

Calgary



ARCADIS
IBI GROUP

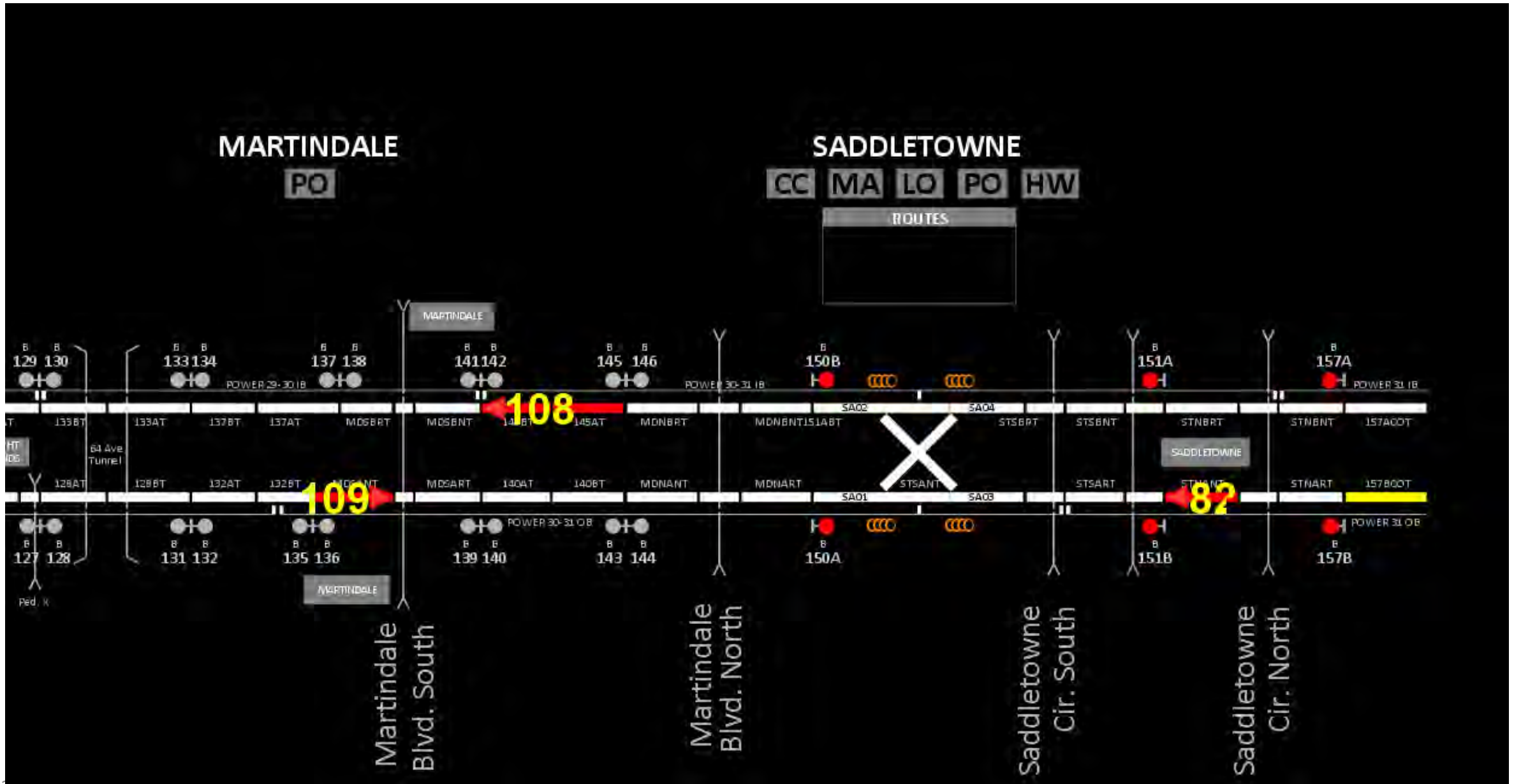


HATCH

At-grade LRT Crossing Safety Enhancements Initiatives



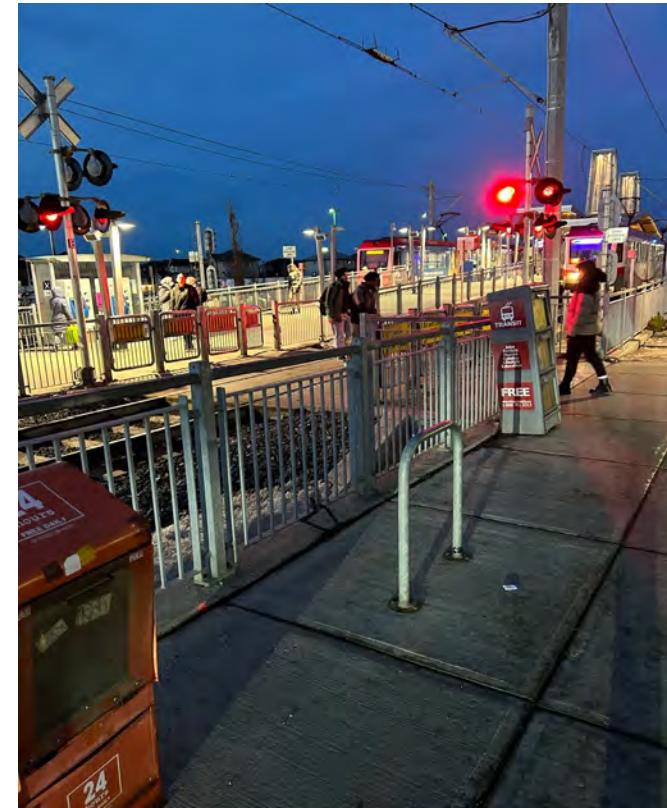
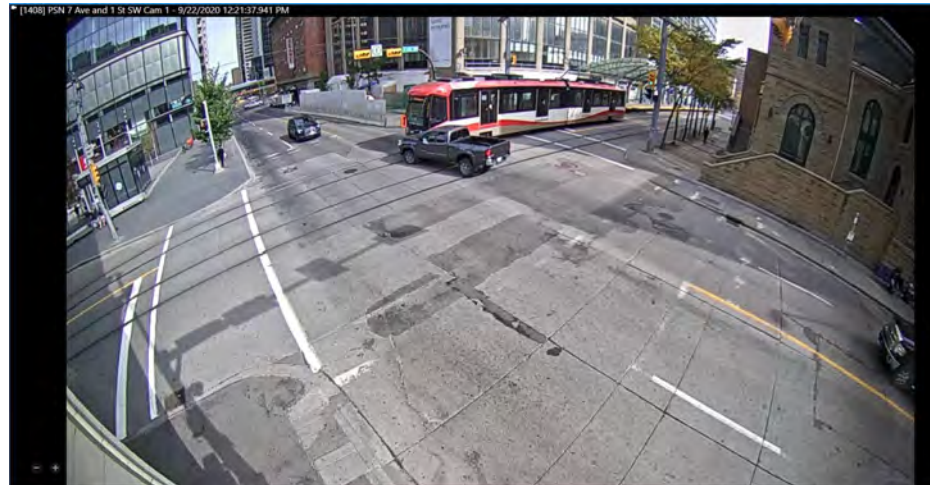
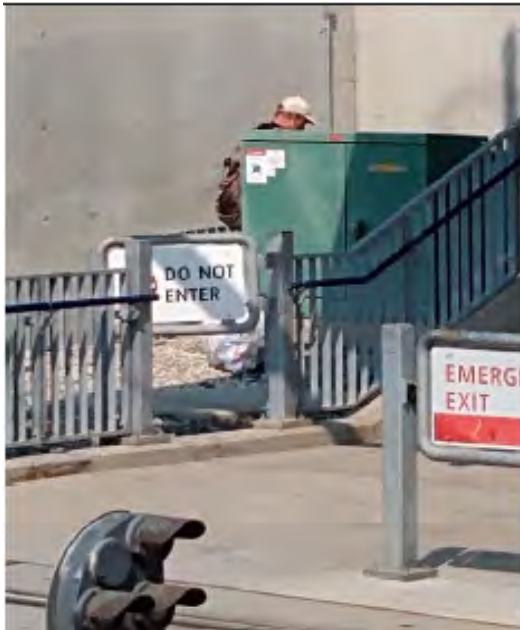
Calgary's Light Rail Transit System





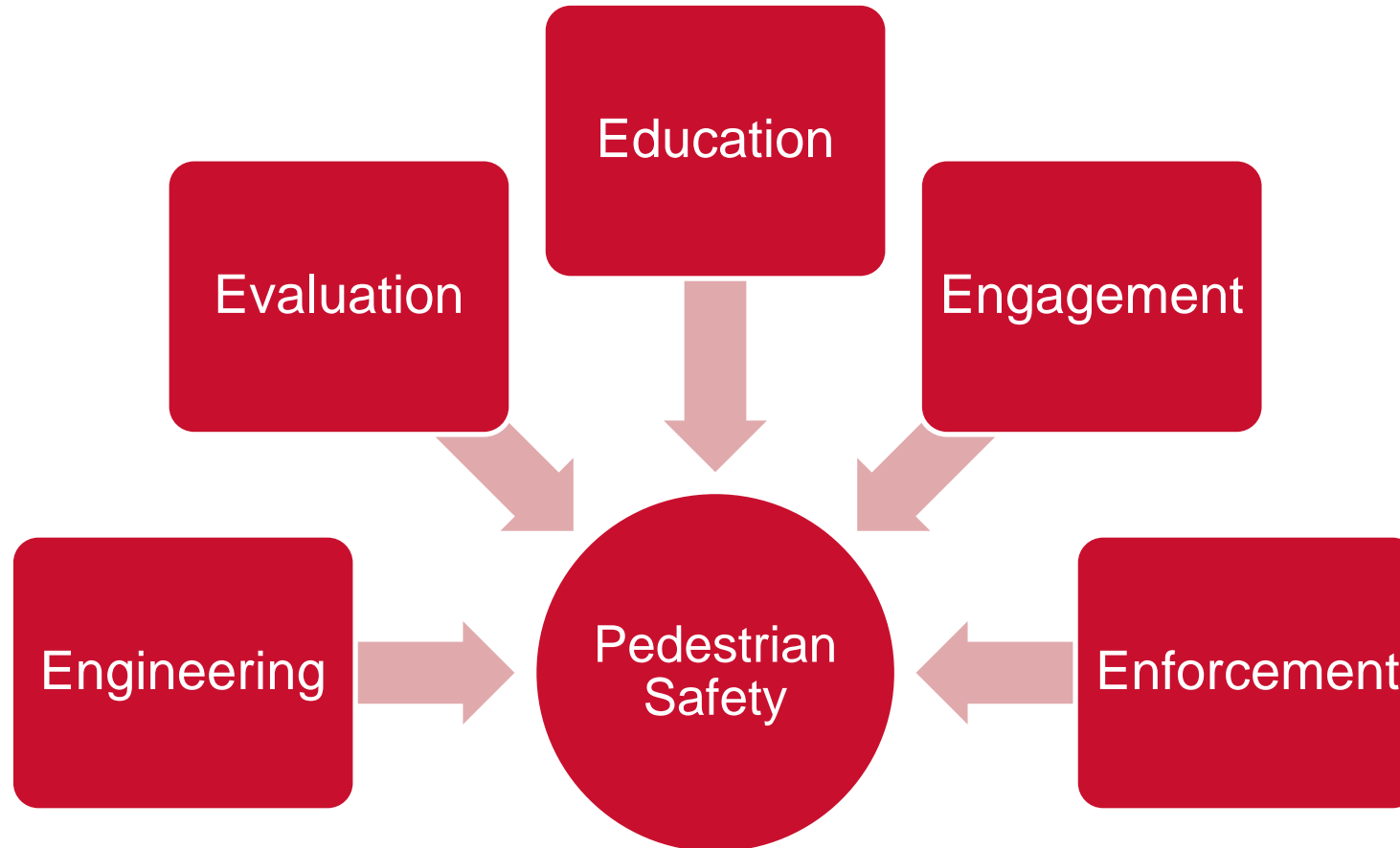
Crossing Safety Challenges

- Distracted walking
- Pedestrians ignoring warning devices
- Jaywalking
- Impatience – Running to catch a train or a bus
- Thinking they can outrun the train
- Herd mentality
- Not looking both ways when crossing LRT tracks
- Vehicles running red light at LRT crossings





