



Report Executive Summary

25 AVENUE LRT GRADE SEPARATION - FUNCTIONAL PLANNING STUDY

April 2018



Prepared for The City of Calgary
by McElhanney



25 Avenue LRT Grade Separation -
Functional Planning Study Executive Summary

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25 Avenue S.E. LRT Grade Separation Functional Planning Study
Prepared for the City of Calgary

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Executive Summary

ES 1.0 Study Purpose and Objective

The intersection of Macleod Trail and 25 Avenue S.E. is an important node in Calgary's road network, where converging traffic from the southern part of the city crosses the Elbow River to reach Downtown. Adjacent to the intersection, the Erlton Station, on the Red Line LRT (C-Train), attracts pedestrians from the surrounding area and provides access to the Calgary Stampede Grounds north of the Elbow River.

The presence of the Red Line LRT adjacent to Macleod Trail complicates the operation of the traffic signal system at the 25 Avenue S.E. intersection by pre-empting the signal phasing to accommodate the passing of C-Trains in both directions. The at-grade track crossing is gate-arm controlled and facilitates the clearing of vehicles off the track as trains approach. This disruption of the optimal signal phasing is most detrimental to the southbound left-turn movement and the westbound through and left-turn movements, which accommodate heavy traffic volumes to and from the industrial area to the east.

The intersection has been under review by The City of Calgary's Transportation Department, including the Roads and Transportation Planning business units, to identify optimization opportunities. However, optimisation opportunities do not remove the interaction between the LRT and roadway, which is one the primary cause of congestion at this location. In addition, Calgary Transit has recently upgraded the C-Trains to 4-car configurations to increase service capacity. With a future (planned but unfunded) separation of the Red and Blue lines at 8 Avenue S, Calgary Transit also plans to increase the frequency of trains from 5 minutes to 3 minutes during peak periods. These two factors will further exacerbate the problems currently experienced at the intersection.

In July 2016, City Council discarded a previously approved interchange plan for this location and directed Administration to develop a recommended plan for grade separation of the Red Line LRT tracks at 25 Avenue S.E. east of Macleod Trail. While the interchange would have resolved the traffic operation issues experienced at the intersection as a result of LRT pre-emption, it no longer aligns with the Urban Boulevard classification of Macleod Trail provided in the Calgary



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Transportation Plan (CTP). The interchange plan also does not align with land use policies in the area, such as the Municipal Development Plan (MDP) and the Erlton Area Redevelopment Plan (ARP), nor with the Urban Corridor designation of lands adjacent to Macleod Trail. Specifically, an interchange would require a significant footprint of potentially developable land as well as the introduction of a physical and visual barrier.

The study boundary, as shown in *Figure ES-1*, is further extended during the project to integrate the 17 Avenue S.E. extension project. The focus of this project was to determine how a grade separation of 25 Avenue S. the LRT could be accomplished to relieve the traffic congestion caused by the LRT pre-emption at the intersection of Macleod Trail and allow for an increase in LRT service. Other important considerations include land use policies, transit operation, active modes, safety, community and property access, river flooding, and preservation of the Reader Rock Garden historical site.

There are three primary objectives for the study:

- **Road:** Improve accommodations for all road users in accordance with the Complete Streets Policy.
- **Rail:** Enhance transit service to attract transit users, improve customer experience, and meet future demands.
- **Redevelopment:** Encourage transit supportive development on lands adjacent to Erlton Station.



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Figure ES-1: Study Area



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ES 2.0 Existing Conditions

2.1 Road Network

Macleod Trail is an urban boulevard that acts as a central spine connecting south Calgary (and beyond) with the Downtown core. The corridor is used by over 50,000 commuters per day. Macleod Trail extends from Riverfront Avenue S.E. in the north to the southern City limits, where it becomes Highway 2A. Macleod Trail forms a one-way couplet with 1 Street SE and accommodates traffic in the northbound direction north of the Elbow River. It is a two-way roadway south of the Elbow River, where 1 Street S.E. joins and becomes the southbound portion of Macleod Trail.

25 Avenue S.E. is an east-west roadway with a collector classification west of Macleod Trail, and an arterial classification east of Macleod Trail. It connects the communities of Cliff Bungalow, Mission, Erlton, Ramsay and Alyth / Bonnybrook / Manchester. It extends west to Hillcrest Avenue and east to Dartmouth Road. 25 Avenue S.E. provides an important east-west connection to Macleod Trail and is used by commuters from adjacent communities. As approved by Council in the 25 Avenue S.E. Connector Study, the 25 Avenue S.E. corridor is planned to connect Macleod Trail with Blackfoot Trail in the future. As such, 25 Avenue S.E. is expected to carry higher traffic volumes once a direct connection to Blackfoot Trail is provided.

2A Street S.E. is a two-lane local road located east of Macleod Trail. It provides access to the Erlton LRT Station and Calgary Stampede Grounds parking lots.

3 Street S.E. is a four-lane local road located east of 2A Street S.E. It provides direct access into the Calgary Stampede Grounds.

Erlton Road is a two-lane local road located west of Macleod Trail. It provides access to the multi-family developments northwest of the study intersection.

Within the study area, Macleod Trail intersects with 25 Avenue S.E. to form a four-leg signalized intersection. 25 Avenue S.E. intersects with Erlton Road and 2A Street S.E. to form three-leg unsignalized intersections and with 3 Street S.E. to form a three-leg signalized intersection.

2.2 Adjacent Projects

Calgary Stampede Master Plan

Calgary Municipal Land Corporation (CMLC) is currently undertaking a master plan of the River District, which includes Victoria Park and Calgary Stampede Grounds. CMLC is working with Denver-based Civitas and Calgary's Gibbs Gage on a 20-year visioning plan that includes removing the Stampede Corral building, increasing the BMO Centre area, construction of a potential new arena, hotels, condo buildings, and increased retail/commercial development. While the master planning is still underway, it is assumed that there will be an additional 10 million square feet of mixed-use development.



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Anthem's Crosstown Development

Anthem Properties has an approved transit-oriented development (TOD) plan for the lands along the west side of Macleod Trail within the study area. The Crosstown Development includes a pedestrian overpass over Macleod Trail connecting it with the Erlton LRT Station. Crosstown consists of 745 residential units, 70,000 square feet of commercial/retail area, and 4,000 square feet of office space.

Repsol Sport Centre Redevelopment

Repsol Sport Centre has submitted a Land Use Application to The City of Calgary to upgrade and expand their existing recreational facility by approximately 7,000 m² (75,000 ft²). The proposed land use district retains the adjacent Special Purpose – Recreation (S-R) District and adjusts the land use boundary to reflect the expansion of the building. It also reproduces the existing approved use of “multi-purpose sports complex”; and additionally includes four new discretionary uses.

