor.

Entry Speed: As outlined in the US Department of Transportation Geometric Design Guide, the recommended entry speed is 30 km/h for an urban single lane. This design enables vehicles to decelerate before entering the roundabout. Entry speed is directly influenced by the entry width and entry radius, as these elements determine the roundabout’s entry deflection. To accurately assess entry speed, a fastest path analysis should be conducted in accordance with TAC guidelines.

Tie-ins to existing roads: The tie-ins to the existing infrastructure are designed to be smooth transitions with minimal changes required. The existing sidewalks will connect to the new MUP approaches. Due to the alignment change of the roadway, zones dedicated for pedestrians will also be adjusted with new MUP around the roundabout. Existing sidewalks within that zone will be abolished for boulevard zone.

Lighting Plan: A lighting plan is needed to ensure the roundabout is actively lit at night. All lights are evenly spaced apart (~30m) based on their lighting angle to minimize cost and light pollution, while maximizing safety. Figure 5 shows the street light locations used for the roundabout.

Figure 5: Street Light Component

3.2. Traffic Analysis

3.2.1 Current Performance

A site investigation and traffic count were conducted to observe and collect data, which was then inputted into PTV Vissim for analysis, using AM Peak Hour and PM Peak Hour traffic volumes. The volume data and results of the PTV Vissim analysis by our team are found in Appendix B. The design modelled on PTV Vissim is presented in Figure 6.

Figure 6. Traffic Modeling using PTV Vissim

Rather than relying on the average annual daily traffic (AADT) data, the focus on the peak-hour volumes allowed HEXALIGN to simulate the intersection under the most critical traffic conditions. This approach ensured that the roundabout's performance during high-demand periods, such as morning and evening commuting hours, was accurately represented. By simulating these peak periods, we assessed key performance metrics, including delay, level of service (LOS), and queue lengths.

3.2.2 Future Growth Analysis

To incorporate future growth into our analysis, HEXALIGN applied a linear growth model based on the 20% projected population increase outlined in UBC Campus Vision 2050. This projection anticipates a rise in the daytime population of the UBC campus from 80,000 in 2023 to approximately 100,000 by 2050 [1]. The linear growth model assumes a consistent annual increase in traffic demand over the 27-year period, which aligns with the gradual expansion of campus facilities, housing, and enrollment.

Table 5. AADT Value Summary

<table>
<tr><th>Approach</th><th>2023 AADT (pcu)</th><th>2050 AADT (pcu)</th><th>Growth Rate</th></tr>
<tr><td>NB</td><td>562</td><td>671</td><td rowspan="4">20%</td></tr>
<tr><td>SB</td><td>639</td><td>762</td></tr>
<tr><td>EB</td><td>3655</td><td>4361</td></tr>
<tr><td>WB</td><td>3347</td><td>3992</td></tr>
</table>

**Note: EB/WB is Chancellor Blvd. which is a major road & NB/SB is NW Marine Dr. which is a minor road*

This method is particularly useful for long-term infrastructure planning, as it avoids overestimating early-stage growth while capturing the gradual intensification of traffic patterns.

Table 6. Level of Service Summary

<table>
<tr><th></th><th>Approach</th><th>LOS</th></tr>
<tr><td rowspan="5">AM PEAK HOURS</td><td>NB</td><td>A</td></tr>
<tr><td>SB</td><td>A</td></tr>
<tr><td>EB</td><td>C</td></tr>
<tr><td>WB</td><td>B</td></tr>
<tr><td>Total Intersection</td><td>A</td></tr>
<tr><td rowspan="5">PM PEAK HOURS</td><td>NB</td><td>A</td></tr>
<tr><td>SB</td><td>A</td></tr>
<tr><td>EB</td><td>D</td></tr>
<tr><td>WB</td><td>C</td></tr>
<tr><td>Total Intersection</td><td>A</td></tr>
</table>

**Note: EB/WB is Chancellor Blvd. which is a major road & NB/SB is NW Marine Dr. which is a minor road*

The proposed single-lane roundabout design at the Chancellor Blvd./East Mall intersection is a direct response to observed traffic patterns and aligns with the project's objectives of reducing vehicle speeds, minimizing land use, and enhancing safety for all users. PTV Vissim simulations during AM and PM peak hours indicated that the intersection can operate efficiently with one entry and exit lane per approach, maintaining acceptable levels of service (LOS A–D) across all directions even under projected 2050 traffic volumes.

Overall, the roundabout received a **level of service (LOS) of A**. This indicates that the roundabout balances vehicle convenience with active transportation accessibility.

3.2.3 Collision and Safety Assessment

The following sections discuss the expected crash reductions if a roundabout is constructed as well as the safety assessment for all active modes.

Collision Modification Factors (CMF)

The reduction of collisions that occur as a result of converting an urban stop-controlled intersection into a modern roundabout is due to the fact that speeds are reduced with a roundabout and conflicting traffics are reduced [2]. Thus, a CMF of 0.76 was used to calculate the predicted crash frequency for the roundabout. Based on Table 7, a roundabout would provide an approximate 25% reduction in crashes per year.

Table 7. Collision Modification Factors for BC

Exhibit 6.3: Convert Urban Stop-Controlled Intersection to Roundabout

Treatment	Intersection Type	Target Collisions	CMF
Convert Urban Stop-Controlled Intersection to Roundabout	Urban One-Lane	All	0.76
	Urban Two-Lane	All	0.89

Target Collisions: All collisions

(Photo Credit: BC Ministry of Transportation and Infrastructure)

Safety Assessment

The main criterion for this assessment is based on how safe it is for each active mode traversing through the proposed roundabout.

Table 8. Safety Assessment for Various Active Modes Utilizing the Proposed Roundabout

Active Modes	Assessments	Overall Rating
Walking	Pedestrian safety is enhanced through clearly marked, at-grade crosswalks at each leg of the roundabout, all equipped with Rectangular Rapid Flashing Beacons (RRFBs) to improve driver awareness and yielding compliance. Refuge islands between lanes provide a safe waiting space for two-stage crossings. Wide sidewalks and 4.0m Multi-Use Pathways (MUPs) along each approach create consistent and safe pedestrian routes, physically separated from vehicle traffic.	High
Cycling, Rolling, In-line Skating & Micro-mobility	Crossrides allow cyclists to cross with priority alongside pedestrians, minimizing the need to dismount. Conflict points with vehicles are reduced through clear separation and signage (Please refer to section 3.3 for Signage Plan). Dedicated 4.0m wide Multi-Use Pathways (MUPs) accommodate cyclists and skaters on all approaches. Entry radii ensure vehicle speeds remain low near crossings. (Please refer to section 3.1 Geometric Design)	High
Adapted micro-mobility devices for individuals with disabilities	Curb ramps, refuge islands, and wide MUPs provide smoother, safer navigation for users with mobility devices. The roundabout's geometry reduces sudden vehicle movements. (Please refer to section 3.1 Geometric Design)	Moderate to High

3.3. Active Transportation Infrastructure

3.3.1 Transit

Considering the future traffic data, HEXALIGN recommends increasing the frequency of TransLink bus route 68 - UBC Exchange / Wesbrook Village rather than opting for larger buses with higher capacity. Larger buses may struggle with the turning radii, which could lead to a less smooth and comfortable experience for passengers. According to the TransLink schedule, bus route 68's frequency is now every 20 minutes. HEXALIGN proposes to increase the frequency to now every 10 or 15 minutes designing for future growth. UBC Campus Vision 2050 mentions that there will be a rapid SkyTrain on campus. However, after analyzing the SkyTrain route, HEXALIGN noticed that the SkyTrain route will not traverse through the roundabout.

3.3.2 Pedestrians and Individuals with Disabilities

Multi-Use Pathways (MUPs) will be added at all approaches, making the space accessible to all active modes of transportation including walking, cycling, rolling, in-line skating, and micro-mobility. The wide width of the MUP gives plenty of space for all users to co-exist. To improve safety and visibility at all four crossings, HEXALIGN has also incorporated Rectangular Rapid Flashing Beacons (RRFBs) along with crossrides, helping ensure a clear and safe passage for everyone.

Tactile Attention Indicator (1): Tactile Attention Indicators will be installed along the Multi-Use Paths (MUPs) to alert users—particularly those who are blind or have low vision—of upcoming changes in the environment. Placing these indicators at path crossings and junctions helps improve safety and spatial awareness for all users. In line with CSA B651-18 guidelines, the indicators will be installed with high visual contrast (typically yellow) to maximize visibility and detection by both cane and foot.

Tactile Direction Indicator (2): Tactile Direction Indicators will also be incorporated into the MUP design to assist with wayfinding, especially in open areas where visual cues may be limited. These elongated, flat-topped bars indicate a clear direction of travel and will be installed to guide users along the designated path or across open plazas where traditional curbs and edges are absent. These indicators will be especially helpful at transitions between shared-use areas, rest nodes, and major connection points with adjacent infrastructure.

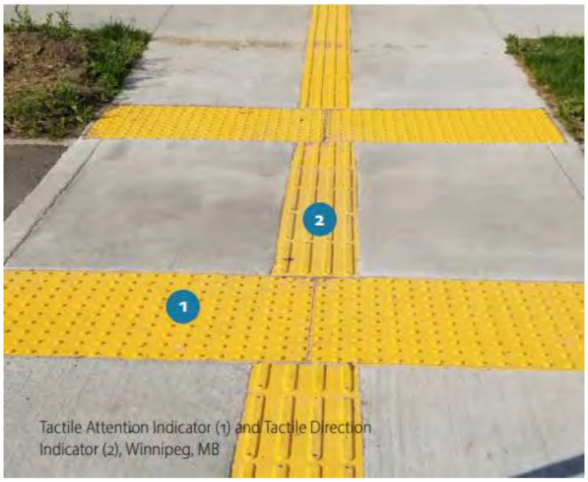

Figure 7. Tactile Indicators used on the MUPs

Pedestrians and the disabilities will navigate the roundabout as shown in Figure 8 below.

Figure 8. Pedestrian Paths

3.3.3 Cyclists

Navigating roundabouts can be challenging for cyclists, particularly for those with varying levels of experience. Proper infrastructure and guidance help ensure safety and efficiency for all users. There are different options available for cyclists when accessing and maneuvering through the roundabout, based on their experience levels.

More experienced cyclists may choose to enter the roundabout via the circulating roadway, where they are treated as vehicles. Option 1 in Figure 8 reflects these biking paths. This option allows for a more direct and time-efficient route through the intersection. By following standard traffic rules, experienced cyclists can navigate the roundabout safely while maintaining their speed with traffic flow.

Less experienced cyclists can access the intersection using a ramp leading to the Multi-Use Pathway, which is Option 2 in Figure 9 below. This pathway provides a safer and more comfortable route, allowing cyclists to avoid direct interaction with motor vehicles in the circulating roadway. The pathway then connects to the existing shared lane, ensuring continuity in the cycling network.

Figure 9. Bike Paths

3.4. Signage and Pavement Markings

The permanent signage plan can be seen in Appendix A (part of the Drawing Package, Sheet No. “S-300”). This plan indicates all the necessary signs needed within the roundabout to provide the users with a clear understanding of how to maneuver around the roundabout. The different signs range from regulatory and warning signs to informative and directional signs. Finally, all signs used within the roundabout comply with the BC MoTI standards.

Custom Guide Signs: As per the BC MoTI standards, all guide signs will be part of the Rb-G-503 series in order to ensure consistency with the other UBC guide signs within roundabouts (such as the blue sign color). Figure 10 provides a visual for what the sign is planned to look like.

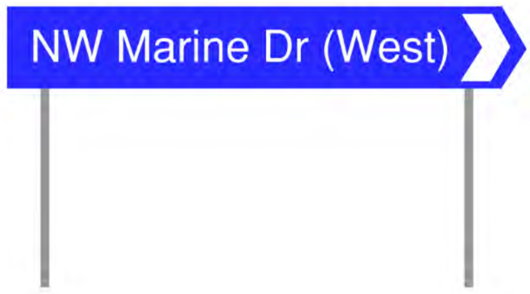

Figure 10. Custom Rb-G-503 UBC Guide Sign

No Right Turn for Trucks*:* A 'No Right Turn' sign for trucks exists at the Chancellor Blvd. entrance of the roundabout to explicitly indicate the right turn restriction onto NW Marine Dr. (North) for all trucks. Figure 11 denotes the custom R-015-R series sign used to prohibit right turns for trucks as explained in Section 3.1. Additionally, Figure 12 shows the custom W-005-L series sign used to provide truck drivers with a clear direction on how to turn right by using the roundabout.

Figure 11. Prohibiting Right Turns for Trucks Sign

Figure 12. Truck Right Turn Maneuver Sign

3.5. Pavement Design

Calculation of Equivalent Single Axle Loads (ESAL)

To determine the pavement structure type, a calculation of the equivalent single axel loads (ESAL) was undertaken using the equation in the BC MoTI Pavement Structure Design Guidelines Technical Circular T-01/15.

Please refer to Section 3.2 for the calculation of average annual daily traffic (AADT). The highest value for AADT was used to ensure a design that requires minimal maintenance overtime. The heavy vehicle percentage (HVP) and heavy vehicle factor (HVDF) was based on the eastbound traffic count. To calculate the number equivalent axle loads per vehicle (NALV), a 17,000 kilogram tandem axle was chosen based off our traffic counts. The tandem axle group was the biggest truck seen navigating through the intersection. The table to assign a pavement structure type is shown in Table 9.

Table 9. Determination of Pavement Structure Type Based on the 20 Year Design ESAL Criteria

Pavement Structure Type	Roadway Designation	20 yr. Design ESAL Criteria	Typical Asphalt Concrete Pavement Thickness
A	High Volume Roads, Truck Lanes, Specialty Locations	> 20,000,000	≥150 mm
B	Medium to High Volume Roads	100,000 to 20,000,000	75 to 150 mm
C	Low Volume & Subdivision Roads	< 100,000	50 to 75 mm
D	Low Volume Sealcoat or Gravel Road	< 100,000	Graded Aggregate Sealcoat Layer(s)

Table 10. ESAL Calculations

ESAL	AADT	HVP	HVDF	NALV	TDY
Base Year: 392	3655	0.012	0.012	2.039	365
20 years: 470					

Utilizing equation in Section 3.5, in the BC MoTI Pavement Structure Design Guidelines Technical Circular T-01/15, the pavement structure **type is C**.

Calculation of Layer Thicknesses

After the pavement structure type was selected, the calculation of layer thicknesses was conducted based on Section 3.1.4 Selection of Layer Thicknesses in the 1993 AASHTO Guide for Design of Pavement Structures. The structural number calculated was 2.89. The actual thicknesses of the surface (asphalt concrete) and base courses (aggregate base) met the minimum thickness requirement on page II-35 in the AASHTO guide. Table 11 below is the summary of parameters to calculate the structural number and the thicknesses for each pavement course.

Table 11. Parameters for Each Pavement Course

Layer	Layer Coefficients (a1, a2, a3)	Actual Thicknesses (in.) of the Surface, Base and Subbase Courses	Drainage Coefficients for Base and Subbase Layers
Surface (Asphalt)	0.40	50mm/25.4=1.97	/
Base	0.14	225mm/25.4=8.86	1.15
Subbase	0.10	150mm/25.4=5.91	1.15

Appendix A provides a drawing of the cross section for the pavement design of the road (part of the Drawing Package, Sheet No. S-200).

3.6. Gateway Design

The gateway structure is located at the North end of the roundabout island and welcomes its users to the UBC campus as shown in Figure 13. The artwork on the gateway structure was designed to reflect the natural beauty of UBC's surroundings and shows UBC's commitment to sustainability and environmental stewardship. Additionally, the specific trees shown pay homage to the native trees on campus which include western red cedar, coastal Douglas fir, western hemlock and grand fir among many others located within the Point Grey area. Table 12 outlines the components comprising the gateway structure.

Figure 13. 3D Model of the Gateway Structure

For a breakdown of the cost and maintenance of the gateway structure, please refer to Section 5. Class A Cost Estimation.

Table 12. Structural Elements Comprising the Gateway Structure

Structural Element		Material	Quantity	Length (mm)	Width (mm)	Thickness (mm)
Sign		CSA G40.21 350W type steel	1	6000	5100	13
Moment Resisting Frame	W310x118 Columns	CSA G40.21 350W type steel	2	8000	310	118
	W360x57 Beams		2	5400, 6000	360	57
Base Plate	Steel Plate		1	400	400	40
	Column Plate	20 MPa Concrete	1	450, 600	450, 600	70
	Hilti HIT-HY Epoxy Anchors	-	4	69.8	-	-
Concrete Footing	Concrete	20 MPa Concrete	2	600	600	300
	Steel	20M Bar	4	0.45	-	-

Moment-Resisting Frame (MRF): When unbraced frames are designed to resist lateral loads, the members must be connected in a way the moment, shear and axial force can be transmitted; this type of connection is referred to as a moment-resisting frame (MRF). HEXALIGN chose to incorporate a MRF made of steel W-sections because the project site is in a seismically active region. The beams and columns that comprise the MRF are bolted and welded together. The MRF is connected to a baseplate which transfers the loads from the MRF to the concrete footing.

Centerpiece: The centerpiece of the gateway structure is composed of a thin steel sign whose dimensions were based on the length and width of the steel W-sections comprising the MRF. The sign's dimensions, however, include construction tolerances in the structural calculations. The artwork is laser cut on the steel sign, and it is welded onto the MRF.

Base Plate: The steel columns from the MRF can deliver large, concentrated loads to the structure below. The load is spread out by a base plate that is large enough to not exceed the bearing capacity of the foundation material. The base plate is comprised of a steel plate that is anchored to a concrete plate; the Hilti PROFIS anchor design software was used to design 4 Hilti HIT-HY epoxy anchors. The concrete plate consists of a 2:1 slope that occurs over a 70mm height to provide a transition between the concrete plate and the concrete footing.

Concrete Footing: The footing dimensions were determined based on a series of standard foundation design calculations to ensure adequate load-bearing capacity of the gateway structure. Concrete was selected as the foundation material in accordance with industry best practices in order to align with both the project requirements and standard design guidelines.

A detailed calculation sheet with the design calculations following design codes, along with the associated assumptions and limitations are in Appendix C.

3.7. Stormwater Design

The proposed stormwater management strategy follows the recommendations of the *2017 UBC Integrated Stormwater Management Plan (ISMP)* which sets guidelines for stormwater management at UBC. The UBC ISMP sets out three main objectives below

- Reduce flow of water from the campus
- Reduce impact of stormwater flows off campus
- Maintain or enhance water quality

3.7.1 Design Rational

To address the runoff and erosion risks, a 1,000 m^3 underground detention tank is proposed along East Chancellor. The tank was sized to accommodate a 1-in-100 year, 24-hour storm event. A detention tank was chosen because infiltration methods are not allowed due to the intersection’s proximity to erosion-prone cliffs located west of the site. This makes options such as draining stormwater into the underground aquifer unviable. Additionally, the client requested that rainfall be captured and reused on-site and the UBC ISMP report recommends a detention tank solution making it a practical choice for the design.

The tank is equipped with a controlled orifice system to release stormwater slowly, reducing peak flows and preventing overload of the downstream minor system. A 450mm bypass pipe will be installed at Manhole 1 (MH1), MH3 and MH4 (refer to Appendix A part of the Drawing Package, Sheet No 400) to connect to the detention tank. This size was chosen to allow the detention tank to release stormwater discharge at predevelopment flows. This strategy aligns with guidelines from the *BC Stormwater Management Guidebook 2002*

To remove pollutants prior to detention, a baffle box is installed upstream of the tank. This device captures sediments, debris, and floatables to improve water quality and reduce maintenance frequency downstream. A rain garden will be added within the roundabout as a tertiary treatment component, using engineered soil and native vegetation to enhance infiltration, filter runoff, and support ecological resilience. This helps meet the federal guideline to collect and treat the volume of the 24-hour precipitation event equaling 90% of the total rainfall from impervious areas with suitable BMPs. Additionally, due to the realignment of curbs near the intersection, 10 catch basins will need to be relocated, 2 new catch basins installed, and an additional manhole will be installed. They will be in accordance with *City of Vancouver Standard Detail Drawings and City of Vancouver Construction Specifications*.

Table 13. Dimensions of Stormwater Detention Tank System

Detail number	Parameter	Dimension
1	Clearance to roadway	2.0 m
2	Tank length	55.5 m
3	Tank width	6.0 m
4	Tank depth	3.0 m
5	Inflow orifice diameter	0.45 m
6	Outflow orifice diameter	0.25 m
7	Bottom plate slope	2 %

3.7.2 Stormwater Modelling

The first step involved delineating the catchment area in QGIS, using the LiDAR data from City of Vancouver and converting it to a Digital Elevation Model (DEM) projected to UTM 10N to ensure accurate area measurements. HEXALIGN refined the DEM by removing noise with the SAGA toolbox and carried out a hydrologic analysis. The blue flow lines in Figure 14 indicate the pathways of surface water flow and the red contour lines show the elevation relative to sea level. A catchment area is defined by the highest points (ridges) that encircle the area contributing water to a specific flow point. The flow path analysis, presented in Figure 14, was instrumental in identifying the flow path and catchment area, resulting in an estimated total area of 1.24ha. The data gathered from the QGIS model along with rainfall data obtained using the IDF_CC tool was used to create a stormwater model in EPA SWMM. Rainfall data and future climate projections ensure the design is resilient under changing rainfall intensities due to climate change. The model employs a Horton infiltration approach, assuming the native glacial till soil exhibits hydraulic conductivity characteristics similar to silty clay, to represent its low permeability. Please refer to model results and parameters in Appendix D.

Figure 14. Contour and Flow Path Map

3.7.3 Rain Garden

To address concerns related to cliff erosion and to reduce flooding in the intersection, 228m^2 of landscaped area has been converted into rain gardens. These rain gardens are designed as retention facilities, providing temporary storage for 50% of the rainfall volume from a 1:2-year storm event. The rain garden sizing follows the *Metro Vancouver Stormwater Source Control Guideline (2012)*, with rock trench depths specified in Appendix A (part of the Drawing Package, Sheet No 401), for a Rain Garden cross section. A geotextile fabric layer at the base of the system prevents infiltration, while a perforated drainpipe conveys stormwater to the minor system at a controlled rate. The perforated pipe, orifice, and connecting pipes regulate flow discharge into the existing system. Planting soil and vegetation will be selected by UBC Landscape Architects, in accordance with the approved rain garden species list outlined in *the Metro Vancouver Guidelines (2012)*. The growing medium must meet the minimum hydraulic conductivity requirement of 70 mm/hr, as specified in the same guideline.

3.8. Stakeholder Engagement

Key stakeholders were identified and consulted to determine the key components and priorities for the project. Stakeholders involved in our project include:

- Metro Vancouver Regional District
- University Endowment Land (UEL)
- The University of British Columbia (UBC) Administration
- University Neighborhoods Association Development Studies (SEEDS)
- The xʷməθkʷəy̓əm (Musqueam) People

To keep the community informed, project signage will be place throughout the UEL, providing residents and visitors with key details about the project's progress (See section 4.4 for our TMPs). Additionally, a dedicated project website will be regularly updated with the latest information, and bi-weekly email updates will be sent to community members to ensure consistent communication.

4. Construction Plan

4.1. Anticipated Site Issues and Risk Analysis

During the preliminary design stage, the team prepared a list of potential risks during the construction phase, their category, and mitigation method as tabulated in Table 14 below.

Table 14. Risk and Associated Mitigation Plan

Risk	Category	Mitigation
Construction Delay	Scheduling	Effective procurement of materials, proper sourcing of vendors, and effective use of personnel
Weather Delay	Scheduling	Built-in contingencies in schedule and forecast
Permitting Delay	Scheduling	Identify required permits early during the design phase
Contractor Performance Issues	Scheduling	Conduct thorough prequalification of contractors, and include performance incentives in estimates
Injuries	Worker Safety	Develop a robust safety plan & proper worker training, and follow the hierarchy of controls
Traffic Congestion	Public Impact	Prepare detailed traffic management plan and traffic management personnel
Utility Strikes/Conflict	Construction	Conduct thorough utility locates and utilize BC OneCall
Public Opposition	Public Impact	Public consultation, clear communications and addressing key concerns
Cost Overruns	Cost Estimates	Accurate cost estimates with contingencies
Environmental Damage	Environmental	Conduct environmental assessment early and prepare a prevention and response plan for any spills or discharge

The above issues have been analyzed using a comprehensive risk assessment matrix that considers both likelihood and severity. The matrix will allow us to recognize which issue is easy or difficult to mitigate. We can then focus our resources on issues that could significantly disrupt or suspend the project. The main risk assessment matrix is displayed in Table 15 below.

Table 15. Risk Matrix for the Chancellor Blvd./East Mall Intersection Redesign

Severity/ Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Severe (5)
Rare (1)	Low (1)	Low (2)	Low (3)	Low (4)	Medium (5)
Unlikely (2)	Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)
Possible (3)	Low (3)	Medium (6)	Medium (9)	High (12)	Critical (15)
Likely (4)	Low (4)	Medium (8)	High (12)	High (16)	Critical (20)
Very Likely (5)	Medium (5)	High (10)	High (15)	Critical (20)	Critical (25)

The team collectively scored each risk based on the matrix above, and its results are tabulated in Table 16 below.

Table 16. Risk Level for the Chancellor Blvd./East Mall Intersection Redesign

Risk	Likelihood	Impact	Risk Level
Construction Delay	Possible (3)	Major (4)	High (12)
Weather Delay	Likely (4)	Moderate (3)	High (12)
Permitting Delay	Possible (3)	Moderate (3)	Medium (9)
Contractor Performance Issues	Unlikely (2)	Major (4)	Medium (8)
Injuries	Unlikely (2)	Severe (5)	High (10)
Traffic Congestion	Likely (4)	Moderate (3)	High (12)
Utility Strikes/Conflict	Possible (3)	Major (4)	High (12)
Public Opposition	Unlikely (2)	Moderate (3)	Medium (6)
Cost Overruns	Likely (4)	Major (4)	Critical (16)
Environmental Damage	Possible (3)	Severe (5)	Critical (15)

Based on the results, the team will focus most of its efforts on mitigating cost overruns, environmental damage and weather-related delays. Cost overruns are typical in many construction projects; however, this roundabout will be under extra scrutiny as it is publicly funded by the university. The peanut-shaped roundabout is also situated in a very environmentally sensitive area, between Pacific Spirit Park, residential, and academic lands. Any type of spills, runoffs into the nearby land could decimate the local habitat and wellbeing of residents. Lastly, Vancouver has extremely unpredictable weather, even in the summer when construction is occurring, and major contingency will need to be applied to prevent any substantial delays.

On the other hand, public opposition, permitting delays and contractor performance issues are minor worries for this project. The roundabout isn't a high-profile project and should not significantly disrupt the livelihood of residents. Early planning, permit submission and thorough vetting of contractors should mitigate any of those issues.

4.2. Maintenance Plan

The roundabout was designed and is expected to serve for 25 years. As such, it is important that proper maintenance and service is carried out throughout its service life. The team has prepared the following maintenance plan to be included with the Issued for Construction (IFC) drawings. The plan follows the suggestions provided in the 2015 [5].

Table 17. Maintenance Plan for the Chancellor Blvd./East Mall Intersection Redesign

Action	Description	Frequency
Snow Plowing	Clear snow from road and sidewalks surrounding the roundabout	Every snowfall event
De-icing	Apply granular salt on road to prevent the occurrence of black ice hazards	During periods of sub-zero Temperature
Landscaping	Mowing, trimming and maintain vegetation on roundabout island and surrounding sidewalks	Monthly
Island & Gateway Structure Maintenance	Inspect and repair any damage to island and gateway structure. Ensure that there are no damage to the structural components	Monthly
Street Sweeping	Remove debris from pavement and sidewalks	Monthly
Pavement Markings	Repaint worn or faded road markings, sidewalks, or boundaries	Annually
Pavement Repairs	Patch any cracks, potholes and damages from regular use	As needed based on inspections
Stormwater Management System Repairs	Ensure that the stormwater management system works as intended to prevent any flood or drainage of hazardous materials	As needed based on inspections

4.3. Construction Phasing

As mentioned in the preliminary report, the construction will be conducted in phases to ensure that there will always be at least two-way traffic going through the roundabout on Chancellor Blvd.

Table 18. Phases of Construction for the Chancellor Blvd./East Mall Intersection Redesign

Name	Work Completed	Start Date (YYYY-MM-DD)	End Date (YYYY-MM-DD)
Preconstruction	Surveying and Site Preparation	2025-03-17	2025-04-25
Phase 1	Demolition of Existing Infrastructure, Utility Relocation, Stormwater Detention Tank Installation	2025-05-01	2025-06-12
Phase 2	Top Half of Roundabout Construction	2025-06-13	2025-06-20
Phase 3	Bottom Half of Roundabout Construction	2025-06-23	2025-06-30
Phase 4	Sidewalk Curbing and Landscaping, Installation of MUPs, Lighting & Signage, Pavement Markings, Gateway Structure	2025-07-01	2025-08-20

Figure 15. Simplified Construction Phases

4.4. Traffic Management Plans (TMPs)

The contractor must have or hire a Traffic Management team dedicated to ensuring the safe and efficient flow of traffic during the entire construction phase; this is included in the 'General' costs on Table 19. Appendix E include 4 traffic management plans (TMPs) relating to each phase of construction as noted in the table above, as well as the Figure 16 below. The TMPs were created based on the BC 2020 Traffic Management Manual for Work on Roadway (TMM). Every stage requires substantial temporary signages and coordination of Traffic Control Persons (TCPs) to ensure the safety of the workers as well as pedestrians and motor vehicles during construction.

Figure 16. Overview of Construction Plan

Throughout all phases, HEXALIGN will ensure that crosswalks, either existing or newly built, remain accessible to the public, particularly at Chancellor Blvd. and NW Marine Dr.

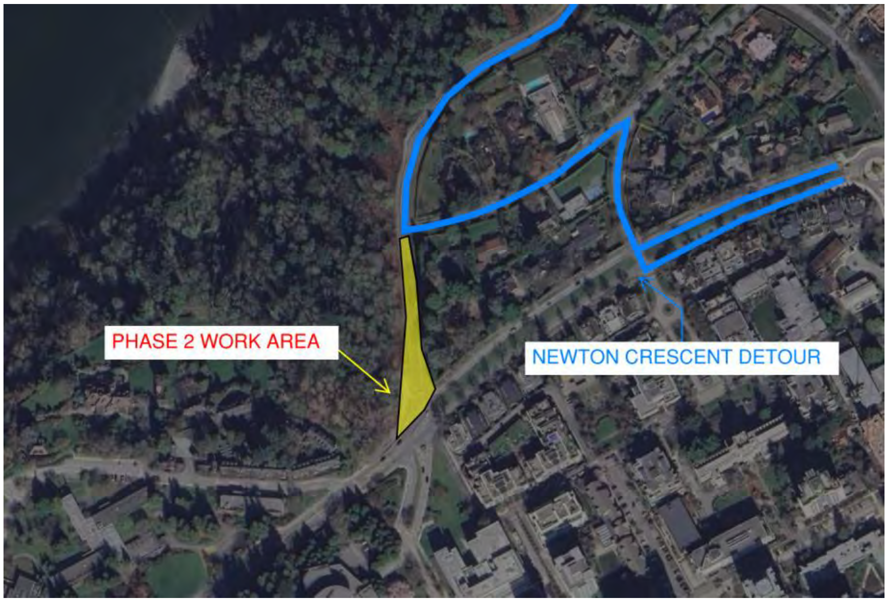

Figure 17. Phase 2 Road Closure and Detour

During phase 2, NW Marine Dr. on the north side of the roundabout will be closed to all traffic and will be rerouted to Newton Crescent. The contractor will install appropriate signage and detour routes for vehicles, pedestrians, and cyclists. Temporary pedestrian walkways will be created to maintain public accessibility. The contractor must also coordinate closely with local authorities to ensure that emergency vehicle access remains uninterrupted during the closure.