5E's of Transportation Safety





Engineering and Evaluation



Whitehorn Station



Shawnessy



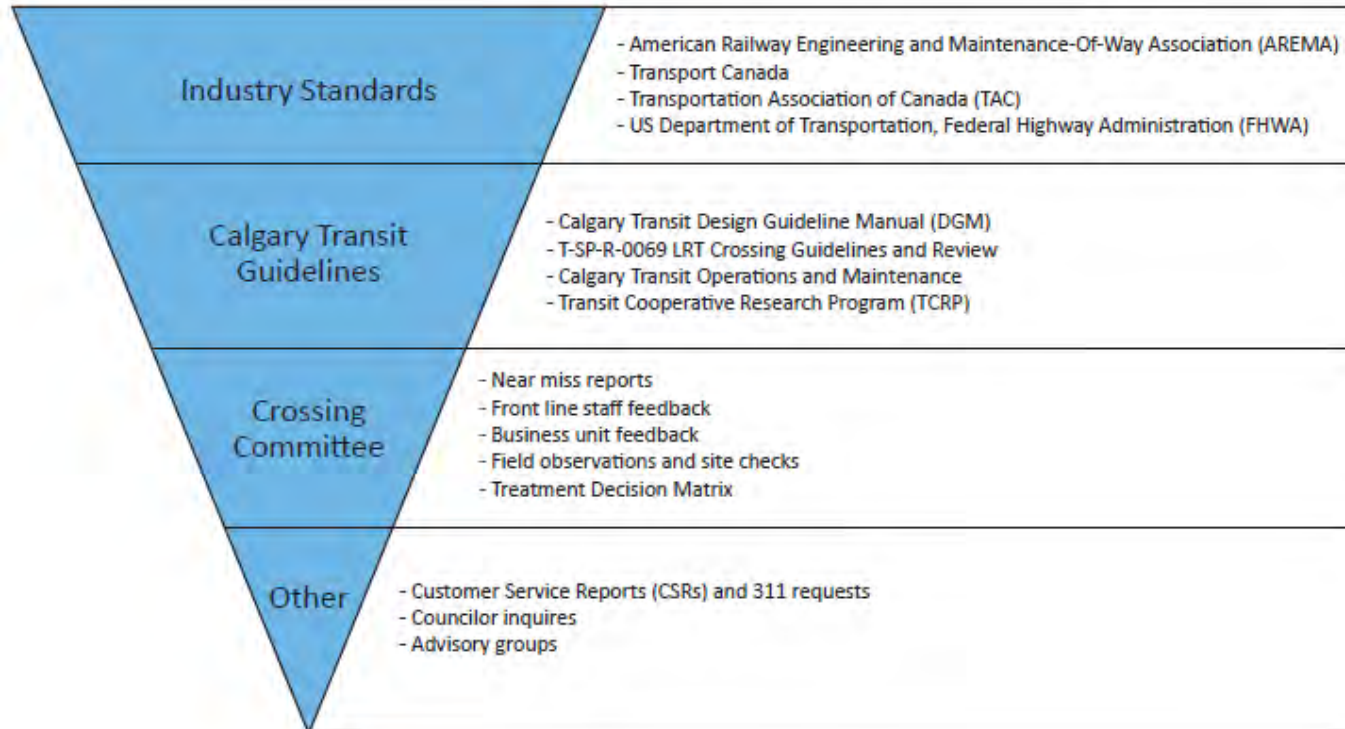
162 Ave SW



Chinook



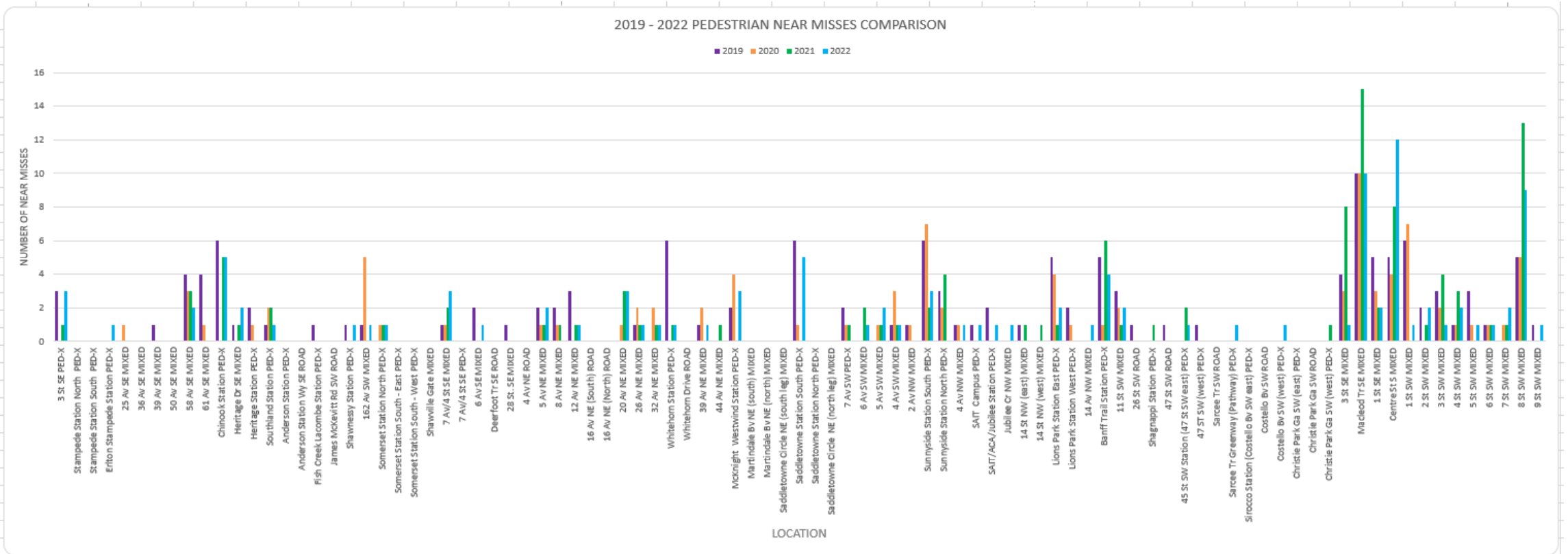
39 Ave NE





In-take Data Review

- Near Misses, Vehicles on the ROW and Collision data
- Pedestrian and Vehicle Count data
- Plainclothes Surveys Findings
- SRs and Maintenance Feedback
- PSE Enforcement Blitz Data
- CPS Data

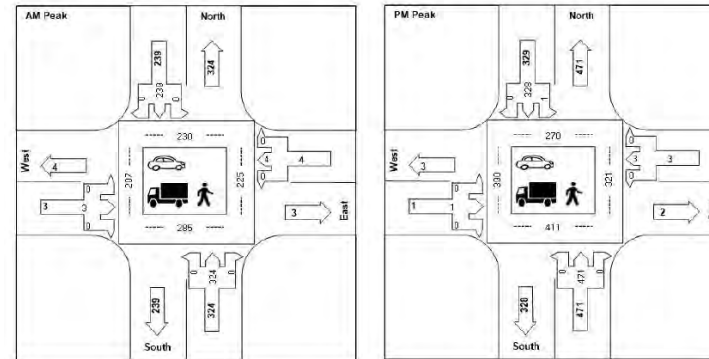




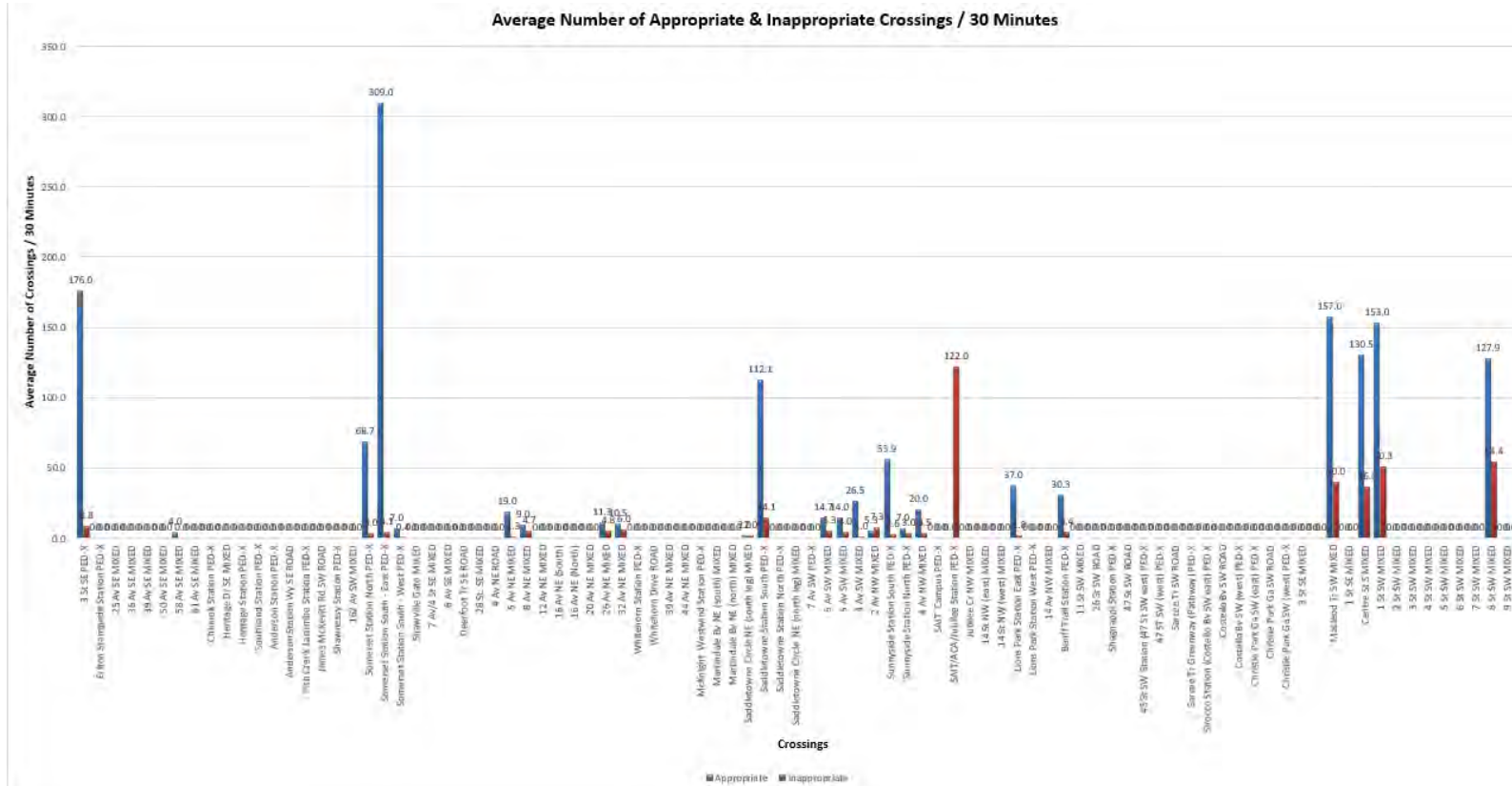
In-take Data Review

Intersection Id: 460
 Status: Valid
 Study Name: Peak Hour TMC Diagrams

Study Date: Tuesday, 19 July 2022
 Location: 6 ST SW & 7 AV SW
 Weather: Sunny, 29.0°C