17 Avenue S.E. Extension

To support the East Village Development, the River District Master Plan, and the Calgary Stampede Master Plan, a new pedestrian/vehicle access is proposed at-grade at 17 Avenue S.E. across the Red Line LRT tracks into Stampede Park. Calgary Transit was tasked with reviewing the previous studies and developing a Proof of Concept based on a mid-term solution to ensure that transportation needs can be met (Phase 1). The Proof of Concept report was received from Hatch in November 2016 and concluded that at a conceptual level, it is possible to extend 17 Avenue S.E. across Macleod Trail, and proceeding with the preliminary design was recommended.

The scope of the 17 Avenue S.E. Extension project includes a review of previous studies, stakeholder engagement, public open house presentations, detailed multi-modal traffic and open track modelling, cost estimating, a review of operational and safety concerns, risk assessment and mitigation, land transfer assessments, site investigations and surveys, materials testing, geotechnical studies, and operations protocol for the crossing and Calgary Stampede parking gates. Also included is the assessment of impacts to Calgary Transit and the LRT, as well as the resulting modifications of the Victoria Park/Stampede LRT Station, the C-train, infrastructure for tracks, signals, and communications. Modifications to roads, sidewalks, crosswalks, traffic signals and urban realm integration is also within the project scope.

2.3 Floodway

The Elbow River is a dominant natural feature that flows north of the study area. The Elbow River is subject to periodic flooding causing Provincial and City flood hazard mitigation policies to be in effect. Provincial policies emanate from the *Water Act* and are administered by Alberta Environment and Parks (AEP). In 1983 (with updates in 1996), the AEP created maps showing the Flood Hazard Area (FHA) in Calgary. The FHA was divided into three zones:



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- Floodway – the river channel and some areas just out of the channel, where the flood water is deepest and fastest. Most of the flood water flows through the floodway;
- Flood Fringe – areas along the river that flood, but where the water is not as deep or as fast as in the floodway; and
- Overland Flow Zone – Areas where water leaves the river channel, flows over land through streets or communities, and eventually flows back into the river somewhere downstream.

Figure ES-2 outlines the Floodway and Flood Fringe boundaries that are delineated in the current (1996) mapping. The provincial flood hazard map is the basis of the flood policy and zones in Calgary's Land Use Bylaw. Current City Bylaw states that no new building or other new structures are allowed in the floodway.

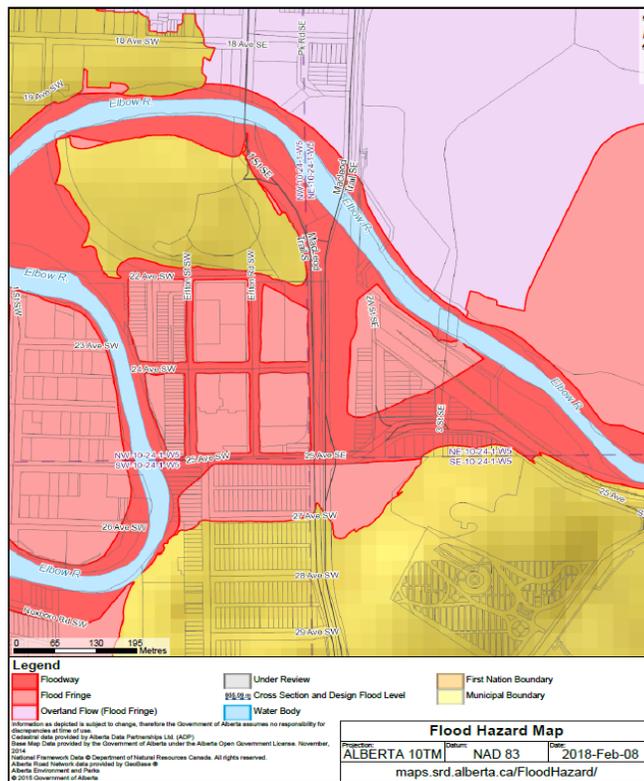


Figure ES-2: Provincial Flood Hazard Map for Study Area

Following the major 2013 flood event in Calgary, The City of Calgary (The City) has conducted several studies to better understand the flood risk and identify mitigation measures. Current flood mitigation projects underway include raising the gates at the Glenmore Dam, and constructing several parries at key locations, such as West Eau Claire, Heritage Drive, Bonnybrook Wastewater Facility, and the Centre Street Bridge. In addition, the Government of Alberta confirmed in 2015 that it would proceed with the development of a dry-storage reservoir at



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Springbank. The Springbank Reservoir is currently undergoing a federal Environmental Impact Assessment. It is expected that the upstream reservoirs, including the proposed Springbank Reservoir, and the new gates on the Glenmore Dam will be able to support a 2013-sized flood without overland flooding along the Elbow River. This would likely impact the developability of the parcels that are currently in the floodway around the Erlton Station.

2.4 Traffic Volumes Projection

Traffic volumes for the 2038 future horizon were developed with consideration of several factors. These included the existing traffic volumes and patterns, adjacent sites proposed for development, area road network changes and anticipated future connections to major roadways, as well as potential redevelopment plans of existing developments in the area.

- Traffic associated with Anthem's proposed Crosstown development in the northwest corner of the intersection of Macleod Trail and 25 Avenue S.E. was included in the review. Development volumes were taken from the *Transportation Impact Assessment for the Proposed Development at Erlton Road / 25th Ave. Calgary, Alberta* completed by IBI Group in 2013.
- The proposed construction of the 25 Avenue S.E. Connector to Blackfoot Trail was considered, along with the associated rerouting of anticipated traffic.
- Traffic associated with the redevelopment of the Stampede Grounds was based on the *Green Line LRT Beltline Traffic Modeling Assumptions* technical memorandum completed by Stantec in 2017.
- The traffic generation associated with the redevelopment of the existing Repsol Sport Centre was estimated based on existing traffic patterns and trip generation data provided by The City of Calgary.

Based on these road network, traffic volume, and area development details, 2038 future horizon traffic volumes were developed as follows:

- 100% balanced existing volumes (no growth assumed for future horizons)
- 100% of Anthem's Crosstown development volumes
- 50% of volumes associated with the redevelopment of the Stampede Grounds
- 50% of volumes associated with the redevelopment of the Repsol Centre
- 100% of volumes associated with the 25 Avenue S.E. Connector (assumed to be constructed)

ES 3.0 Concept Development

3.1 Study Constraints

There are multiple other projects occurring within the study area that need to be considered when developing concepts. In addition, Macleod Trail and 25 Avenue S. are important traffic and transit links within the transportation network. As such, it was important to develop an understanding of design constraints and assumptions that should be taken into consideration. The following list highlights the main constraints and assumptions considered during the concept development stage.