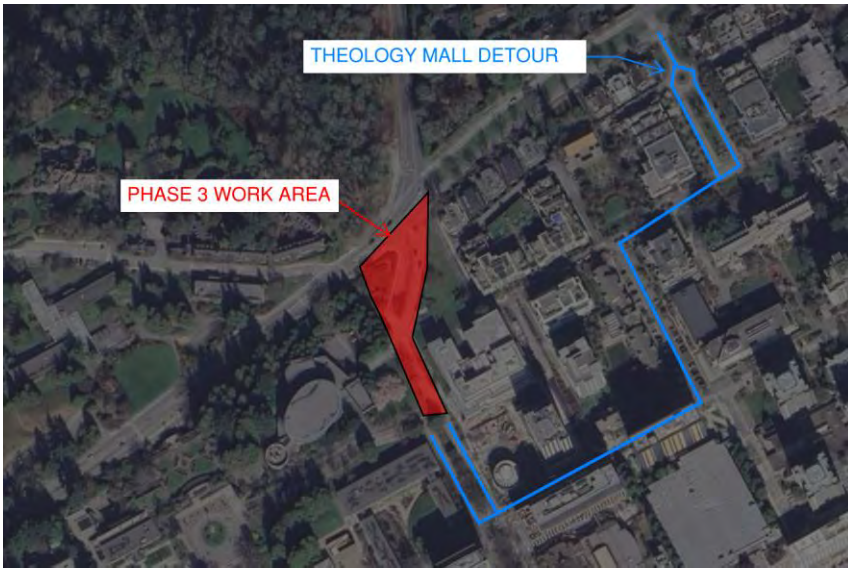

Figure 18. Phase 3 Road Closure and Detour

During phase 3, NW Marine Dr on the north side of the roundabout will be closed to all traffic and will be rerouted to Newton Crescent. As with Phase 2, the contractor will implement traffic control measures, including detours and signage. Provisions for pedestrian access will be maintained and communicated to the public via variable message signs (VMS) and other public outreach methods.

4.5. Construction Specifications

The construction specifications are available for the following components:

- Concrete
- Roadworks
- Environmental
- Site Earthworks
- Landscaping

- Gateway Structure
- Signage
- Pavement Markings
- Streetlighting

Please refer to Appendix H for the full Construction Specifications.

4.6. Construction Schedule

Please refer to Appendix F for the detailed construction schedule and Gantt Chart.

5. Class A Cost Estimation

5.1. Construction Cost Estimate

The Class A cost estimate follows a historical bid-based approach, leveraging detailed design and historical cost data to establish an accurate estimate. Direct unit costs include labor, materials, and equipment, aligning with the estimating method. This estimate encompasses all project phases, from pre-construction to maintenance, while explicitly excluding design costs. The Class A construction cost estimate can be seen in Table 19. For a detailed cost breakdown, refer to Appendix G.

Table 19. Class A Construction Cost Estimate

Construction Cost Element	Subtotal
Project Management	$113,000
General	$190,000
Demolition and Removal	$21,000
Earthworks	$2,102,000
Utilities and Stormwater Management	$187,000
Concrete Works	$252,000
Roadwork	$265,000
Gateway	$13,000
Landscaping	$7,000
Contingency (15%)	$476,000
Total	**$3,626,000**

5.2. Maintenance Cost Estimate

The Class A maintenance cost estimate can be seen in Table 20. Miscellaneous items in this estimate include pavement maintenance, damaged signage replacement, storm drain upkeep, electrical street light repairs, and other occasional or unforeseen maintenance needs.

Table 20. Class A Maintenance Cost Estimate

Maintenance Cost Element	Subtotal
Landscaping	$12,000
Miscellaneous	$10,000
Contingency (15%)	$3,000
Total	**$25,000**

6. Conclusion

The team at HEXALIGN is proud and honored to have been the consultant for this project. We firmly believe that our design philosophies, methodology and chosen features will ensure that this roundabout will serve the community of UBC, Vancouver, and British Columbia for years to come. Our design prioritizes the safety and convenience of every user of the roundabout, including drivers, cyclists, pedestrians and individuals with disabilities. All design choices were taken with utmost care in regard to UBC's values and identities. The proposed roundabout overwhelmingly achieves the following objectives which include to:

- Reduce vehicle speeds approaching the campus
- Minimize land usage requirements and refrain from encroaching on preoccupied properties
- Retain all rainwater on-site to manage a 100-year storm event
- Create a gateway to welcome university faculty, students residents and visitors to campus

The team at HEXALIGN once again is thankful for this wonderful opportunity to provide a resilient, innovative, and sustainable solution.

References

[1] U. C. +. C. Planning, "Campus Vision 2050: Shaping the Future of UBC Vancouver," December 2023. [Online]. Available: https://planning.ubc.ca/sites/default/files/2024-11/20241031_CV2050_Final-v23_Dec2023.pdf.

[2] B. C. M. o. T. a. Infrastructure, "Crash Modification Factors for British Columbia," 2008. [Online]. Available: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/traffic-engineering-and-safety/highway-safety/cmfs_for_bc_2008.pdf.

[3] I. LTAP, Roundabout Maintenance Manual, Indiana Local Technical Assistance Program (LTAP) Publications, 2015.

[4] B.C. Supplement to TAC Geometric Design Guide, British Columbia: Ministry of Transportation and Highways, Engineering Branch, 2019.

[5] LTAP, Indiana, "Roundabout Maintenance Manual" (2015). *Indiana Local Technical Assistance Program (LTAP) Publications*. Paper 4. https://docs.lib.purdue.edu/inltappubs/4

[6] Manitoba Transportation and Infrastructure, *Standard Construction Specifications: Section 1030 – Grassing*, Manitoba, Canada, Apr. 2023. [Online]. Available: https://www.gov.mb.ca/mti/contracts/pdf/manual/1030.pdf. [Accessed: Mar. 31, 2025].

Appendix A – Drawing Package

UBC CAMPUS +COMMUNITY PLANNING

CHANCELLOR BOULEVARD & NW MARINE DRIVE INTERSECTION REDESIGN

DRAWING INDEX

Sheet No.	DWG No.	Sheet Name	Date
DRAWING INDEX, GENERAL NOTES, & SITE PLAN			
1	100	DRAWING INDEX	2025–04–05
2	101	GENERAL NOTES	2025–03–29
3	102	SITE PLAN	2025–03–29
PLAN & PROFILE			
4	103	MAIN PEANUT	2025–04–04
5	104	EAST MALL	2025–04–04
6	105	NW MARINE DRIVE	2025–04–04
7	106	EAST CHANCELLOR (ENTRY LANE)	2025–04–04
8	107	EAST CHANCELLOR (EXIT LANE)	2025–04–04
9	108	WEST CHANCELLOR	2025–04–04
CROSS SECTIONS			
10	200	TYPICAL CROSS SECTIONS	2025–04–04
11	201	MAIN PEANUT (1)	2025–04–04
12	202	MAIN PEANUT (2)	2025–04–04
13	203	NW MARINE DRIVE	2025–04–04
14	204	EAST CHANCELLOR (ENTRY LANE)	2025–04–04
15	205	EAST CHANCELLOR (EXIT LANE)	2025–04–04
16	206	WEST CHANCELLOR	2025–04–04
17	207	EAST MALL	2025–04–04

SIGNAGE & PAVEMENT MARKINGS			
18	300	SIGNAGE & PAVEMENT MARKINGS (1)	2025–04–04
19	301	SIGNAGE & PAVEMENT MARKINGS (2)	2025–04–04
STORMWATER MANAGEMENT			
20	400	STORMWATER MANAGEMENT OVERVIEW	2025–04–04
21	401	RAIN GARDEN – TYPICAL CROSS SECTIONS	2025–04–04
GATEWAY DESIGN			
22	500	GATEWAY DESIGN	2025–04–04
23	501	CONNECTIONS DETAILED	2025–04–04

HEXALIGN

GENERAL NOTES:
1. THE DRAWINGS PRODUCED BY HEXALIGN ARE INTENDED FOR THE PURPOSE OF THE CIVL 446 COURSE ONLY
2. ALL DIMENSIONS ARE IN METERS UNLESS NOTED
3. HEXALIGN IS NOT LIABLE FOR THE DESIGN INTEGRITY AS IT IS NOT SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER
4. THE ROADWAY DESIGN ASPECTS OF THE ROUNDABOUT ARE DESIGNED TO BC MOTI AND TAC GEOMETRIC DESIGN GUIDELINES
5. THE STRUCTURAL ASPECTS OF THE GATEWAY ARE DESIGNED TO NBC 2015

REV	DESCRIPTION	BY	DATE
A	Issued for Review	XX	2024-12-07
B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: N/A

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
SITE PLAN

DRAWN: JN
CHECKED: KN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-100

GENERAL NOTES:

1. ALL CONSTRUCTION, MATERIALS AND TRAFFIC MANAGEMENT SHALL BE IN ACCORDANCE WITH:
   - BC MOTI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION 2020
   - BC BUILDING CODES 2024 (BCBC)
   - BC 2020 TRAFFIC MANAGEMENT MANUAL FOR WORK ON ROADWAYS
   - UBC DEVELOPMENT & BUILDING REGULATIONS 2019
   - UBC TRAFFIC MANAGEMENT PLAN (TMP) GUIDELINES FOR EVENTS & CONSTRUCTION
   - MASTER MUNICIPAL CONSTRUCTION DOCUMENTS (MMCD) 2019
   - WORKSAFEBC OCCUPATIONAL HEALTH AND SAFETY REGULATION

2. READ AND COMPARE ALL STRUCTURAL AND CIVIL DRAWINGS TOGETHER WITH CONTRACT DOCUMENTS AND DESIGN SPECIFICATIONS TO ENSURE CONSISTENCY.

3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL DIMENSIONS ON-SITE BEFORE PROCEEDING WITH CONSTRUCTION.

4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONDUCT THOROUGH FIELD ASSESSMENT OF SITE CONDITIONS PRIOR TO CONSTRUCTION.

5. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN A CLEAN AND SAFE WORK SITE THROUGHOUT THE DURATION OF THE CONSTRUCTION.

6. CONTRACTOR MUST RESTORE ANY DAMAGED EXISTING INFRASTRUCTURE THAT IS NOT PART OF THE SCOPE TO ITS ORIGINAL CONDITION AT THE CONTRACTOR'S COST.

7. ANY CHANGES OR DEVIATION FROM ISSUED FOR CONSTRUCTION DRAWINGS MUST BE REVIEWED AND APPROVED BY THE ENGINEER (HEXALIGN) PRIOR TO IMPLEMENTATION.

8. CONTRACTOR MUST DOCUMENT ALL CHANGES, DEVIATION, AND DISCREPANCIES.

9. IF THERE ARE ANY DISCREPANCIES BETWEEN THE ISSUED DRAWINGS, CONTRACT DOCUMENTS, AND DESIGN SPECIFICATIONS, DO NOT PROCEED AND CONTACT THE ENGINEER (HEXALIGN) IMMEDIATELY FOR GUIDANCE.

10. DO NOT SCALE THESE DRAWINGS.

11. CONTRACTOR MUST REGISTER WITH BC ONE CALL AND ENSURE GROUND DISTURBANCE PERMITS ALWAYS ARE UP TO DATE.

BACKFILL MATERIALS:

1. INSPECT AND ENSURE THAT ALL MATERIALS DELIVERED TO SITE ARE FREE FROM DEFECTS AND CONFORM TO TARGET DESIGN SPECIFICATIONS.

2. CONTRACTOR MUST REJECT AND DOCUMENT ANY DAMAGED MATERIALS.

3. STORE MATERIALS SAFELY AND SECURELY TO PREVENT CONTAMINATION, DETERIORATION, DAMAGE AND THEFT BEFORE USE.

4. BACKFILL MATERIAL MUST MEET BC MOTI STANDARD SPECIFICATIONS.

5. GRANULAR BACKFILL MATERIAL MUST BE WELL-GRADED, COMPACTED IN 150MM LIFTS AND ACHIEVE A MINIMUM OF 95% MODIFIED PROCTOR DENSITY.

6. TESTING OF SOIL DENSITY MUST BE CONDUCTED BY A THIRD PARTY INSPECTOR HIRED BY THE ENGINEER PRIOR TO PLACEMENT

7. TRENCH BACKFILL FOR UTILITIES RELOCATION MUST BE COMPACTED PER GEOTECHNICAL ENGINEER'S RECOMMENDATIONS

8. DO NOT USE ANY FROZEN OR ORGANIC MATERIALS IN BACKFILL.

9. CLEAN EXCAVATED MATERIAL MAY BE REUSED FOR BACKFILL IF APPROVED BY GEOTECHNICAL ENGINEER

10. CONTAMINATED OR UNUSABLE MATERIAL MUST BE DISPOSED OFF-SITE AT AN LICENSED FACILITY IN ACCORDANCE WITH METRO VANCOUVER WASTE MANAGEMENT REGULATIONS

11. HAZARDOUS MATERIALS MUST BE HANDLED PER WORKSAFE BC AND ENVIRONMENTAL REGULATIONS

CONCRETE:

1. ALL CONCRETE MUST MEET CSA A23.1 (LATEST EDITION) STANDARDS

2. ALL CONCRETE STRENGTH MUST MEET MINIMUM COMPRESSIVE STRENGTH BASED ON ITS APPLICATION AS DEFINED IN CSA A23.1

3. ALL CONCRETE MUST BE CURED TO STANDARD PROCEDURES AND SPECIFICATIONS

4. SUBMIT ALL CONCRETE MIX DESIGN TO THE ENGINEER (HEXALIGN) PRIOR TO PRODUCTION

5. DO NOT ADD WATER TO CONCRETE AT THE SITE

6. CONCRETE MUST BE TESTED TO SPECIFIED STRENGTH, SLUMP PRIOR TO PLACEMENTS, 7 DAYS AND 28 DAYS IN ACCORDANCE WITH CSA A23.1

7. ALL EXPOSED CONCRETE MUST HAVE AIR ENTRANMENT OF 5-8%

8. VIBRATE ALL CONCRETE AND ENSURE THAT THERE IS NO HONEYCOMBS OR SEGREGATION

9. INSPECT ALL REBARS AND ENSURE THEY ARE CLEAN AND PLACED CORRECTLY PRIOR TO POURING

ROAD WORKS

1. CONTRACTOR MUST REMOVE ALL ORGANIC MATERIALS, UNSUITABLE SOILS, AND DEBRIS FROM SUB GRADE BEFORE CONSTRUCTION.

2. CONTRACTOR TO VERIFY SUB GRADE COMPACTION TO A MINIMUM OF 98% STANDARD PROCTOR DENSITY PRIOR TO PLACEMENT OF GRANULAR MATERIALS.

3. CONTRACTOR TO PERFORM STAKING AND LAYOUT PER PROJECT DRAWINGS WITH A LICENSED SURVEYOR (P. SURV).

4. ALL STORM DRAINAGE, CULVERTS AND UTILITIES MUST BE INSTALLED PRIOR TO ROAD WORKS.

5. ALL ASPHALT MUST CONFORM TO SECTION 502 - ASPHALT PAVEMENT CONSTRUCTION OF THE BC 2020 STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION.

6. CONTRACTOR TO PLACE ASPHALT USING PAVER WITH AUTOMATIC GRADE AND SLOPE CONTROLS.

7. COMPACT ALL ASPHALT WITH VIBRATORY ROLLERS TO AT LEAST 93% OF THE THEORETICAL MAXIMUM DENSITY.

8. NUCLEAR DENSITY TESTING OF THE ASPHALT WILL BE PERFORMED BY A THIRD PARTY CONTRACTOR HIRED BY THE OWNER.

9. CONTRACTOR TO PERFORM VISUAL INSPECTIONS FOR ANY CRACKS, RAVELING, SEGRAGATION OR SURFACE DEFECTS.

10. CONTRACTOR TO REMOVE EXCESS MATERIALS, DEBRIS AND TEMPORARY SIGNAGES AFTER COMPLETION OF ROADWORK.

ENVIRONMENTAL

1. CONTRACTOR TO UTILIZE APPROPRIATE TREE PROTECTION AND VEGETATION BARRIERS BEFORE STARTING ANY NEARBY CONSTRUCTION.

2. CONTRACTOR MUST TAKE APPROPRIATE ACTIONS TO NOT DISTURB ANY NEARBY NESTS AND ANIMAL HABITATS.

3. CONTRACTOR MUST PREPARE A EROSION AND SEDIMENT CONTROL PLAN TO THE ENGINEER PRIOR TO EVERY PHASE OF THE WORK.

4. EROSION AND SEDIMENT CONTROL (ESC) INSPECTIONS WILL BE PERFORMED BY A THIRD PARTY CONTRACTOR HIRED BY THE OWNER.

5. ANY ESC DEFICIENCIES DETECTED BY THE CONTRACTOR OR INSPECTOR MUST BE RECORDED AND PROMPTLY ADDRESSED.

5. CONTRACTOR MUST TAKE APPROPRIATE TO PREVENT SPILLS AND RUNOFFS OF FLUIDS.

6. CONTRACTOR TO SUBMIT AN EMERGENCY SPILL PREVENTION AND CONTROL PLAN TO THE ENGINEER FOR APPROVAL.

7. CONTRACTOR MUST REPORT ALL SPILLS TO THE ENGINEER AND THE APPROPRIATE AUTHORITIES AND PROMPTLY START THE CLEAN-UP PROCESS AS DENOTED IN THE SPILL PREVENTION AND CONTROL PLAN.

STORM & SEWER UTILITIES RELOCATION

1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM ALL EXISTING UNDERGROUND UTILITIES AGAINST PROVIDED LOCATES

2. CONTRACTOR TO OBTAIN NECESSARY APPROVALS AND PERMITS FROM ALL AFFECTED UTILITY PROVIDERS

3. CONTRACTOR TO NOTIFY ALL AFFECTED UTILITY PROVIDERS PRIOR TO EXCAVATION.

4. WHERE REQUIRED, CONTRACTOR SHALL INSTALL TEMPORARY BYPASS SYSTEMS FOR EXISTING STORM AND SEWER LINES TO MAINTAIN SERVICE.

5. CONTRACTOR TO EXCAVATE TRENCHES TO REQUIRED DEPTH WHILE MAINTAINING MINIMUM COVER REQUIREMENTS OF EXISTING PIPES.

6. TRENCH SHORING AND SLOPING MUST ADHERE TO WORKSAFE BC STANDARDS AND MINIMUMS.

7. ALL STORM AND SEWER PIPES TO BE POLY VINYL CHLORIDE (PVC) UNLESS NOTED OTHERWISE.

8. CONTRACTOR TO INSPECT ALL PIPES, MANHOLES, AND CATCH BASINS DELIVERIES FOR IMPERFECTIONS AND DEFICIENCIES.

9. CONTRACTOR TO REJECT AND RECORD ANY DAMAGED PIPES, MANHOLES, AND CATCH BASINS.

10. INSTALL MINIMUM 150MM GRANULAR BEDDING UNDER PIPES FOR STABILITY.

11. LAY PIPES TO REQUIRED SLOPE AND ALIGNMENT AS PER DESIGN DRAWINGS.

12. CONSTRUCT PRECAST CONCRETE MANHOLES AND CATCH BASINS PER BC MOTI STANDARDS.

13. CONTRACTOR TO CONFIRM AS BUILT ELEVATIONS OF ALL MANHOLES AND CATCH BASINS.

14. CONTRACTOR TO CONDUCT CCTV INSPECTIONS TO CHECK FOR LEAKAGES AND VERIFY ALIGNMENT AND JOINT INTEGRITY.

15. CONTRACTOR TO CONDUCT STORMWATER INFILTRATION TESTS TO ENSURE PROPER DRAINAGE PERFORMANCE.

16. CONTRACTOR TO RESTORE ROADWAYS, SIDEWALKS, AND LANDSCAPING AFFECTED BY EXCAVATION TO ORIGINAL CONDITION.

PAVEMENT MARKINGS

1. CONTRACTOR SHALL USE DURABLE THERMOPLASTIC PAINT FOR ALL PAVEMENT MARKINGS.

2. PAVEMENT MARKINGS SHALL BE APPLIED ONLY ON CLEAN AND DRY SURFACES.

3. PAVEMENT MARKINGS SHALL CONFORM TO THE BC MANUAL OF STANDARD TRAFFIC SIGNS & PAVEMENT MARKINGS (LATEST EDITION.

4. YIELD LINES (SHARK'S TEETH) SHALL BE INSTALLED AT ALL ENTRY POINTS TO THE ROUNDABOUT.

5. CONTRACTOR SHALL INSTALL ZEBRA-STYLE CROSSWALKS AT ALL PEDESTRIAN CROSSINGS.

6. BICYCLE CROSSRIDER SYMBOLS SHALL BE APPLIED AT ALL MULTI-USE PATH (MUP) CROSSINGS.

7. CONTRACTOR SHALL APPLY RETROREFLECTIVE GLASS BEADS INTO THE PAINT FOR NIGHT VISIBILITY.

8. TACTILE WARNING STRIPS SHALL BE INSTALLED AT ALL PEDESTRIAN CROSSINGS.

LANDSCAPING

1. CONTRACTOR SHALL USE LOW-MAINTENANCE NATIVE VEGETATION FOR THE CENTRAL ISLANDS AND MEDIANS

2. ALL PLANTINGS SHALL BE SELECTED TO ENSURE DRIVER SIGHTLINES ARE MAINTAINED.

3. CONTRACTOR SHALL ENSURE PROPER SOIL PREPARATION WITH COMPOST AND TOPSOIL TO PROMOTE PLANT GROWTH.

4. ALL TREE PLANTINGS SHALL BE A MINIMUM OF 2M AWAY FROM THE ROADWAY TO AVOID OBSTRUCTION.

5. CONTRACTOR SHALL IMPLEMENT HYDROSEEDING OR EROSION CONTROL BLANKETS FOR ALL NEWLY GRADED AREAS.

6. MULCH OR ROCK BEDS SHALL BE USED TO MINIMIZE SOIL DISPLACEMENT AND RUNOFF.

7. CONTRACTOR TO ENSURE THAT RAIN GARDEN IS CONSTRUCTED AS PER DESIGN SPECIFICATIONS AND STORMWATER MANAGEMENT PLAN.

GATEWAY STRUCTURE

1. CONTRACTOR SHALL CONSTRUCT THE GATEWAY STRUCTURE AS PER BC BUILDING CODE (LATEST EDITION).

2. STEEL COLUMNS TO BE 310x118 AND WELDED TO BASEPLATES.

3. STEEL BEAMS TO BE W360x57 AND SECURED ACCORDING TO DESIGN REQUIREMENTS.

4. BASEPLATES TO BE 400mm x 400mm AND SECURED WITH 4 HILTI HIT-Y EPOXY ANCHORS INTO CONCRETE.

5. CONCRETE BASE TO BE 450mm x 450mm WITH A FOOTING SIZE OF 600mm x 600mm.

6. ALL WELDS TO BE COMPLETED IN ACCORDANCE WITH CSA W59 AND INSPECTED BY A CERTIFIED WELDING INSPECTOR.

7. LASER-CUT STEEL GATEWAY ARTWORK TO BE FABRICATED AS PER APPROVED SHOP DRAWINGS.

8. ALL EXPOSED STEEL COMPONENTS TO BE PRIMED AND PAINTED WITH A WEATHER-RESISTANT COATING.

9. FINAL STRUCTURE MUST BE REVIEWED AND APPROVED BY THE ENGINEER BEFORE PROJECT COMPLETION.

STREETLIGHTING

1. CONTRACTOR SHALL INSTALL LED STREETLIGHTS AT ALL ROUNDABOUT APPROACHES AND KEY PEDESTRIAN CROSSINGS.

2. CONTRACTOR SHALL INSTALL RECTANGULAR RAPID FLASHING BEACON (RRFB) AT ALL CROSSWALKS AND MUP CROSSINGS.

3. ALL ELECTRICAL WIRING SHALL BE UNDERGROUND IN CONDUIT TO PROTECT FROM DAMAGE.

4. ALL STREETLIGHT POLES SHALL HAVE BREAKAWAY BASES TO REDUCE IMPACT HAZARDS.

HEXALIGN

GENERAL NOTES:
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3. HEXALIGN IS NOT LIABLE FOR THE DESIGN INTEGRITY AS IT IS NOT SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER
4. THE ROADWAY DESIGN ASPECTS OF THE ROUNDABOUT ARE DESIGNED TO BC MOTI AND TAC GEOMETRIC DESIGN GUIDELINES
5. THE STRUCTURAL ASPECTS OF THE GATEWAY ARE DESIGNED TO NBC 2015

REV	DESCRIPTION	BY	DATE
A	Issued for Review	XX	2024-12-07
B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-29
REV: A
PAPER: B / 11x17
SCALE: N/A

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
GENERAL NOTES

DRAWN: KN
CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-101

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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: B
PAPER: B / 11x17
SCALE: 1:2000

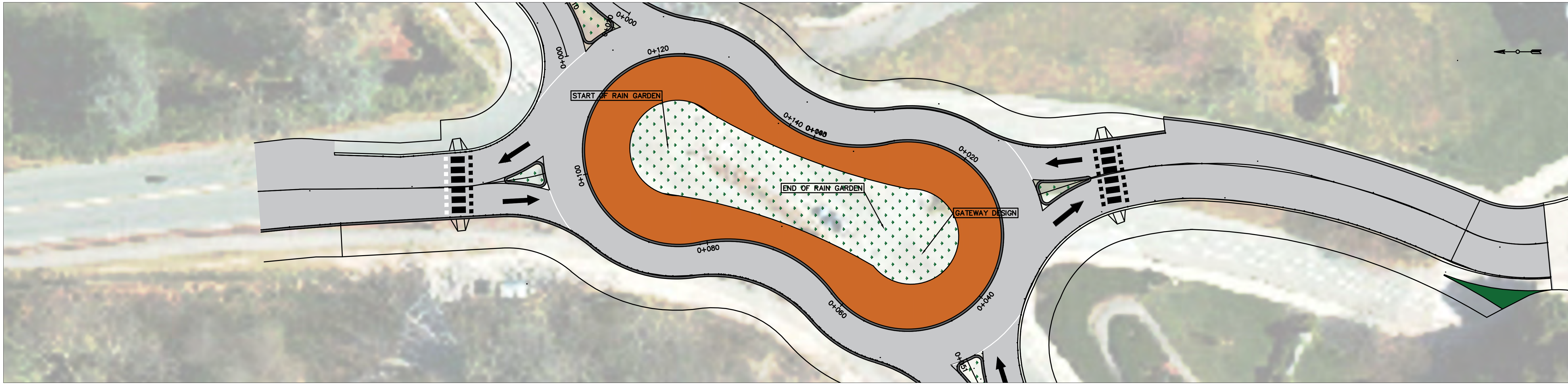
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN

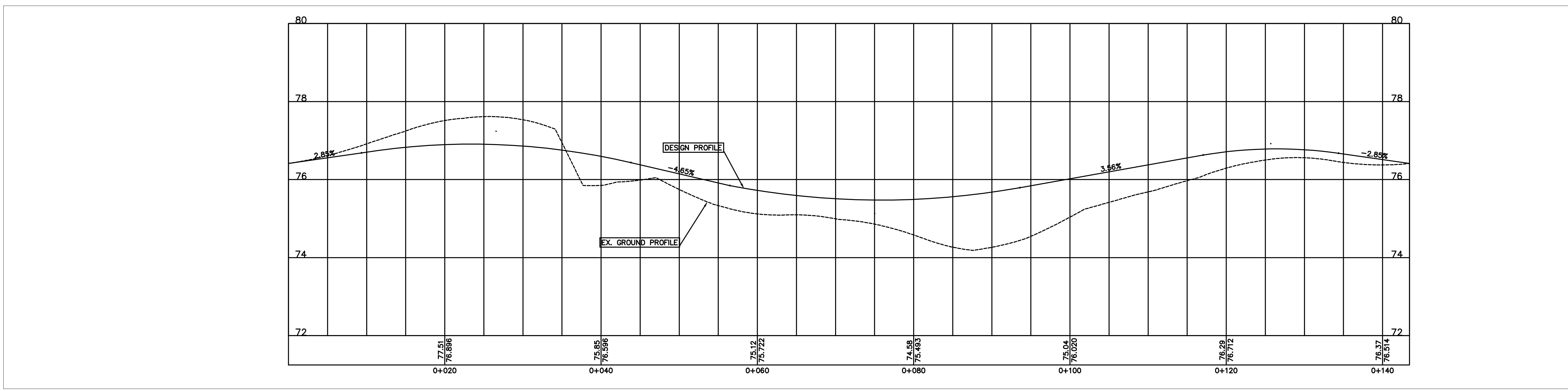
SITE OVERVIEW

DRAWN: EJ
CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C.,
CANADA V6T 1Z4

DRAWING SHEET: S-102





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A	Issued for Review	XX	2024-12-07
B	Issued for Construction	XX	2025-03-31

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

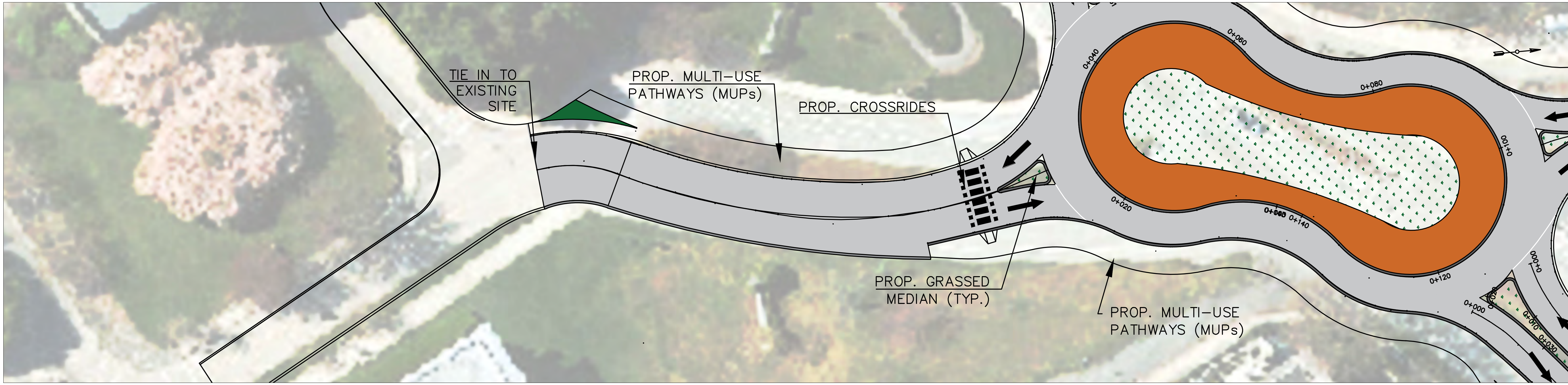
DATE: 2025-03-31
REV: B
PAPER: B / 11x17
SCALE: 1:150

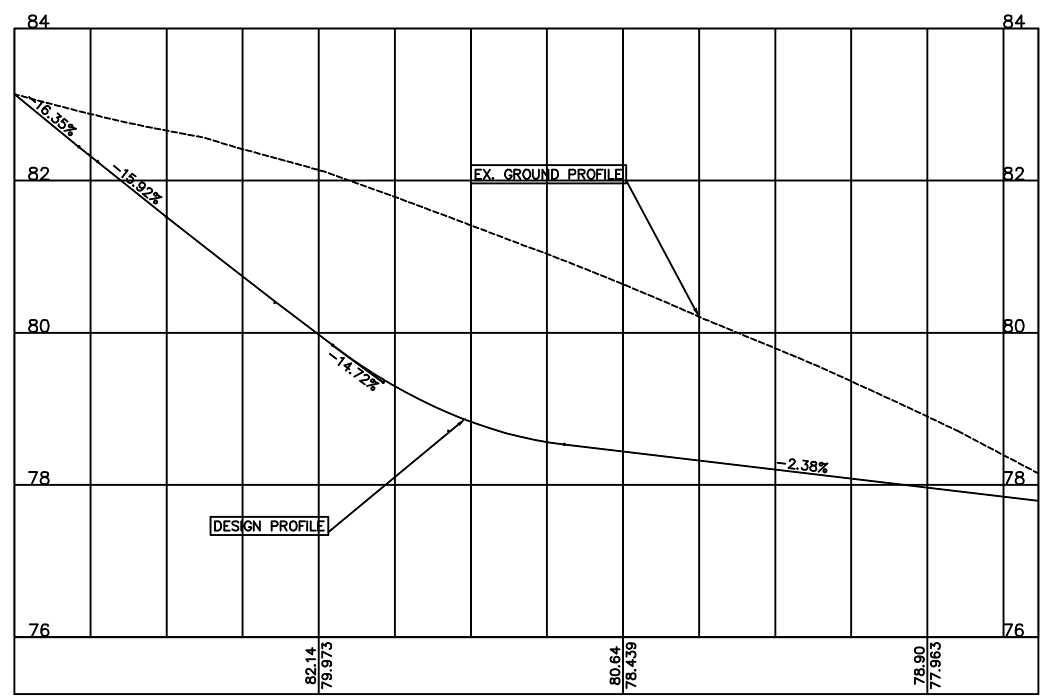
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PLAN & PROFILE - MAIN PEANUT