Average Number of Appropriate & Inappropriate Crossings / 30 Minutes



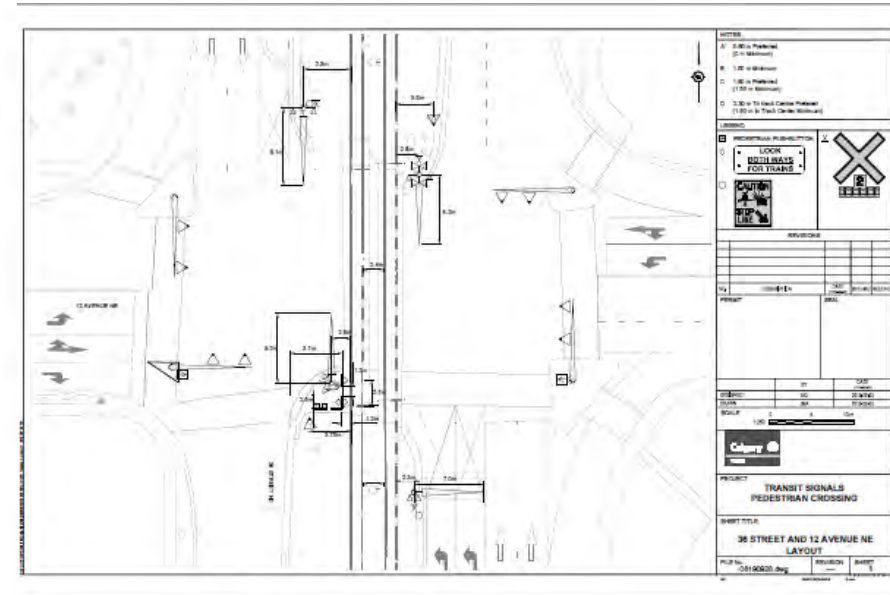


Crossing Inspection Reports

LRT Crossings – Field Inspection Worksheet

Page 1

Date of Inspection <u>Sept 8, 2019</u> Indicate if Joint Inspection <u>Crossing Committee</u>	
Location of Crossing <u>12 Avenue NE Crossing</u> Name of Crossing <u>12 Avenue NE Crossing</u>	
Basic Information about crossing	
Existing <input checked="" type="checkbox"/> New <input type="checkbox"/> R or W Classification at location of crossing, Type <u>0.2</u> Shared by Freight Railway? <u>No</u> Pedestrian only <input type="checkbox"/> Vehicle only <input type="checkbox"/> Both pedestrian and vehicle <input checked="" type="checkbox"/> Tangent track? <u>No</u>	
LRV Speed at Crossing <u>IB=80km/h OB= 60km/h</u> <small>(Mark items not assessed/generating raised safety calls or photos, and provide special speed warning crossing by direction, which may be different than specified) (Minimum height when used, include height (see notes) (Maximum height when used, include height (see notes))</small>	
Pedestrian Crossing	
<small>A crossing is the set of track location where pedestrians are provided to cross, e.g. a road crossing with a sidewalk on each side, two pedestrian overpasses should be complete</small>	
Crossing Angle <u>90</u> Number of Tracks <u>2</u> Distance between tracks <u>2.5m</u>	
Width of Crossing Surface <u>3.8m</u> Type of Crossing Surface <u>Concrete Paved</u> Condition of Crossing Surface <u>Good</u>	
Is crossing used for station platform access? <u>No</u> <small>(If so, give location of platform and general route to station) (Provide sufficient number, priority of access, crossing details, and other details of pedestrian use, usage by pedestrians will include details)</small>	
Description of crossing use <u>Access to commercial and residential area</u> <small>(Provide sufficient number, priority of access, crossing details, and other details of pedestrian use, usage by pedestrians will include details)</small>	
Passive Pedestrian Protection – indicate all that apply, add description and remarks as indicated	
Signage	
Number and location of signs for pedestrians <u>See sketch</u> <small>(Include signs for reference, show location in sketch, include details as required)</small>	
Types of signs <u>Black lettering on yellow metallic background</u> <small>(Include sign form or sign number, e.g. 100, 100-1, 100-2, 100-3, 100-4, 100-5, 100-6, 100-7, 100-8, 100-9, 100-10, 100-11, 100-12, 100-13, 100-14, 100-15, 100-16, 100-17, 100-18, 100-19, 100-20, 100-21, 100-22, 100-23, 100-24, 100-25, 100-26, 100-27, 100-28, 100-29, 100-30, 100-31, 100-32, 100-33, 100-34, 100-35, 100-36, 100-37, 100-38, 100-39, 100-40, 100-41, 100-42, 100-43, 100-44, 100-45, 100-46, 100-47, 100-48, 100-49, 100-50, 100-51, 100-52, 100-53, 100-54, 100-55, 100-56, 100-57, 100-58, 100-59, 100-60, 100-61, 100-62, 100-63, 100-64, 100-65, 100-66, 100-67, 100-68, 100-69, 100-70, 100-71, 100-72, 100-73, 100-74, 100-75, 100-76, 100-77, 100-78, 100-79, 100-80, 100-81, 100-82, 100-83, 100-84, 100-85, 100-86, 100-87, 100-88, 100-89, 100-90, 100-91, 100-92, 100-93, 100-94, 100-95, 100-96, 100-97, 100-98, 100-99, 100-100)</small>	
Wording of signs <u>LOOK BOTH WAYS FOR TRAINS</u> <small>(Include wording by sign number)</small>	
Condition and Visibility of signs <u>Height: 0.5m Stop Line: 1.37m</u> <small>(Include height of sign above eye line and additional conditions for sign (e.g. visibility of sign by sign number) (e.g. height, lighting, reflectivity, etc.)</small>	
<u>Bedstead signs deteriorated</u>	
<u>NO</u> Pavement Markings and Tactile Warning	
Describe Markings/Tactile Warning <small>(Include details for reference, show location in sketch, include details as required)</small>	
Condition of Markings/Tactile Warning <small>(Include by tactile condition of each element, e.g. worn, in large cells, etc.)</small>	



Pedestrian Crossing – Summary of Deficiencies

List crossing deficiencies

(List all crossing deficiencies, may be required to include a photo for each deficiency)
(Include nature of deficiency, i.e. a surface deficiency or use of inappropriate sign to solve)

- No major civil changes to this intersection in the last years.
- No direct illumination
- No warning visible devices when pedestrian is standing in refuge area facing east (photo 5)
- 2 push buttons could be confusing (photo 6)
- Markings on southbound 36 street, not aligned with pedestrian refuge area
- Tripping hazard between plank and asphalt – uneven surface (photo 1)
- Narrow ramp on southeast refuge island (photo 2)
- Bedstead signs deteriorated (photo 3)



Crossings Prioritization

- Crossing locations are picked considering the following factors:
 - High Near Misses, Collision and Vehicles on the ROW data
 - Increased non-compliance of safety measures
 - High pedestrian volume
 - Site conditions – proximity to school, mall etc.
 - Pedestrians jay-walking in the area
 - Long Crossing wait times
 - Enforcement blitz not being effective
 - Feedback/Complaints from Operations, 311, internal inspections
 - Increased Gate arm hits
 - Daily logs from Rail Control and Maintenance Reports
 - Non-standard solution in place



Priorities for Crossing Safety Enhancement Program

Program Description	Priority	Locations Completed
Automatic Gate arms installation	1	Chinook, Whitehorn, Lions Park and 162 Ave SW Crossing
Splitting Crossing Operation (IB/OB Track)	1	25 Ave SE, Whitehorn
2nd Train Warning Light implementation	2	25 Ave SE, 39 Ave SE
Lighting Upgrades	3	162 Ave S
Addressing Vehicles on the ROW issues	2	7 Ave/Macleod Trail Pilot
Accessibility Concerns	1	All Gate Arms Project locations, 26 Ave NE
Cantilevered Wig-wags	2	7 Ave/4 Street, Whitehorn, 25 Ave SE, 39 Ave SE
Small Scale Safety Enhancements	2	Systemwide
Advance Pre-emption Warning Time Upgrades	1	28 St SE, 4 Ave NE, 5 Ave NE, 8 Ave NE, 12 Ave NE, 20 Ave NE, 26 Ave NE, 32 Ave NE, Whitehorn Drive, 39 Ave NE, 44 Ave NE

Automatic Pedestrian Crossing Gate Arms



Lions Park

Automatic Pedestrian Crossing Gate Arms



Lions Park



Lions Park



Lions Park



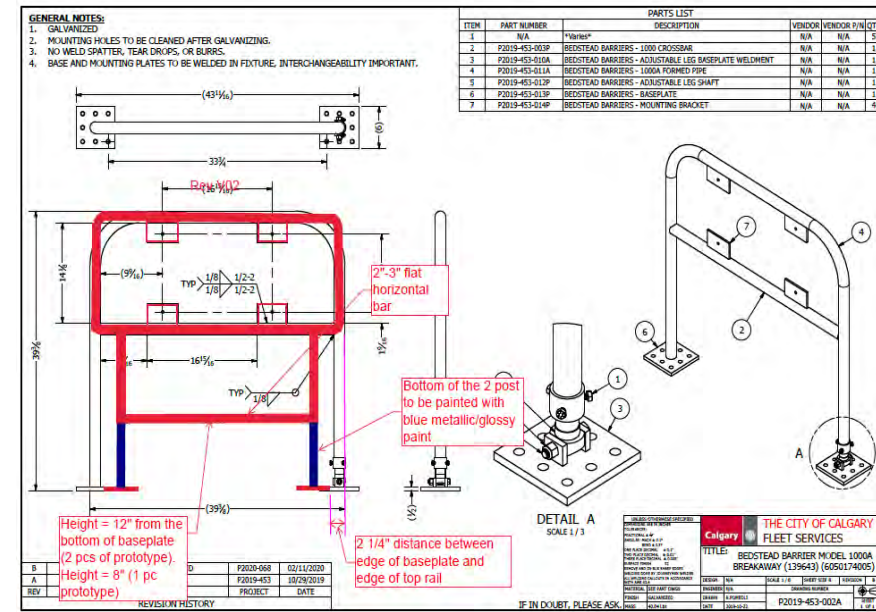
Whitehorn



Accessibility improvements – 26 Ave NE



Accessibility improvements – Continuous Handrail and Cane Detectability Improvements Pilot Project