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- The majority of the study area falls within either the floodway or the flood fringe. The City's Land Use Bylaw does not permit alteration of grades or construction of new structures in a floodway. Any structures or grade changes require further analysis and approval.
- Reader Rock Garden has been designated as a Municipal Historic Resource and any impacts to it should be minimized.
- If changes are made to the station location, the pedestrian bridge from Anthem's Crosstown development should be reviewed to ensure the continued provision of a pedestrian crossing of Macleod Trail.
- 17 Avenue S.E. will extend east of Macleod Trail into Stampede Grounds as part of another project being undertaken between The City, Calgary Stampede, and CMLC.
- Long-term plans for the Big Four building are currently unknown and impacts to the building should be minimized.
- Impacts to the Union Cemetery grounds should be minimized.
- A storage track in a siding must be provided in the Erlton Station study area in the interim and ultimate horizons due to changes associated with the 17 Avenue S.E. Extension project.
- The Erlton LRT Station platform must accommodate a future 5 car train (135m overall length).
- Modification of the Cemetery Hill Tunnel north portal track structure should be avoided to eliminate the need for a major LRT service disruption, making this portal the southern limit of any LRT track re-alignment.
- The existing LRT right-of-way adjacent to the south-west corner of the Big Four building is assumed to be the northern limit of any LRT track re-alignment.
- New construction within the existing LRT right-of-way should be minimized to reduce the duration of service disruption when transitioning from existing to any new LRT alignment.
- LRT re-alignment should not result in any significant increase in travel time.
- Either a centre or side-loading platform station configuration is acceptable for a new station if required to replace the existing Erlton Station.

3.2 Initial Concepts

The first step in the development of concepts was to meet with stakeholders and the public. The community priorities were identified through the use of a dotmocracy process. This process allows the public and stakeholders to select the criteria they feel is most important by placing sticker dots on a board identifying a wide range of criteria. The top community priorities identified were:

- Pedestrian accommodation, such as new or improved pedestrian infrastructure.
- Improved vehicle travel times, including looking at the signal timing and dedicated turn lanes.
- Bicycle accommodation, such as new infrastructure or improvements that enhance cycling.
- Improved public transit
- Revitalization of the community.



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In addition to the public engagement, a concept development workshop was held with key internal and external stakeholders including City of Calgary business units, Calgary Stampede, CMLC, and project team members. The objectives of the workshop were to:

- Work with the internal and external stakeholders to generate feasible concepts to grade separate the LRT at Erlton Station, while meeting the multiple study objectives.
- Produce several ultimate LRT grade separation design concepts that can be further refined and evaluated.
- Reduce re-work and fast-track the evaluation process by including stakeholder feedback early as part of the concept development process.

Following the initial engagement events, preliminary concepts were developed with the intention of addressing the following:

- Issues identified by the internal, external and public stakeholders.
- Maintaining access to key developments and attractions.
- Better accommodation for pedestrians and cyclists.
- Removing the LRT pre-emption at the intersection of Macleod Trail and 25 Avenue S.E.
- Optimizing future opportunities for redevelopment within the study area.

Concept A – Elevated LRT Station

This concept elevates the Red Line LRT tracks as they come out of the existing Cemetery Hill tunnel. Erlton Station is also elevated, and the new LRT guideway continues over the Elbow River returning to grade approaching the Big Four building. All roadways remain at-grade, but the east leg of 25 Avenue S.E. is relocated north of the existing intersection at Macleod Trail. *Figure ES-3* illustrates a 3D rendering of the preliminary concept with hypothetical future development.



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Figure ES-3: Concept A Aerial Rendering

Benefits

- Access to Reader Rock Garden and Stampede Grounds have been improved.
- Pathways and sidewalks have been added to improve connections for people walking and cycling within the study area.
- Complete separation between the LRT and traffic and removal of the LRT and vehicle conflict at the intersection of Macleod Trail and 25 Avenue S.E.
- Two at-grade pedestrian crossings along Macleod Trail.

Trade-offs

- Stairs, ramps and elevators are required to access the Erlton LRT Station.
- High construction costs.
- The travel distance for people driving along 25 Avenue S. is slightly longer.

Concept B – Median Flyover to Existing 25 Avenue

This concept does not move the LRT station and tracks, but grade separates the traffic through a be-directional flyover from the median of Macleod Trail. The U-turn south of the river is also reversed. The east leg of the Macleod Trail and 25 Avenue S.E. intersection is closed and motorists on 25 Avenue S. must use ramps and the U-turn to complete certain movements. *Figure ES-4* illustrates a 3D rendering of the preliminary concept with hypothetical future development.



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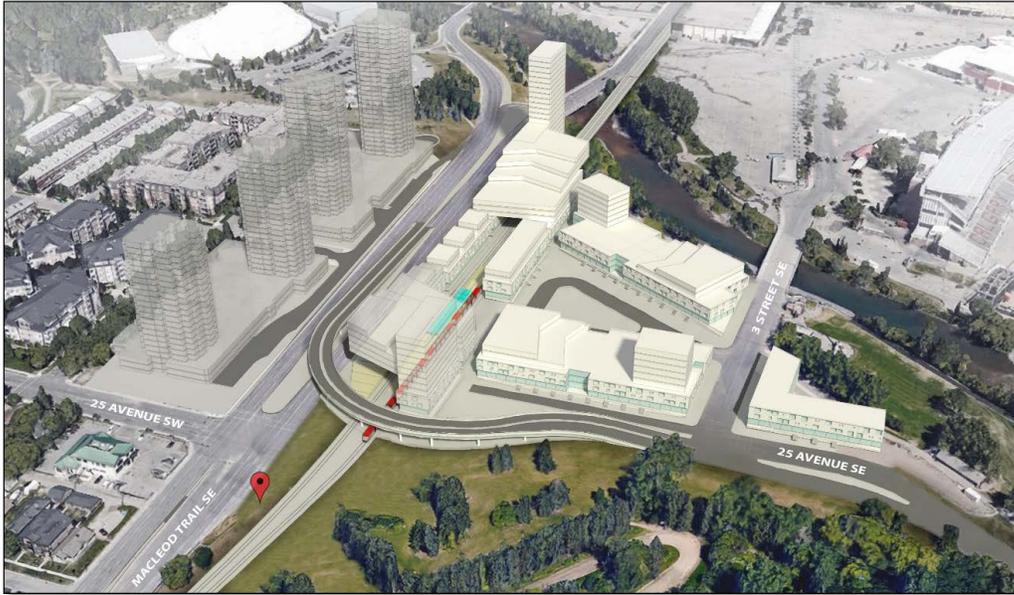


Figure ES-4: Concept B Aerial Rendering

Benefits

- Low construction costs.
- Complete separation between the LRT and traffic and removal of the LRT and vehicle conflict at the intersection of Macleod Trail and 25 Avenue S.E.
- Least disruptive to LRT service long term and during construction.

Trade-offs

- Increased travel distance and convoluted paths for vehicular traffic along 25 Avenue S. relative to existing network.
- The ramp is inconsistent with the characteristics of Macleod Trail's designation as an Urban Boulevard.