DRAWN: JN
CHECKED: EJ

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-103





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REV	DESCRIPTION	BY	DATE
A	Issued for Review	XX	2024-12-08
B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

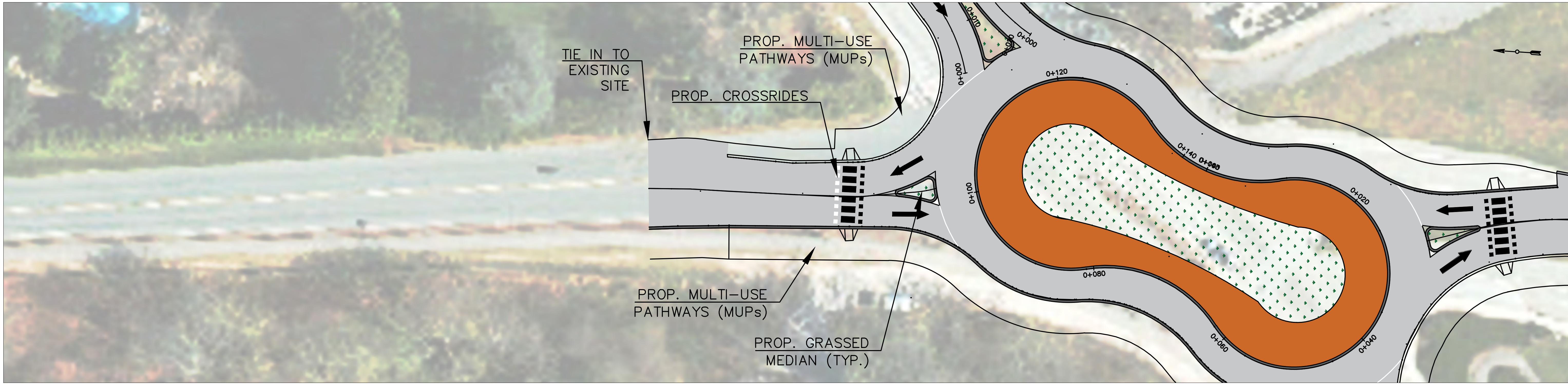
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:150

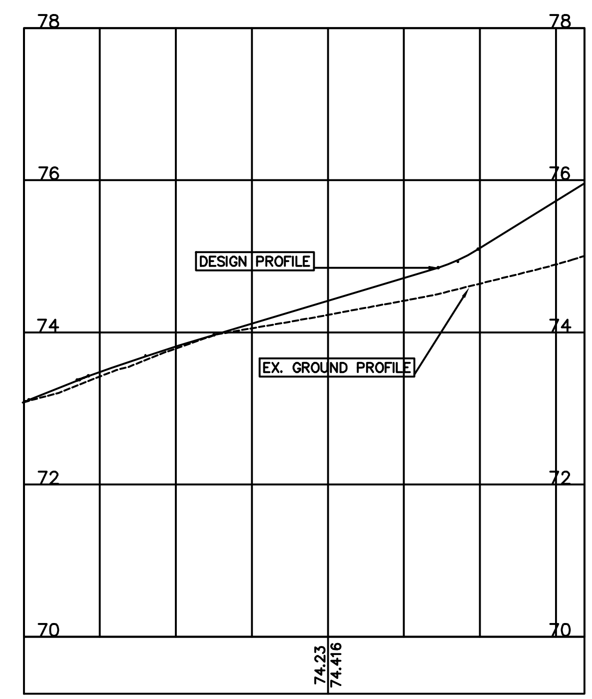
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PLAN & PROFILE - EAST MALL

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: EJ

DRAWING SHEET: S-104





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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

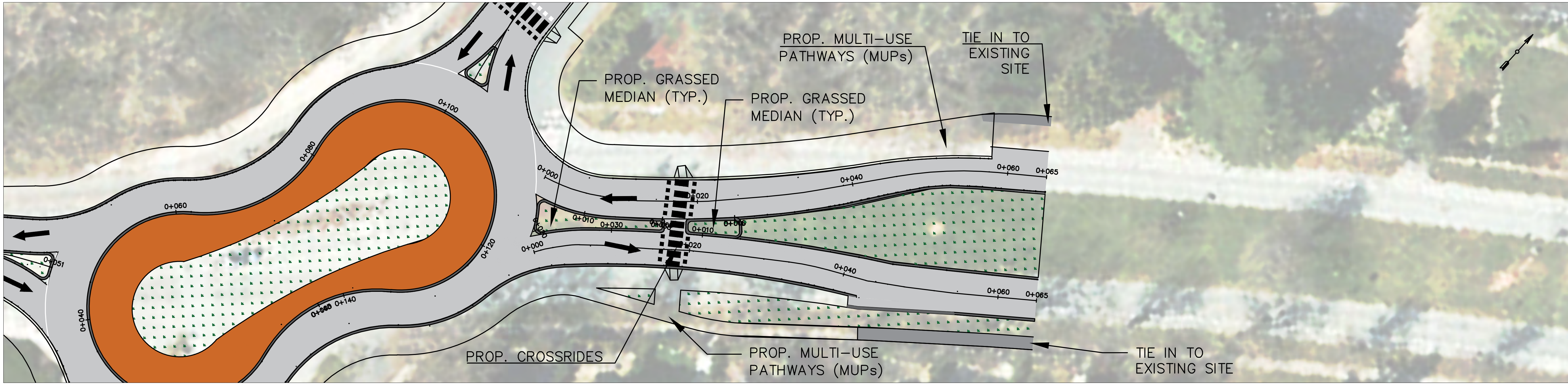
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:150

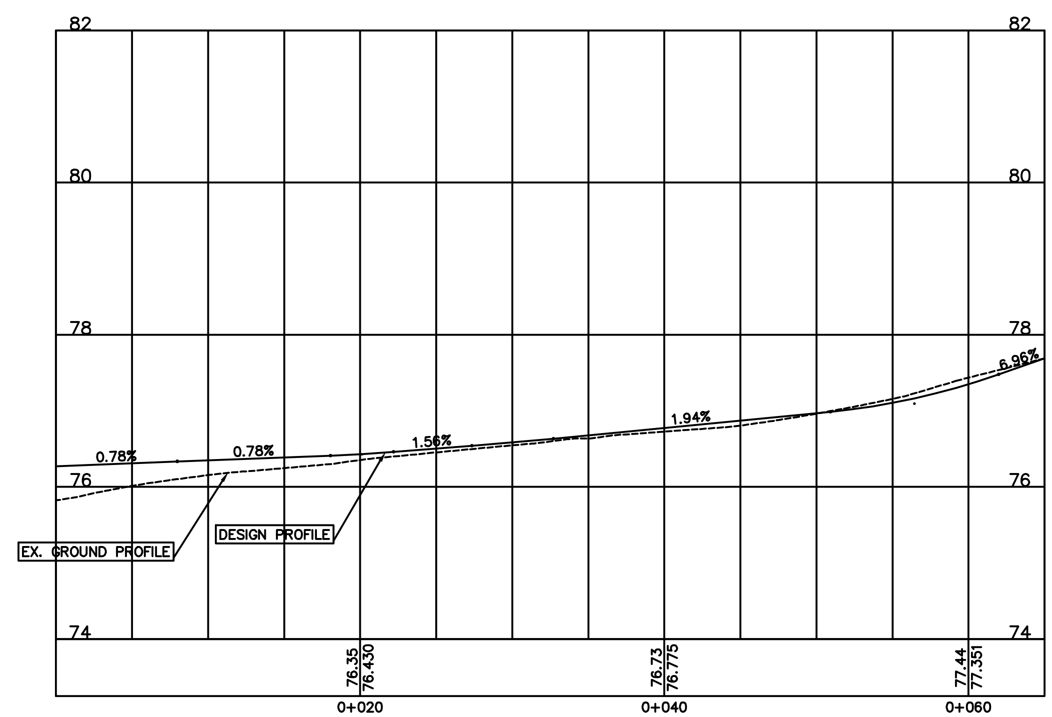
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PLAN & PROFILE - NW MARINE DR.

DRAWN: JN
CHECKED: EJ

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-105





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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

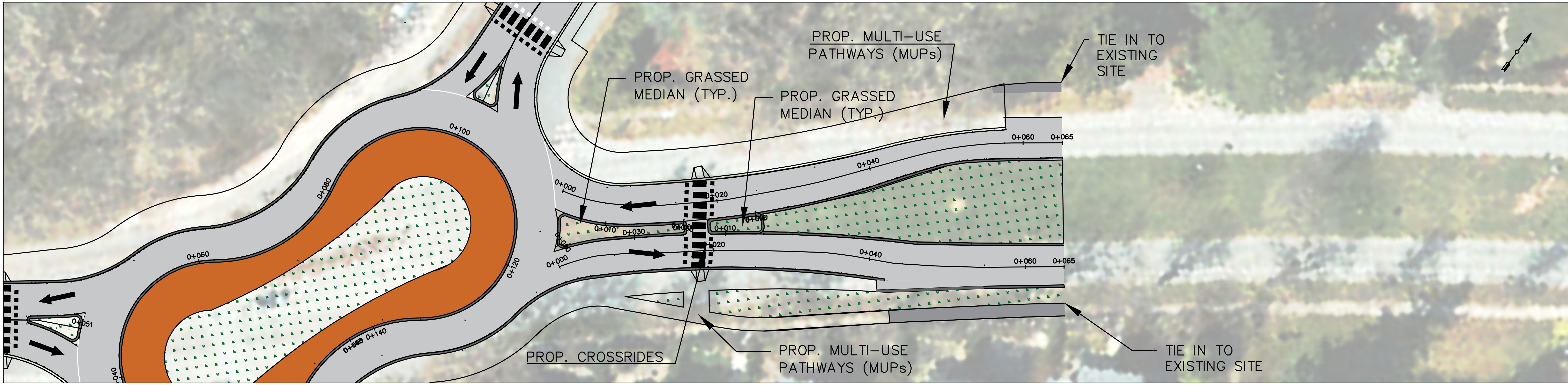
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:150

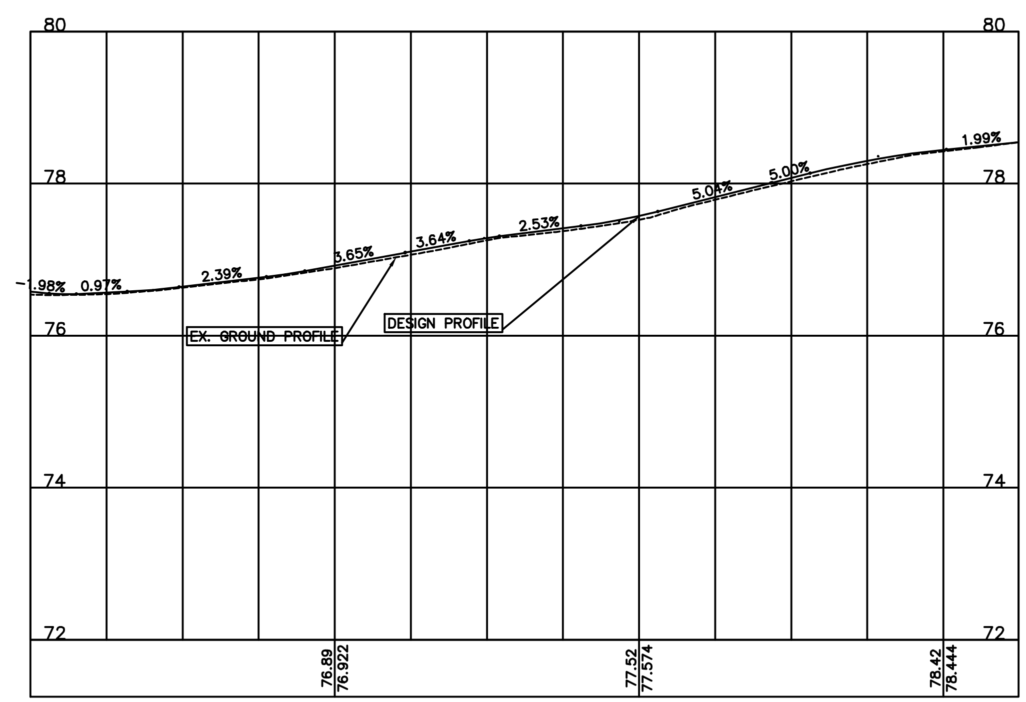
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PLAN & PROFILE - EAST CHANCELLOR (ENTRY LANE)

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: EJ

DRAWING SHEET: S-106





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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

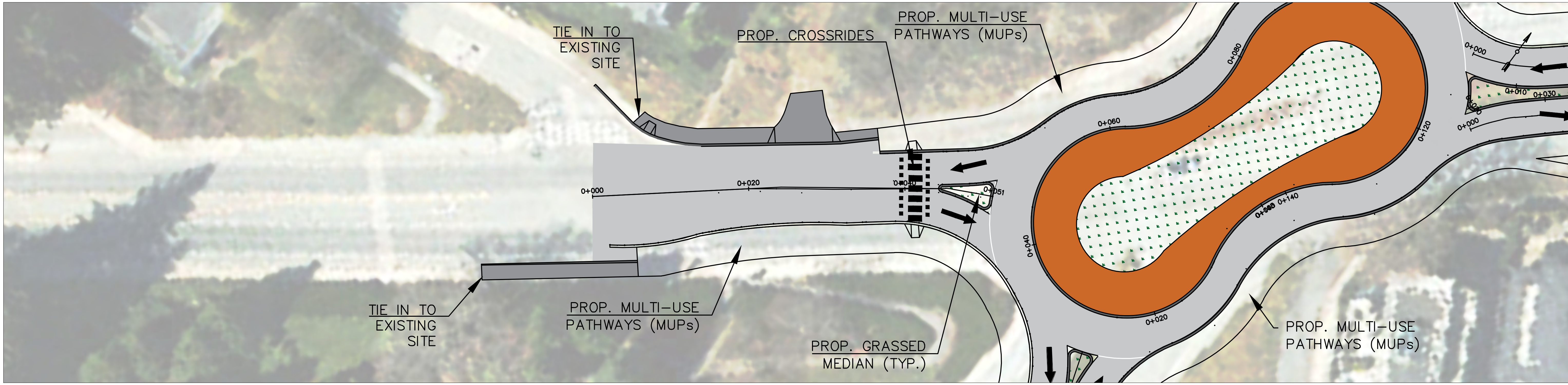
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:150

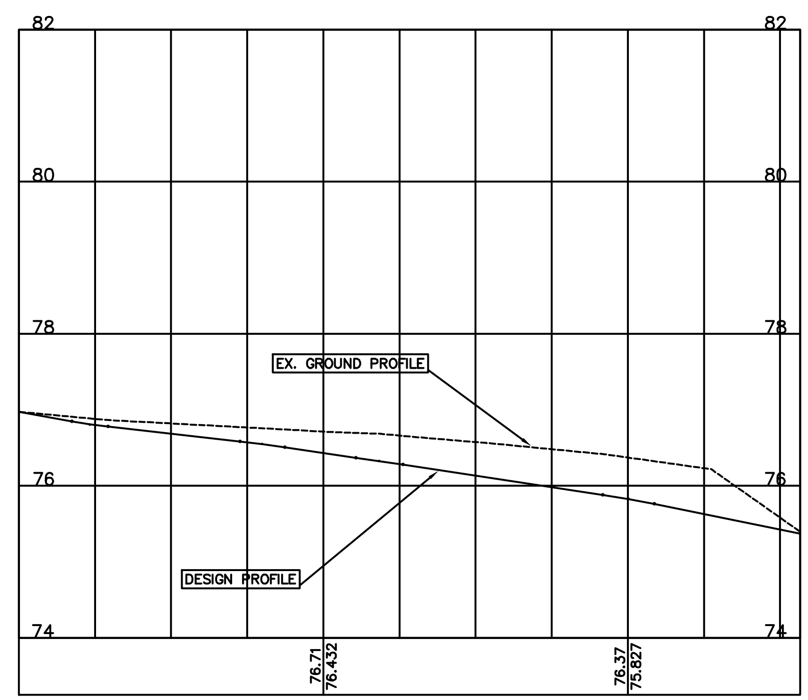
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PLAN & PROFILE - EAST CHANCELLOR (EXIT LANE)

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: EJ

DRAWING SHEET: S-107





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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

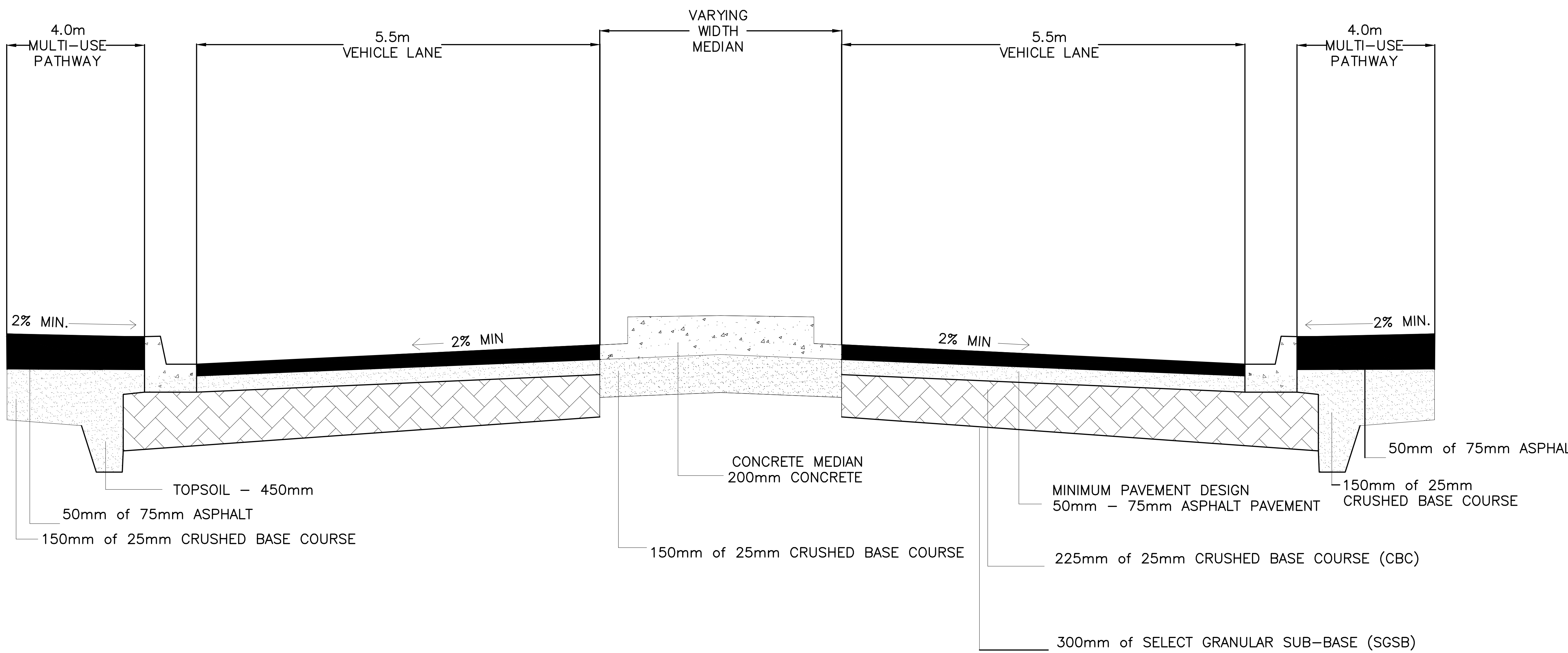
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:150

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PLAN & PROFILE - WEST CHANCELLOR

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: EJ

DRAWING SHEET: S-108



HEXALIGN

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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31

REV: A

PAPER: B / 11x17

SCALE: 1:3000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN

TYPICAL CROSS SECTION

DRAWN: EJ

CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-200

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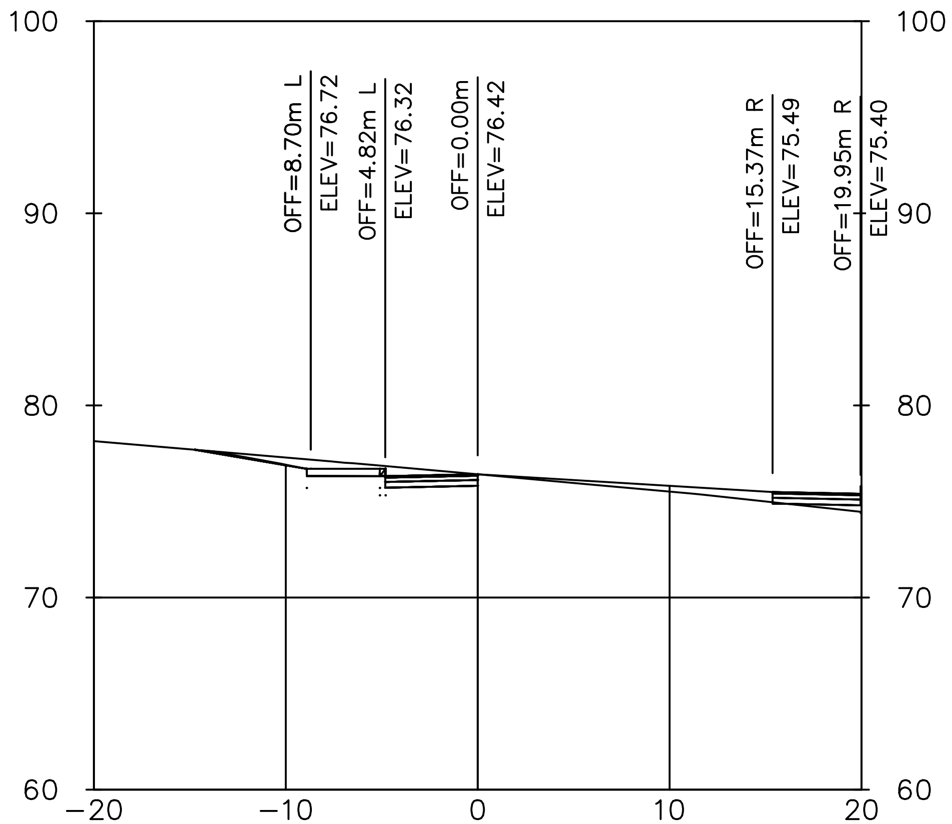

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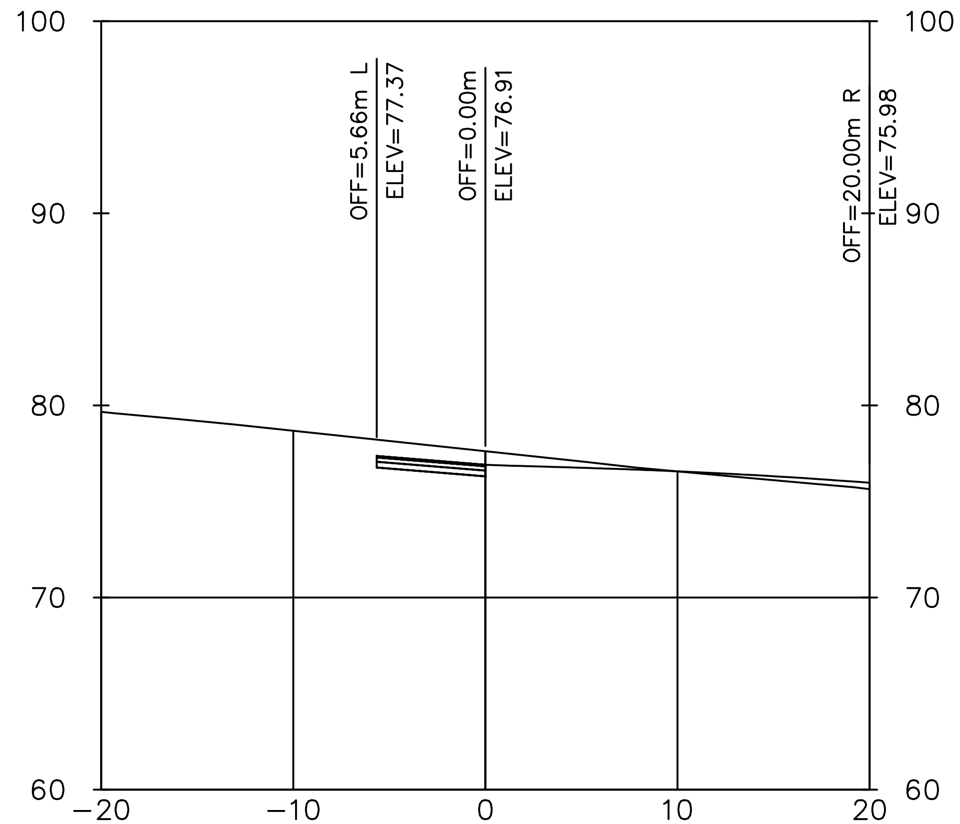

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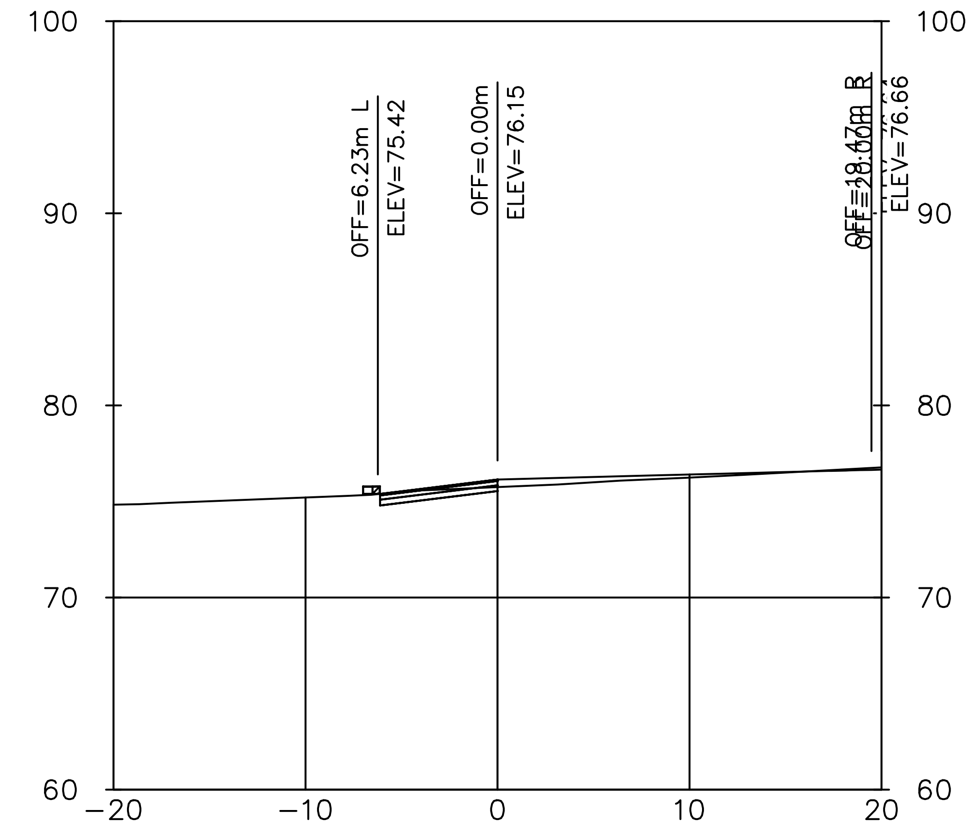

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REV	DESCRIPTION	BY	DATE
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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
CROSS SECTIONS - MAIN PEANUT (1)

DRAWN: JN
CHECKED: SA

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-201

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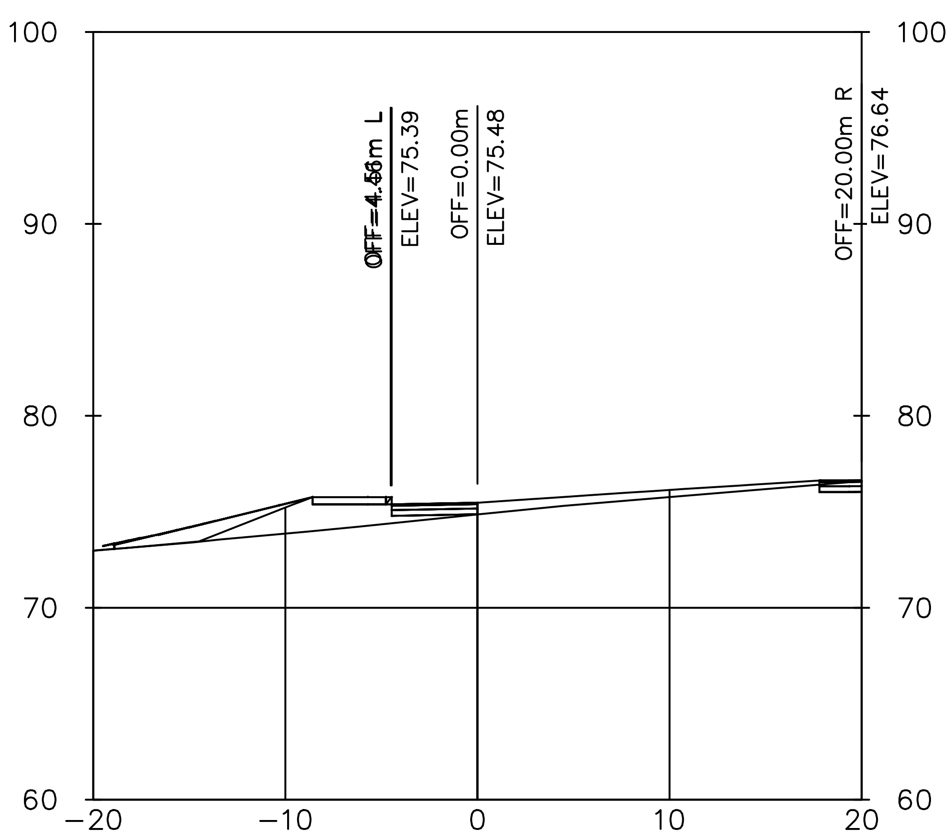

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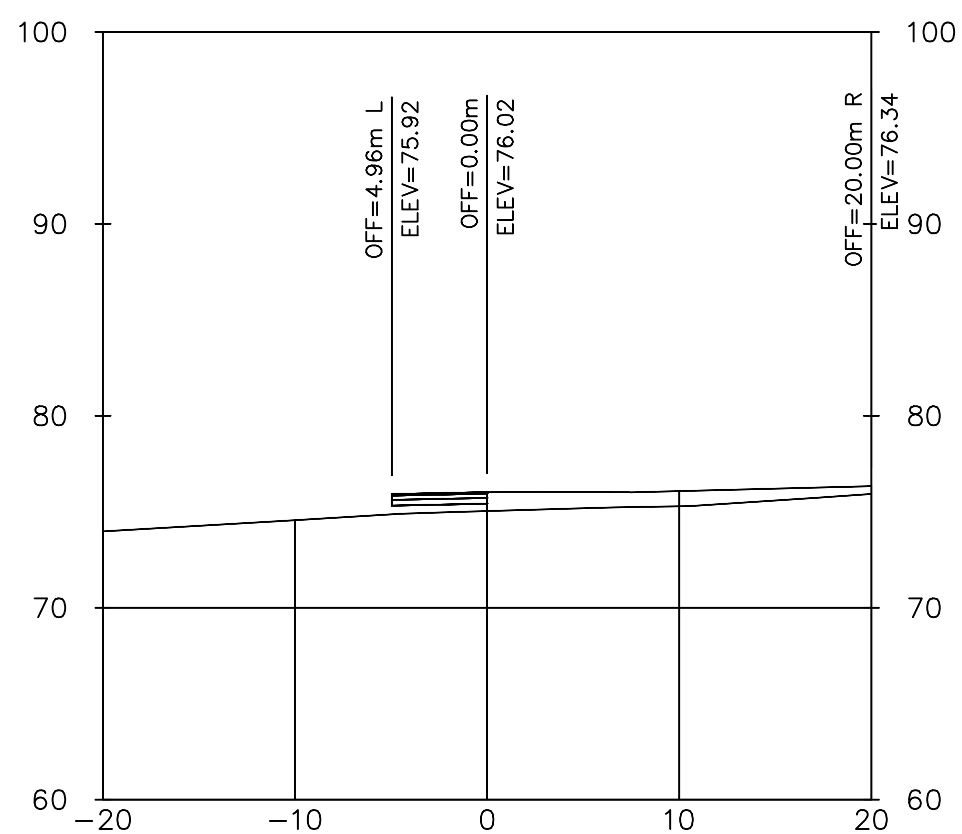