Cantilevered Wig-wags Installation – 7 Ave/4 St SE



Cantilevered Wig-wags Installation – 7 Ave/4 St SE





Splitting Crossing Operation and 2nd Train Warning Light - 25 Ave SE Crossing



Addressing Vehicles on the ROW





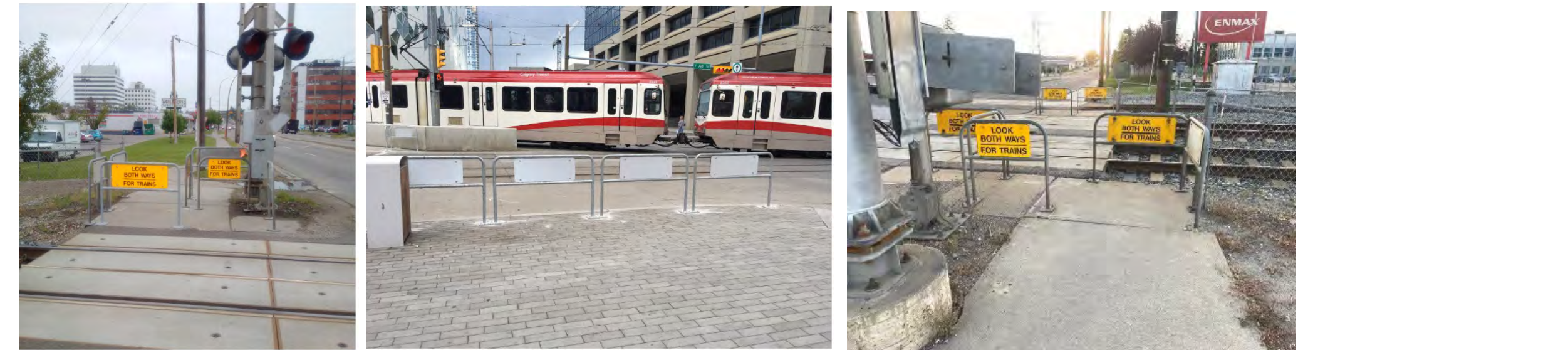
Channelization, Standard Signage and Bedsteads Reconfiguration

To create overlap and to eliminate jaywalking – 9 St 4Ave/5 Ave and 6 Ave SW.



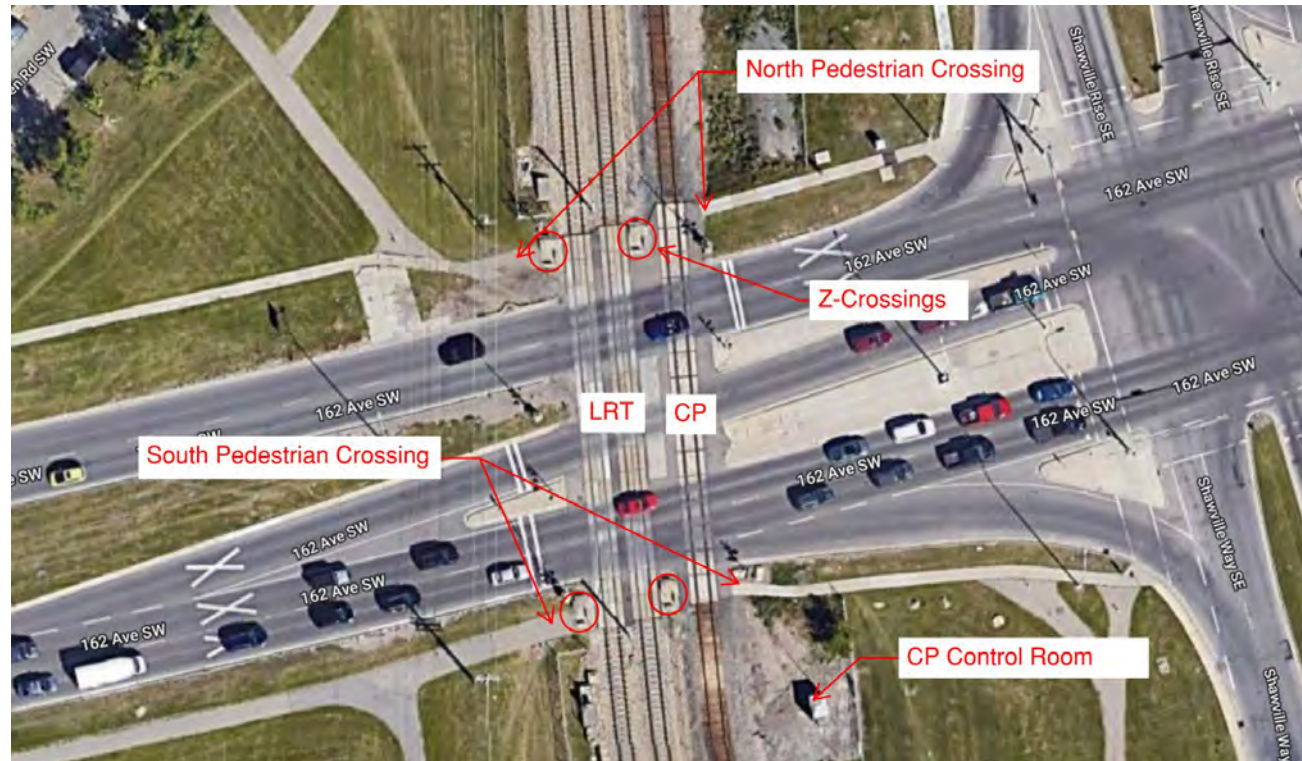


Small Scale Safety Enhancements Systemwide



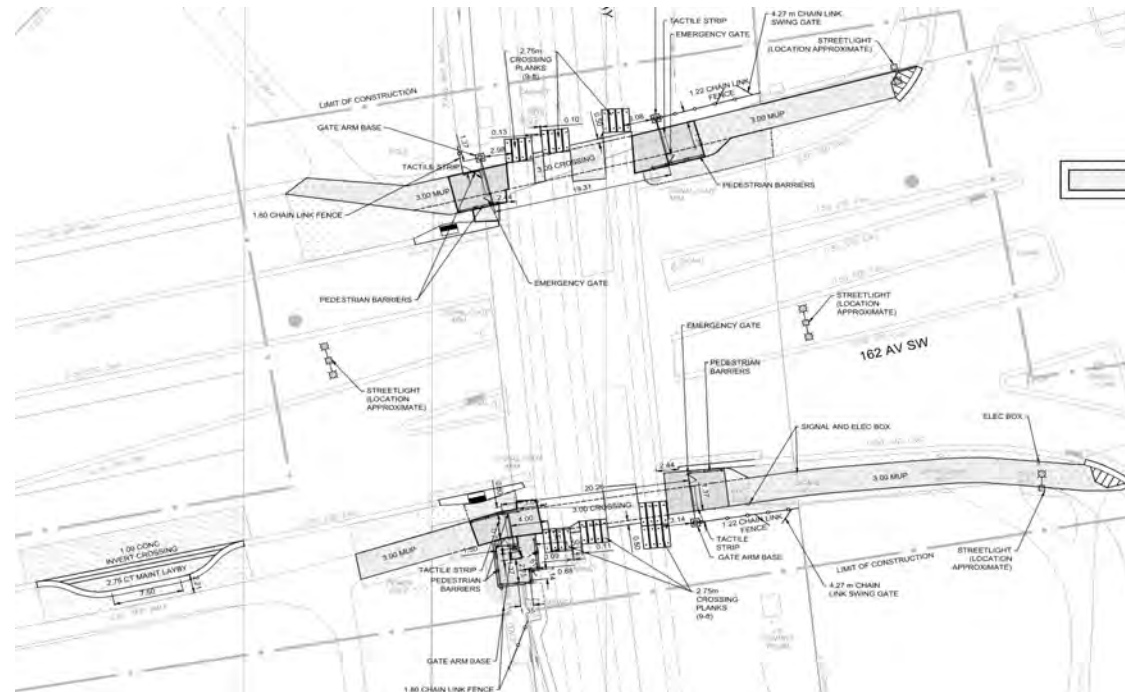
162 Ave Crossing Automatic Pedestrian Gates

- Pre-existing conditions:
 - LRT and CP crossings with 2 Z-Crossings
 - Low lighting conditions including CPTED concerns
 - Open public access to tracks
 - Inconsistent public realm features (i.e. sidewalks/MUP's)
 - No accessibility features



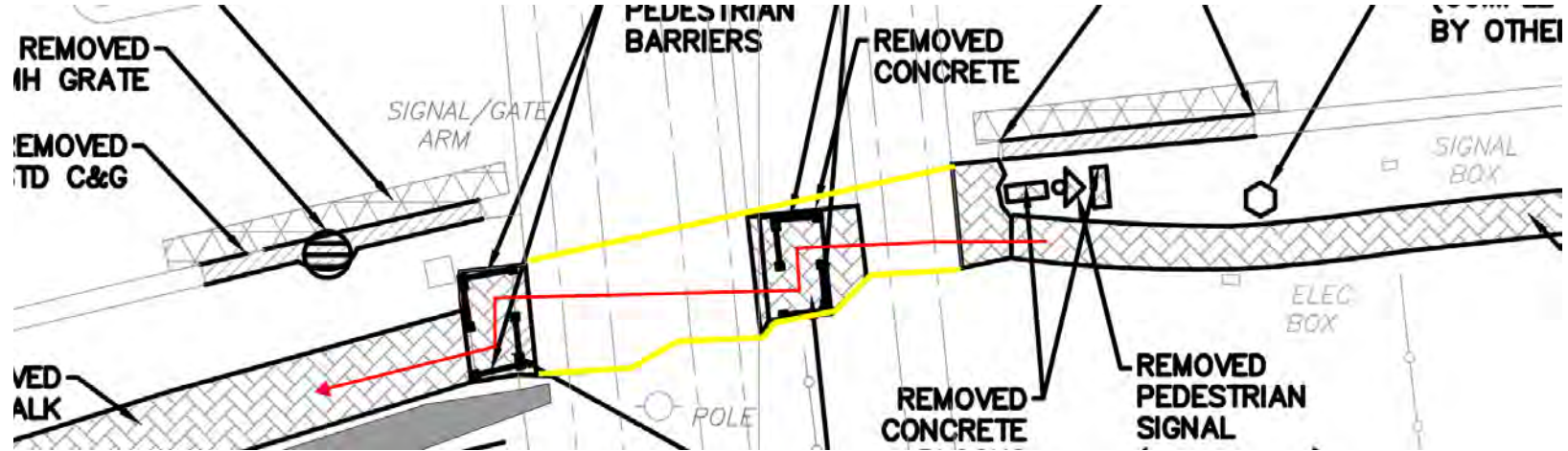
162 Ave Crossing Automatic Pedestrian Gates

- Crossing Upgrades
 - Implementation of automatic mechanical pedestrian gates at all 4 corners including emergency gates
 - 3m MUP approaches at all 4 corners including wider pedestrian refuge spaces
 - Consistent 3m crossing on both sides
 - Drainage and lighting improvements at crossing
 - Extension of fencing at all 4 corners including gates for CP maintenance vehicles