Concept C – Relocated At-Grade LRT Crossing

This concept leaves the LRT alignment, station and surrounding roads at-grade. The LRT alignment is shifted to the east where it intersects with a realigned 25 Avenue S.E. at a new level crossing. By shifting the LRT further east from Macleod Trail, this concept eliminates traffic signal delays due to the pre-emption at the existing 25 Avenue S.E. and Macleod Trail intersection.

Figure ES-5 illustrates a 3D rendering of the preliminary concept with hypothetical future development.



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Figure ES-5: Concept C Aerial Rendering

Benefits

- Removes the LRT and vehicle conflict on 25 Avenue S.E. and Macleod Trail.
- Improved access to Reader Rock Garden.
- The LRT station and road are all at-grade.
- There are two at-grade pedestrian crossings along Macleod Trail.

Trade-offs

- People walking, cycling and driving cross the Red Line LRT tracks at an at-grade crossing.
- The travel distance for people driving along 25 Avenue S. is slightly longer.
- Limited opportunities for LRT service to increase in frequency as the LRT still impacts the vehicular operation of 25 Avenue S.
- High construction costs.

3.3 Depressed LRT Considerations

The option of constructing a depressed LRT alignment beneath 25 Avenue S.E. was raised at various times during the study. Initial assessment of this option presented several major difficulties in the constrained confines of the area between Cemetery Hill and the Elbow River.

The profile shows the existing LRT tracks are on a steep downward slope as they approach the Cemetery Hill tunnel portal and then transition into an upward 3.7% gradient to cross 25 Avenue.



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Re-grading the LRT alignment to pass below the existing 25 Avenue would mean that the complete tunnel portal would have to be reconstructed. Alternatively, the east leg of 25 Avenue could be relocated farther north to provide some distance in which to depress the alignment below the roadway without major reconstruction of the tunnel portal. In order for the LRT to pass under a relocated 25 Avenue E and then re-connect to the existing LRT bridge across the Elbow River, the station would have to be constructed on the maximum permitted 1.5% grade adjacent to a significant 4.5% approach grade north of the station. In addition, this re-alignment requires severe horizontal curvature resulting in less than desirable sub-standard geometry for the LRT operation.

Construction of any form of below-grade LRT would shut down LRT service for an extended period and also impact the operation of adjacent roadways. Ameliorating the impacts of ground water and flooding would also have to be considered in the design of the depressed station. The below-grade option south of the river would be much more disruptive to LRT service requiring closure of Erlton Station and a temporary mainline diversion, as well as lower standard, more expensive infrastructure to build and maintain than any of the at-grade or above-grade concepts investigated in this study.

Given the complexities, disruption and costs associated with this option, it was not considered further as a viable concept.

3.4 Refined Concepts

Additional investigation was undertaken to see how the three concepts could be further refined to incorporate:

- stakeholder feedback regarding redevelopment, accessibility, and Stampede Grounds operations;
- retaining adequate capacity for traffic entering and exiting the Stampede Grounds;
- accommodating people walking and cycling, with allowances for sidewalks or pathways along all new roadways and connections to existing facilities;
- providing access for transit vehicles servicing Erlton Station;
- providing access to Reader Rock Garden; and
- keeping maintenance access to the LRT tunnel portal.

The proposed access in each concept provides a replacement U-turn route for traffic exiting from the Repsol Sport Centre that wishes to travel northbound on Macleod Trail.

Concept A – Elevated LRT Station

The plan view for the refined Concept A is provided in *Figure ES-6*. Refinements to this concept include:

- Pathways and sidewalks added along all new roadways and connections to existing facilities to improve connections for people walking and cycling.
- Relocation of current southbound U-turn traffic on Macleod Trail to an alternative route. This is to create additional southbound left-turn storage at 25 Avenue S.



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- Bus pullouts on 25 Avenue S.E. to accommodate transit service and access to Erlton Station.
- New intersection on 25 Avenue S.E. to provide access to Reader Rock Garden and the LRT portal.
- Extension of the Anthem Crosstown development's pedestrian overpass to the new elevated Erlton Station.

Concept B – Median Flyover to Existing 25 Avenue S.E.

Concept B originally proposed the use of flyover ramps and the U-turn south of the Elbow River to route traffic to and from the east leg of 25 Avenue S.E. This concept was further refined to use both the U-turn as well as 18 Avenue S.E. to serve the traffic originally expected to use the U-turn, thereby reducing the volume of traffic at the U-turn. In this way, the weaving issues along northbound and southbound Macleod Trail would be improved, with increased space for vehicle storage.

This refinement, Concept B2, allows a portion of the east leg of 25 Avenue S.E. to remain at-grade forming a right-in/right-out with Macleod Trail. The refined concept also includes a single southbound left-turn lane ramp from the median of Macleod Trail to 25 Avenue S.E. Through movements would still not be allowed at the intersection to keep the signal operating without LRT pre-emption. Westbound vehicles on 25 Avenue S.E. would use the at-grade right-out but would be prohibited from merging in with northbound Macleod Trail until north of the U-turn.

Vissim analysis showed overall capacity improvements and a reduction in weaving issues along Macleod Trail. Maintaining some at-grade access for the east leg of 25 Avenue S.E. was also preferred by Calgary Stampede relative to the original Concept B as it provides better connections in and out of the Stampede Grounds. Overall, Concept B2 has slightly better active modes accommodation, vehicle operations, and community/property access than Concept B. However, traffic is no longer completely separated from the LRT and gates would still be required at the LRT crossing.

The plan view for Concept B and refined Concept B2 are provided in *Figure ES-7* and *Figure ES-8*. Other refinements, in addition to the road configuration discussed above, include:

- Pathways and sidewalks have been added along all new roadways and connections to existing facilities to improve connections for people walking and cycling.
- A cul-de-sac to allow Erlton Station traffic to turn around.
- A roundabout at the intersection of 25 Avenue S.E. and 3 Street to facilitate multiple turning movements.

Concept C – Relocated at-Grade LRT Crossing

The plan view for the refined Concept C is provided in *Figure ES-9*. Refinements to this concept include:

- Pathways and sidewalks have been added along all new roadways and connections to existing facilities to improve connections for people walking and cycling.