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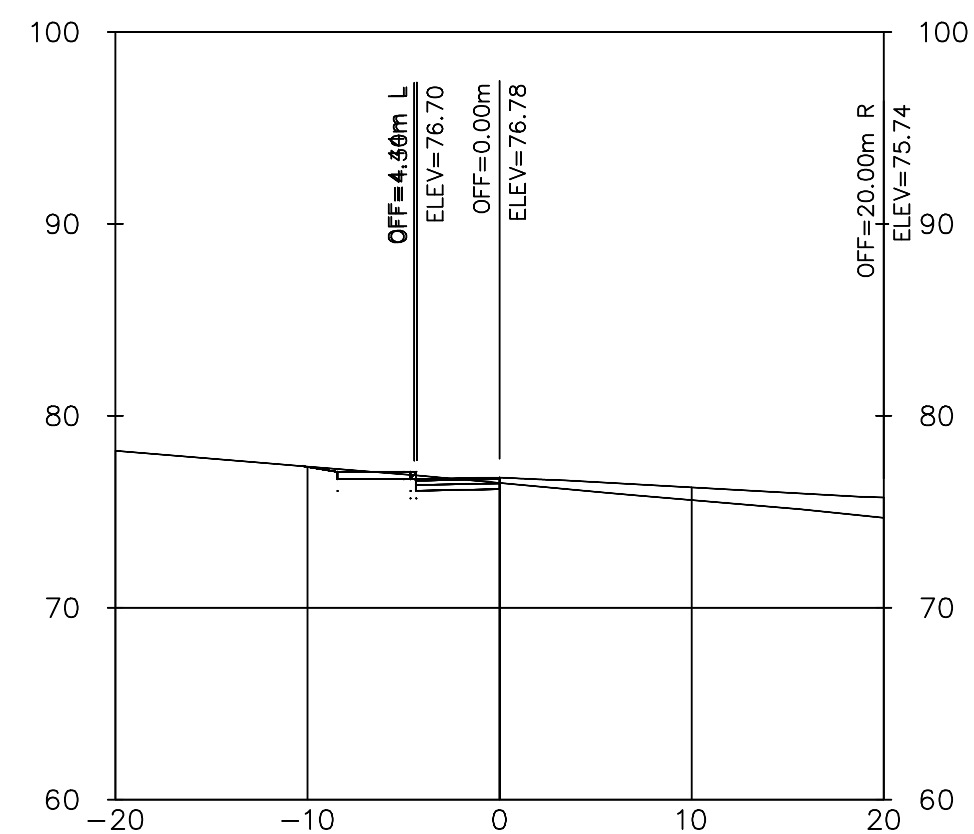

HEXALIGN

GENERAL NOTES:
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2. ALL DIMENSIONS ARE IN METERS UNLESS NOTED
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5. THE STRUCTURAL ASPECTS OF THE GATEWAY ARE DESIGNED TO NBC 2015

REV	DESCRIPTION	BY	DATE
A	Issued for Review	XX	2024-12-07
B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

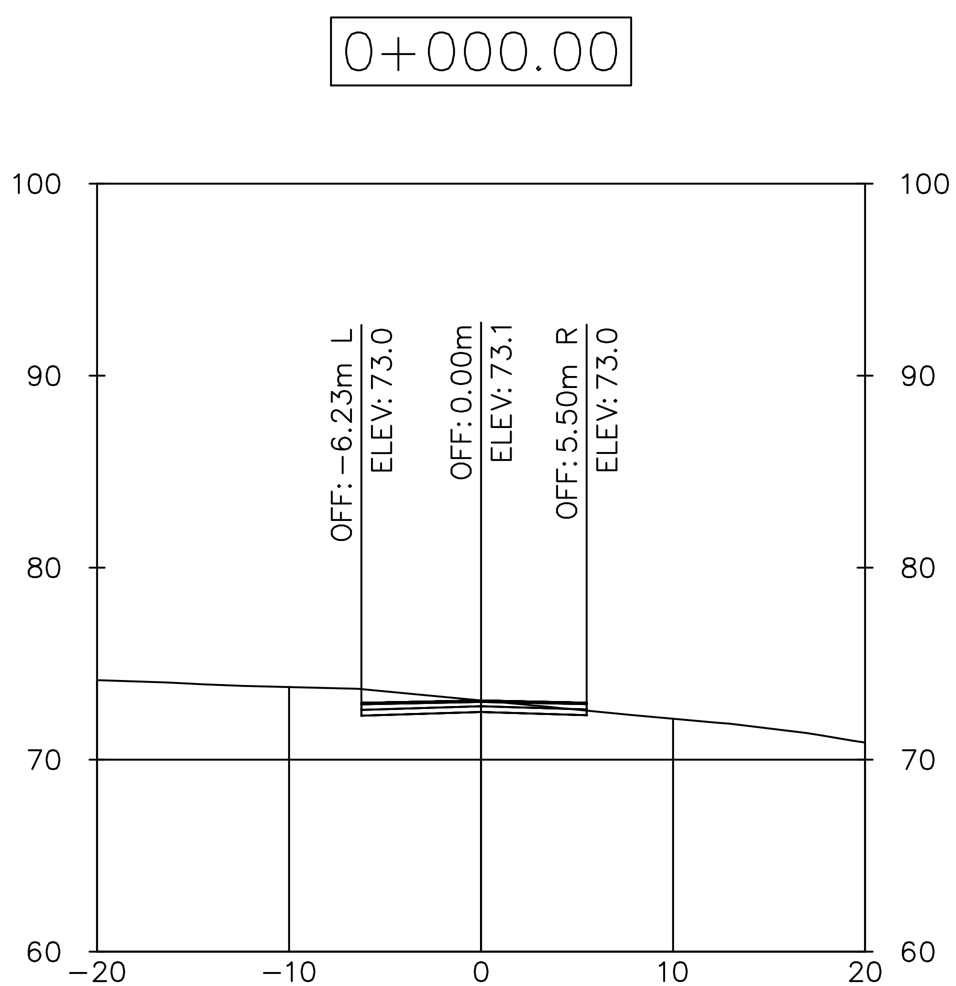
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1000

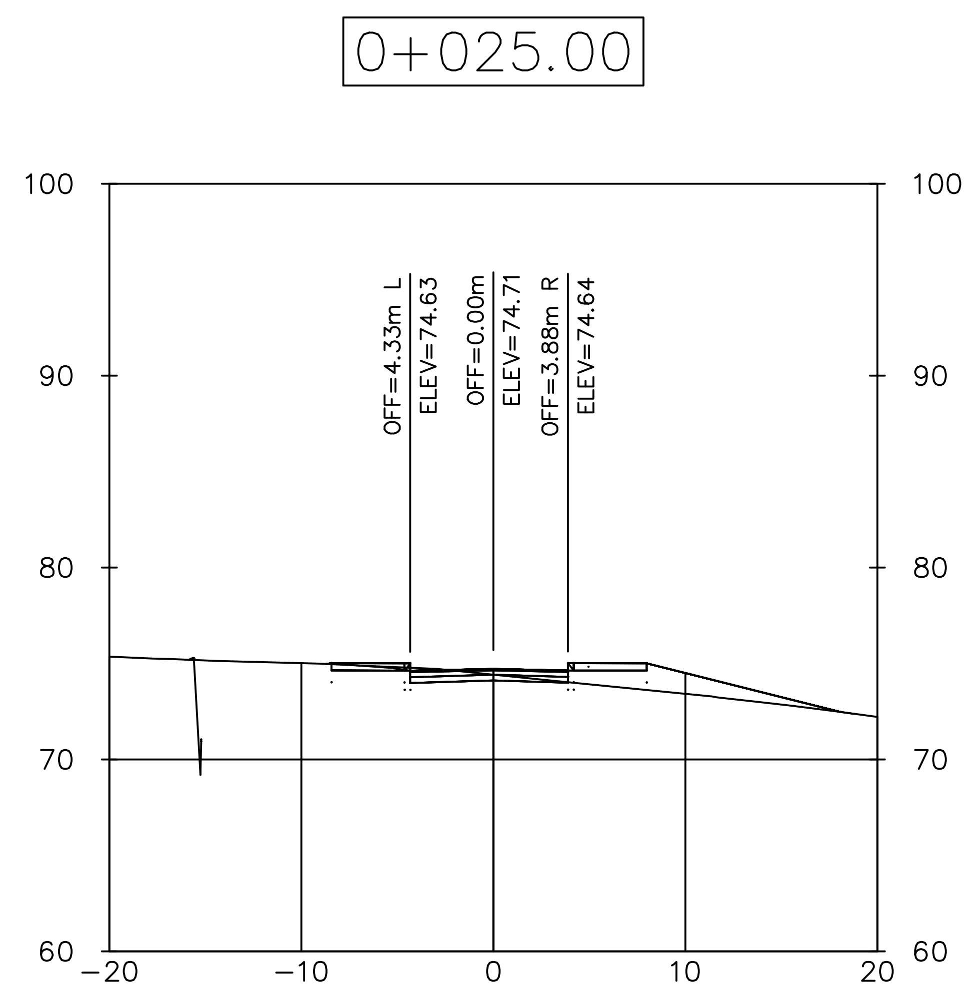
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
CROSS SECTIONS - MAIN PEANUT (2)

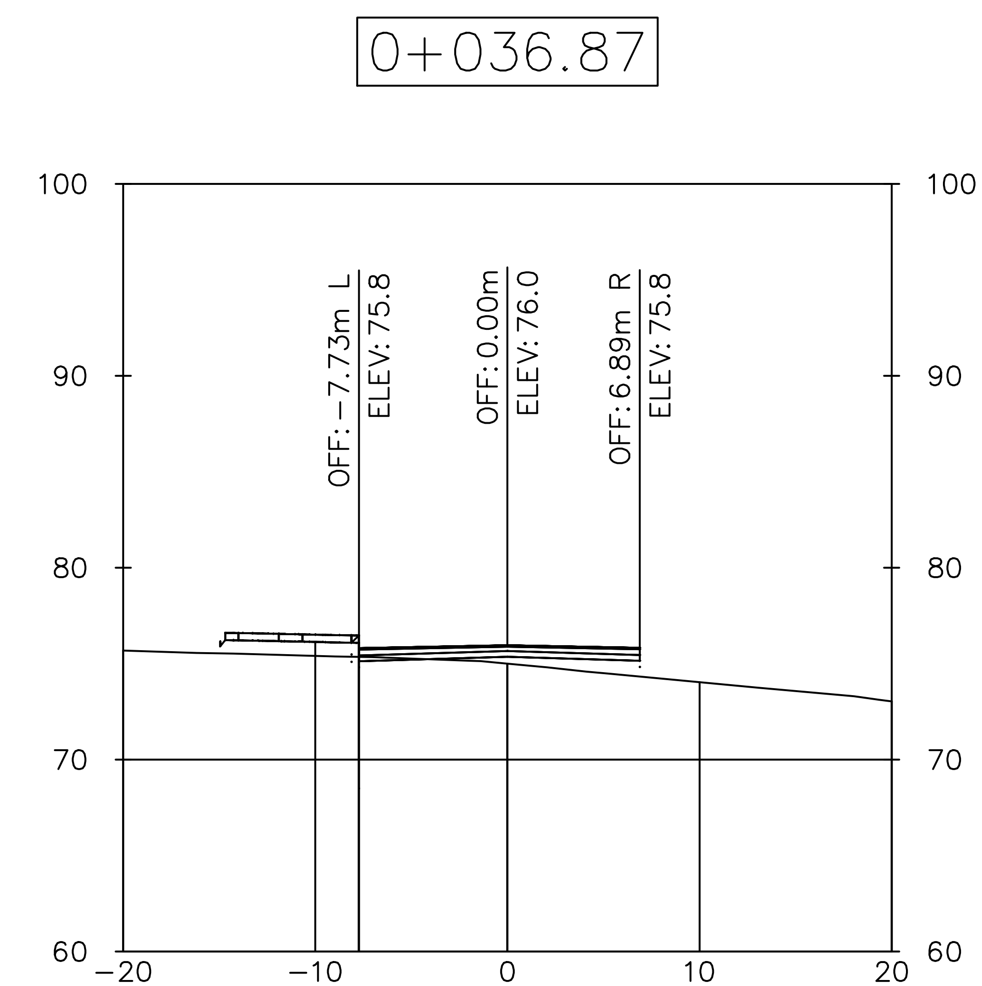
CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C.,
CANADA V6T 1Z4

DRAWN: JN
CHECKED: SA

DRAWING SHEET: S-202







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A	Issued for Review	XX	2024-03-31
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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
CROSS SECTIONS - NW MARINE DRIVE

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: SA

DRAWING SHEET: S-203

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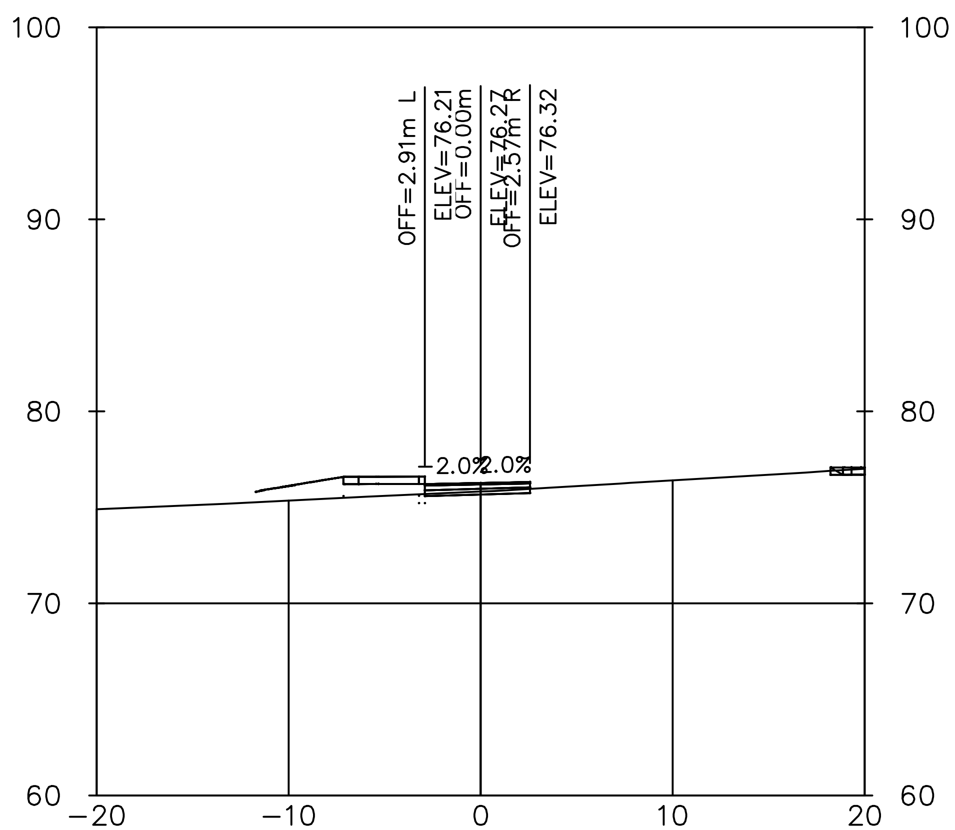

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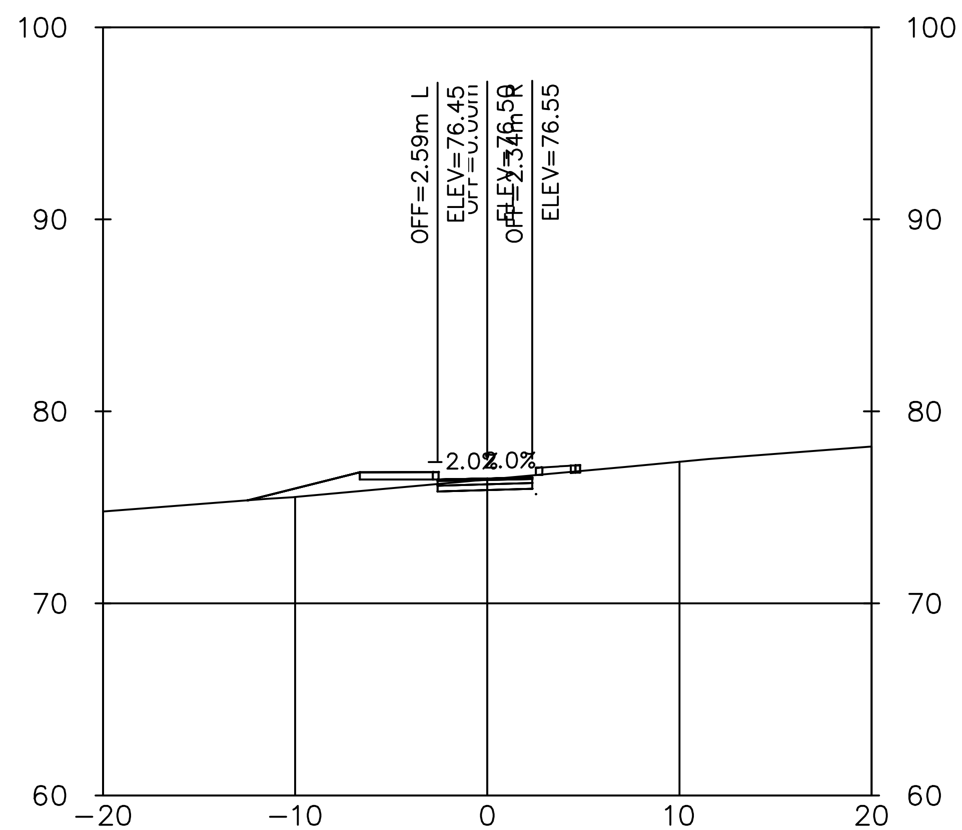

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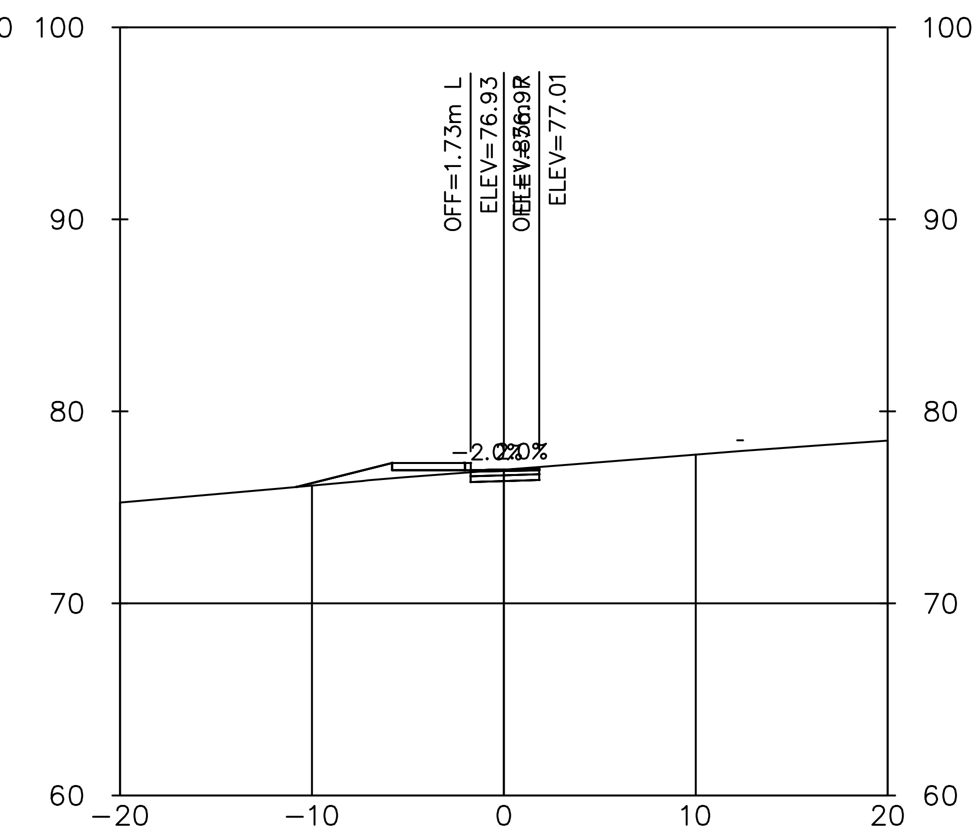

HEXALIGN

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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1000

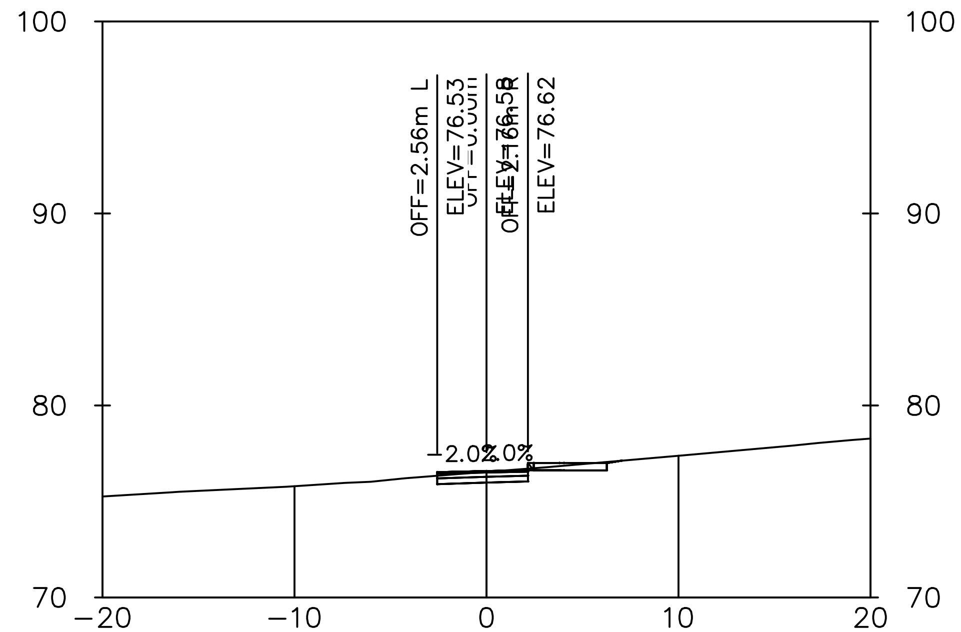
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
CROSS SECTION - EAST CHANCELLOR (ENTRY LANE)

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: SA

DRAWING SHEET: S-204

0+000.00



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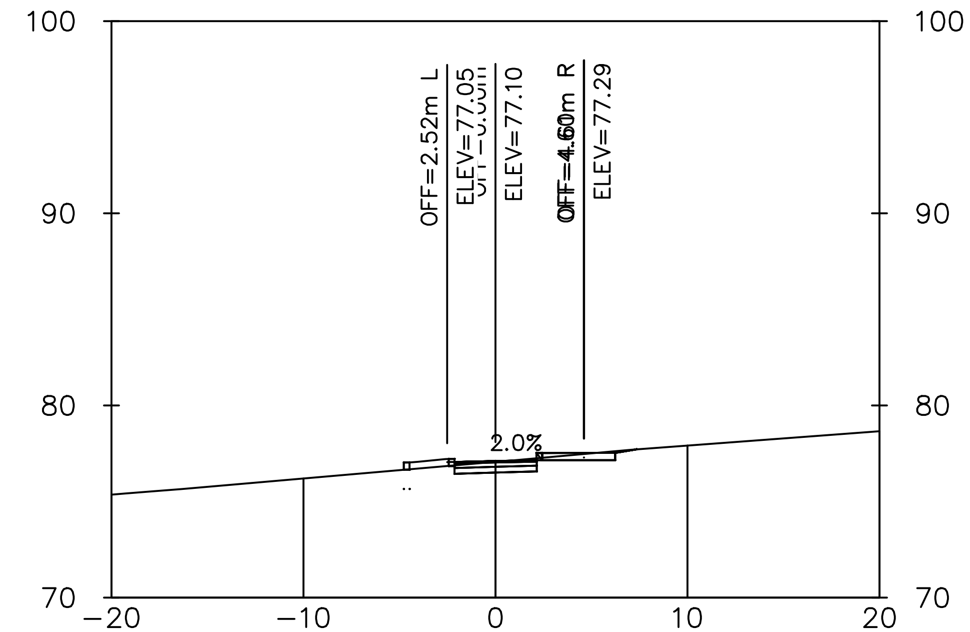

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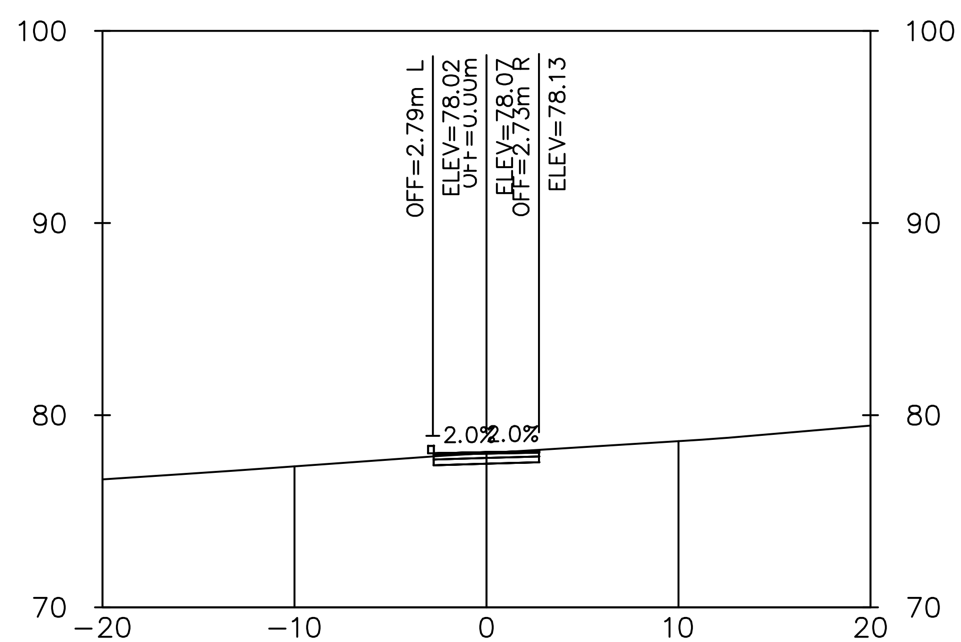

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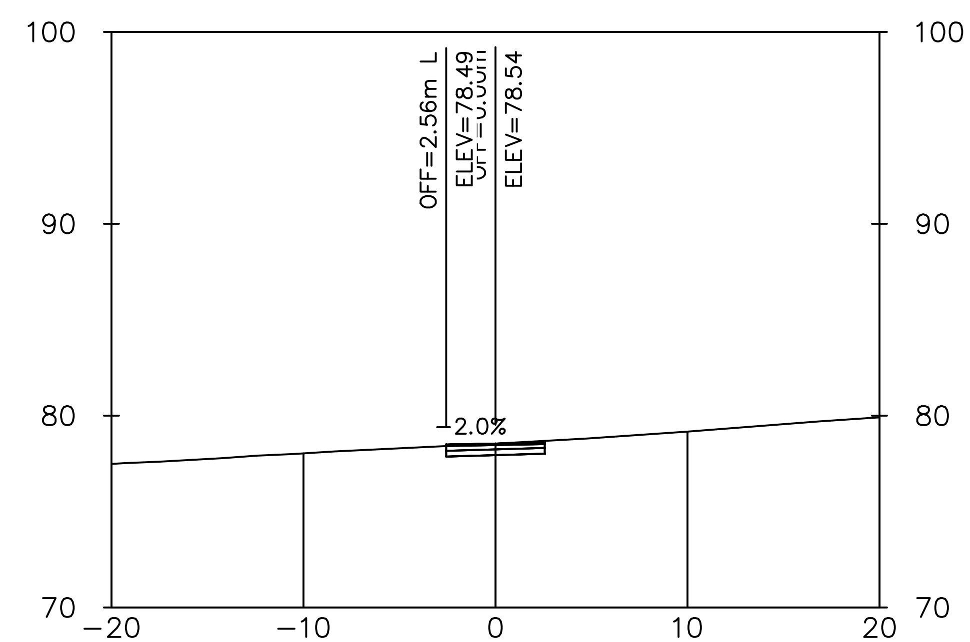

HEXALIGN

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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN

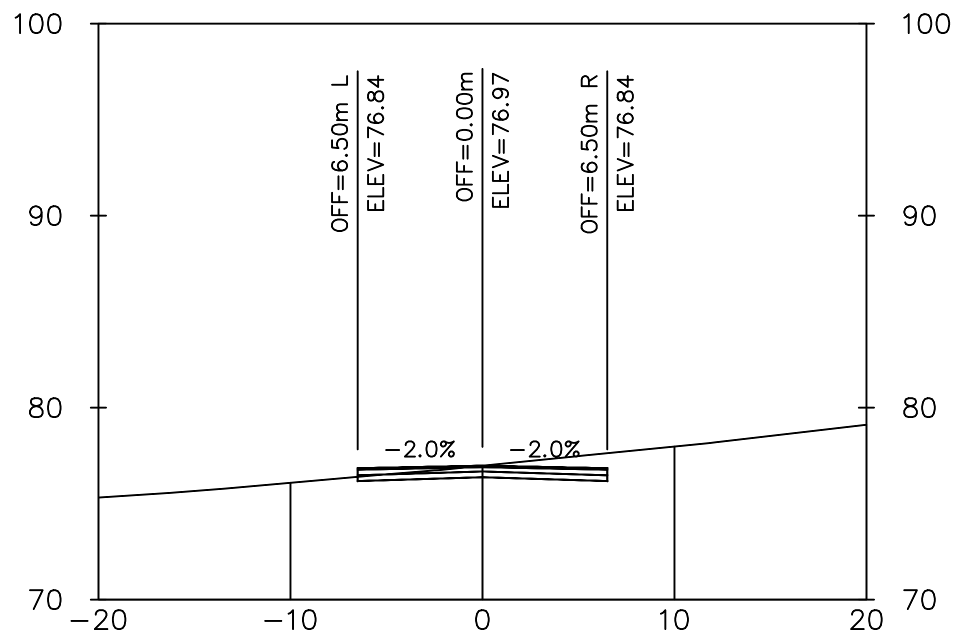
CROSS SECTIONS - EAST CHANCELLOR (EXIT LANE)