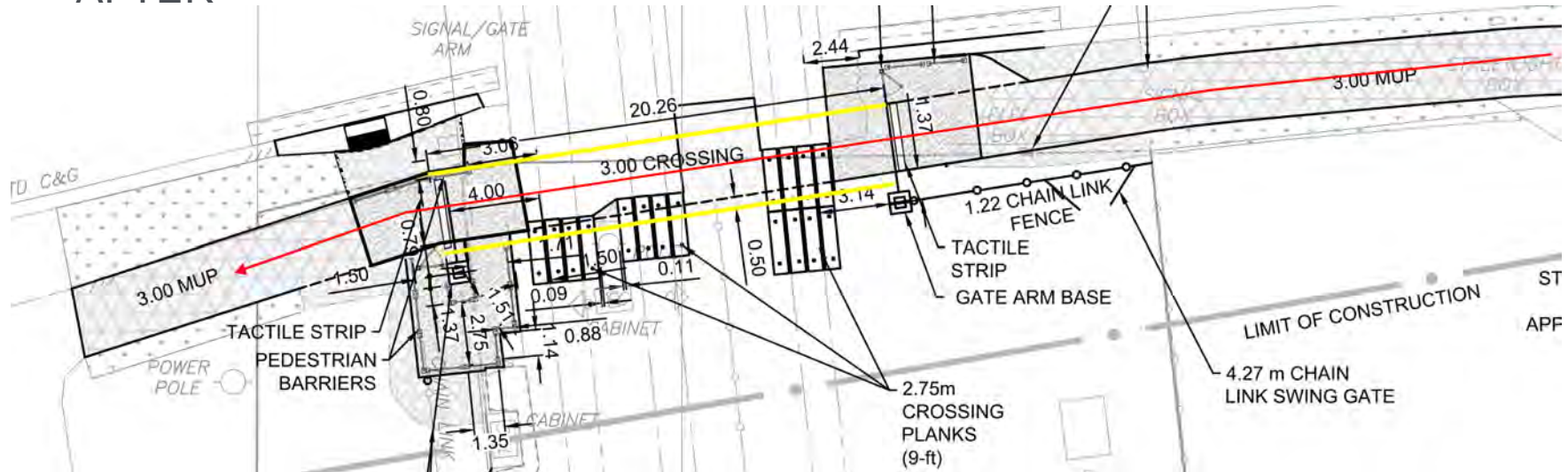


162 Avenue – South Crossing

BEFORE

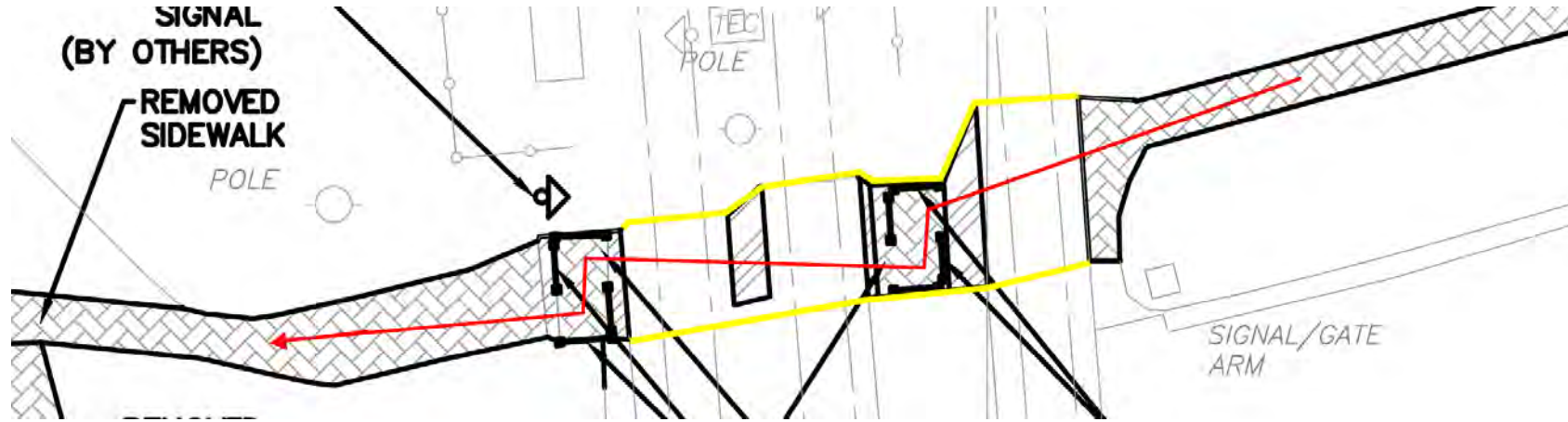


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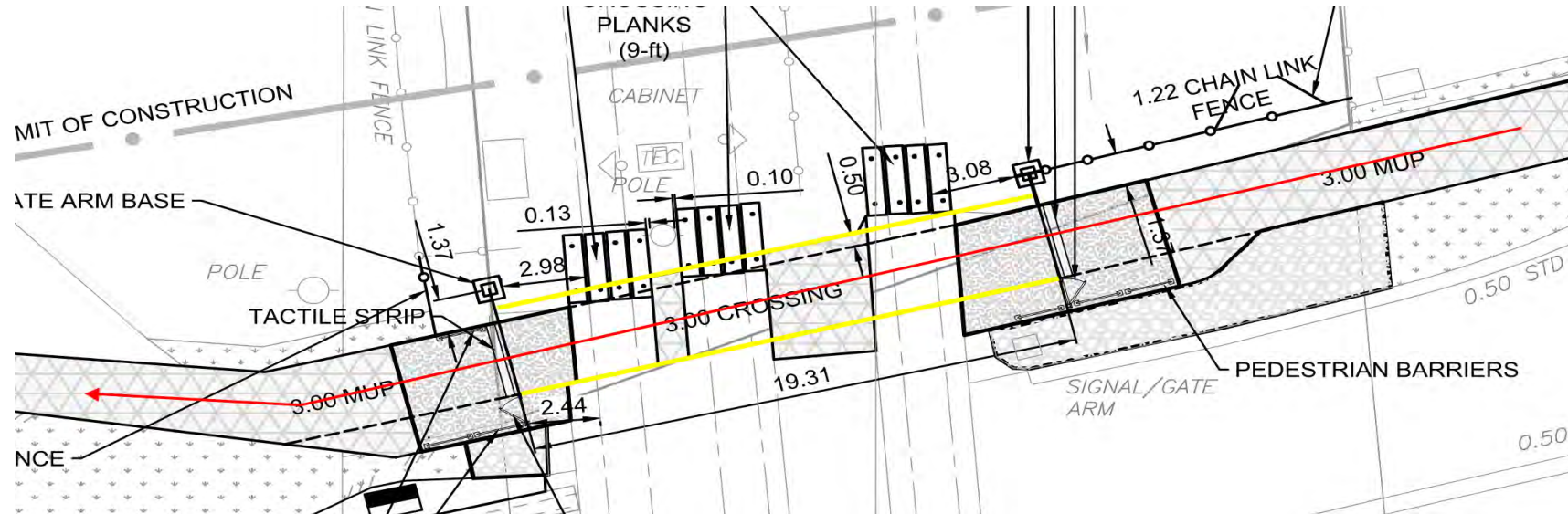


162 Avenue – North Crossing

BEFORE



AFTER



162 Avenue – South Crossing



BEFORE



AFTER



162 Avenue – North Crossing



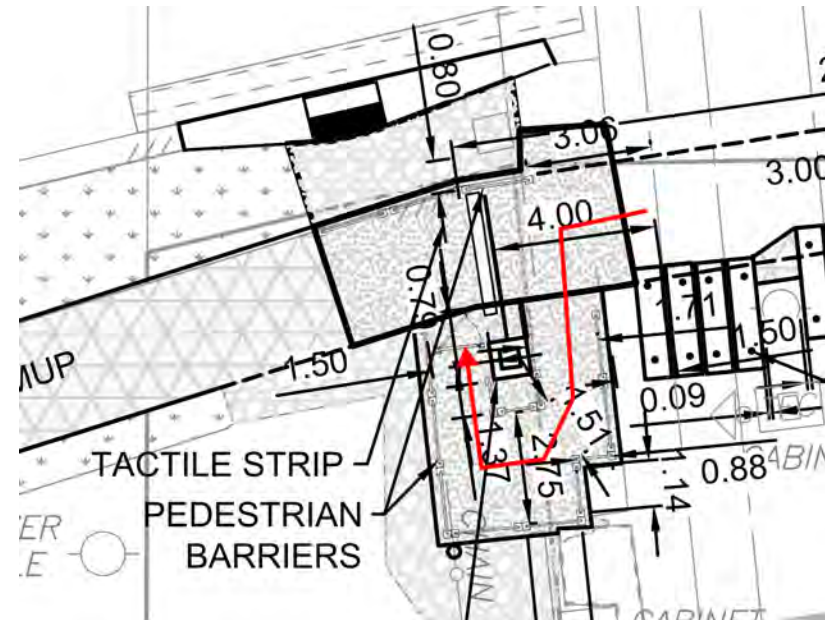
BEFORE



AFTER

162 Ave Crossing Automatic Pedestrian Gates

- Retrofit Challenges
 - Emergency gate at SW corner due to conflict with vehicular gate arm base
 - Maintenance Access for CP on both sides of 162 Avenue
 - Construction sequencing to ensure minimal delays and impacts to pedestrians, vehicular traffic, and LRT/CP operations



162 Ave Crossing Automatic Pedestrian Gates

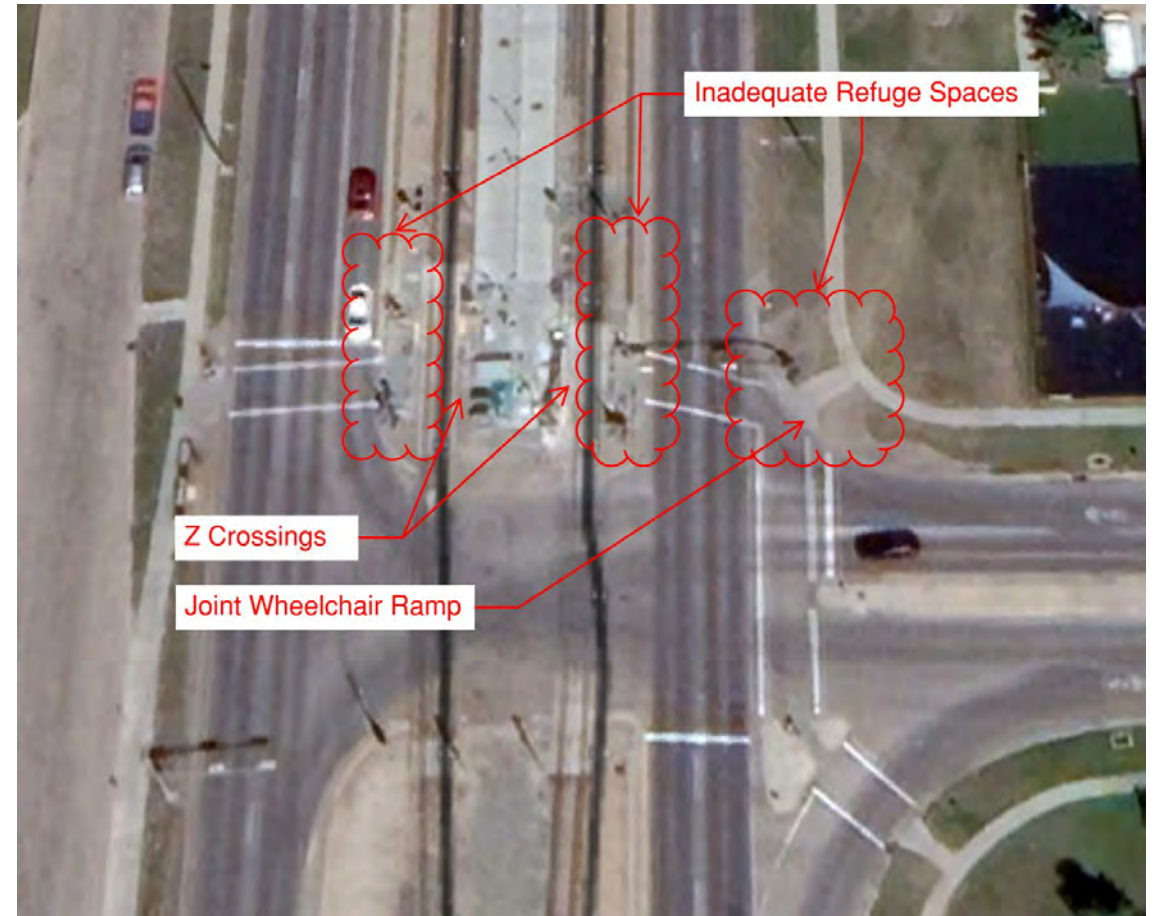
- Team Collaboration
 - Coordination on crossing distances (19.31m north / 20.26m south), walking times and pedestrian warning device operation
 - Gate arm placement to accommodate clear zone requirements to adjacent road (civil), conduit layout (signals team/CP), crossing distances (signals), pedestrian connectivity and accessibility, Transport Canada guidelines