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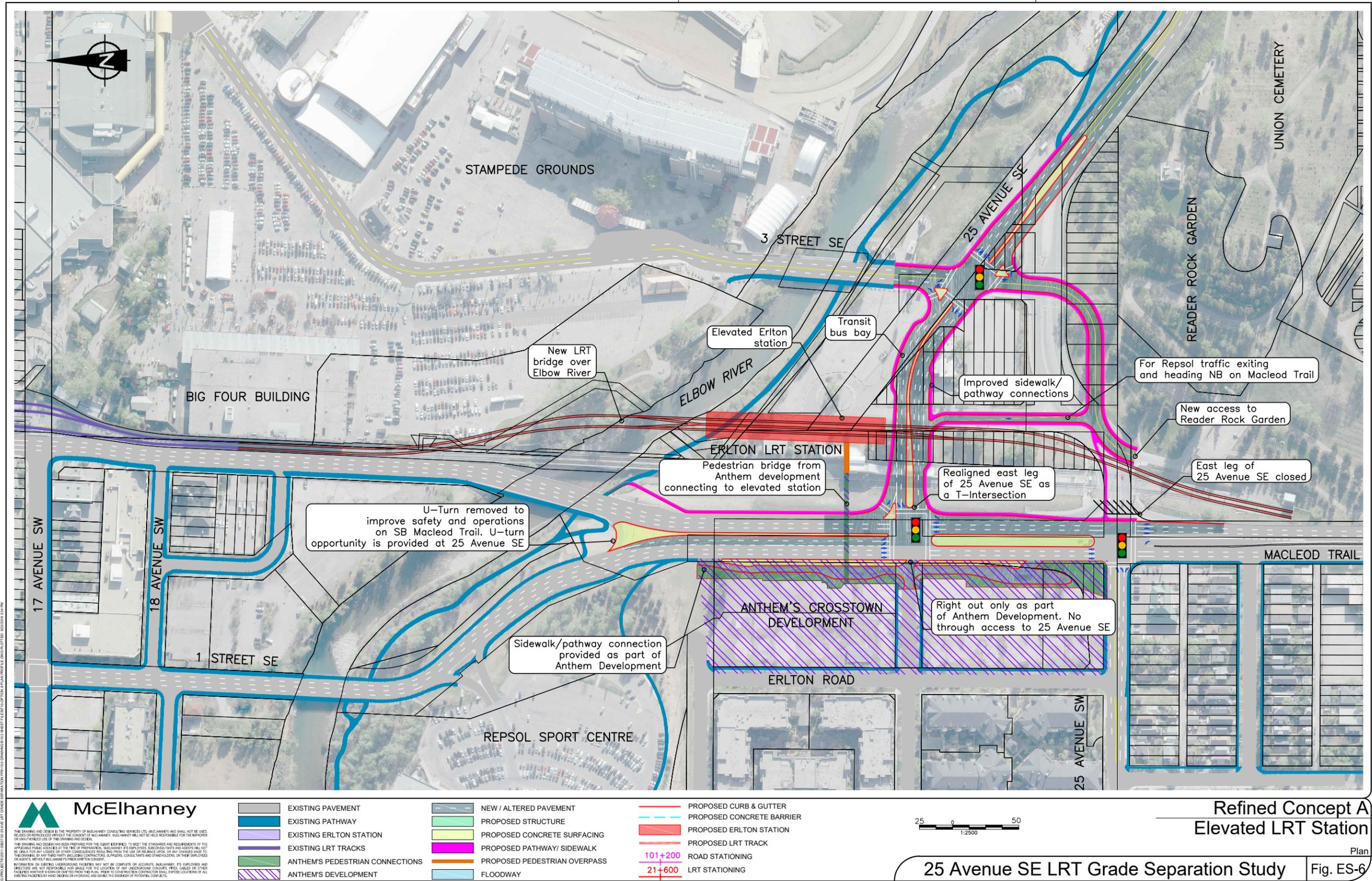
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- Relocation of current southbound U-turn traffic on Macleod Trail to an alternative route. This is to create additional southbound left-turn storage at 25 Avenue S.
- Bus pullouts on 25 Avenue S.E. and the new road in front of Erlton Station.
- A cul-de-sac to allow Erlton Station traffic to turn around.
- Relocation of 3 Street and 25 Avenue S.E. intersection.
- A ramp extension from the Crosstown development pedestrian overpass to the relocated Erlton Station.



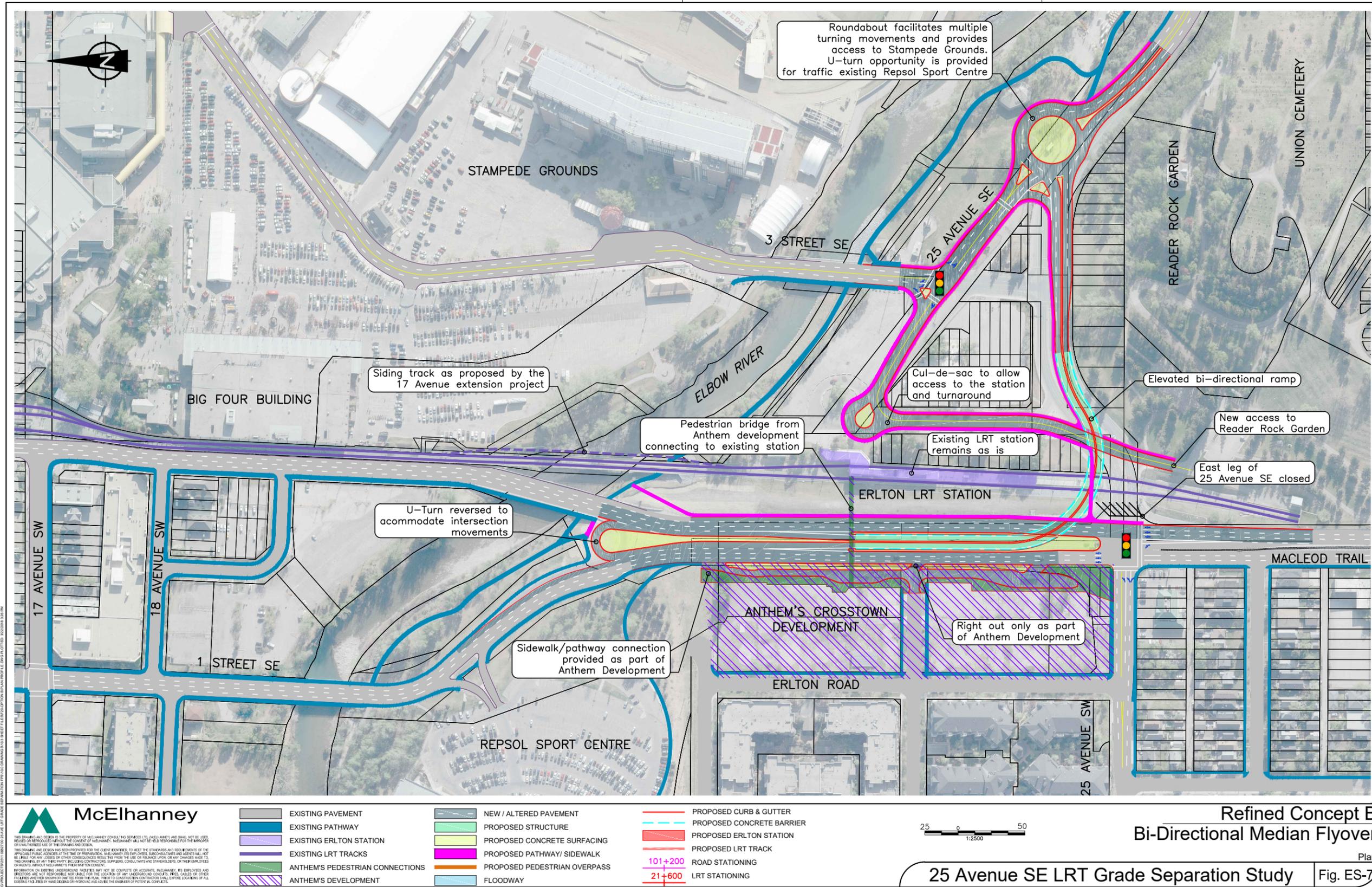
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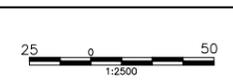
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EXISTING PAVEMENT	NEW / ALTERED PAVEMENT	PROPOSED CURB & GUTTER
EXISTING PATHWAY	PROPOSED STRUCTURE	PROPOSED CONCRETE BARRIER
EXISTING ERLTON STATION	PROPOSED CONCRETE SURFACING	PROPOSED ERLTON STATION
EXISTING LRT TRACKS	PROPOSED PATHWAY/ SIDEWALK	PROPOSED LRT TRACK
ANTHEM'S PEDESTRIAN CONNECTIONS	PROPOSED PEDESTRIAN OVERPASS	ROAD STATIONING
ANTHEM'S DEVELOPMENT	FLOODWAY	LRT STATIONING