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C.,
CANADA V6T 1Z4

DRAWN: JN
CHECKED: SA

DRAWING SHEET: S-205

0+000.00



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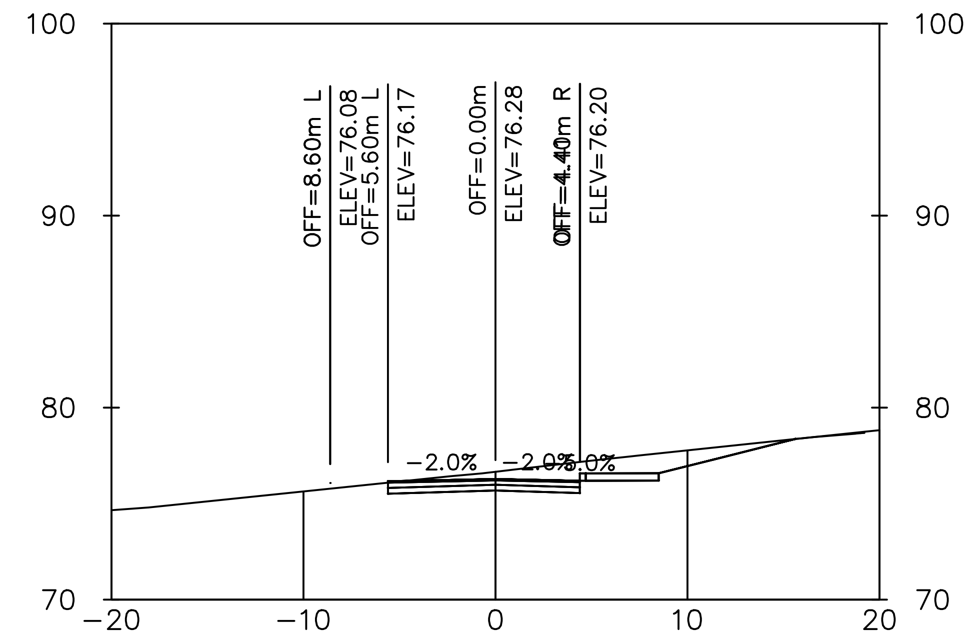

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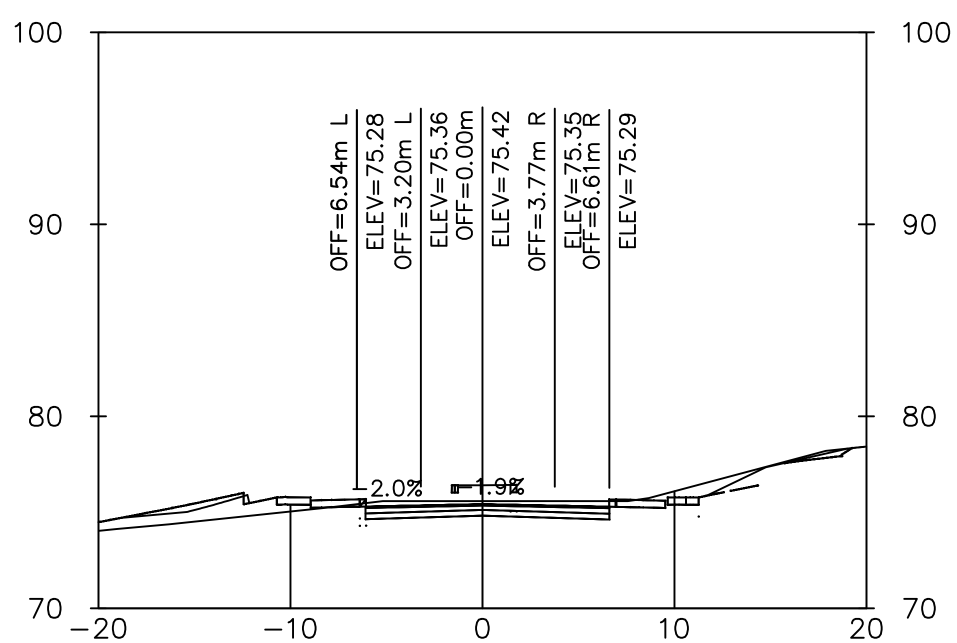

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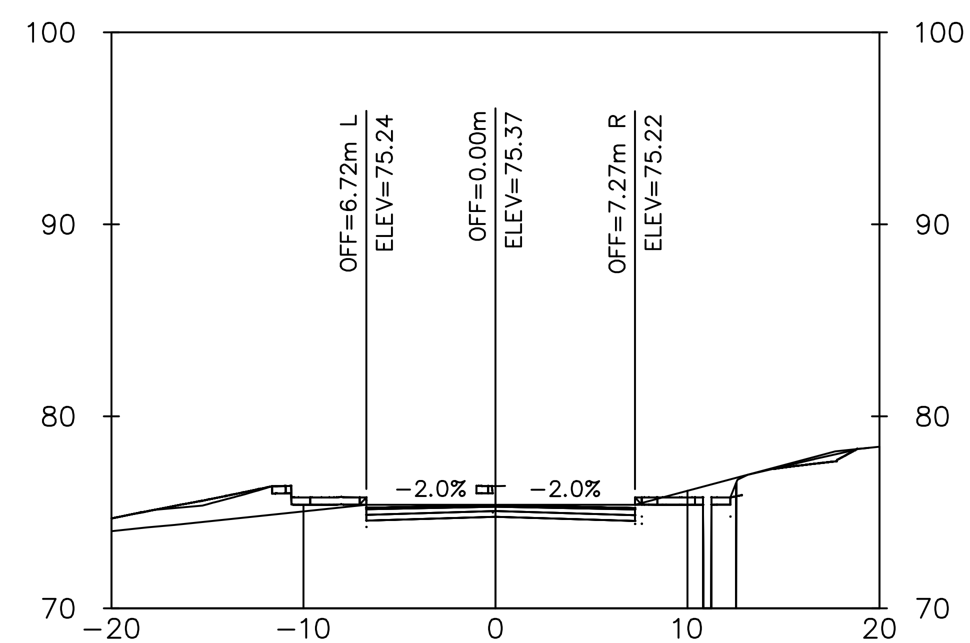

HEXALIGN

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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1000

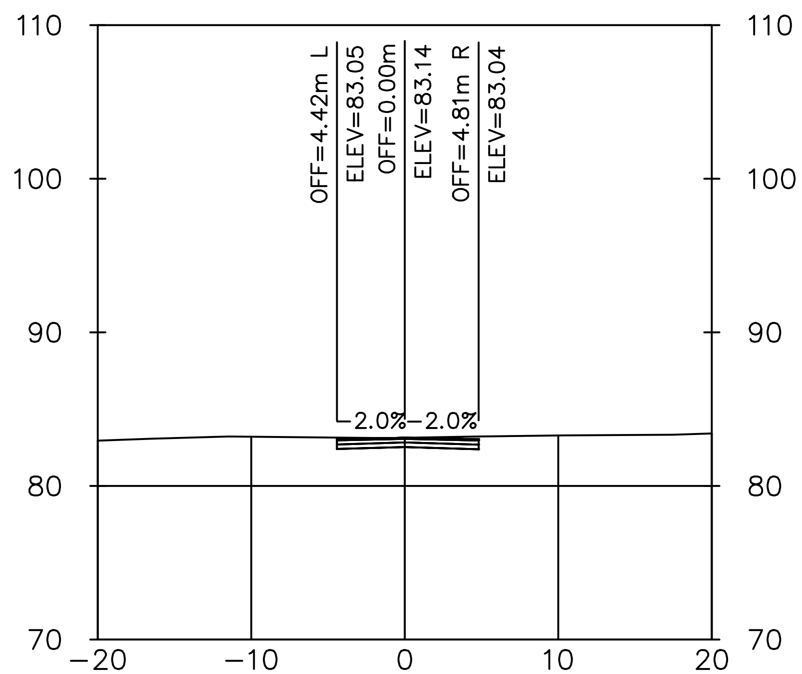
TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
CROSS SECTIONS - WEST CHANCELLOR

DRAWN: JN
CHECKED: SA

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-206

0+000.00



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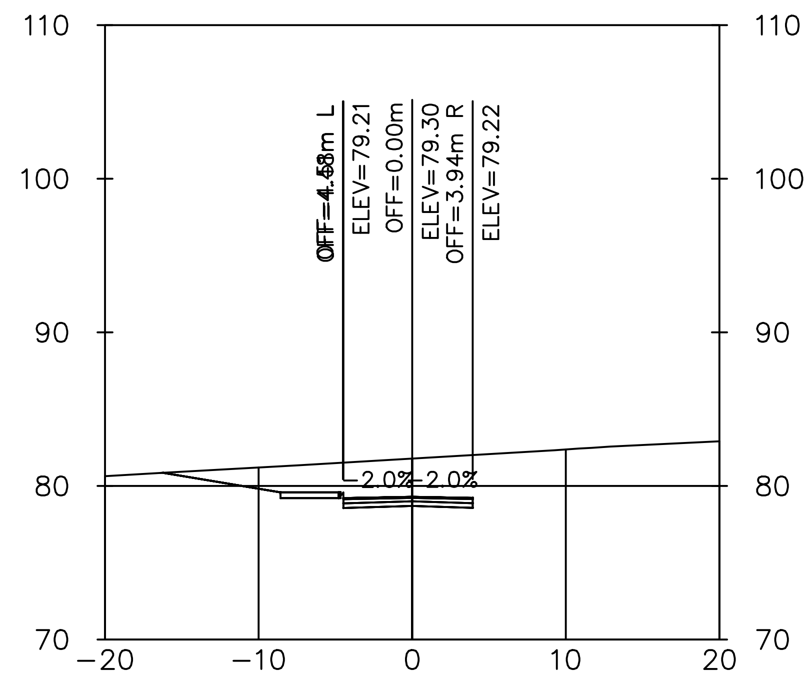

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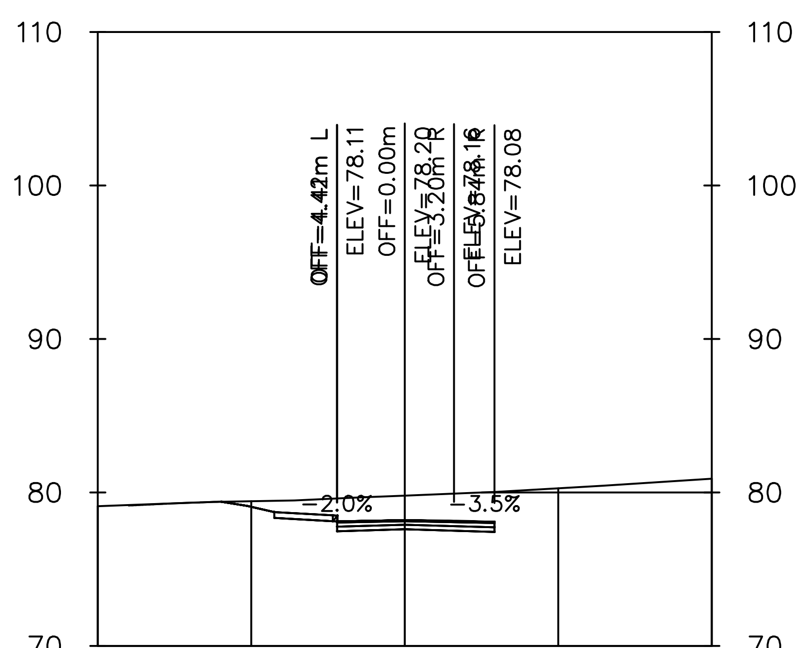

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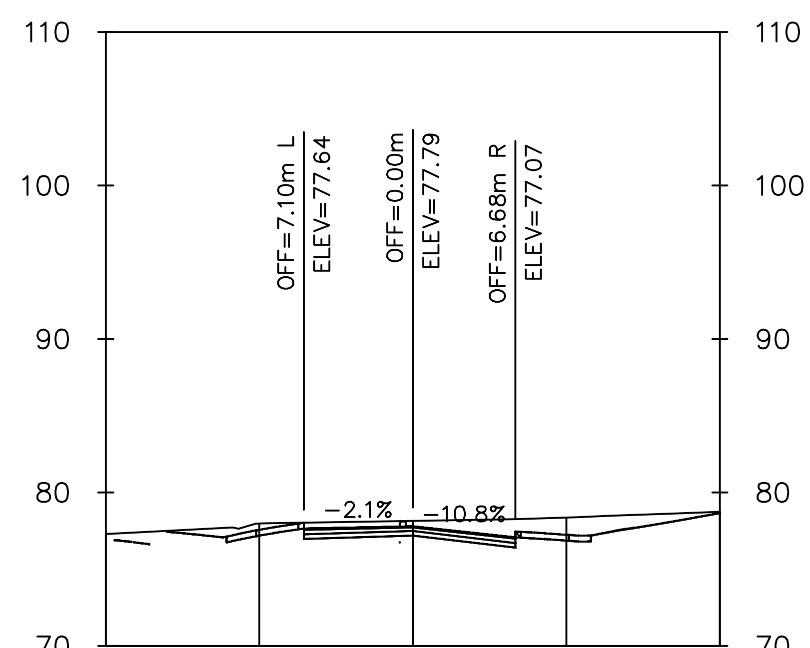

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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

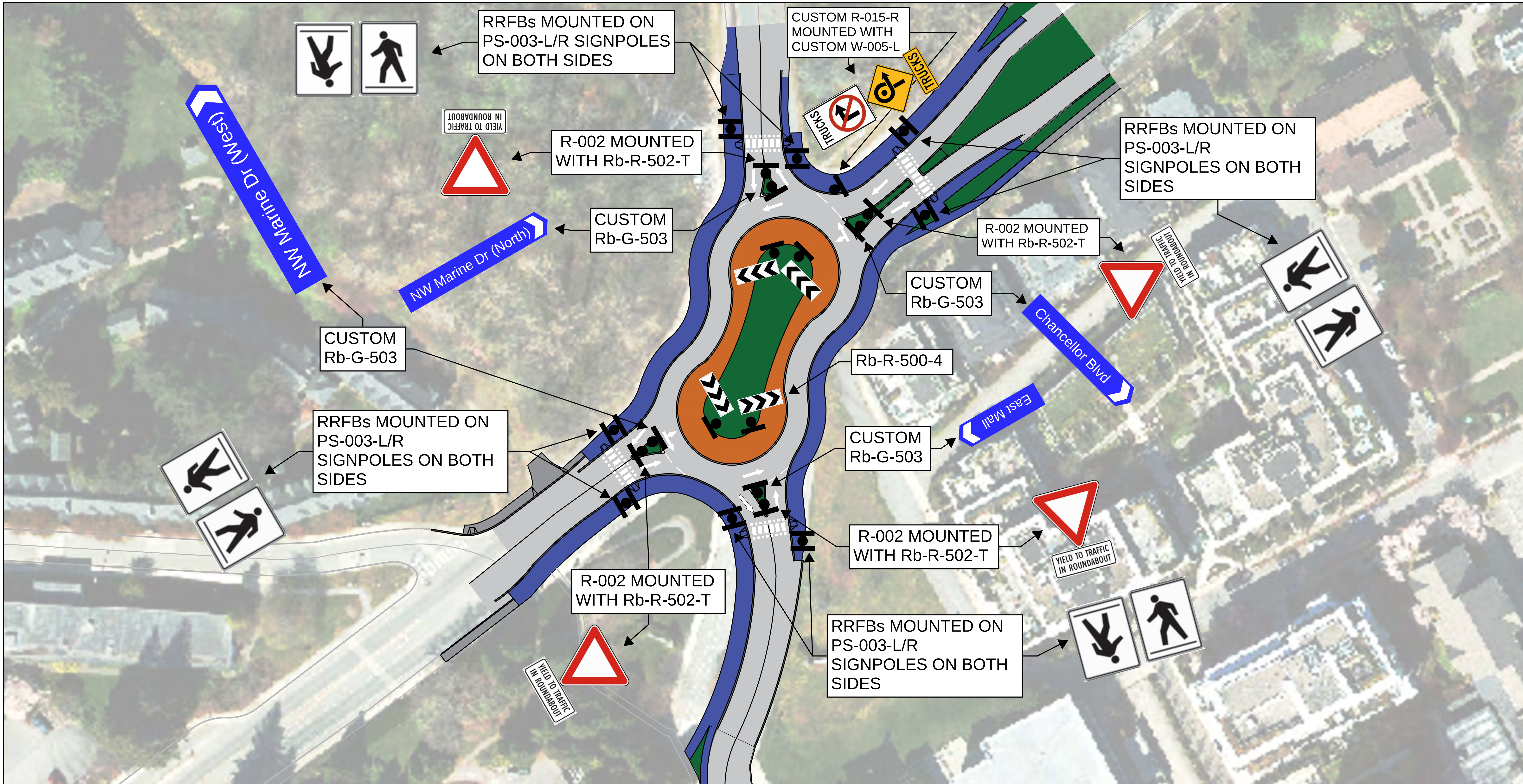
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:1250

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
CROSS SECTIONS - EAST MALL

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWN: JN
CHECKED: SA

DRAWING SHEET: S-207



HEXALIGN

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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

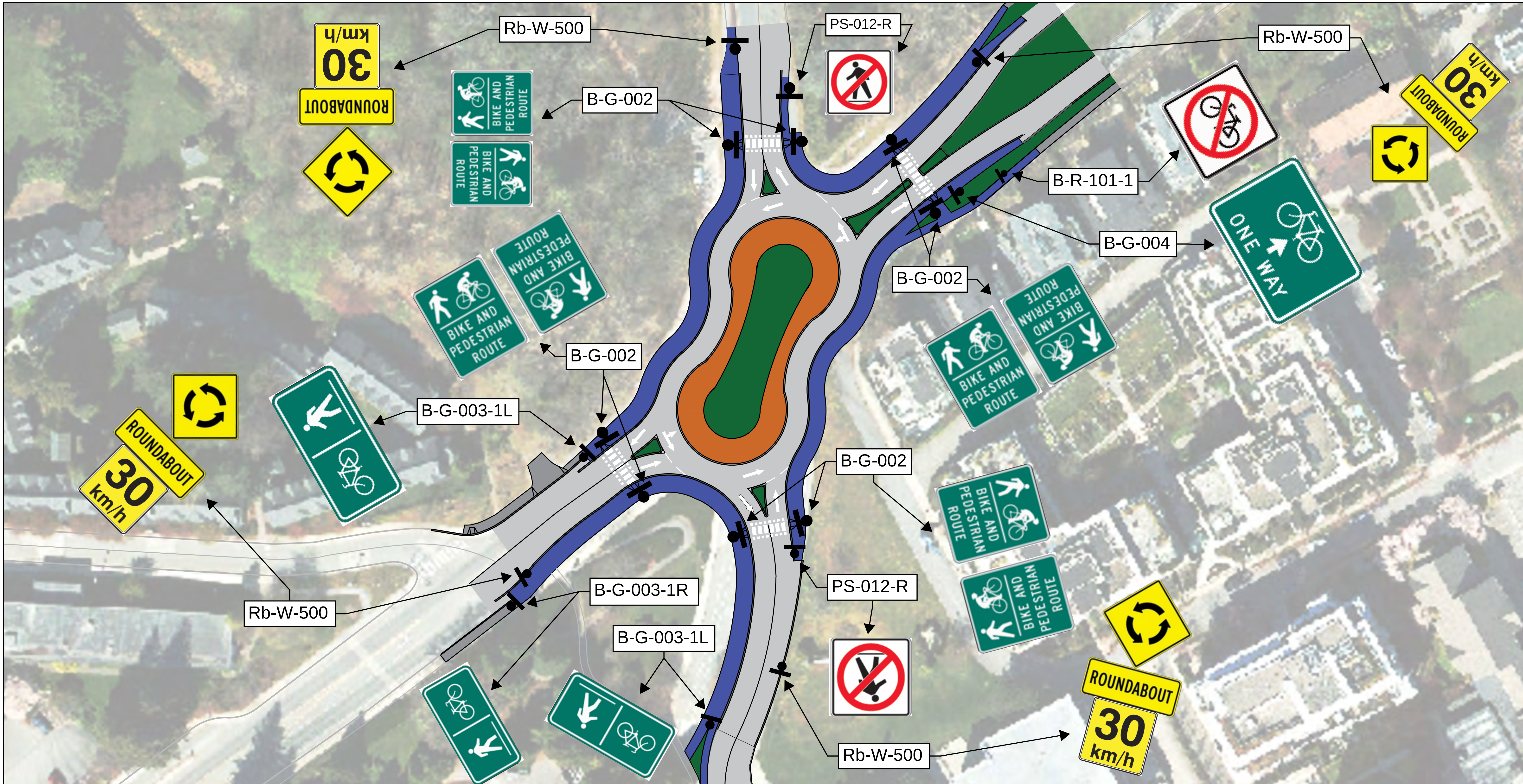
DATE: 2025-03-30
REV: B
PAPER: B / 11x17
SCALE: 1:2000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PAVEMENT MARKING & SIGNAGE

DRAWN: SA
CHECKED: KN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-300



HEXALIGN

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B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-30
REV: B
PAPER: B / 11x17
SCALE: 1:2000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
PAVEMENT MARKING & SIGNAGE

DRAWN: SA
CHECKED: KN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-301

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CB2	TYPE C	SINGLE
CB3	TYPE C	SINGLE
CB4	TYPE C	SINGLE
CB5	TYPE C	SINGLE
CB6	TYPE C	SINGLE
CB7	TYPE C	TWIN
CB8	TYPE C	TWIN
CB9	TYPE C	SINGLE
CB10	TYPE C	SINGLE
CB11	TYPE C	TWIN
CB12	TYPE C	SINGLE
MH1	TYPE 5A	STANDARD
MH2	TYPE 5A	STANDARD
MH3	TYPE 5A	STANDARD
MH4	TYPE 5A	STANDARD
MH5	TYPE 5A	STANDARD
MH6	TYPE 5A	STANDARD
MH7	TYPE 5A	STANDARD
MH8	TYPE 5A	STANDARD

HEXALIGN

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2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

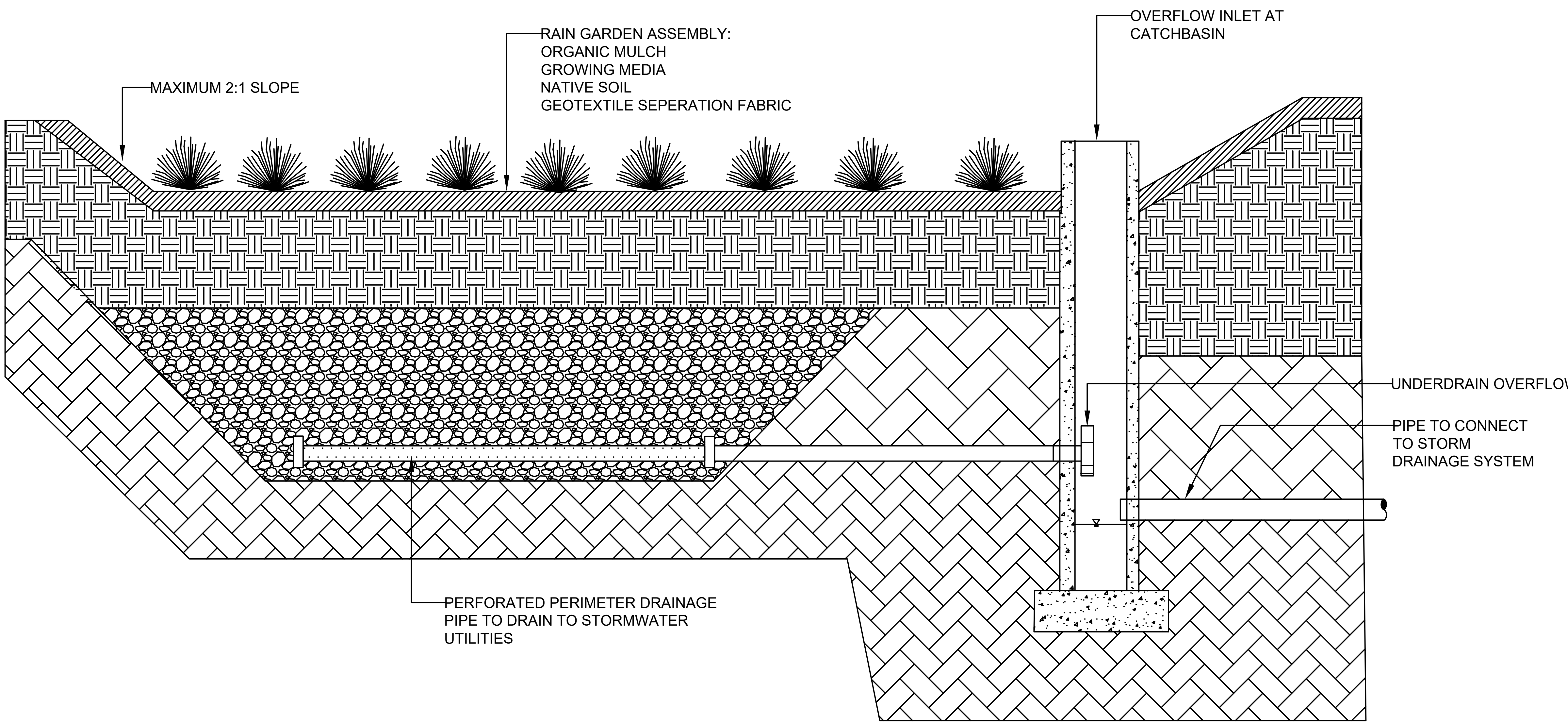
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:2000

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
STORMWATER MANAGEMENT OVERVIEW

DRAWN: JSe
CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-400



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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

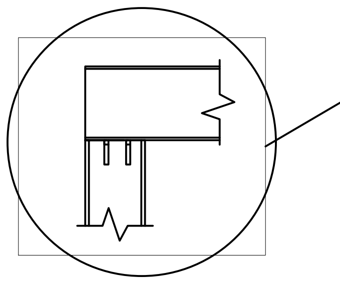
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: 1:500

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
RAIN GARDEN - TYP. CROSS SECTION

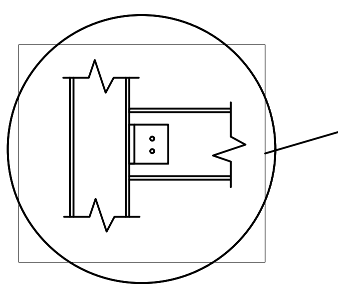
DRAWN: JSe
CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

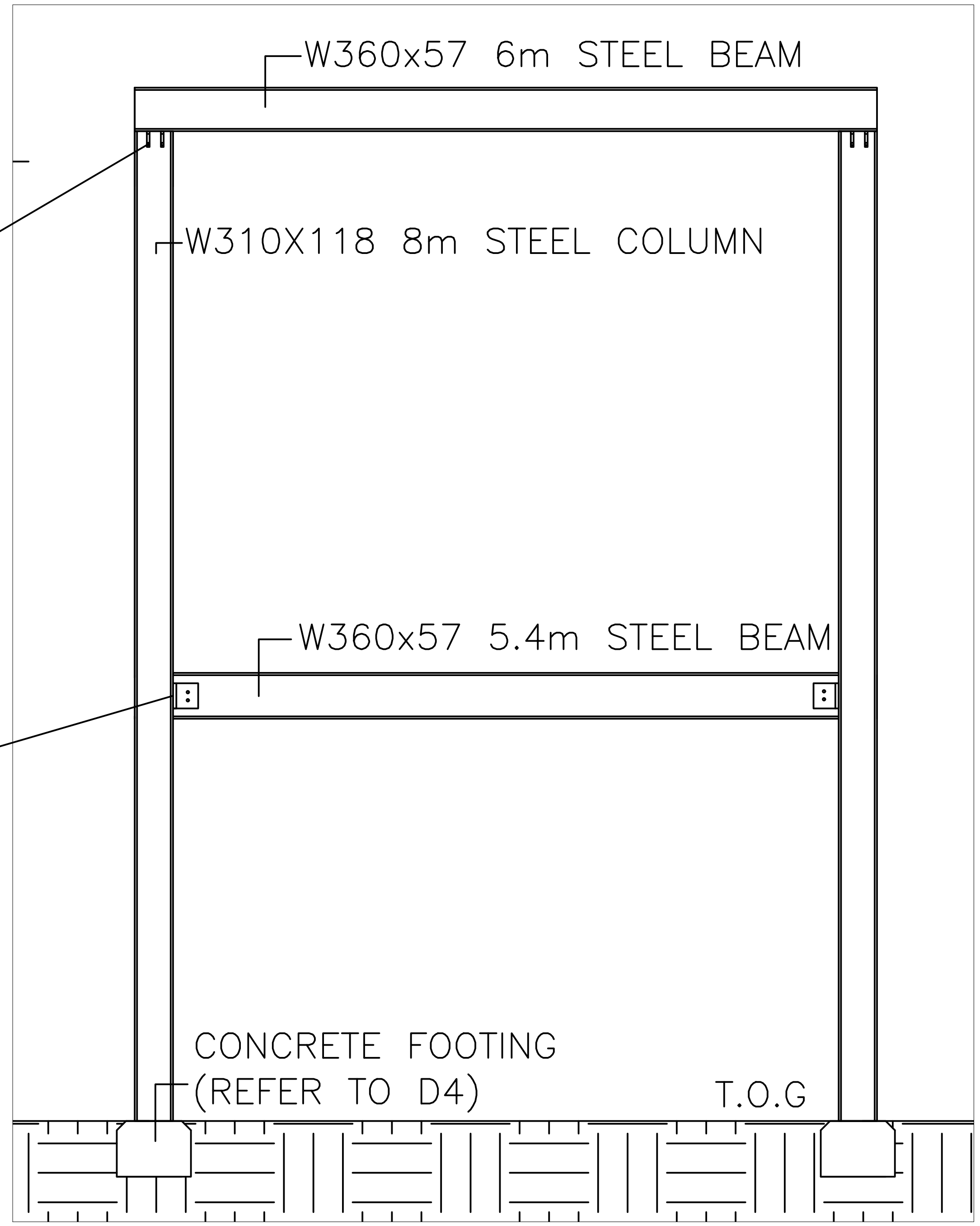
DRAWING SHEET: S-401



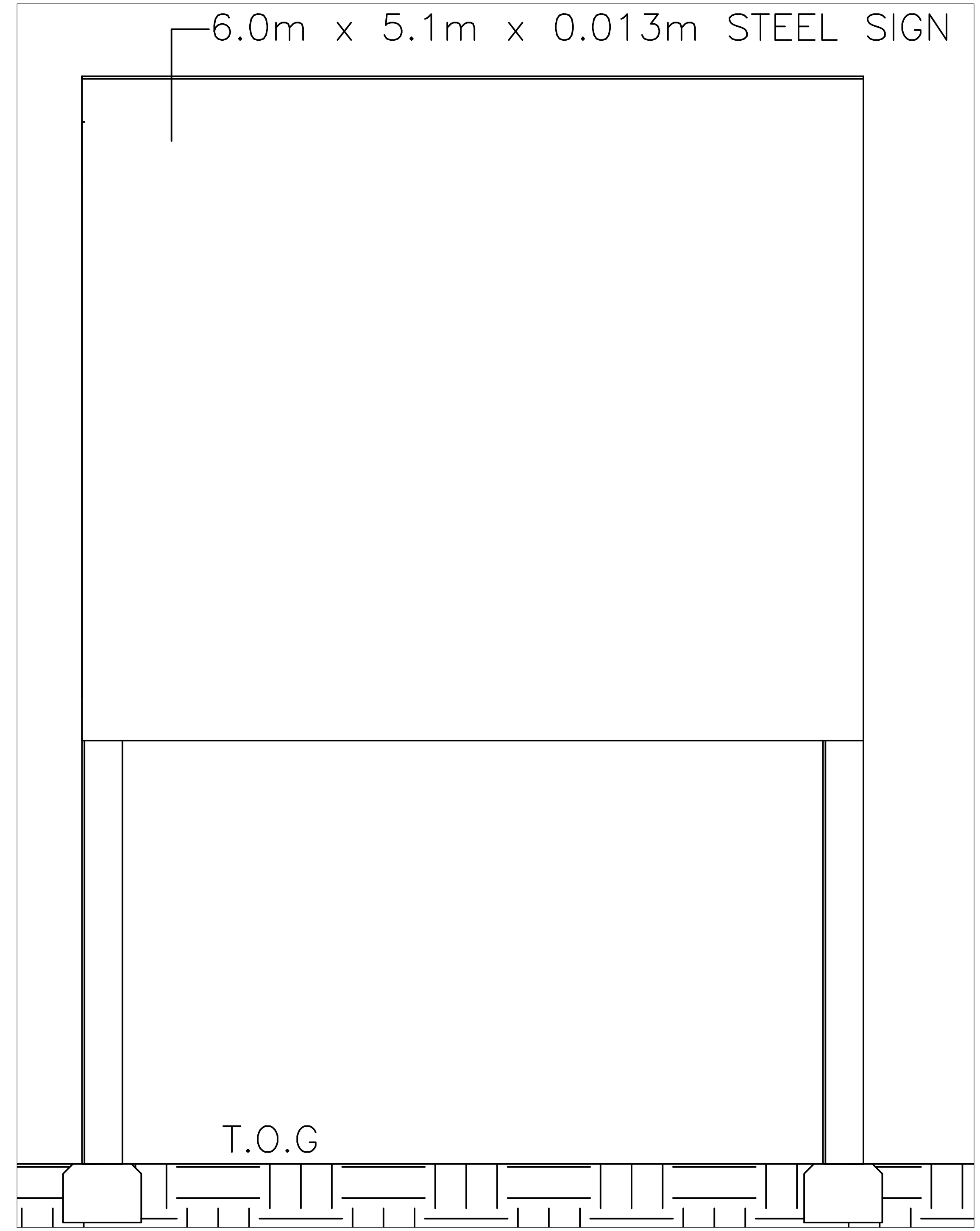
2 D3 **CONNECTION 1**
SCALE: 1:400



3 D3 **CONNECTION 2**
SCALE: 1:400



1 D3 **SIDE VIEW**
SCALE: 1:750



4 D3 **FRONT VIEW**
SCALE: 1:750

HEXALIGN

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CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