- Opportunities
 - Calgary Transit Maintenance Layby
 - Stormwater Improvements at the crossing
 - Retrofitting of tactile panels at all crossings and adjacent intersection
 - Advance Traffic Pre-Signal



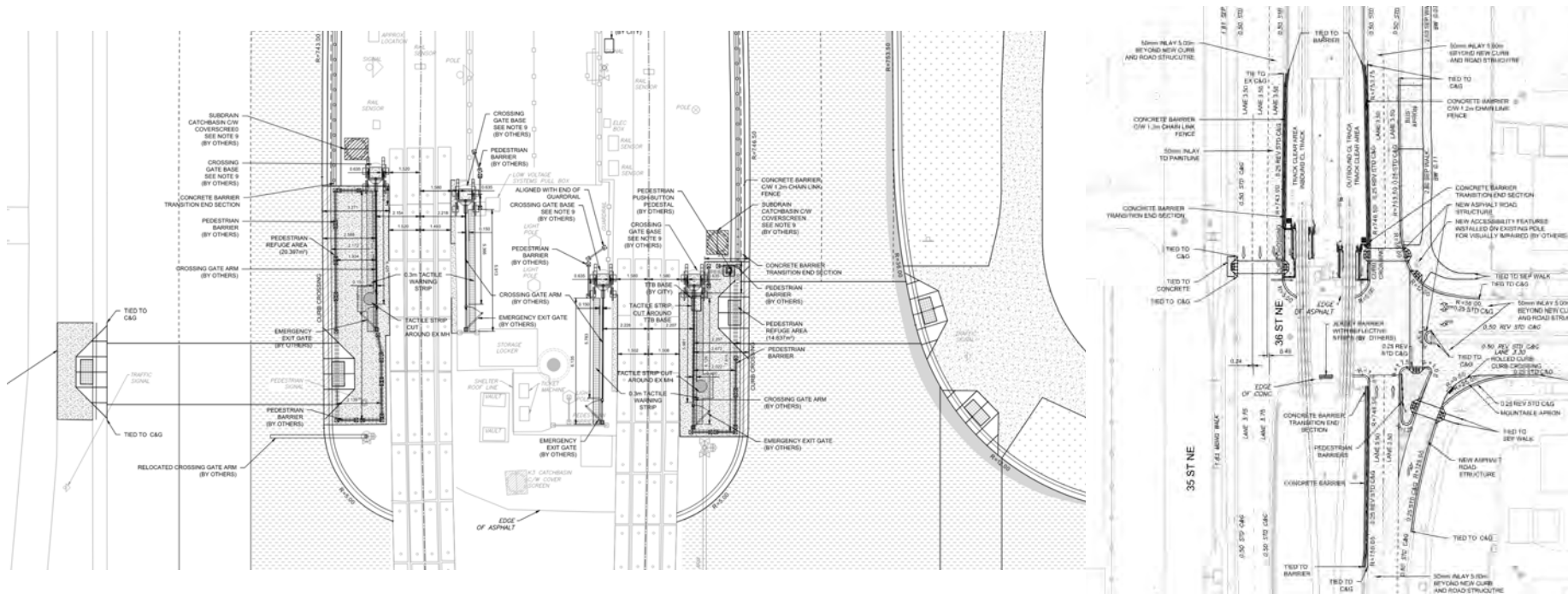
Whitehorn Station Pedestrian Gates + Station and Roadway Improvements

- Pre-existing conditions:
 - LRT Z-Crossings on south end of Whitehorn Station (east/west access)
 - Inadequate pedestrian refuge spaces
 - Joint wheelchair ramps
 - Sightline concerns / driver stress
 - No accessibility features



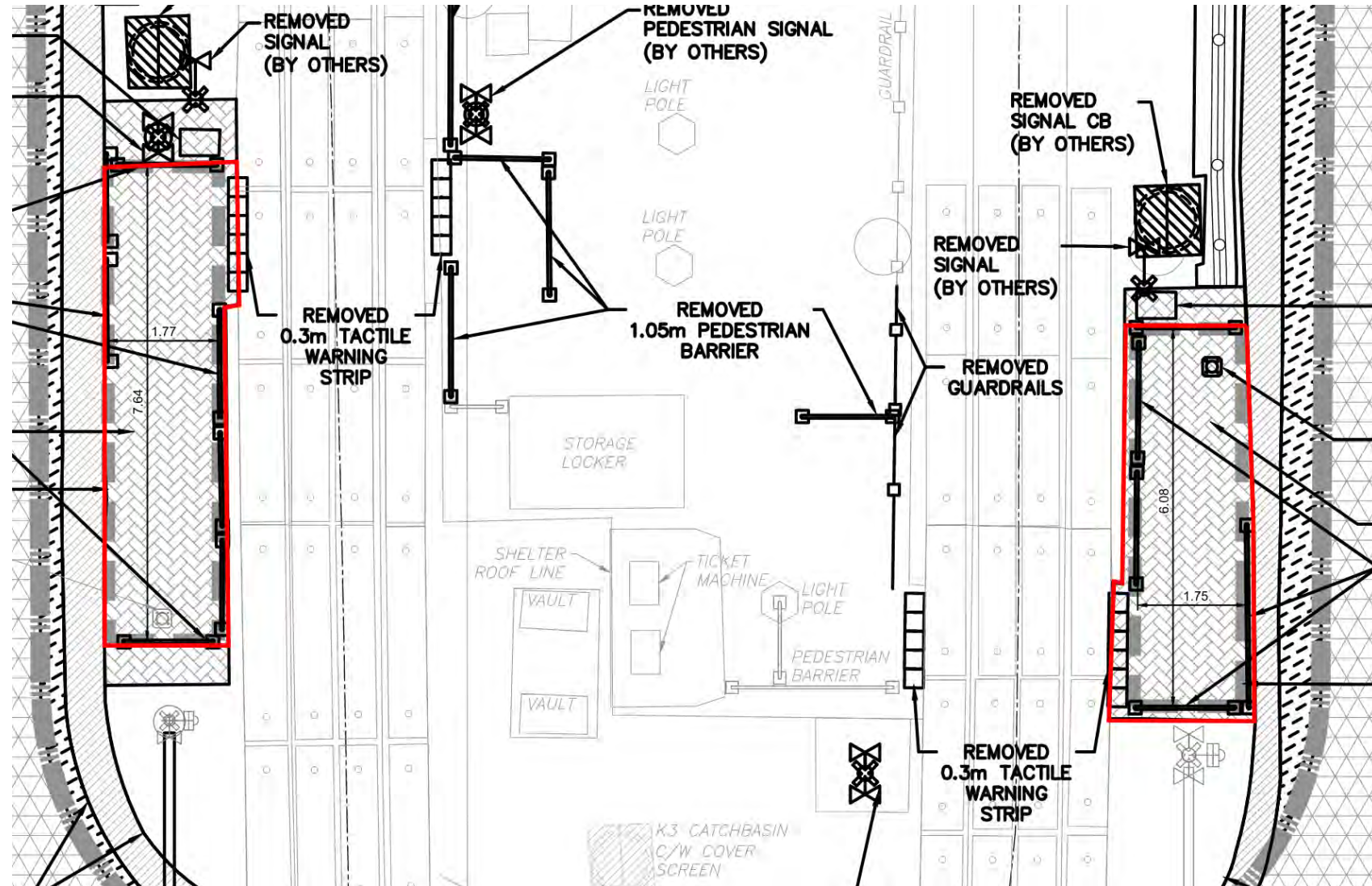
Whitehorn Station Pedestrian Gates + Station and Roadway Improvements

- Crossing Upgrades
 - Implementation of automatic mechanical pedestrian gates at south end of Whitehorn Station
 - Expansion of pedestrian refuge spaces within station and roadway
 - Realigned crossings at 36 Street NE for the visually impaired
 - Implementation of dual wheelchair ramps
 - Implementation of a NB smart-right turn (Whitehorn Dr / 36 St NE)