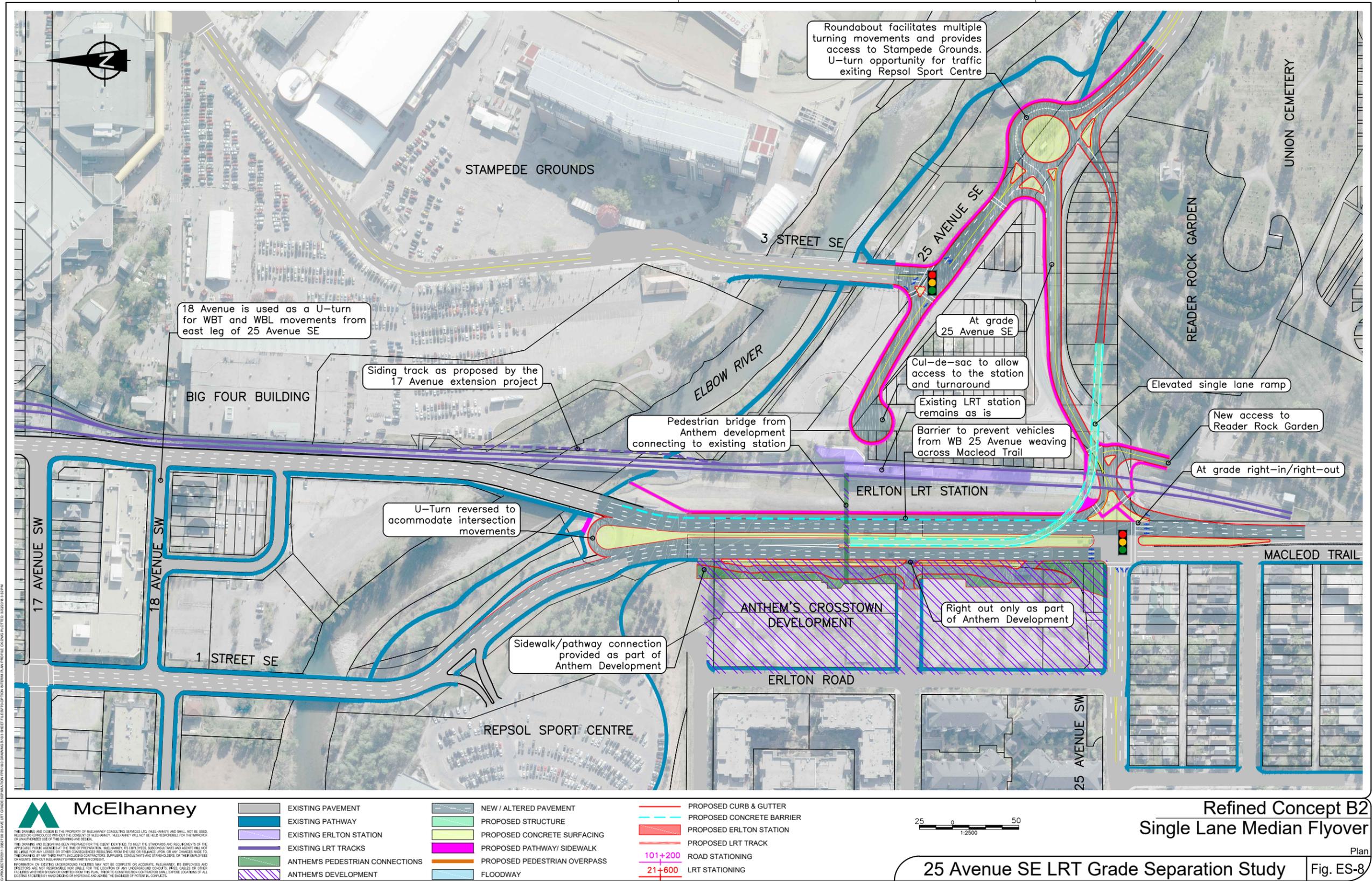


Refined Concept B
Bi-Directional Median Flyover

25 Avenue SE LRT Grade Separation Study | Fig. ES-7

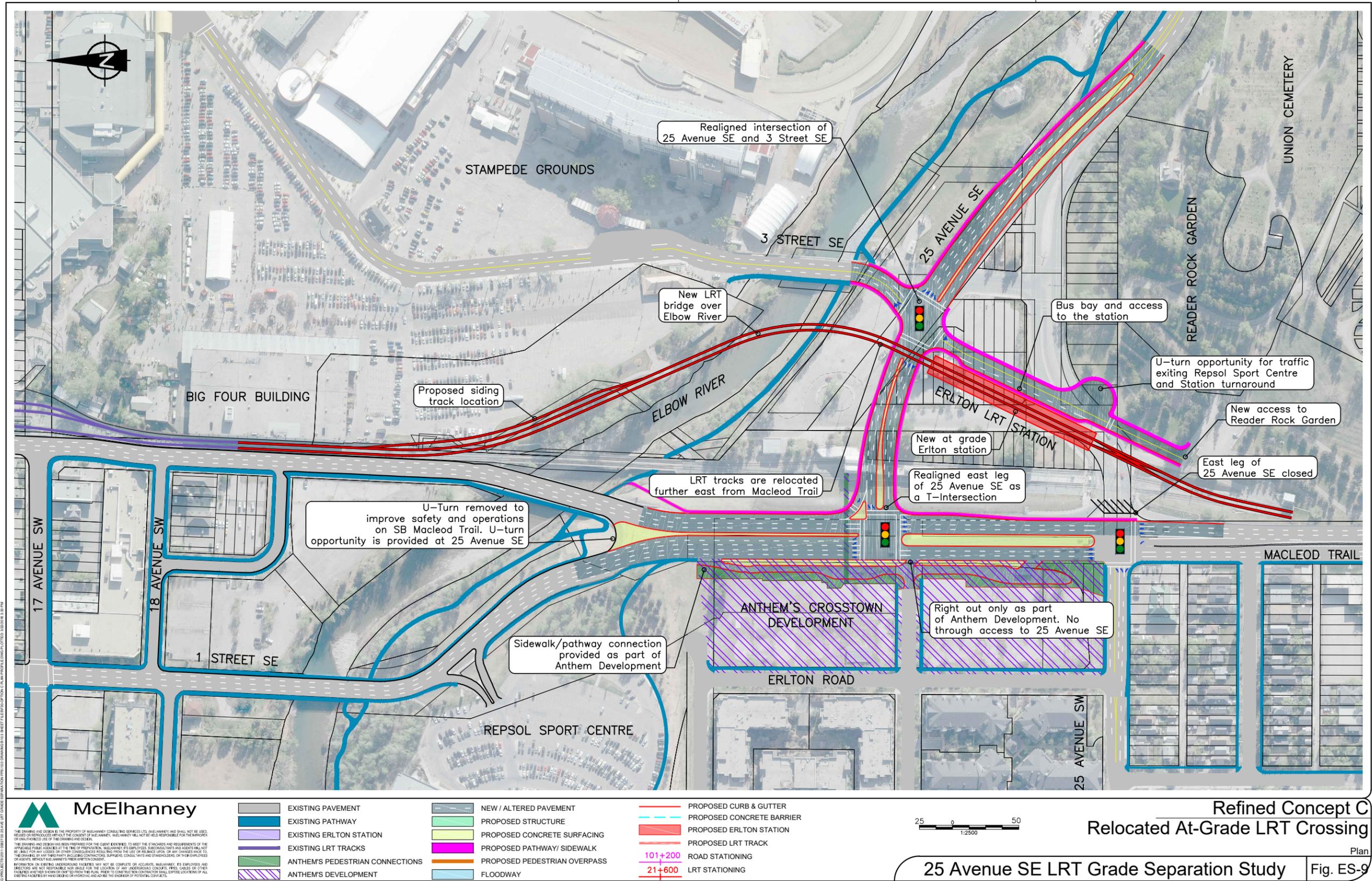
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3.5 Concept Evaluation

The evaluation criteria were established by the project team based on the feedback received from stakeholders during the initial engagement events, as well as input provided by The City of Calgary based on policies and guidelines. Combining the feedback received from stakeholders and The City identified a total of eleven major evaluation criteria categories. A summary of the selected evaluation criteria is provided in *Table ES-1*, along with descriptions of each criterion.

Table ES-1: Evaluation Criteria and Description

Evaluation Criteria	Description
LRT Service	<ul style="list-style-type: none"> Ability to increase train frequency Changes to LRT speed or travel time
Active Modes Accommodation	<ul style="list-style-type: none"> Active modes opportunities to cross Macleod Trail The ease of access to the LRT station
Vehicle Operations	<ul style="list-style-type: none"> The efficiency of vehicular travel within and through the area, including delays, travel distances, wayfinding, and maneuverability
Access Management	<ul style="list-style-type: none"> Changes to existing property access (Calgary Stampede Grounds, Reader Rock Garden, Repsol Sport Centre) Changes to community access Future development access opportunities
TOD Potential	<ul style="list-style-type: none"> The attractiveness of the developments given the surrounding area and infrastructure for leasing / resale, including land parcel sizes and orientation Total land area available
Staging of Development	<ul style="list-style-type: none"> The ease with which surrounding land can be utilized/developed in the short-term
Safety	<ul style="list-style-type: none"> Conflict points at intersections, vehicular maneuvering abilities, and geometric/operational issues Crossings of the LRT with pedestrian, cyclist, or vehicular traffic
Disruption to Floodway	<ul style="list-style-type: none"> Impacts to the flow of water in storm events
Construction Cost	<ul style="list-style-type: none"> The total cost of construction & contingencies
LRT Service Disruption During Construction	<ul style="list-style-type: none"> The disruption to LRT service and operations that construction will cause, including service interruptions, shut down or shuttle service, and extended delays