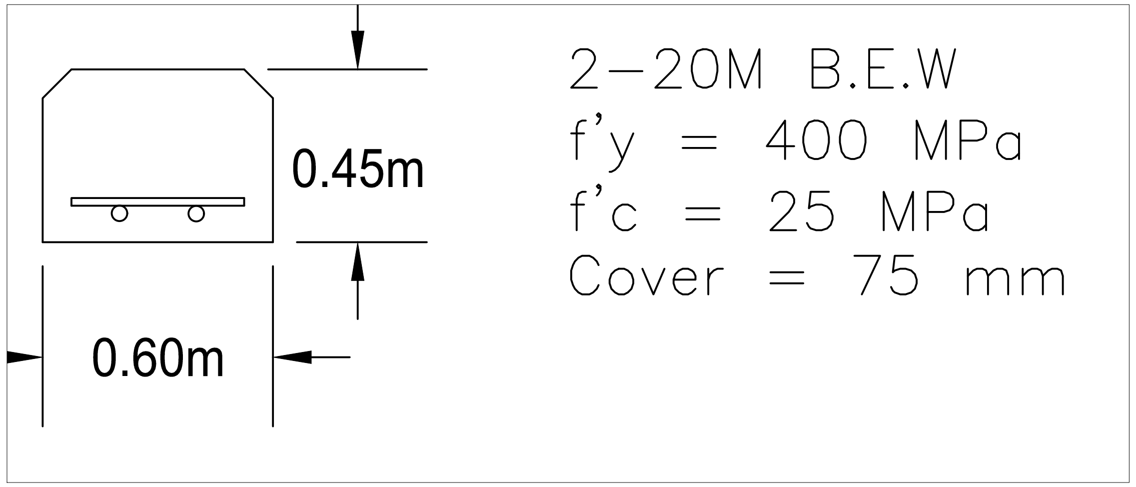
DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: VARIES

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
GATEWAY DESIGN

DRAWN: EJ
CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C.,
CANADA V6T 1Z4

DRAWING SHEET: S-500



1 D4 **SIDE VIEW**
SCALE: 1:500

1 D4 **SIDE VIEW**
SCALE: 1:500

HEXALIGN

GENERAL NOTES:
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4. THE ROADWAY DESIGN ASPECTS OF THE ROUNDABOUT ARE DESIGNED TO BC MOTI AND TAC GEOMETRIC DESIGN GUIDELINES
5. THE STRUCTURAL ASPECTS OF THE GATEWAY ARE DESIGNED TO NBC 2015

REV	DESCRIPTION	BY	DATE
A	Issued for Review	XX	2024-12-07
B	Issued for Construction	XX	2025-04-04

CIVL 446 - ENGINEERING DESIGN PROJECT | UBC CIVIL ENGINEERING
2002 - 6250 APPLIED SCIENCE LANE, VANCOUVER, BC V6T 1Z4

DATE: 2025-03-31
REV: A
PAPER: B / 11x17
SCALE: VARIES

TITLE: CHANCELLOR BLVD. & NW MARINE DR. INTERSECTION REDESIGN
GATEWAY DESIGN - CONNECTIONS

DRAWN: EJ
CHECKED: JN

CLIENT: UBC CAMPUS + COMMUNITY PLANNING
CIRS, 2210 WEST MALL VANCOUVER, B.C., CANADA V6T 1Z4

DRAWING SHEET: S-501

Appendix B – Traffic Analysis

Manual Traffic Counts

AM Peak Hours

Time Interval: 900-4500 seconds

Lane Use and Performance: AM Peak Hours									
MOVEMENT	VEHS(ALL)	PERS(ALL)	LOS(ALL)	VEHDELAY(ALL)	PERSDELAY(ALL)	STOPDELAY(ALL)	STOPS(ALL)	EMISSIONSCO	FUELCONSUMPTION
NW. Marine Dr. (SB)@11.4-5: East Mall (SB)@22.8	58	58	LOS_A	9.52	9.52	3.57	0.81	43.746	0.626
NW. Marine Dr. (SB)@11.4-6: Chancellor Blvd. (WB) Downstream@67.4	0	0	LOS_A						
NW. Marine Dr. (SB)@11.4-7: NW. Marine Dr (NB)@24.2	0	0	LOS_A						
NW. Marine Dr. (SB)@11.4-8: Chancellor Blvd. (EB) Downstream@28.8	0	0	LOS_A						
Chancellor Blvd. (WB) Upstream@40.7-5: East Mall (SB)@22.8	155	155	LOS_A	5.8	5.8	0.42	0.22	80.664	1.154
Chancellor Blvd. (WB) Upstream@40.7-6: Chancellor Blvd. (WB) Downstream@67.4	163	183	LOS_A	6.42	6.62	0.63	0.23	84.638	1.211
Chancellor Blvd. (WB) Upstream@40.7-7: NW. Marine Dr (NB)@24.2	159	159	LOS_A	4.29	4.29	0.27	0.2	54.763	54.763
Chancellor Blvd. (WB) Upstream@40.7-8: Chancellor Blvd. (EB) Downstream@28.8	153	153	LOS_A	5.57	5.57	0.24	0.21	96.458	1.38
East Mall (NB)@5.5-5: East Mall (SB)@22.8	0	0	LOS_A						
East Mall (NB)@5.5-6: Chancellor Blvd. (WB) Downstream@67.4	0	0	LOS_A						
East Mall (NB)@5.5-7: NW. Marine Dr (NB)@24.2	0	0	LOS_A						
East Mall (NB)@5.5-8: Chancellor Blvd. (EB) Downstream@28.8	38	38	LOS_A	4.35	4.35	1.14	0.41	17.332	0.248
Chancellor Blvd. (EB) Upstream@31.1-5: East Mall (SB)@22.8	282	282	LOS_C	14.82	14.82	6.08	1.15	263.098	3.764
Chancellor Blvd. (EB) Upstream@31.1-6: Chancellor Blvd. (WB) Downstream@67.4	0	0	LOS_A						
Chancellor Blvd. (EB) Upstream@31.1-7: NW. Marine Dr (NB)@24.2	0	0	LOS_A						
Chancellor Blvd. (EB) Upstream@31.1-8: Chancellor Blvd. (EB) Downstream@28.8	3	4	LOS_C	30.23	30.56	9.45	2.67	3.779	0.054
1	1010	1031	LOS_A	8.38	8.41	2.22	0.53	645.424	9.234

DELAY RESULTS						
DIRECTIONS	STOPDELAY(ALL)	STOPS(ALL)	VEHDELAY(ALL)	VEHS(ALL)	PERSDELAY(ALL)	PERS(ALL)
Chancellor Blvd. (WB) Upstream@40.7-7: NW. Marine Dr (NB)@24.2	0.27	0.2	4.19	203	4.19	203
Chancellor Blvd. (WB) Upstream@40.7-6: Chancellor Blvd. (WB) Downstream@67.4	0.59	0.22	6.39	202	6.25	199
Chancellor Blvd. (WB) Upstream@40.7-5: East Mall (SB)@22.8	0.43	0.24	5.93	196	5.93	196
Chancellor Blvd. (WB) Upstream@40.7-8: Chancellor Blvd. (EB) Downstream@28.8	0.31	0.23	5.82	194	5.82	194

QUEUE RESULTS			
MOVEMENTS	QLEN	QLENMAX	QSTOPS
NW. Marine Dr. (SB)@11.4-5: East Mall (SB)@22.8	0	2.45	1
NW. Marine Dr. (SB)@11.4-6: Chancellor Blvd. (WB) Downstream@67.4	3.7	69.5	229
NW. Marine Dr. (SB)@11.4-7: NW. Marine Dr (NB)@24.2	0.01	8.4	7
NW. Marine Dr. (SB)@11.4-8: Chancellor Blvd. (EB) Downstream@28.8	7.19	72.89	237
Chancellor Blvd. (WB) Upstream@40.7-5: East Mall (SB)@22.8	0	5.77	2
Chancellor Blvd. (WB) Upstream@40.7-6: Chancellor Blvd. (WB) Downstream@67.4	0.53	39.58	39
Chancellor Blvd. (WB) Upstream@40.7-7: NW. Marine Dr (NB)@24.2	0	0	0
Chancellor Blvd. (WB) Upstream@40.7-8: Chancellor Blvd. (EB) Downstream@28.8	0.16	23.77	23

PM Peak Hours

Time Interval: 900-4500 seconds

Lane Use and Performance: PM Peak Hours									
MOVEMENT	VEHS(ALL)	PERS(ALL)	LOS(ALL)	VEHDELAY(ALL)	PERSDELAY(ALL)	STOPDELAY(ALL)	STOPS(ALL)	EMISSIONSCO	FUELCONSUMPTION
1-1: NW. Marine Dr. (SB)@11.4-5: East Mall (SB)@22.8	74	74	LOS_A	3.84	3.84	0.52	0.25	31.063	0.444
1-1: NW. Marine Dr. (SB)@11.4-6: Chancellor Blvd. (WB) Downstream@67.4	0	0	LOS_A						
1-1: NW. Marine Dr. (SB)@11.4-7: NW. Marine Dr (NB)@24.2	0	0	LOS_A						
1-1: NW. Marine Dr. (SB)@11.4-8: Chancellor Blvd. (EB) Downstream@28.8	0	0	LOS_A						
1-2: Chancellor Blvd. (WB) Upstream@40.7-5: East Mall (SB)@22.8	80	80	LOS_A	3.86	3.86	0.37	0.28	41.729	0.597
1-2: Chancellor Blvd. (WB) Upstream@40.7-6: Chancellor Blvd. (WB) Downstream@67.4	85	105	LOS_A	3.71	4.12	0.6	0.12	36.594	0.524
1-2: Chancellor Blvd. (WB) Upstream@40.7-7: NW. Marine Dr (NB)@24.2	83	83	LOS_A	1.57	1.57	0.05	0.02	18.427	0.264
1-2: Chancellor Blvd. (WB) Upstream@40.7-8: Chancellor Blvd. (EB) Downstream@28.8	66	66	LOS_A	3.31	3.31	0.1	0.15	37.363	0.535
1-4: East Mall (NB)@5.5-5: East Mall (SB)@22.8	0	0	LOS_A						
1-4: East Mall (NB)@5.5-6: Chancellor Blvd. (WB) Downstream@67.4	0	0	LOS_A						
1-4: East Mall (NB)@5.5-7: NW. Marine Dr (NB)@24.2	0	0	LOS_A						
1-4: East Mall (NB)@5.5-8: Chancellor Blvd. (EB) Downstream@28.8	55	55	LOS_A	5	5	2.02	0.46	26.909	0.385
1-11: Chancellor Blvd. (EB) Upstream@31.1-5: East Mall (SB)@22.8	601	601	LOS_B	14.03	14.03	4.13	1.05	525.98	7.525
1-11: Chancellor Blvd. (EB) Upstream@31.1-6: Chancellor Blvd. (WB) Downstream@67.4	0	0	LOS_A						
1-11: Chancellor Blvd. (EB) Upstream@31.1-7: NW. Marine Dr (NB)@24.2	0	0	LOS_A						
1-11: Chancellor Blvd. (EB) Upstream@31.1-8: Chancellor Blvd. (EB) Downstream@28.8	3	4	LOS_D	23.02	23.93	3.22	2.33	3.302	0.047
1	1046	1067	LOS_A	9.58	9.53	2.61	0.7	722.165	10.331

DELAY RESULTS						
DIRECTIONS	STOPDELAY(ALL)	STOPS(ALL)	VEHDELAY(ALL)	VEHS(ALL)	PERSDELAY(ALL)	PERS(ALL)
Chancellor Blvd. (WB) Upstream@40.7-7: NW. Marine Dr (NB)@24.2	0.14	0.04	1.74	101	1.74	101
Chancellor Blvd. (WB) Upstream@40.7-6: Chancellor Blvd. (WB) Downstream@67.4	0.5	0.11	3.85	102	3.52	99
Chancellor Blvd. (WB) Upstream@40.7-5: East Mall (SB)@22.8	0.33	0.25	3.81	95	3.81	95
Chancellor Blvd. (WB) Upstream@40.7-8: Chancellor Blvd. (EB) Downstream@28.8	0.08	0.12	3.3	85	3.3	85

QUEUE RESULTS			
MOVEMENTS	QLEN	QLENMAX	QSTOPS
NW. Marine Dr. (SB)@11.4-5: East Mall (SB)@22.8	0	0	0
NW. Marine Dr. (SB)@11.4-6: Chancellor Blvd. (WB) Downstream@67.4	0.28	32.59	30
NW. Marine Dr. (SB)@11.4-7: NW. Marine Dr (NB)@24.2	0.03	8.41	34
NW. Marine Dr. (SB)@11.4-8: Chancellor Blvd. (EB) Downstream@28.8	17.91	72.91	587
Chancellor Blvd. (WB) Upstream@40.7-5: East Mall (SB)@22.8	0	2.66	1
Chancellor Blvd. (WB) Upstream@40.7-6: Chancellor Blvd. (WB) Downstream@67.4	0.21	30.85	20
Chancellor Blvd. (WB) Upstream@40.7-7: NW. Marine Dr (NB)@24.2	0	0	0
Chancellor Blvd. (WB) Upstream@40.7-8: Chancellor Blvd. (EB) Downstream@28.8	0.18	26.64	29

Appendix C – Structural Calculations

	CALCULATION SHEET	USER INFORMATION		CREATOR INFORMATION	
		CALCULATION SHEET #	00	REF #: 502-PRBR-HEXA-PKG0-CALC	
CLIENT & NUMBER	MS. KRISTA FALKNER	BY	Sam Abusalih & Julia Sydorova	BY	Sam Abusalih Julia Sydorova
PROJECT NAME	INTERSECTION REDESIGN - CHANCELLOR BOULEVARD AND EAST MALL	VERIFIED BY:	Eric Jung	AUTHENTICATED BY	Eric Jung
SUBJECT	GATEWAY DESIGN CALCULATIONS	DATE	1/20/2025	DATE	2/28/2025
GATEWAY DESIGN CALCULATIONS					

This page summarizes the relevant information of the calculation sheet and it may be used by the client as reference

1. SUMMARY OF THE CALCULATION NOTES

This calculation note provides the structural design required to construct the gateway structure for the Chancellor Boulevard - East Mall Intersection Redesign project. This will include associated concrete and steel design calculations in accordance to CSA A23.3, CSA S16 and the CISC handbook. Design of anchors is excluded from this spreadsheet.

2. REVISIONS HISTORY OF THE MASTER FILE

Rev #	Description	CREATED BY	CREATED DATE	VERIFIED BY	VERIFIED DATE
AA	For verification	S. Abusalih, J. Sydorova	1/20/2025	Eric Jung	1/25/2025
00	For publication	S. Abusalih, J. Sydorova	2/20/2025	Eric Jung	2/25/2025

3. CODES, STANDARDS and other REFERENCES

[REF 1] NBCC 2020
[REF 2] CSA S16-14
[REF 3] CISC Handbook of Steel Construction
[REF 4] CSA A23.3

4. ASSUMPTIONS AND LIMITATIONS

1.	Snow and rain only lands on top of the gateway structure.
2.	Internal and external pressures are the same for wind load calculations.
3.	Used one way tributary area for weld calculations.
4.	Leg size of 6 mm was chosen for weld calculations.
5.	0 degree weld orientation for column to beam welds and 90 degree weld orientation for sign to beam/column welds.
6.	The equivalent moment factor, ω_1 is equal to 1.0
7.	A325 bolts were used.
8.	2 shear planes (angles to web) and 1 shear plane (angles to column) for bolt shear checks.
9.	Assumed maximum angle dimensions were 174.4 mm and 104.8 mm checks which involved pitch and edge distance.
10.	Little to no transfer of moments.
11.	Design of base plate is done considering Limit state design (LRFD in US)
12.	Capacity of anchors is not verified.
13.	Prying forces in the anchor rods are neglected.
14.	Vertical, horizontal and diagonal stiffeners are not required.
15.	P-Delta effects were not accounted for.

5. DISCLAIMER

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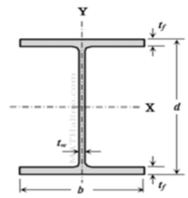
	CALCULATION SHEET	USER'S INFORMATION			
		CALCULATION SHEET #:	REF.#: 502-PRBR-HEXA-PKG5-CALC		
CLIENT & NUMBER:	MS. KRISTA FALKNER	BY:	Sam Abasalti & Julia Sydorova	DATE:	2/20/2025
PROJECT NAME:	INTERSECTION REDESIGN - CHANCELLOR BOULEVARD AND EAST MALL	VERIFIED BY:	Eric Jung	DATE:	2/25/2025
SUBJECT:	GATEWAY DESIGN CALCULATIONS	REVISION#:	00	PAGE:	/

LOAD CALCULATIONS

1. DATA & SUMMARY

1.1 Column Information

Steel Region: **CA&US**



I- Section:	**W310x118**	
Area, A =	15000	mm^2
Depth, d =	314	mm
Width, b =	307	mm
Flange thickness, t_f =	19	mm
Web thickness, t_w =	12	mm

1.2 Beam Information

Steel Region: **CA&US**

I- Section:	**W360x57**	
Area, A =	7220	mm^2
Depth, d =	358	mm
Width, b =	172	mm
Flange thickness, t_f =	13	mm
Web thickness, t_w =	8	mm

2. LOAD CALCULATIONS

2.1 Dead Load — 62 kN

Steel unit weight, γ_s =	78.5	kN/m^3

2.1.1 Signage — 30 kN

Sign thickness =	0.0130	m
Sign dead load =	1.021	kN/m^2
Sign area =	29.250	m^2

2.1.2 Columns — 19 kN

Number of columns =	4	
Length of columns =	4	m

2.1.3 Beams — 7 kN

Number of beams =	2	
Length of beams =	6	m

2.1.4 Angles and Bolts — 6 kN

Bolt dead load =	0.0445	kN
Number of bolts =	32	
Double angle dead load (L203X203X29) =	0.848	kN
Number of double angles =	4	
Double angle dead load (L127X127X22) =	0.404	kN
Number of double angles =	4	

2.2 Live Load — 4 kN

3) Exterior areas accessible to pedestrian traffic, but not vehicular traffic, shall be designed for their intended use, but not for less than the greater of
a) the *live load* prescribed for assembly areas in Table 4.1.5.3., or
b) the snow and rain loads prescribed in Subsection 4.1.6.

[NBCC 2020 - Section 4.1.5.5. Loads on Exterior Areas]

2.2 Snow and Rain Loads — 4 kN

1) The specified load on a roof or any other *building* surface subject to snow and associated rain shall be the snow load specified in Article 4.1.6.2., or the rain load specified in Article 4.1.6.4., whichever produces the more critical effect. (See Note A-4.1.6.1.(1).)

[NBCC 2020 - Section 4.1.6.1. Specified Load Due to Rain or Snow and Associated Rain]

Importance factor for snow load, I_s =	1		*[NBCC 2020 - Table 4.1.6.2-A Importance Factor for Snow Load, I_s]*
$70/(C_w)^2$=	70		
Characteristic length of the upper or lower roof, l_c =	0.000658	m	
Basic roof snow load factor, C_b =	0.8		*[NBCC 2020 - Section 4.1.6.2. Specified Snow Load, Sentence 2a]*
Slope factor, C_s =	1		*[NBCC 2020 - Section 4.1.6.2. Specified Snow Load, Sentence 5a]*
Accumulation factor, C_a =	1		*[NBCC 2020 - Section 4.1.6.2. Specified Snow Load, Sentence 8]*
1-in-50-year associated rain load, S_r =	0.25		*[NBCC 2020 - Table C-2 Climatic Design Data for Selected Locations in Canada]*
1-in-50-year ground snow load, S_s =	1.85		*[NBCC 2020 - Table C-2 Climatic Design Data for Selected Locations in Canada]*
Snow load =	1.73	kN/m^2	
1 day rain in Vancouver =	0.1095	m	*[NBCC 2020 - Table C-2 Climatic Design Data for Selected Locations in Canada]*
Water unit weight, γ_w =	9.81	kN/m^3	
Rain load =	1.074	kN/m^2	

2.3 Wind Loads — 6 kN

Importance factor for wind load, I_w =	0.8		*[NBCC 2020 - Table 4.1.7.3. Importance Factor for Wind Load, I_w]*
Reference velocity pressure, q =	0.45	kN/m^2	*[NBCC 2020 - Table C-2 Climatic Design Data for Selected Locations in Canada]*
Exposure factor, C_e =	0.956		*[NBCC 2020 - Section 4.1.7.3. Static Procedure, Sentence 5a]*
Gust effect factor, C_g =	2		*[NBCC 2020 - Section 4.1.7.3. Static Procedure, Sentence 8a]*
External pressure coefficient, C_p =	1		*[NBCC 2020 - Section 4.1.7.5 External Pressure Coefficients]*
Topographic factor, C_t =	1		*[NBCC 2020 - Section 4.1.7.4 Topographic Factor, Sentence 1]*

2.4 Earthquake Loads — 2 kN

Floor area =	1	m^2	
Seismic Load =	10	kN/m^2	
Fundamental lateral period of vibration, T_a =	0.404		*[NBCC 2020 - Section 4.1.8.1 Analysis, Sentence 7; since $T_a \leq 0.7s$, F_t is equal to zero]*

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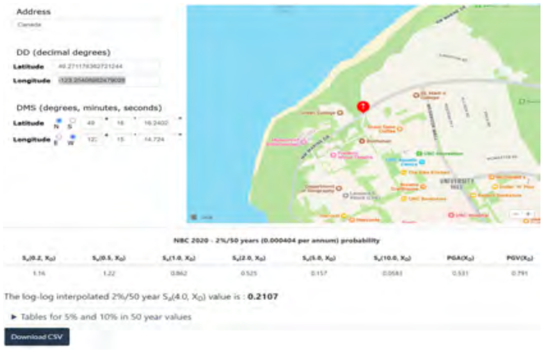
		CALCULATION SHEET #:	REF.#: 502-PRBR-HEXA-PKG5-CALC		
CLIENT & NUMBER:	MS. KRISTA FALKNER	BY:	Sam Abasalti & Julia Sydorova	DATE:	2/20/2025
PROJECT NAME:	INTERSECTION REDESIGN - CHANCELLOR BOULEVARD AND EAST MALL	VERIFIED BY:	Eric Jung	DATE:	2/25/2025
SUBJECT:	GATEWAY DESIGN CALCULATIONS	REVISION#:	00	PAGE:	/

LOAD CALCULATIONS



Design spectral acceleration at the fundamental period of the structure, $S(T_a)$ =	1.206		*[Used a log interpolation between $S_a(0.2)$ and $S_a(0.5)$ ⟶1.2654 + 0.0655·ln(x)]*
Ductility-related force modification factor, R_d =	5.0		*[NBCC 2020 - Table 4.1.8.9.]*
Overstrength-related force modification factor, R_o =	1.5		*[NBCC 2020 - Table 4.1.8.9.]*
Lateral earthquake design force at the base of the structure, V =	0.161	W	*[NBCC 2020 - Section 4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1*
Lateral earthquake design force at the base of the structure, V =	3.319		
V, $S_a(2.0)$ =	0.070	W	*[NBCC 2020 - Section 4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1*
V, $S_a(0.2)$ =	0.103	W	*[NBCC 2020 - Section 4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1*
V, $S_a(0.5)$ =	0.163	W	*[NBCC 2020 - Section 4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1*

Seismic Weight Calculation =

Storey	Height	Level	W_x	$W_x·h_x$	(Wx·hx)/Σ(Wi·hi)	F_x
Roof	4	8	10.320	82.560	0.667	2.213
L2	4	4	10.320	41.280	0.333	1.106
G	/	/	/	/	/	/
			20.640	123.840		

3. LOAD COMBINATIONS

[NBCC 2020 - Table 4.1.3.2.-A Load Combinations Without Crane Loads for Ultimate Limit States]

1.4D =	86.693	kN
1.25D + 1.5 L =	82.761	kN
1.25D + 1.5 L + 1.0 S =	86.331	kN
1.25D + 1.5 L + 0.4 W =	84.964	kN
1.25D + 1.5S =	82.761	kN
1.25D +1.5S + 1.0L =	86.331	kN
1.25D + 1.5S + 0.4W =	84.964	kN
1.25D + 1.4 W =	85.117	kN
1.25D + 1.4W + 0.5L =	86.902	kN
1.25D + 1.4W + 0.5S =	86.902	kN
1.0D + 1.0E =	64.136	kN
1.0D + 1.0E + 0.5L =	65.922	kN
1.0D + 1.0E +0.25 S =	65.029	kN
Max =	86.902	kN

	CALCULATION SHEET	USER'S INFORMATION			
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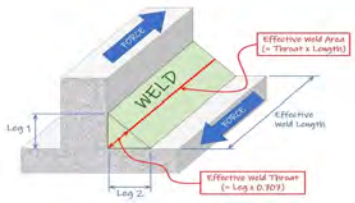
CLIENT & NUMBER:	MS. KRISTA FALKNER	BY:	Sam Abasalti & Julia Sydorova	DATE:	2/20/2025
PROJECT NAME:	INTERSECTION REDESIGN - CHANCELLOR BOULEVARD AND EAST MALL	VERIFIED BY:	Eric Jung	DATE:	2/25/2025
SUBJECT:	GATEWAY DESIGN CALCULATIONS	REVISION#:	00	PAGE:	/

WELD CHECKS

1.WELD CALCULATIONS

1.1 Weld Checks for the Connection Between the Beam and Column

Length of a beam =	6000	mm	
Tributary area =	516000	mm^2	*[Assumed the tributary area for these welds is half the distance of the beam multiplied by the width of the bear*
Yield strength of steel, F_y =	350	MPa	
Ultimate strength of steel, F_u =	450	MPa	
`ensile yeilding on the gross section, T_r =	162540	kN	*[1 out 3 CSA-S16 ultimate limit state checks for tension members that is applicable to weld design]*



Effective weld throat =	4.242	L

1.1.1 Weld Check 1

Strength of the weld metal, V_r =	933.075	L
L needs to be greater than =	174.198	

1.1.2 Weld Check 2

Strength of the base metal, V_r =	1212.030	L
L needs to be greater than =	134.106	

1.1.3 Minimum Length of Weld

Minimum length of weld =	174198.297	mm	*[Will design more double angles as a result]*

1.2 Weld Checks for the Sign

Sign area =	14.625	mm^2	
Tributary area =	14.625	mm^2	*[Assumed the tributary area for these welds is half of the area of the sign]*
Yield strength of steel, F_y =	350	MPa	
Ultimate strength of steel, F_u =	450	MPa	
`ensile yeilding on the gross section, T_r =	4.607	kN	*[1 out 3 CSA-S16 ultimate limit state checks for tension members that is applicable to weld design]*
Effective weld throat =	4.242	L	

1.2.1 Weld Check 1

Strength of the weld metal, V_r =	1327.432	L	*[Works if theta is equal to zero]*
L needs to be greater than =	0.003		

1.2.2 Weld Check 2

Strength of the base metal, V_r =	1212.030	L
L needs to be greater than =	0.004	

1.2.3 Minimum Length of Weld

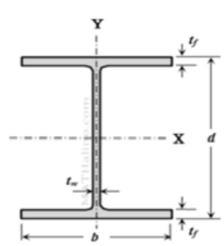
Minimum length of weld =	3.801	mm
	5.000	mm

DOUBLE ANGLE BOLT DESIGN

1. DATA & SUMMARY

1.1 Beam Information

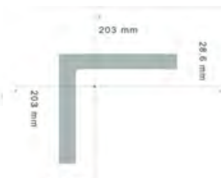
Steel Region:	**CA&US**	
I- Section:	**W360x57**	
Area, A =	7220	mm^2
Depth, d =	358	mm
Width, b =	172	mm
Flange thickness, t_f =	13	mm
Web thickness, t_w =	8	mm
Moment of inertia about the y-axis, I_y =	11.1	10^6 mm^4
Torsional constant, J =	334	10^3 mm^4
Warping constant, C_w =	331	10^9 mm^6
Elastic section modulus, S_x =	897	10^3 mm^3
Plastic section modulus, Z_x =	1010	10^3 mm^3
Length =	6	m



[Used worst case scenario (longer length)]

1.2 Angle Information - Beam < 6m Long

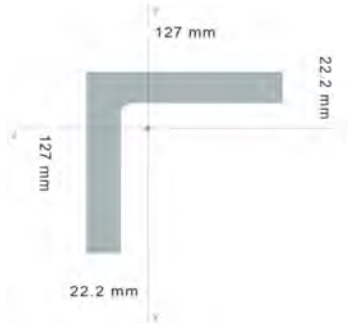
Steel Region:	**CA&US**
L: Single Angles	**L203X203X29**



	CALCULATION SHEET	USER'S INFORMATION			
		CALCULATION SHEET #:	REF.#: 502-PRBR-HEXA-PKG5-CALC		
CLIENT & NUMBER:	MS. KRISTA FALKNER	BY:	Sam Abasalti & Julia Sydorova	DATE:	2/20/2025
PROJECT NAME:	INTERSECTION REDESIGN - CHANCELLOR BOULEVARD AND EAST MALL	VERIFIED BY:	Eric Jung	DATE:	2/25/2025
SUBJECT:	GATEWAY DESIGN CALCULATIONS	REVISION#:	00	PAGE:	/

WELD CHECKS

Area, A =	10800	mm^2
Depth, d =	203	mm
Width, b =	203	mm
Thickness =	28.6	mm



1.3 Angle Information - Beam = 6m Long

Steel Region:	CA&US	
L: Single Angles	L127X127X22	
Area, A =	5150	mm^2
Depth, d =	127	mm
Width, b =	127	mm
Thickness =	22.2	mm

2. BEAM CLASSIFICATION

Yield strength of steel, F_y =	350	MPa	
Flange class =	6.565	Class 1	*[CSA S-16 - Table 2 - Maximum width (or diameter)-to-thickness ratios: Elements in flexural compression]*
Web class =	42	Class 1	*[CSA S-16 - Table 2 - Maximum width (or diameter)-to-thickness ratios: Elements in flexural compression]*
Governing class =	Class 1		*[CSA S-16 - Table 2 - Maximum width (or diameter)-to-thickness ratios: Elements in flexural compression]*

3. ASSESS IF LATERAL TORSIONAL BUCKLING WILL OCCUR

lateral torsional buckling capacity, M_u =	312065.658	kNm
ment resistance, M_p/yield moment, M_y =	236.845	kNm
Moment capacity, M_r (Class 1 and 2) =	213.161	kNm
Moment capacity, M_r (Class 3) =	Invalid Class	
Factored moment capacity, M_f =	213.161	kNm
q_{max} =	47.369	kN/m
Factored shear capacity, V_f =	142.107	kN