Whitehorn Station – Refuge Spaces

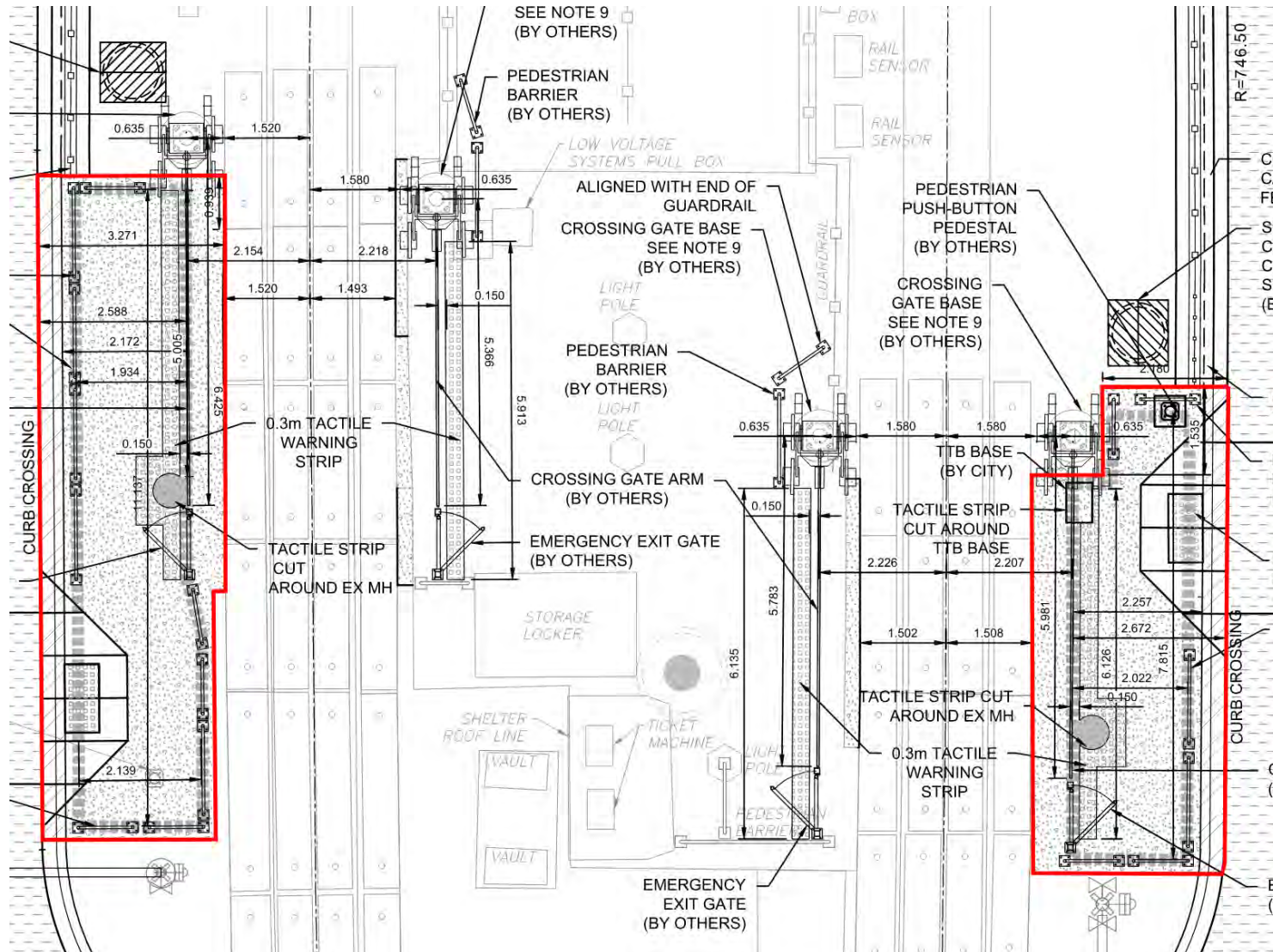
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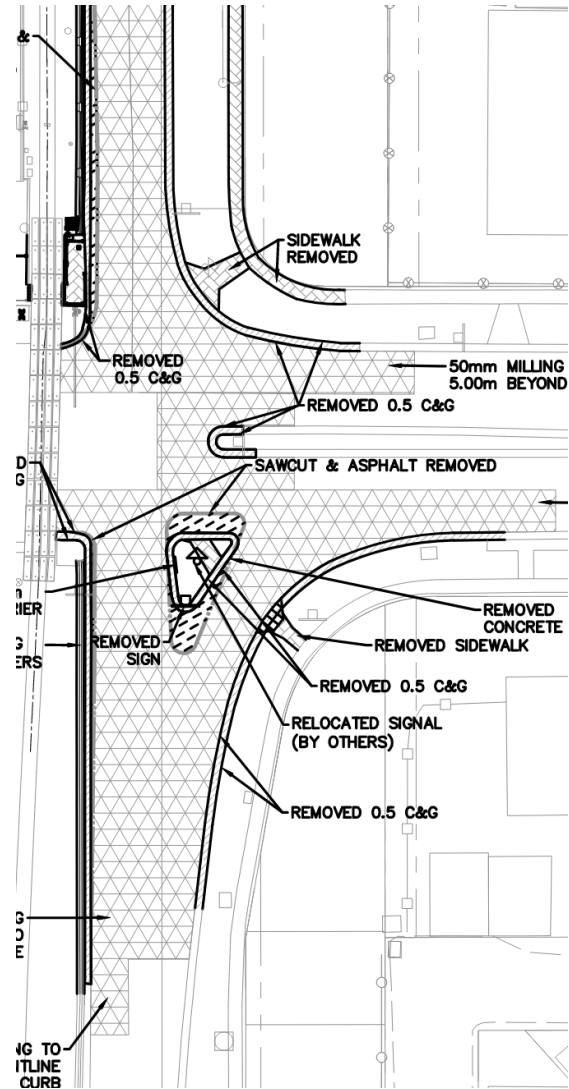
Whitehorn Station – Refuge Spaces

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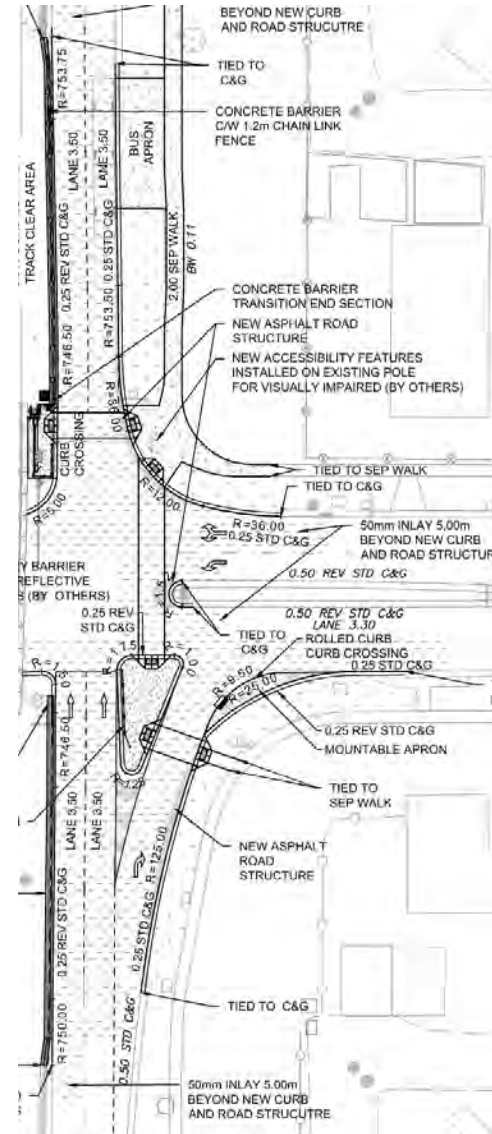


Whitehorn Station – Intersection Improvements

BEFORE



AFTER



Whitehorn Station – Refuge Spaces

BEFORE



Whitehorn Station – Refuge Spaces

AFTER





Whitehorn Station – Intersection Improvements

BEFORE



AFTER

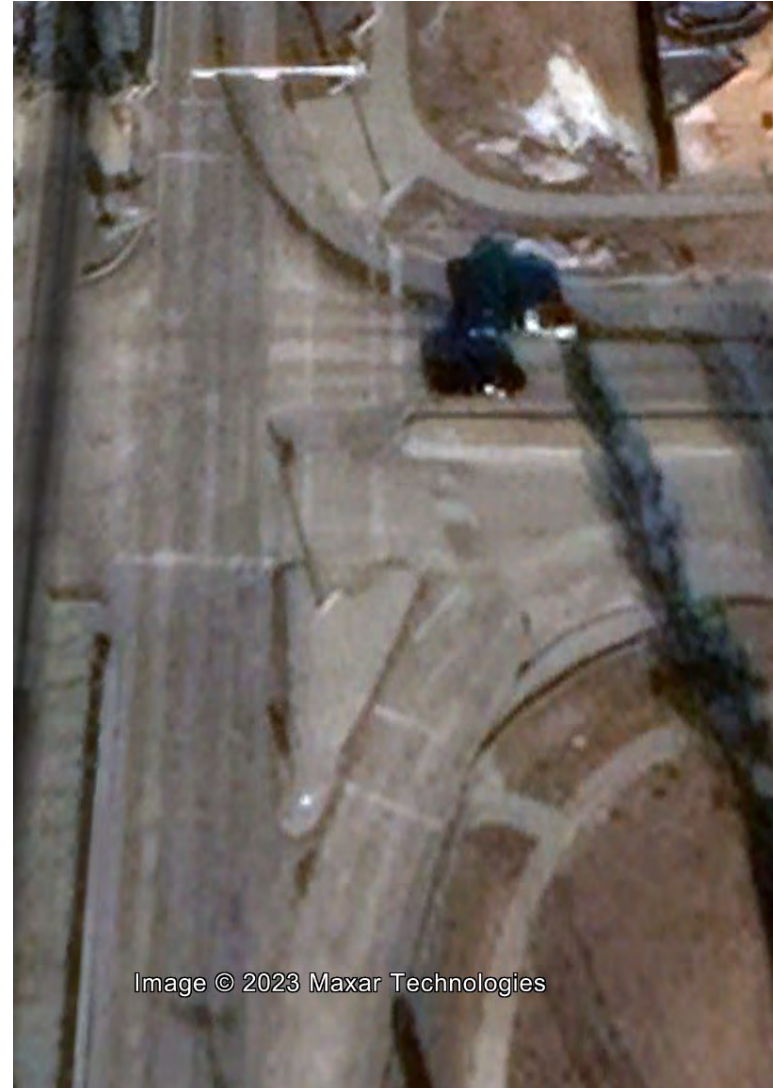


Whitehorn Station – Intersection Improvements

BEFORE



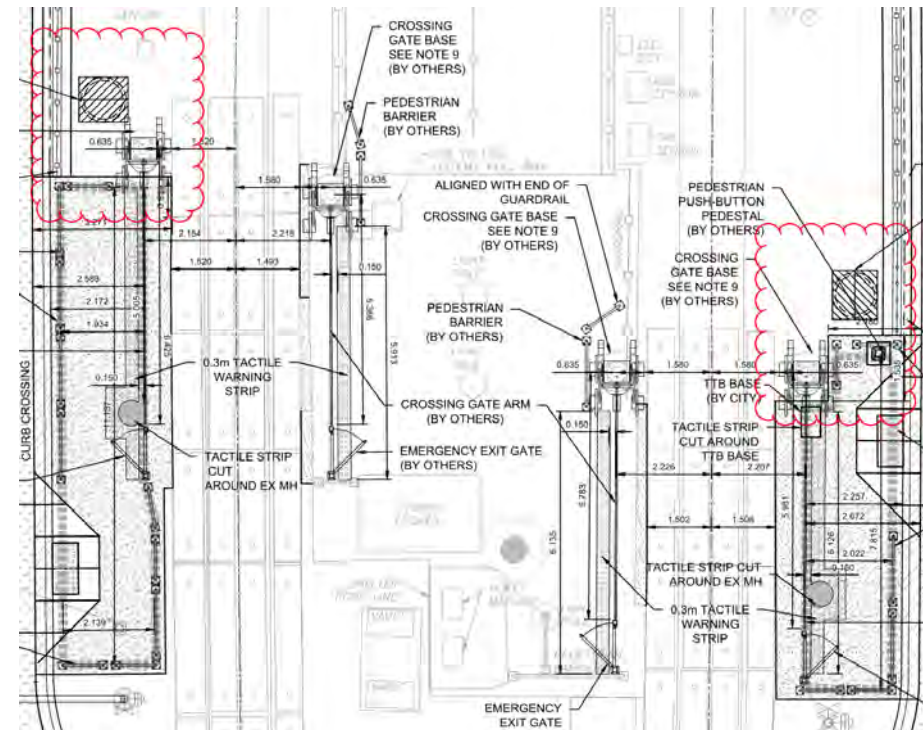
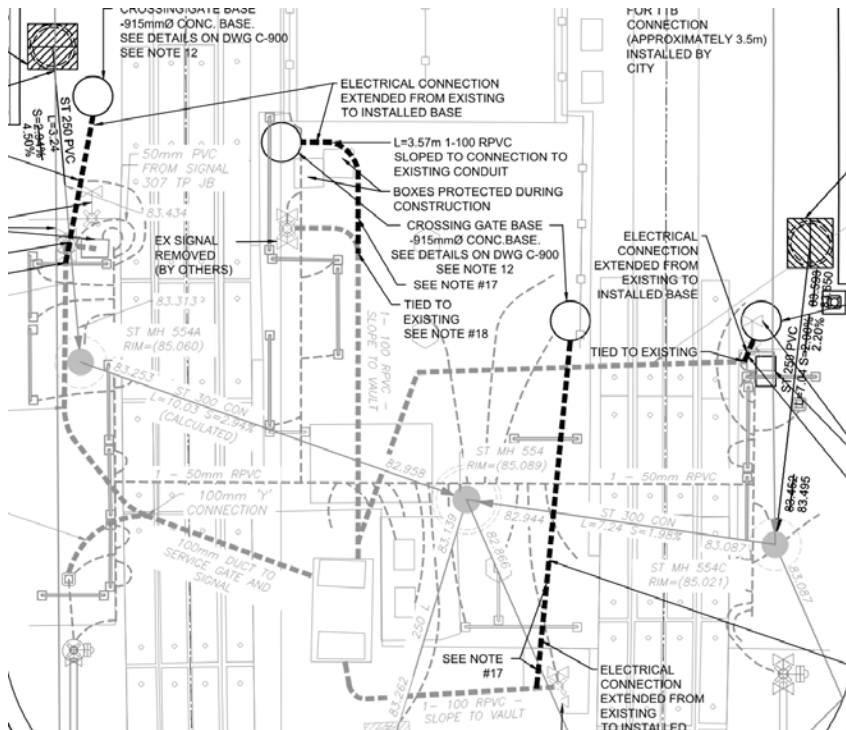
AFTER