Traffic Disruption During Construction	<ul style="list-style-type: none"> The disruption to traffic operations that construction will cause, including lane closures, detours, and extended delays



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Each criterion was prioritized based on its relative importance in achieving the project objectives and community priorities. Prioritization was assigned by giving each criterion a different weighting. The higher the weighting of each criterion was, the higher its priority would be. As such, pedestrian and cyclist accommodation, safety, TOD potential, and LRT service were given higher weightings than the other criteria, as identified by the community prioritization exercises.

The completed evaluation matrix, including the weighting of each criterion and overall scores, can be found in *Table ES-2* and *Table ES-3*. The current potential for development in the study area is very dependent on existing flood mapping and the Land Use Bylaw. However, the flood mapping and Land Use Bylaw may change with the flood mitigation measures currently underway and/or planned. The overall evaluation of the concepts was undertaken for the two development scenarios: conservative TOD potential based on current bylaws, and maximum TOD potential assuming full development of the area can occur. All other criteria remain the same for the two scenarios.

Table ES-2: Refined Concept Evaluation Matrix with Conservative TOD Potential

Evaluation Criteria	Weight	Do Nothing	Concept A	Concept B	Concept B2	Concept C
LRT Service	10.0	1.0	3.0	5.0	4.0	2.0
Pedestrian and Cyclist Accommodation	14.0	2.0	4.0	3.0	4.0	5.0
Vehicle Operations	8.0	1.0	4.0	3.0	4.0	2.0
Access Management	8.0	3.0	4.0	2.0	3.0	3.0
TOD Potential	13.0	5.0	2.0	4.0	4.0	3.0
Staging of Development	6.0	5.0	2.0	4.0	4.0	3.0
Safety	16.0	1.0	5.0	3.0	3.0	2.0
Disruption to Floodway	5.0	5.0	4.0	2.0	2.0	3.0
Construction Cost	8.0	5.0	1.0	4.0	4.0	2.0
LRT Service Disruption During Construction	8.0	5.0	1.0	5.0	5.0	3.0
Traffic Disruption During Construction	4.0	5.0	4.0	2.0	2.0	3.0
Total Score	100	38.0	34.0	37.0	39.0	31.0
Total Weighted Score	500	306.0	320.0	346.0	366.0	286.0



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Table ES-3: Refined Concept Evaluation Matrix with Maximum TOD Potential