4. BOLT CHECKS

Bolt diameter =	19	mm	
Area of bolts =	283.529	mm^2	
Ultimate strength of steel, F_u =	450	MPa	
	65	mm	
Pitch =	63	mm	*[2.7 of the bolt diameter; for L127X127X22 it is = 0]*
Edge distance =	33	mm	*[1.5 of the bolt diameter for L127X127X22 it is = 40]*
φ_b, φ_{br} =	0.8		

3.1 Bolt shear check [angles to web]

L: Single Angles	L203X203X29		L127X127X22	
Area, A =	10800	mm^2	5150	mm^2
Depth, d =	203	mm	127	mm
Width, b =	203	mm	127	mm
Thickness =	28.6	mm	22.2	mm
Bolt shear check [angles to web], V_r =	157.188	kN/bolt	157.188	kN/bolt

3.2 Bolt bearing check [angles to web]

Angles·2 =	57.2	mm	44.4	mm
Flange thickness, t_f =	13	mm	13	mm
Governing case =	13	mm	13	mm
Bolt bearing check [angles to web], B_r =	268.812	kN/bolt	268.812	kN/bolt
Minimum of bolt shear and bolt bearing =	157.188	kN/bolt	157.188	kN/bolt
Number of bolts =	0.904	bolts	0.904	bolts
	1	bolt	1	bolt

3.3 Bolt shear check [angles to column]

Bolt shear check [angles to column], V_r =	78.594	kN/bolt	78.594	kN/bolt
Number of bolts =	1.808	bolts	1.808	bolts
	2	bolts	2	bolts

3.4 Block shear check [in angle]

Net area in tension, A_n =	3617.900	mm^2	1121.100	mm^2
Gross area in shear, A_{gv} =	6349.2	mm^2	4928.4	mm^2
Block shear check, T_r =	2363.897	kN	1265.483	kN
2 Angles·T_r =	4727.795	kN	2530.967	kN

3.5 Shear rupture check [in angle]

A_{gv} =	7293	mm^2	5661	mm^2
V_r=	1312.740	kN	1018.980	kN
2 Angles·V_r=	2625.480	kN	2037.960	kN

3.6 Check against V_f

	OK	OK

5. WEIGHTS OF MATERIALS

Steel unit weight, γ_s =	78.5	kN/m^3		
Weight of bolts =	0.0445	kN		
Weight of double angle =	0.8478	kN	0.404	kN

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BASE PLATE AND ANCHOR DESIGN

1. DATA & SUMMARY

1.1 Column Information

Steel Region:	**CA&US**	
I- Section:	**W310x118**	
Area, A =	15000	mm^2
Depth, d =	314	mm
Width, b =	307	mm
Flange thickness, t_f =	19	mm
Web thickness, t_w =	12	mm

1.2 Base Information

F_y =	350	MPa
f'_c =	20	MPa
ϕ_s =	0.85	
ϕ_c =	0.65	

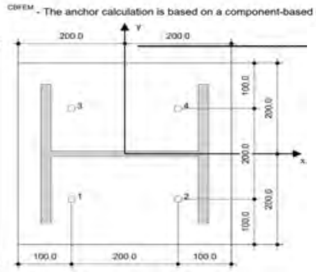
1.3 Factored Loads

Compression, C_f =	86.902	kN
Tension, T_f =	0	kN

3. ANCHOR DESIGN

Anchor type and diameter:	**HIT-HY 200 V3 + HAS-V-36 (ASTM F1554 Gr.36) 1/2**
Item number:	2198022 HAS-V-36 1/2"x6-1/2" (element) / 2334276 HIT-HY 200-R V3 (adhesive)
Specification text:	Hilti ⌀ 1/2 in HIT-HY 200 V3 + HAS-V-36 (ASTM F1554 Gr.36) with 69.9 mm nominal embedment depth per ICC-ES ESR-4868 , Hammer drilled installation per MPII
Effective embedment depth:	$h_{ef,opti}$ = 69.8 mm ($h_{ef,limit}$ = 254.0 mm)
Material:	ASTM F1554 Grade 36
Evaluation Service Report:	ESR-4868
Issued I Valid:	- | -
Proof:	Design Method CSA A23.3-14 / Chem.
Shear edge breakout verification:	Row closest to edge (Case 3 only from CSA A23.3-14 Fig. D.13)
Stand-off installation:	e_b = 0.0 mm (no stand-off); t = 40.0 mm
Anchor plate[CBFEM] :	l_x x l_y x t = 400.0 mm x 400.0 mm x 40.0 mm;
Profile:	W shape (AISC), ; (L x W x T x FT) = 314.0 mm x 307.0 mm x 12.0 mm x 19.0 mm
Base material:	cracked concrete, f_c' = 17.24 N/mm²; h = 10,668.0 mm, Temp. short/long: 20/20 °C
Installation:	**Hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < 15M bar

[CBFEM] - The anchor calculation is based on a component-based Finite Element Method (CBFEM)



1.4 Summary

ADEQUATE DESIGN

Base plate dimension:	**400 mm**	x	**400 mm**	x	**40 mm**
	C		*B*		t_p

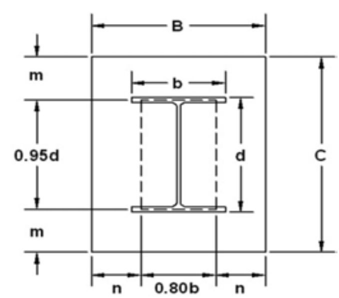
Utilization in compression: U_{max} = 0.39 < 1

2. PLATE DESIGN - COMPRESSION

[CSA S16-14 Part 4 - Compression Members]
[S16-14 page 4-153]

2.1 Bearing Resistance Calculation

Conc base width, B =	450	mm
Conc base length, C =	450	mm
Plate width, B =	400	mm
Plate length, C =	400	mm
$\sqrt{(A_2/A_1)}$	1.125	
m =	50.850	mm
n =	77.2	mm
C_f =	87	kN
$B_r = 0.85\phi_c f'_c \sqrt{(A_2/A_1)}$ =	12.431	MPa
$A_{req} = C_f/B_r$ =	6991	mm^2
A_{prov} =	160000	mm^2
$U = A_{req} / A_{prov}$ =	0.044	



2.1 Plate Thickness Calculation

[S16-14 page 4-153]

Strength criteria

t_{p1} = 4.665 mm

[Thickness based on the yielding of the cantilever portion of the plate subjected to bending. Plastic section modulus considered]

Deflection criteria

t_{p2} = max{n/5, m/5} = 15.440 mm

Use t_p = 40.0 mm

$U = t_{p\,min} / t_p$ = 0.39

[User choice, must be larger than both required minimums t_{p1} and t_{p2}]

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FOOTING DESIGN

1. DATA & SUMMARY

1.1 Column Information

Bearing capacity =	300	kNm²
Unit weight of soil =	23.5	kNm²
Service load =	72	kN
P_f =	86.902	kN
Cover =	75	mm
Column width =	118	mm
Column length =	310	mm
Area of column =	36580	mm²
β_c =	2.627	

1.2 Footing Parameters

Footing thickness =	0.3	m
	300	mm
Bearing strength =	292.95	kNm²
Footing area =	0.36	m²
Footing width =	0.6	m
	600	mm
Footing length =	0.6	m
	600	mm
Concrete strength =	25	N/mm²
Bar diameter =	20	mm
d_{min} =	195	mm
d_v =	175.5	mm
d_{avg} =	205	mm

2.FOOTING DESIGN CALCULATIONS

2.1 Two-Way Shear

Critical section area =	0.166	m²
Pf/footing area =	241.394	kNm²
V_f =	46.747	kN

Check which eqn to use:

Eqn_1 =	1.0876
Eqn_2 =	2.208
Eqn3 =	1.235
Smallest:	Eqn1

Size effect (width) =	1.176		<	2	Not critical
Size effect (length) =	0.707		<	2	Not critical
V_r =	373.676	kN	>	V_f	OK

2.2 One-Way Shear

V_f (width) =	9.487	kN			
Size effect (width) =	1.373		<	2	Not critical
V_r (width) =	71.867	kN	>	V_f	OK
V_f (length) =	4.418	kN			
Size effect (length) =	0.826		<	2	Not critical
V_r (length) =	71.867	kN	>	V_f	OK

2.3 Flexure Design

Min A_s =	360	mm²

Test 20M Bar:

Bar area =	300	mm²
Number of bars (each direction) =	2	bars
Total number of bars =	4	bars
Bar spacing (each direction) =	450	mm

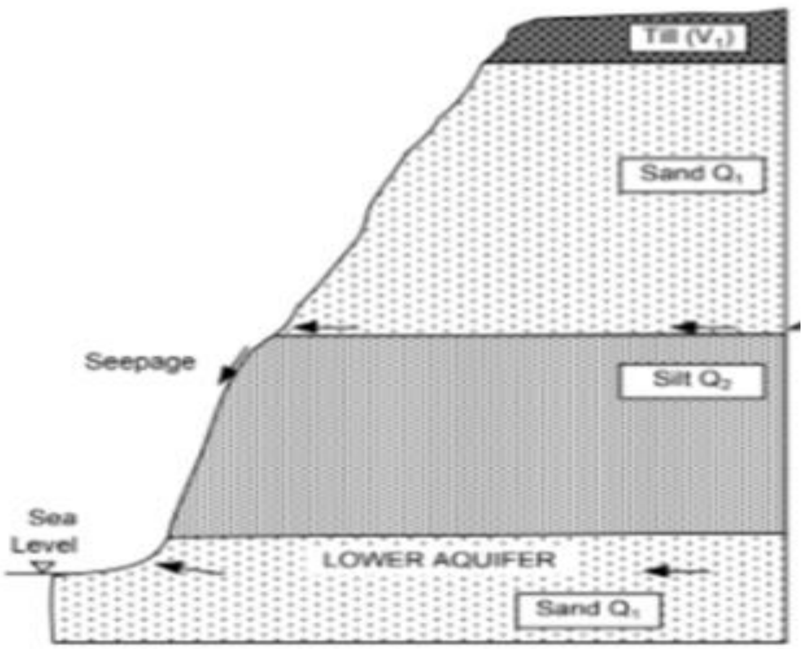
Check M_r > Mf

A_s =	1200	mm²			
β_{1c} =	51.662	mm			
α_1 =	0.81				
β_1 =	0.91				
$0.5d_{min}$ =	97.5	mm			
c =	56.771	mm	<	$0.5d_{min}$ =	OK
Column edge to footing edge =	0.241	m			
Mf_{width} =	4.206	kNm			
Column Edge to footing edge =	0.145	m			
Mf_{length} =	1.523	kNm			
M_r =	69.021	kNm	>	Mf_{width} =	OK
M_r =	3.076	kNm	>	Mf_{length} =	OK

Therefore, Select 4 - 20M bars (2 in each direction)

1 Layer of rebar

Appendix D – Stormwater Calculations



Property	Value
Name	Catchment
X-Coordinate	481616.735
Y-Coordinate	5457710.975
Description	
Tag	
Rain Gage	IDF_DATA
Outlet	Tank
Area	1.24
Width	220
% Slope	2
% Imperv	54
N-Imperv	0.02
N-Perv	0.2
Dstore-Imperv	0.5
Dstore-Perv	5
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration Data	HORTON
Groundwater	NO

Infiltration Method: HORTON

Property	Value
Max. Infil. Rate	62
Min. Infil. Rate	10
Decay Constant	1.98
Drying Time	7
Max. Volume	0

Maximum rate on the Horton infiltration curve (in/hr or mm/hr)

Storage Unit	Average Volume 1000 m^3	Average Percent Full	Evaporation Loss %	Exfiltration Loss %	Maximum Volume 1000 m^3	Maximum Percent Full	Day of Maximum Volume	Hour of Maximum Volume
Tank	0.497	1.7	0.0	0.0	0.763	2.5	0	06:00

Topic: Subcatchment Runoff   Click a column header to sort the column.

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr
2	104.62	0.00	0.00	39.30	56.44	6.79	63.23	0.78

IDF for: VANCOUVER UBC ID:1108487

Station Info | IDF historical data | IDF under climate change

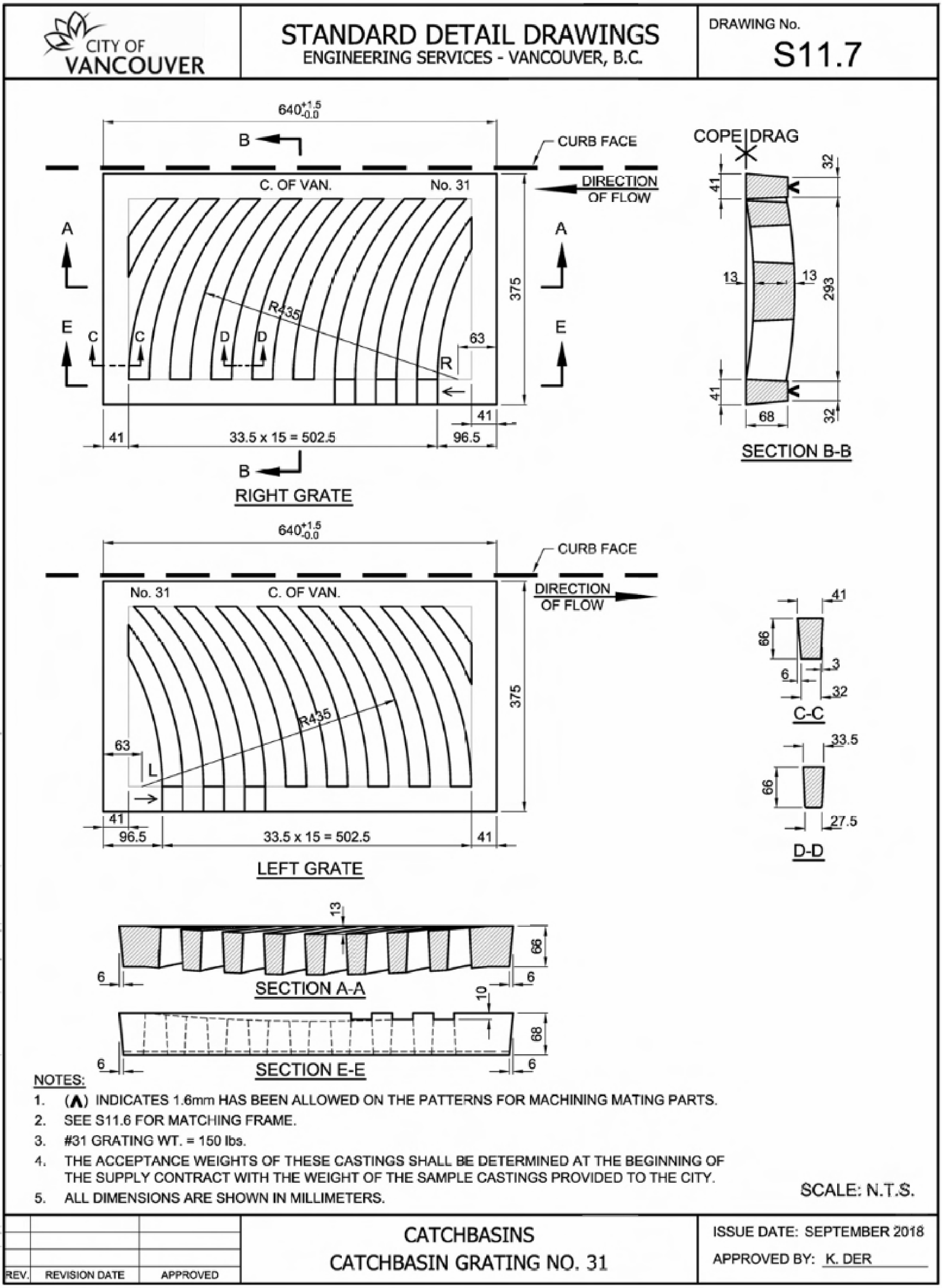
GEV | Gumbel

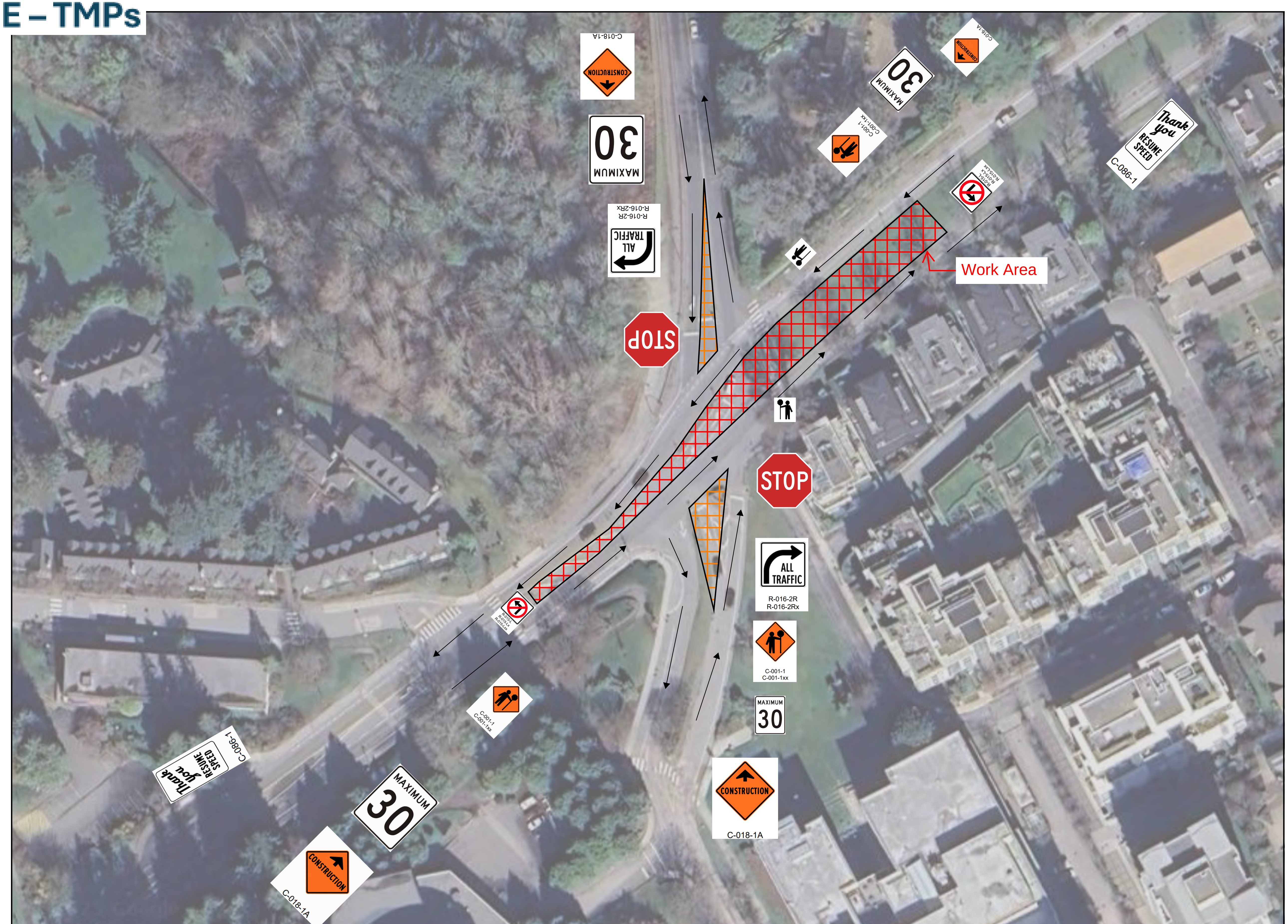
Tables | Plots | Interpolation Equations

Total precipitation amounts are presented in mm and precipitation intensity rates are presented in mm/h for different return periods (T) presented in years

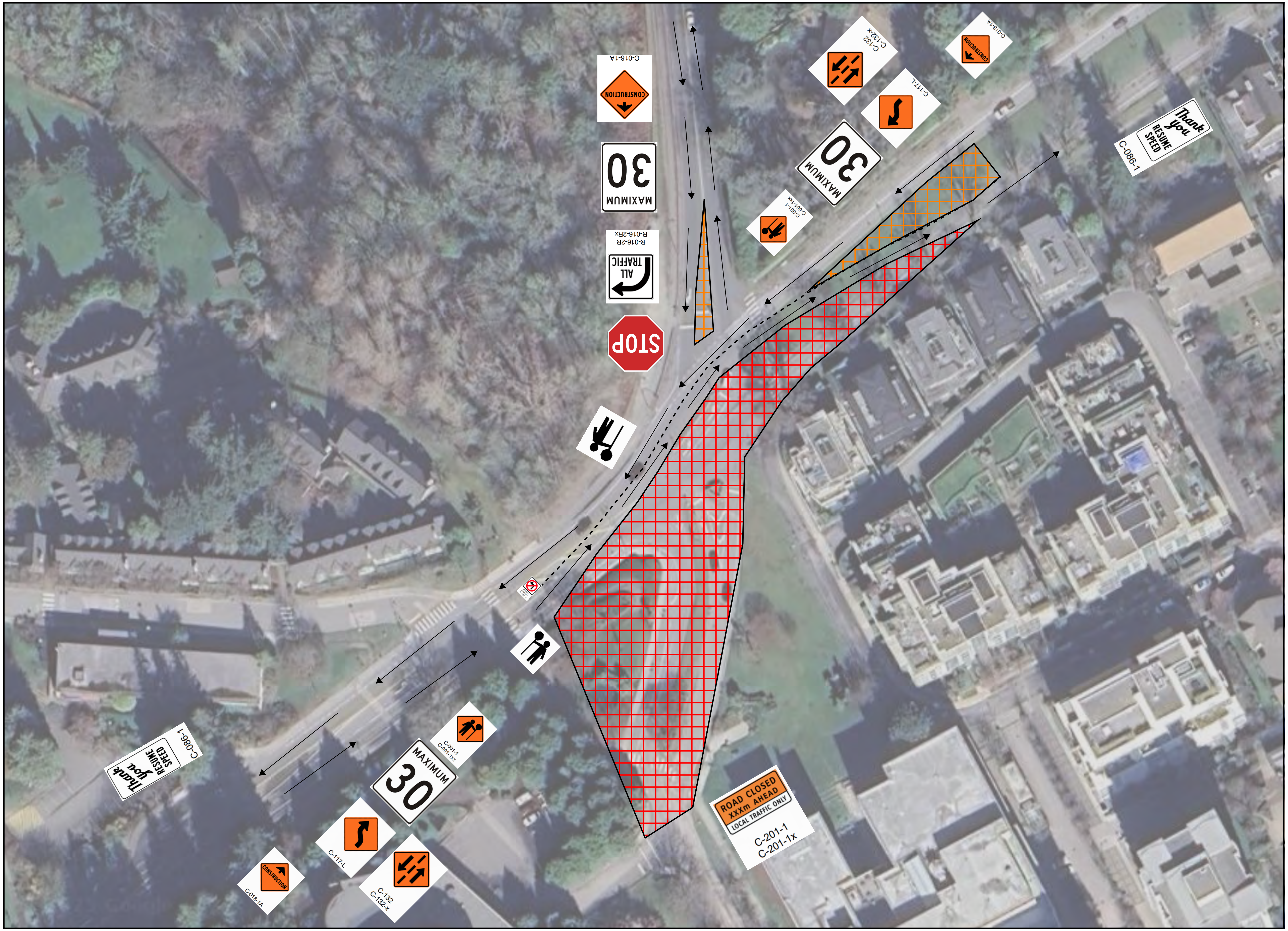
○ Total PPT (mm) ● Intensity rates (mm/h)

T (years)	2	5	10	20	25	50	100
5 min	32.23	46.26	57.62	70.39	74.88	90.15	107.79
10 min	24.25	34.31	41.86	49.86	52.56	61.44	71.12
15 min	20.17	28.01	33.78	39.77	41.78	48.28	55.25
30 min	13.89	18.66	22.06	25.53	26.67	30.33	34.16
1 h	9.36	12.10	14.35	16.89	17.78	20.84	24.40
2 h	6.71	8.03	9.02	10.08	10.44	11.62	12.91
6 h	4.40	5.21	5.75	6.26	6.43	6.93	7.43
12 h	3.36	4.17	4.70	5.20	5.36	5.86	6.35
24 h	2.27	2.89	3.35	3.85	4.02	4.57	5.17

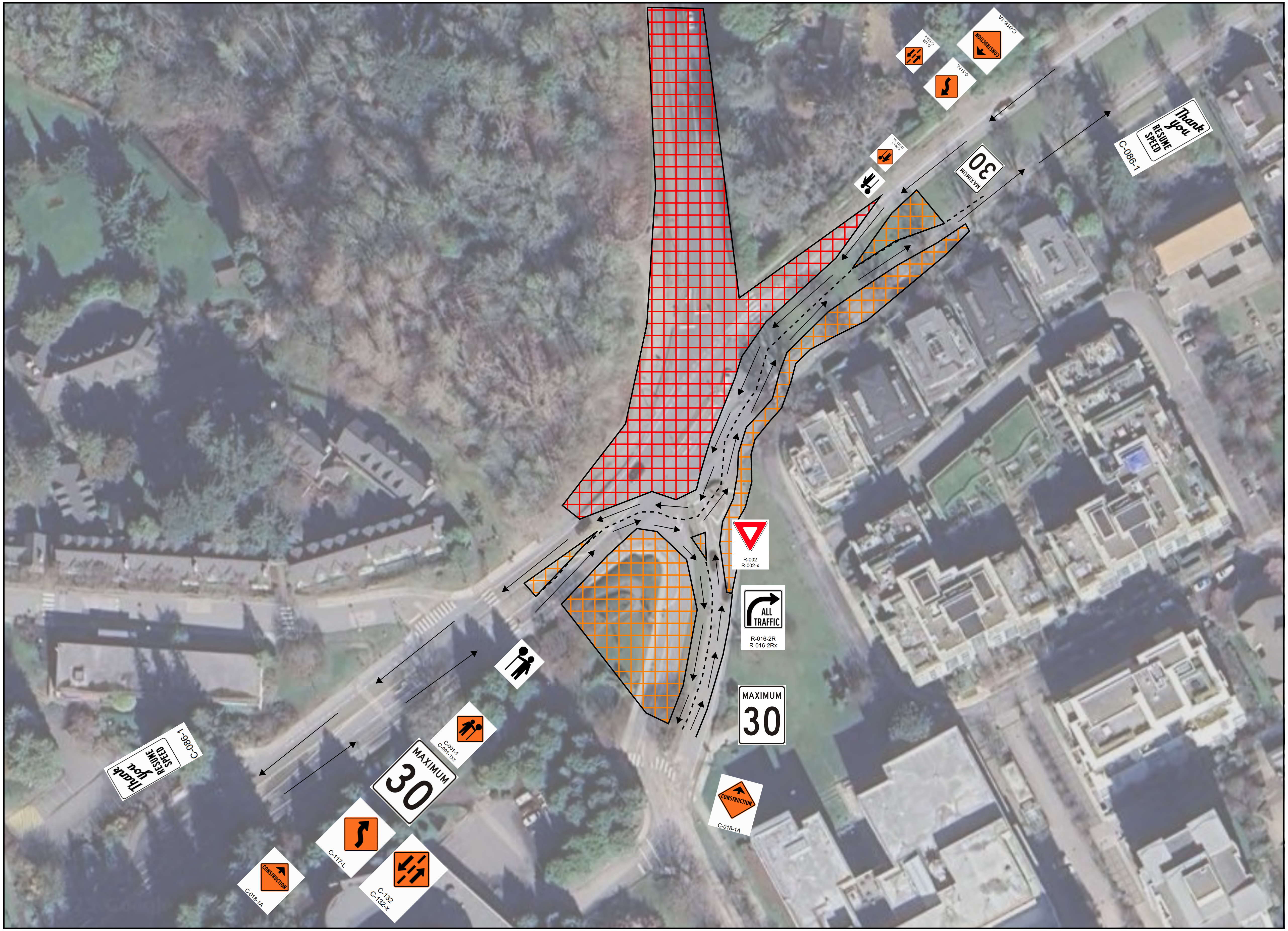

CITY OF VANCOUVER
STANDARD DETAIL DRAWINGS
ENGINEERING SERVICES - VANCOUVER, B.C.
DRAWING No.
S11.7
CURB FACE
DIRECTION OF FLOW
C. OF VAN.
No. 31
R435
375
33.5 x 15 = 502.5
96.5
41
63
RIGHT GRATE
LEFT GRATE
COPE DRAG
SECTION B-B
C-C
D-D
SECTION A-A
SECTION E-E
NOTES:
1. (∧) INDICATES 1.6mm HAS BEEN ALLOWED ON THE PATTERNS FOR MACHINING MATING PARTS.
2. SEE S11.6 FOR MATCHING FRAME.
3. #31 GRATING WT. = 150 lbs.
4. THE ACCEPTANCE WEIGHTS OF THESE CASTINGS SHALL BE DETERMINED AT THE BEGINNING OF THE SUPPLY CONTRACT WITH THE WEIGHT OF THE SAMPLE CASTINGS PROVIDED TO THE CITY.
5. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS.
SCALE: N.T.S.
REV. REVISION DATE APPROVED
CATCHBASINS
CATCHBASIN GRATING NO. 31
ISSUE DATE: SEPTEMBER 2018
APPROVED BY: K. DER