Evaluation Criteria	Weight	Do Nothing	Concept A	Concept B	Concept B2	Concept C
LRT Service	10.0	1.0	3.0	5.0	4.0	2.0
Pedestrian and Cyclist Accommodation	14.0	2.0	4.0	3.0	4.0	5.0
Vehicle Operations	8.0	1.0	4.0	3.0	4.0	2.0
Access Management	8.0	3.0	4.0	2.0	3.0	3.0
TOD Potential	13.0	3.0	4.0	2.0	2.0	5.0
Staging of Development	6.0	5.0	2.0	4.0	4.0	3.0
Safety	16.0	1.0	5.0	3.0	3.0	2.0
Disruption to Floodway	5.0	5.0	4.0	2.0	2.0	3.0
Construction Cost	8.0	5.0	1.0	4.0	4.0	2.0
LRT Service Disruption During Construction	8.0	5.0	1.0	5.0	5.0	3.0
Traffic Disruption During Construction	4.0	5.0	4.0	2.0	2.0	3.0
Total Score	100	36.0	36.0	35.0	37.0	33.0
Total Weighted Score	500	280.0	346.0	320.0	340.0	312.0

Based on the evaluation, the 'Do Nothing' and Concept C were the lowest scored concepts for both development scenarios and should not be pursued further. Concept A and Concept B2 continue to have merits in meeting the study objectives and should be re-evaluated once the flood mitigation measures are in place and a new floodway zone has been identified. At that time, the TOD potential can be better determined with the actual developable land area.

ES 4.0 Cost Estimates

The cost estimation includes four basic types of costs; Roadway, Track, Station, and Structural costs. All costs were based on recent costs from similar projects. The costs are presented in 2017 dollars and have not been adjusted for inflation as timelines for this project are unknown. Contingency (25%) and engineering costs (15%) have been added on to the construction sub totals to account for the high-level nature of this estimate and uncertain timelines. Costs for Concept A, Concept B, Concept B2 and Concept C are included in *Table ES-4*.



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Table ES-4: Refined Concept Cost Estimates

Description	Concept A	Concept B	Concept B2	Concept C
Roadway				
Removals & site preparation	\$1,800,000	\$1,800,000	\$1,800,000	\$1,800,000
New roadway (paved area)	\$1,500,000	\$2,045,000	\$2,310,000	\$1,800,000
New walkway (sidewalk/pathways)	\$652,500	\$652,500	\$697,500	\$731,250
New roadway (concrete medians / islands)	\$495,000	\$690,000	\$750,000	\$555,000
New roadway (barriers)	\$0	\$180,000	\$292,500	\$0
New roadway (storm system)	\$200,000	\$100,000	\$100,000	\$200,000
Subtotal	\$4,647,500	\$5,467,500	\$5,950,000	\$5,166,250
LRT Track				
At-grade track (including earthworks)	\$5,720,000	\$0	\$0	\$10,230,000
Level crossing infrastructure	\$140,000	\$0	\$0	\$840,000
Elevated track (including guideway structure)	\$7,440,000	\$0	\$0	\$0
At-grade track (including siding & all earthworks)	\$26,100,000	\$0	\$0	\$22,620,000
Special trackwork (crossovers, turnouts etc.)	\$2,700,000	\$0	\$0	\$2,400,000
Traction power sub-station	\$990,000	\$0	\$0	\$3,000,000
LRT systems (traction power, train control, comms.)	\$4,488,000	\$0	\$0	\$4,785,000
Subtotal	\$47,578,000	\$0	\$0	\$43,875,000
Station				
Demolition and removal of existing LRT track/station	\$2,500,000	\$0	\$0	\$2,500,000
Maintaining transit service during LRT closure	\$3,000,000	\$0	\$0	\$2,000,000
Elevated station infrastructure	\$33,000,000	\$0	\$0	\$18,000,000
Subtotal	\$38,500,000	\$0	\$0	\$22,500,000
Other Structures				
Flyover structure	\$0	\$23,400,000	\$10,800,000	\$0
LRT river crossing bridge	\$0	\$0	\$0	\$5,850,000
Subtotal	\$0	\$23,400,000	\$10,800,000	\$5,850,000
Miscellaneous Costs				
Traffic signals	\$750,000	\$300,000	\$300,000	\$750,000
Utility relocations	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Subtotal	\$1,750,000	\$1,300,000	\$1,300,000	\$1,750,000
Cost Summary				
Subtotal	\$92,475,500	\$30,167,500	\$18,050,000	\$79,141,250
Contingency (25%)	\$23,118,875	\$7,541,875	\$4,512,500	\$19,785,313
Engineering (15%)	\$13,871,325	\$4,525,125	\$2,707,500	\$11,871,188
Total	\$129,465,700	\$42,234,500	\$25,270,000	\$110,797,750



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ES 5.0 Recommendations

The intersection of Macleod Trail and 25 Avenue S.E. will continue to play a key role in Calgary's transportation system. The continued evolution of Macleod Trail as an Urban Boulevard, including future mixed-use and TOD development, will further increase the importance of this area. Due to its location, the intersection is a key node for all modes of travel and is expected to be so well into the future. There are potential solutions to improve pedestrian and cyclist accommodation and traffic flow in the area, while maintaining LRT operations and providing opportunities for development.

This study identified three alternative concepts to an interchange and has evaluated these concepts relative to The City's policies and objectives as well as stakeholder priorities. The three concepts were:

- Concept A: elevated LRT and Erlton Station above realigned 25 Avenue S.E.
- Concept B: a median flyover from Macleod Trail to existing 25 Avenue S.E.
- Concept C: relocated at-grade crossing further east of Macleod Trail.

The lack of clarity regarding the relationship between the Elbow River Floodway and hypothetical redevelopment in the area poses a dilemma. This area of the Elbow River is one of the most complex and important flood areas in Calgary. The boundary of the floodway is under review by Alberta Environment and Parks and may be subject to further modification when upstream flood mitigation measures are implemented. It is expected that with the upstream reservoirs, Springbank Reservoir, and the new gates on the Glenmore Dam, a 2013-sized flood could be managed without overland flooding along the Elbow River. Consequently, until these mitigation measures are in place, the area of land that may be developable under future Provincial and City flood mitigation policies is uncertain.

Nevertheless, it has been established that Concept B2 would provide several improvements over the existing conditions and could be implemented at City Council's discretion whenever deemed necessary. Concept A may also be a viable choice depending on the resolution of redevelopment and floodway issues.

Since there is neither funding allocated for grade separation of 25 Avenue S.E. and the Red Line LRT, nor new redevelopment proposals imminent in the area, it is recommended to defer a decision between Concept A and Concept B2 until the flooding and redevelopment matter is clarified. Once the mitigation measures are in place and a new floodway zone has been identified, a re-evaluation of the TOD potential can be undertaken at that stage.

In the interim, modest traffic improvements can be achieved by implementing improved traffic signal control technology at the 25 Avenue S.E. and Macleod Trail intersection. Construction of a pathway along the east side of Macleod Trail would improve connectivity between the Elbow River Pathway and Reader Rock Garden. Re-grading the pathway area between Macleod Trail and the Red Line LRT would improve floodwater conveyance in the area as well. Also, reduction of the posted speed limit on Macleod Trail to 50 km/h in the study area would improve the pedestrian environment on both sides of the roadway.



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