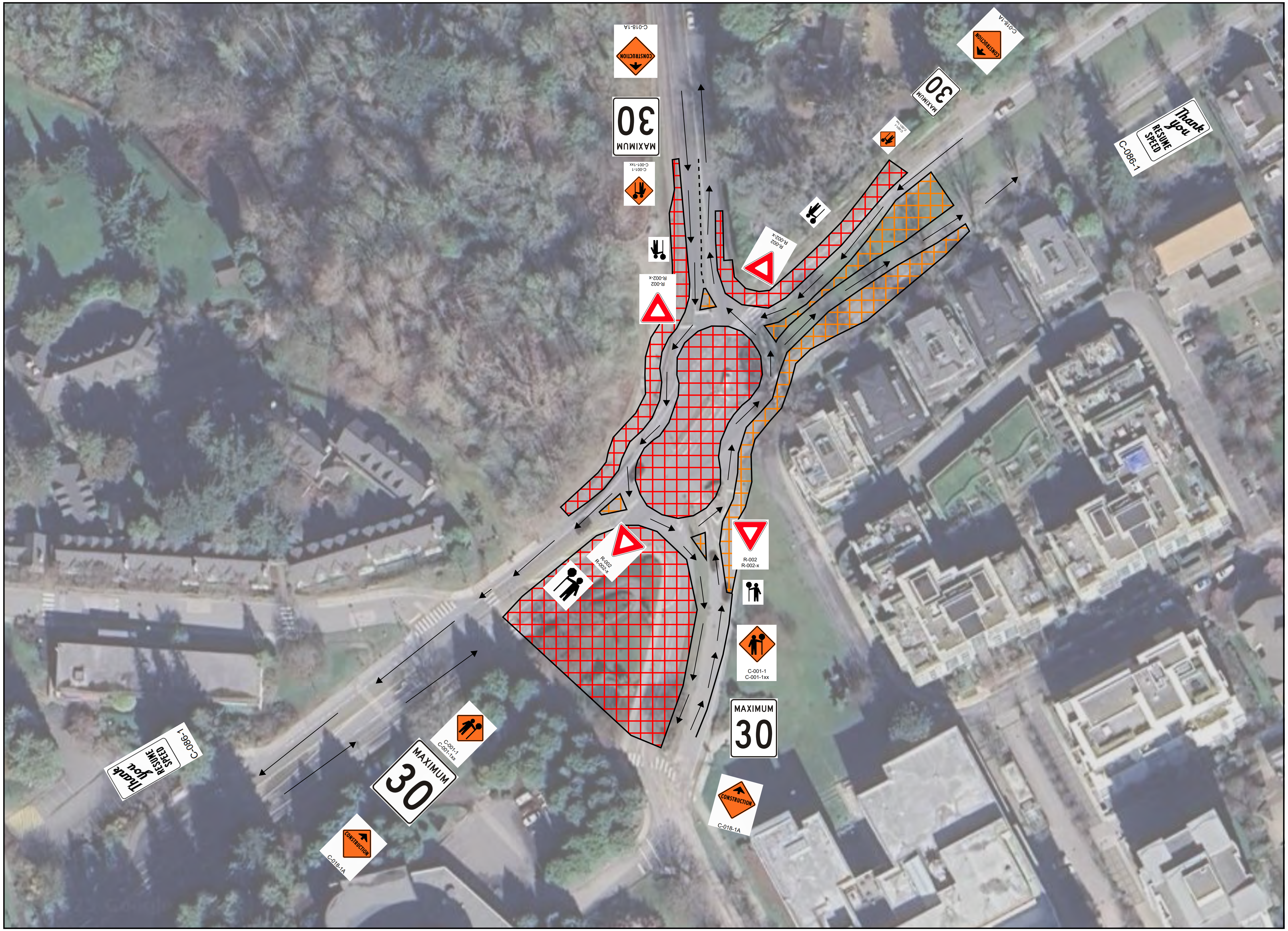
Traffic Management Plan - Stage 1



Traffic Management Plan - Stage 2



Traffic Management Plan - Stage 3

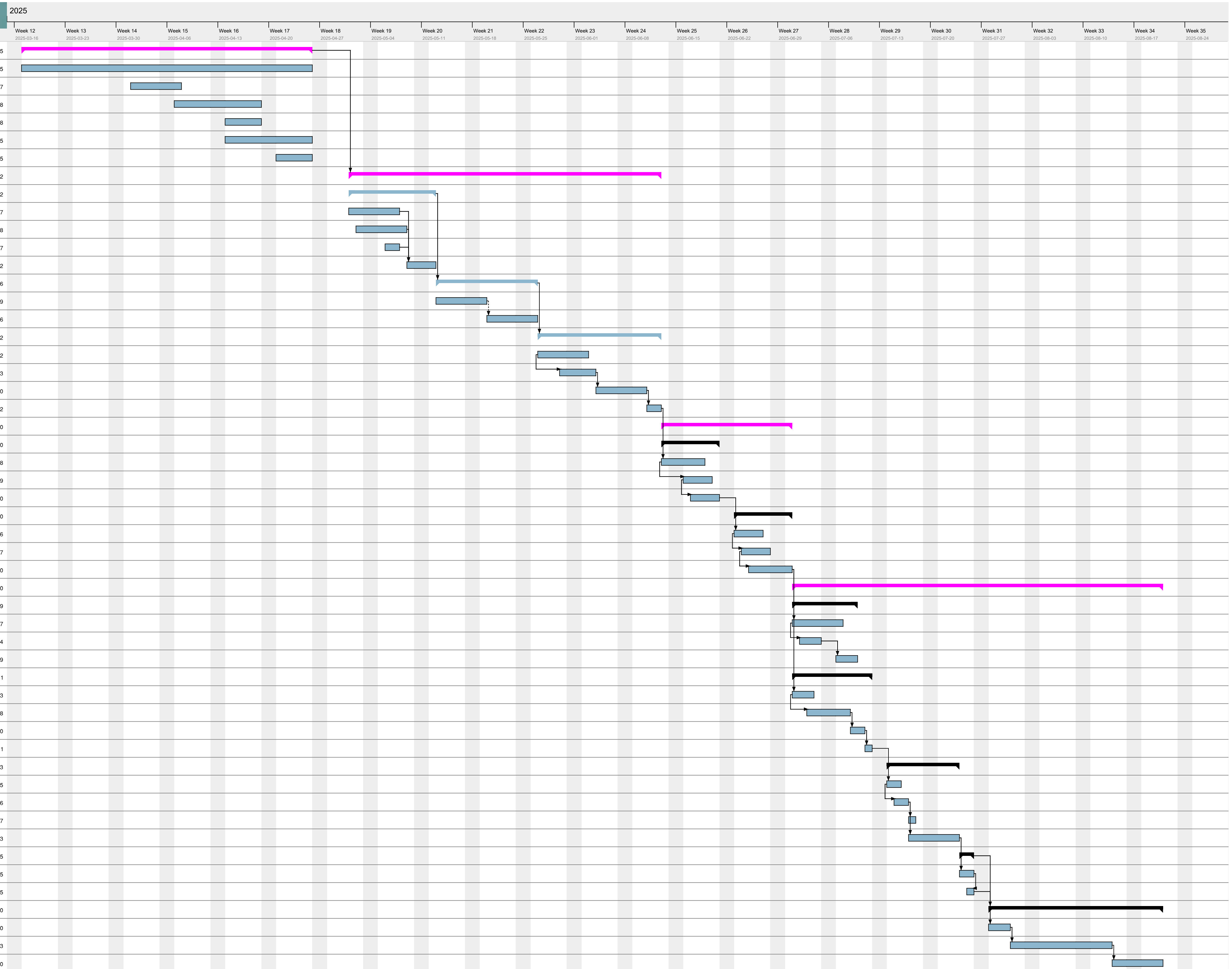


Traffic Management Plan - Stage 4

Appendix F – Construction Schedule

Gantt Chart

Name	Begin date	End date
Preconstruction Surveying & Site-Prep	2025-03-17	2025-04-25
Topographic & Geotechnical Surveys	2025-03-17	2025-04-25
Mark Boundaries of Construction Zone	2025-04-01	2025-04-07
Identify Underground Utilities & Alignments	2025-04-07	2025-04-18
Set Up Signages, Fencing, Storage	2025-04-14	2025-04-18
Mobilization of equipment	2025-04-14	2025-04-25
Clear Vegetations	2025-04-21	2025-04-25
Phase 1: Early Work	2025-05-01	2025-06-12
Demolition of Existing Infrastructure	2025-05-01	2025-05-12
Remove existing pavements, sidewalks, curbs	2025-05-01	2025-05-07
Remove part of Chancellor BLVD median	2025-05-02	2025-05-08
Remove old road signages and lighting poles	2025-05-06	2025-05-07
Disposal/recycling of removed materials	2025-05-09	2025-05-12
Utility Relocations	2025-05-13	2025-05-26
Install temporary bypasses	2025-05-13	2025-05-19
Relocate utilities to new alignments	2025-05-20	2025-05-26
Installation of Stormwater Detention Tank	2025-05-27	2025-06-12
Excavation of tank area	2025-05-27	2025-06-02
Shoring	2025-05-30	2025-06-03
Place and secure tank	2025-06-04	2025-06-10
Backfill & Compaction	2025-06-11	2025-06-12
Phase 2 & 3: Road Construction	2025-06-13	2025-06-30
Phase 2: Top Half of Roundabout	2025-06-13	2025-06-20
Excavation and Earthworks	2025-06-13	2025-06-18
Subbase Construction	2025-06-16	2025-06-19
Road Paving	2025-06-17	2025-06-20
Phase 3: Bottom Half of Roundabout	2025-06-23	2025-06-30
Excavation	2025-06-23	2025-06-26
Subbase Construction	2025-06-24	2025-06-27
Road Paving	2025-06-25	2025-06-30
Phase 4: Finalization	2025-07-01	2025-08-20
Sidewalk Curbing and Landscaping	2025-07-01	2025-07-09
Curb construction of sidewalks and roundabout perimeter	2025-07-01	2025-07-07
Install tree wells, plant beds and grass patches	2025-07-02	2025-07-04
Mulch and irrigation	2025-07-07	2025-07-09
MUP Installation	2025-07-01	2025-07-11
MUP grading and alignment	2025-07-01	2025-07-03
Lay asphalt base	2025-07-03	2025-07-08
Install signages and tactile walking surfaces	2025-07-09	2025-07-10
Paint pathways with markings	2025-07-11	2025-07-11
Lighting & Signage Installation	2025-07-14	2025-07-23
Light Poles Installation	2025-07-14	2025-07-15
RRFB Installation	2025-07-15	2025-07-16
Directional & Regulatory Signage Installation	2025-07-17	2025-07-17
Electrical Wiring	2025-07-17	2025-07-23
Pavement Markings	2025-07-24	2025-07-25
Paint lane lines, crosswalks, directional markings	2025-07-24	2025-07-25
Apply hi-vis markings for active crossings	2025-07-25	2025-07-25
Gateway Installation	2025-07-28	2025-08-20
Excavate for Foundation of Gateway	2025-07-28	2025-07-30
Build Gateway Towers/Structure	2025-07-31	2025-08-13
Project Handover	2025-08-14	2025-08-20



Item Description	Quantity	Unit	Unit Cost	Total Cost
Project Management				
Superintendant	904	Labour Hours	$50.00	$45,200
Foreman	904	Labour Hours	$40.00	$36,200
Project Coordinator	904	Labour Hours	$35.00	$31,700
SUBTOTAL				**$113,100**
General				
Site Mobilization/Demobilization	1	Lump Sum	$10,000.00	$10,000
Safety Equipment	1	Lump Sum	$363.00	$400
Construction Signage	10	Each Sign	$182.67	$1,900
Traffic Managment	1	Lump Sum	$130,000.00	$130,000
Permitting	1	Lump Sum	$2,000.00	$2,000
Site Clearing and Cleaning	4786	M2	$9.50	$45,500
SUBTOTAL				**$189,800**
Demolition and Removal				
Asphalt Removal and Disposal	361.8	M3	$49.31	$17,900
Pavement Edge Cutting	304	M	$10.25	$3,200
SUBTOTAL				**$21,100**
Earthworks				
Soil Excavation	23410	M3	$9.04	$211,700
Loading Soil Excavation to Trucks	23410	M3	$10.54	$246,800
Truck Haul of Soil Excavation	320	km	$0.92	$300
Soil Backfill	23410	M3	$62.45	$1,462,000
Importing Granular Sub-Base	829.5	Tonne	$23.00	$19,100
Placing Granular Sub-Base	414.75	M3	$139.36	$57,800
Importing Crushed Granular Base	1244.25	Tonne	$37.33	$46,500
Placing Crushed Granular Sub-Base	622.125	M3	$92.91	$57,900
SUBTOTAL				**$2,102,100**
Utilities and Stormwater Management				
Relocating Catch Basins	10	Each Unit	$904.81	$9,100
Supplying and Installing Catch Basins	2	Each Unit	$1,505.31	$3,100
Supplying and Installing Bypass Pipe	15	M	$904.81	$13,600
Adjusting Manholes	5	Each Unit	$1,350.43	$6,800
Supplying and Installing Manholes	1	Each Unit	$1,075.00	$1,100
Supplying and Installing Detention Tank	1	Each Unit	$95,000.00	$95,000
Supplying and Installing Street Lighting	13	Each Unit	$4,500.00	$58,500
SUBTOTAL				**$187,200**
Concrete Works				
Concrete Sidewalk & Curb and Gutter Installment	304	M	$422.96	$128,600
Concrete Mountable Aprons	1108	M	$79.54	$88,200
Concrete Traffic/Central Islands	160	M2	$134.88	$21,600
Concrete Medians	204.3	M2	$63.67	$13,100
SUBTOTAL				**$251,500**
Roadwork				
Importing Hot Mix Asphalt	318.12	Tonne	$159.83	$50,900
Paving Hot Mix Asphalt	2651	M2	$6.00	$16,000
Roadway Line Marking	0.04	km	$330.63	$100
Pavement and Crosswalk Markings	4	Each Set	$963.67	$3,900
Miscellaneous Pavement Markings	8	Each Message	$529.17	$4,300
Rapid rectangular flashing beacon	8	Each Unit	$23,000.00	$184,000
Sign Installation	37	Each Unit	$158.17	$5,900
SUBTOTAL				**$265,100**
Gateway				
Concrete Footings	0.22	M3	1849.14	$500
Steel Members	4	Each Unit	$950.46	$3,900
Prefabricated Steel Sign	1	Each Unit	$8,400.00	$8,400
SUBTOTAL				**$12,800**
Landscaping				
Topsoil Placement	316.6	M3	$7.05	$2,300
Hydroseeding	1583	M2	$3.16	$5,100
SUBTOTAL				**$7,400**
			Contingency (15%)	$475,815
			Total Cost:	**$3,626,000**
Annual Maintenance Costs				
Landscaping	-	-	$12,000.00	$12,000
Miscellaneous	-	-	$10,000.00	$10,000
SUBTOTAL				**$22,000**
		Contingency (15%)		$3,300
		Total Annual Maintenance Cost:		**$25,300**

Appendix G – Class A Cost Estimation

Appendix H – Construction Specifications

GENERAL REQUIREMENTS SPECIFICATIONS:

1. All construction, materials, and traffic management shall comply with the BC MOTI Standard Specifications for Highway Construction 2020, BC Building Codes 2024 (BCBC), BC 2020 Traffic Management Manual for Work on Roadways, UBC Development & Building Regulations 2019, UBC Traffic Management Plan (TMP) Guidelines for Events & Construction, Master Municipal Construction Documents (MMCD) 2019, and WorkSafeBC Occupational Health and Safety Regulation.
2. Review and compare all structural and civil drawings with contract documents and design specifications to ensure consistency.
3. Verify all dimensions on-site before proceeding with construction.
4. Conduct a thorough field assessment of site conditions prior to construction.
5. Maintain a clean and safe work site throughout the construction duration.
6. Restore any damaged existing infrastructure not part of the scope to its original condition.
7. Review and obtain approval from the Engineer (HEXALIGN) for any changes or deviations from the issued-for-construction drawings before implementation.
8. Document all changes, deviations, and discrepancies encountered.
9. Do not proceed with work if discrepancies exist between the issued drawings, contract documents, or design specifications; contact the Engineer (HEXALIGN) for guidance.
10. Do not scale the drawings.
11. Register with BC One Call and ensure all ground disturbance permits are kept up to date.

ENVIRONMENTAL SPECIFICATIONS:

1. All construction, materials, and traffic management shall comply with the BC MOTI Standard Specifications for Highway Construction 2020, BC Building Codes 2024 (BCBC), BC 2020 Traffic Management Manual for Work on Roadways, UBC Development & Building Regulations 2019, UBC Traffic Management Plan (TMP) Guidelines for Events & Construction, Master Municipal Construction Documents (MMCD) 2019, and WorkSafeBC Occupational Health and Safety Regulation.
2. Compliance to the following sections in the BC MoTI 2020 Standard Specifications for Highway Construction shall apply for Environmental Specifications. Refer to Section 145 - General Requirements for Highway, Bridge and Marine Construction and Section 165 - Protection of the Environment for detailed construction specifications.
   a. 145.28.06 Protection and Restoration of Property and Environment
   b. 165.02 Environmental Monitor
   c. 165.02.01 Planning and Scheduling
   d. 165.02.02 Construction Environmental Management Plan
   e. 165.03.03 Temporary Pollution Control
   f. 165.03.04 Responsibility for Damage to Environment
   g. 165.04 Erosion, Sediment, and Drainage Control

CONCRETE SPECIFICATIONS:

1. The Work shall consist of:
   a. Supplying of materials and the mixing and placing of reinforced cast-in-place concrete as shown and described on the Drawings and in this Specification, including placing, vibrating, finishing and curing.
   b. Supplying, fabricating, constructing, maintaining and removing temporary works, including falsework and formwork.
   c. Heating and cooling concrete, if necessary.
   d. Developing concrete mix design(s) that meets the performance requirements, including trial batches.
   e. The quality control (QC) testing of all materials.
   f. Supplying and installing water seals and joint fillers (when applicable).
2. The Contractor shall:
   a. Work with the Supplier to establish the concrete mix properties to meet the performance criteria for the plastic and hardened concrete, considering the Contractor's criteria for construction and placement and the Department's performance criteria.

   b. Submit documentation to the satisfaction of the Engineer (HEXALIGN) demonstrating that the proposed mix design(s) will satisfy the strength, durability, and performance requirements.
   c. Prepare and implement a quality management plan to ensure that the Department's performance criteria will be met and submit documentation demonstrating the Department's performance requirements have been met.
   d. Provide certification from a Professional Engineer (HEXALIGN) registered or licensed to practice in British Columbia that the concrete plant, equipment, and truck mixers comply with the requirements of CSA A23.1 and this Specification.
   e. Certify that all materials to be used in the concrete comply with the requirements of CSA A23.1 and this Specification.
   f. Certify that the concrete mix design(s) satisfy the requirements of CSA A23.1 and this Specification.
   g. Certify that the production and delivery of concrete will meet the requirements of CSA A23.1 and this Specification.
   h. Certify that the concrete complies with the performance criteria specified.
   i. Ensure that the concrete supplier prepares and implements a quality control plan to ensure that the Department's and the Contractor's performance criteria will be met.
3. Contractor's Performance Criteria:
   a. The submission shall include the Contractor's performance criteria for each mix design including:
      i. Placeability (pumping, buggies, truck chute, etc.).
      ii. Workability.
      iii. Proposed slump and slump retention time.
      iv. Set time.
   b. The concrete mix design(s) for the required type(s) of concrete should specify the following:
      i. Cementitious content in kilograms per cubic metre or equivalent units for each type of cementitious material.
      ii. Designated size, or sizes, of aggregates, and the gradation.
      iii. Aggregate source location(s).
      iv. Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis.
      v. Maximum allowable water content in kilograms per cubic metre or equivalent units and the design water/cementitious ratio.
      vi. The limits for slump.
      vii. The limits for air content.
      viii. Quantity in millilitres per cubic meter or equivalent units and brand name for each type of admixture.
      ix. Certification that all concrete constituents are compatible.
      x. Certification that the concrete mix(es) will meet the specified concrete performance criteria requirements.
4. Aggregates:
   a. All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material. If either the coarse or the fine aggregate consists of a blend from more than one source, the aggregate sieve analysis shall show the gradation of the blended aggregates.
5. Admixtures:
   a. Air-entraining admixtures shall conform to the requirements of ASTM C 260.
   b. Chemical admixtures shall conform to the requirements of ASTM C 494 for conventional mixes and ASTM C 1017 for flowing concrete.
   c. All admixtures shall be compatible with all other constituent materials.
   d. The addition of calcium chloride, accelerators and air-reducing agents, will not be permitted, unless otherwise approved by the Engineer (HEXALIGN).
   e. Appropriate low range water reducing and/or superplasticizing admixtures shall be used in all concrete containing silica fume.

6. Water:
    a. Water to be used for mixing and curing concrete or grout and saturating the substrate shall be potable, shall conform to the requirements of CSA A23.1 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.
7. Synthetic Fibres:
    a. The synthetic fibres for the deck, overlay, sidewalk, curb and barrier concrete shall consist of 100% virgin polypropylene. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength as specified.
8. Formwork:
    a. Forms for exposed surfaces shall be made of good quality plywood in "like-new" condition and uniform in thickness, with or without a form liner.
9. Construction Methods:
    a. Mixing Concrete:
        i. Ready-mix concrete shall be mixed and delivered by one of the following operations:
            1. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed, or
            2. Mixed completely in a truck mixer.
        ii. Continuous mixers used in conjunction with volumetric proportioning will not be approved. The use of non-agitating trucks for delivering concrete mixed off-site will not be permitted.
    b. Stationary Mixer:
        i. The mixing of concrete shall be done in a batch mixer of a size and type suitable for the intended use. Mobile continuous mixers or other such concrete supply equipment will not be approved for use. All concrete shall be mixed thoroughly until it is uniform in appearance, with all ingredients uniformly distributed. In no case shall the mixing time per batch be less than one minute for mixers of one cubic metre capacity or less. The "batch" is considered as the quantity of concrete inside the mixer. This figure shall be increased by 15 seconds for each additional half cubic metre capacity or part thereof. The mixing period shall be measured from the time all materials are in the mixer drum.
    c. Truck Mixing:
        i. Truck mixers shall be of the revolving drum type, watertight, and constructed so that the concrete can be mixed to ensure uniform distribution of materials throughout the mass.
    d. Concrete Strength Requirements:
        i. Open to Traffic The structure shall not be opened to traffic until the concrete has attained a minimum compression strength of 100% of the design strength. The Contractor shall be responsible for all costs associated with any additional testing that may be required to satisfy the strength requirement.
10. Quality Control:
    a. General:
        i. Batches of concrete that do not meet the requirements of this Specification will be rejected by the Engineer (HEXALIGN) and his/her decision to be final. The Engineer (HEXALIGN) reserves the right to require immediate removal of any concrete from the rejected batches that may have already been placed in the structure. The Contractor shall be responsible for all concrete testing, including but not limited to making test cylinders, transporting cylinders to an independent certified testing laboratory of his choice, storage, curing, breaking, and providing written reports of the concrete test results to the Engineer (HEXALIGN). The quality control testing shall meet the minimum testing requirements for the specified frequency and test procedure as described in Tables 1 and 2. All testing shall be completed by qualified personnel who are certified at the time of testing as ACI CSA-Based Concrete Field Testing Technician – Grade 1, and shall be conducted at the point of discharge into the forms
    b. Aggregate:
        i. The sample of the aggregates shall be current and fully represent the material to be used in production. Sampling shall be done no more than 90 days prior to concrete production. Additional samples shall be provided periodically if so determined by the Engineer (HEXALIGN).
    c. Concrete:
        i. Compressive Strength Tests:

1. A "Strength Test" shall consist of the compression tests of four standard test specimens, sampled, made, cured, and tested in accordance with CSA Standard Specifications as referenced with modifications as indicated. One cylinder shall be tested at seven days. One cylinder shall be tested at fourteen days. The 28 day test result shall be the average of the strengths of the remaining two specimens. Additional cylinders may be cast, at the discretion of the Engineer (HEXALIGN) or Contractor.

ii. Sampling:

1. Sampling of concrete shall be carried out in accordance with CSA A23.2-1C.

11. Quality Assurance:
    a. Quality assurance testing will be carried out by the Engineer (HEXALIGN) and the costs for breaking and provision of concrete test cylinder reports will be paid for by the Department. The Engineer (HEXALIGN) shall be afforded full facilities for the random quality assurance inspection and testing that may be carried on to the concrete itself and/or the constituent materials. This includes at the worksite and any plant used for the manufacture of concrete. The facilities shall be adequate in the opinion of the Engineer (HEXALIGN)to permit proper sampling of but not limited to, making of test cylinders and testing slump and air content. The proper storage of all site cast concrete cylinders in accordance with the relevant specifications is the responsibility of the Contractor and shall be provided prior to any concrete pour. The results of the quality assurance testing carried out by the Engineer (HEXALIGN) will serve to monitor and review the quality control program of the Contractor.

ROADWORKS SPECIFICATIONS

1. **Geometrics:**
    a. Implement smooth vertical and horizontal curves to shape changes in grade and direction.
    b. Execute earthworks according to the contract documents, which involve tasks such as removing loose or detrimental materials, addressing soft spots, compacting, and grading slopes.
    c. Construct embankments in accordance with the standards and specifications outlined in the contract documents, ensuring proper placement, shaping, compaction, and protection.
    d. In instances where existing ditches need infilling or services are established in fill sections, utilize granular material for filling, ensuring it is supplied, placed, and compacted in accordance with MMCD specifications.
    e. Adhere to MMCD specifications for all sub-base road and granular base materials. Refer to earthworks specifications for details.
    f. Extend the road sub-base and base a minimum of 0.3 meters beyond the road edge or curb and gutter.
    g. Connect to existing pavement by cutting back to sound material as required to create a tidy vertical face.
    h. Ensure that all new pavement is graded to prevent ponding, with a minimum cross slope of 2% on any new or overlain road surface.
    i. Adjust all valve boxes, manholes, etc., within the paved surface of the roadway to the finished course elevation before applying the finish course paving.
    j. Concrete barrier curbs must adhere to the MOTI standard drawing SP582-01.04 and combined curb and gutters must adhere to the MOTI standard drawing SP582-01.01. Mountable concrete curb and gutter must adhere to the MOTI standard drawing SP582-01.02
2. **Asphalt:**
    a. Ensure compliance with the specifications outlined in the MMCD specifications and detail drawings when placing asphalt pavement and concrete.
    b. Unless approved otherwise, asphaltic concrete for road work must be applied in two lifts.
    c. Asphalt mix must be in compliance with Section 952 of the 2020 Standard Specification for Highway Construction Volume 1.
    d. Quality control, inspection, and testing of asphalt pavement must be conducted and recorded according to Section 952.02 of the 2020 Standard Specification for Highway Construction Volume 1.
    e. Sourced aggregates for paving must be compliant with Section 502.06.05 of the 2020 Standard Specification for Highway Construction Volume 1.
    f. Asphalt mixes are the responsibility of the contractor to design and cost as outlined in Section 502.08 of the 2020 Standard Specification for Highway Construction Volume 1.
    g. Construction practices must comply with the specifications outlined in Section 502.20 through Section 502.27.08 of the 2020 Standard Specification for Highway Construction Volume 1

SITE EARTHWORKSSPECIFICATIONS

1. All site earthworks recommendations should be complemented by reference to SS 2020 202. Any deleterious or contaminated filling should be stripped and disposed of in accordance with the recommendation provided in our environmental report. The exposed subgrade should be proof rolled, any existing uncontrolled filling and rubble be removed and replaced with engineered fill as specified below. Engineered fill is to be used to backfill batters and to raise the site level where required.
2. Where clays are exposed at subgrade level, they will undergo substantial loss in strength when wet and may even become untraversable. Therefore, it is important to provide good and effective drainage during construction. The principal aim of the drainage is to promote run-off towards designated sumps by cross-falls and to reduce ponding.
3. Following the stripping and completion of the proposed excavations, it is recommended that the soil subgrade be proof rolled and inspected by an experienced geotechnical engineer. Subgrade heaving may occur during proof rolling in areas where the clays may have become "saturated." Heaving areas should be locally removed to a "stiff" base and replaced with engineered fill as defined below. Depending on the extent and depth of the heaving areas, it may be necessary to provide a bridging layer. If the insitu clays exhibit shrinkage cracking, then the surface should be watered and rolled until the shrinkage cracks are no longer evident. Engineered fill should also be used where it is proposed to raise the levels.
4. Engineered Fill:
    a. Engineered fill should comprise well-graded granular material (sands, ripped or crushed sandstone), free of deleterious substances and having a maximum particle size of 50 mm. Excavated sands from the site may be reused as fill provided that any unsuitable material (organic clays) and any building rubble or deleterious material is excluded. The engineered fill, and any excavation backfill where subgrade support is required, should be compacted in layers of not greater than 300 mm loose thickness, to a density ratio of 98% of Standard Maximum Dry Density (SMDD) or to a minimum of 95% Density Index.
    b. Density tests should be regularly carried out on the fill in accordance of SS 2020 204.04.02 standard to confirm the above specifications are achieved. The frequency of density testing should be at least one test per layer per 1000 m2

LANDSCAPING SPECIFICATIONS

1. The contractor shall use low-maintenance, native vegetation for all central islands and medians, selected in accordance with the Canadian Nursery Landscape Association (CNLA) standards for native plant selection and the BC Landscape Standards for sustainable landscaping.
2. All plantings shall be carefully selected and arranged to maintain proper driver sightlines at all intersections and pedestrian crossings, in compliance with the Transportation Association of Canada (TAC) guidelines for road design and vegetation management.
3. The contractor shall ensure that vegetation does not obstruct visibility or create hazards for motorists, cyclists, or pedestrians.
4. The contractor shall ensure proper soil preparation by incorporating compost and topsoil to promote healthy plant growth. All soil amendments must conform to the BC Landscape Standards.
5. All erosion control methods must comply with the BC Landscape Standards for erosion management and the TAC Roadside Erosion Control Guide.
6. Mulch materials, such as wood chips, bark, or gravel, shall be applied in accordance with the BC Landscape Standards.

GATEWAY STRUCTURE SPECIFICATIONS

1. The contractor shall construct the gateway structure in compliance with the BC Building Code (latest edition).
2. Steel columns shall be fabricated and welded to baseplates following the requirements of CSA S16 for the design and fabrication of steel structures.
3. All welding shall be completed in accordance with CSA W59.
4. Steel beams shall be secured to the structure according to the design requirements and in compliance with CSA S16.
5. Baseplates shall be secured with epoxy anchors as per CSA A23.3 for the design and installation of concrete anchors. Hilti HIT-HY epoxy anchors shall comply with the manufacturer's recommendations and relevant standards for epoxy-based anchoring systems.
6. The concrete base and footing shall be designed and constructed in accordance with CSA A23.3

7. Laser-cut steel gateway artwork shall be fabricated following the approved shop drawings and in compliance with CSA G40.20.
8. Exposed steel components shall be primed and painted with a weather-resistant coating according to CSA S16 and CSA C22.2.

SIGNAGE SPECIFICATIONS

1. All signage recommendations should be complemented by reference to Specifications for Standard Highway Sign Materials, Fabrication and Supply by the Ministry of Transportation and Infrastructure.
2. All signage must be retro-reflective to show the same colour, shape and message at night as they appear in daytime. Signage may be fabricated using sheet aluminum or extruded aluminum, conforming to the requirements of ASTM B209M and ASTM B221M.
3. The signs shall be clearly and permanently labeled (using durable, weather resistant material) or engraved with an identification coding. Sheeting material shall be correctly applied in accordance with the manufacturer's recommendations and accepted quality practice. The edges of all substrate material shall be deburred to provide a smooth finished edge. Sheeting material cannot contain air pockets and shall not have holes, tears, scrapes, compressed cells, or patches.
4. Preserve all currently installed signs, remove any surplus upon completion of the work, and return them to the Ministry. The Ministry is responsible for installing temporary and permanent street, traffic, and advisory signs not explicitly depicted on the drawings.

PAVEMENT MARKINGS SPECIFICATIONS

1. All pavement marking recommendations should be complemented by reference to Pavement Marking Service Agreement 2008 by the Ministry of Transportation and Infrastructure.
2. The Ministry is responsible for installing pavement markings not explicitly depicted on the drawings. The Ministry is also responsible for removing all existing conflicting pavement markings.
3. Utilize extruded thermoplastics for all permanent pavement markings. Traffic paint and thermoplastic material must be in accordance with the Recognized Products List. White paint must conform to US Federal specification 595b White 17886 and yellow paint must conform to US Federal specification 595b Yellow 33538.

STREET LIGHTING SPECIFICATIONS

1. All LED luminaires shall meet the requirements of CSA C22.2 for outdoor use compliant with the Canadian Electrical Code (CEC).
2. The contractor shall ensure that the spacing and placement of streetlights conform to the Transportation Association of Canada (TAC) Manual of Uniform Traffic Control Devices (MUTCD). The LED streetlights shall be fitted with appropriate dimming and control features to comply with energy efficiency goals and regulations.
3. The contractor shall install Rectangular Rapid Flashing Beacons (RRFB) at all pedestrian crosswalks and multi-use pathway (MUP) crossings. The RRFBs shall be compliant with CSA C22.2 for electrical and safety standards, and the contractor shall ensure the devices are properly integrated with the streetlight system for synchronized operation where required. The RRFB units shall feature durable weatherproof housing and be equipped with flashing lights that meet TAC standards for brightness and visibility. Flashing sequences and activation mechanisms shall adhere to the operational guidelines set forth by TAC.

STORMWATER SPECIFICATIONS

1. All storm sewer construction shall conform to:
    a. BC MoTI Standard Specifications for Highway Construction (2020)
    b. MMCD (2019) standards
    c. UBC ISMP (2017)
    d. BC Building Code (2024)
    e. WorkSafeBC OH&S Regulations
2. All discrepancies between drawings and specifications must be reported to the Engineer (HEXALIGN) prior to commencement of work.
3. Contractor to verify all existing utility locations and site dimensions before starting construction.
4. Register with BC One Call and maintain current ground disturbance permits.

5. All installations shall comply with municipal and provincial standards and be inspected by the Engineer (HEXALIGN) before backfilling.
6. PVC drainage pipe specifications:
    a. All pipes shall be PVC SDR 35 or equivalent, conforming to ASTM D3034 or F794.
    b. Cell classification: 12454 or 12364 as per ASTM D1784.
    c. Gaskets to meet ASTM F477.
    d. Minimum stiffness: 320 kPa (ASTM D2412)
    e. Standard pipe lengths: 4 m or 6 m.
    f. All pipes must be free from cracks, inclusions, and visible deformities.
7. Rain garden specifications:
    a. Soil infiltration rate to be verified on-site or replaced with engineered bioretention soil (75% sand, 15% compost, 10% topsoil)
    b. Use drought and flood-tolerant native species following BC Landscape Standards.
    c. Underdrain system: 100 mm perforated pipe wrapped in non-woven geotextile, placed in 300 mm gravel layer
    d. Minimum three layers of vegetation: groundcover, shrubs, and small ornamental grasses.