Whitehorn Station Pedestrian Gates + Station and Roadway Improvements

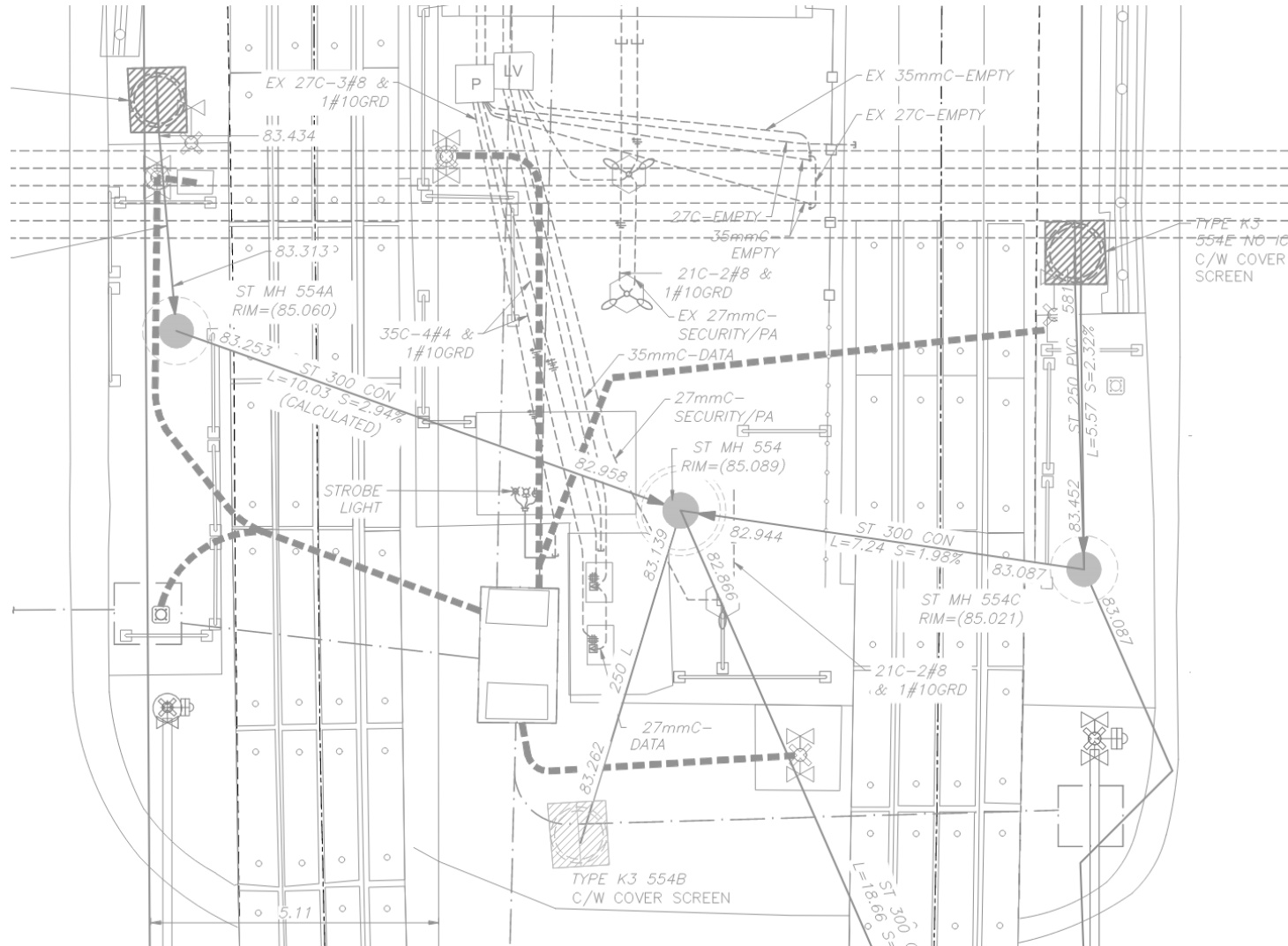
- Retrofit Challenges
 - Stormwater catchbasin proximity to refuge spaces
 - Gate arm base retrofits/splicing in accordance with existing infrastructure/utilities
 - Construction sequencing to ensure minimal delays to pedestrians, vehicle traffic, and LRT operations





Whitehorn Station Pedestrian Gates + Station and Roadway Improvements

- Retrofit Challenges - Existing Utilities



Whitehorn Station Pedestrian Gates + Station and Roadway Improvements

- Team Collaboration
 - Coordination on placement of upgraded traffic signal
 - Gate arm placement to accommodate clear zone requirements to adjacent road (civil), conduit layout connections/splicing (signals team), pedestrian connectivity and accessibility (civil)
- Opportunities
 - Calgary Transit Bus Stop adjacent to south crossing
 - Retrofitting of tactile panels at all crossings and adjacent intersection
 - Smart right turn at 36 Street / Whitehorn Drive
 - Upgraded traffic signal base with accessibility features (chirps/cuckoos)



Automatic Gate Arms Installation Whitehorn PedX



- ❖ Automatic Pedestrian crossing gate arms for both east and west pedX
- ❖ Upgraded crossing controllers to be electronic
- ❖ New wayside cabinet cases – Power and Logic Cases
- ❖ Split crossing operation for IB and OB tracks
- ❖ TTSC upgrade for more visibility of the crossing

ROI

- Fewer near misses
- Operational benefits
- Less SRs
- Less damage to LRVs
- Reduction in # of post-accident cleanup activities/reports

Automatic Gate Arms Installation Whitehorn PedX

BEFORE



AFTER



Automatic Gate Arms Installation Whitehorn PedX

BEFORE



AFTER



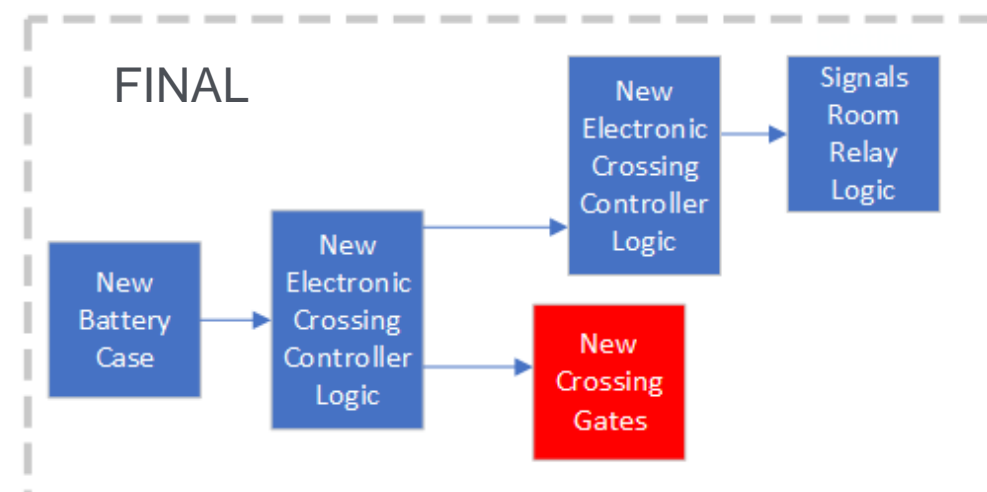
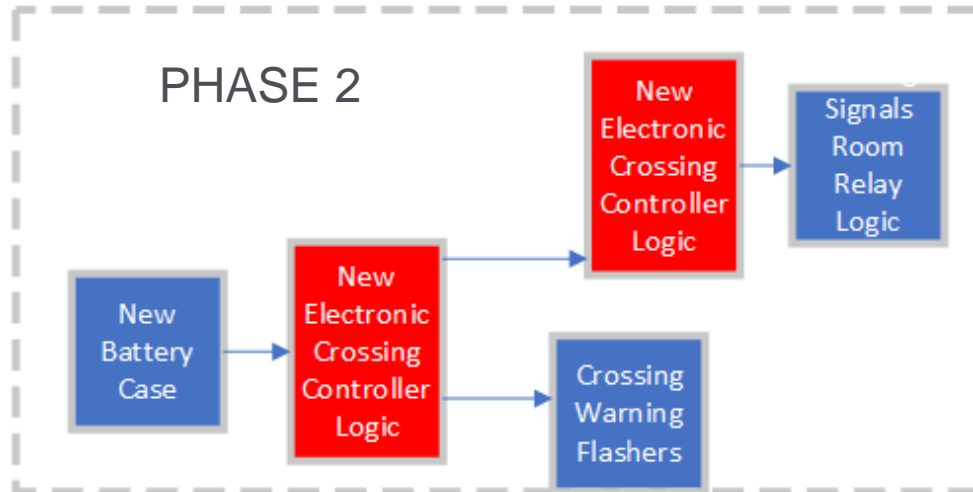
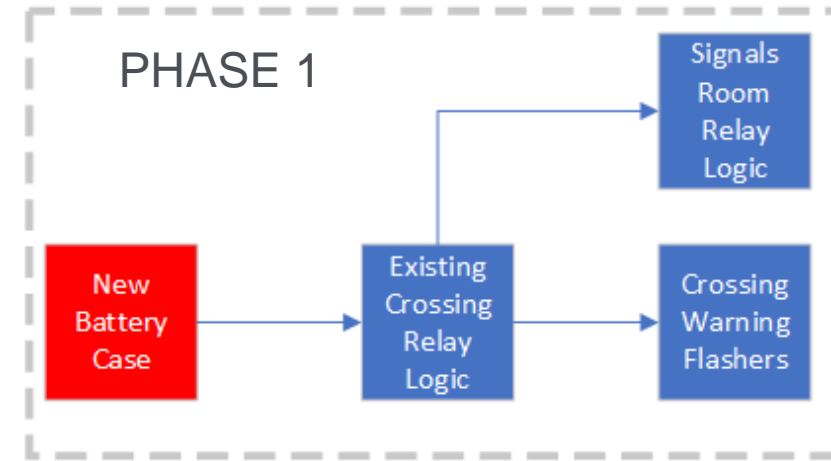
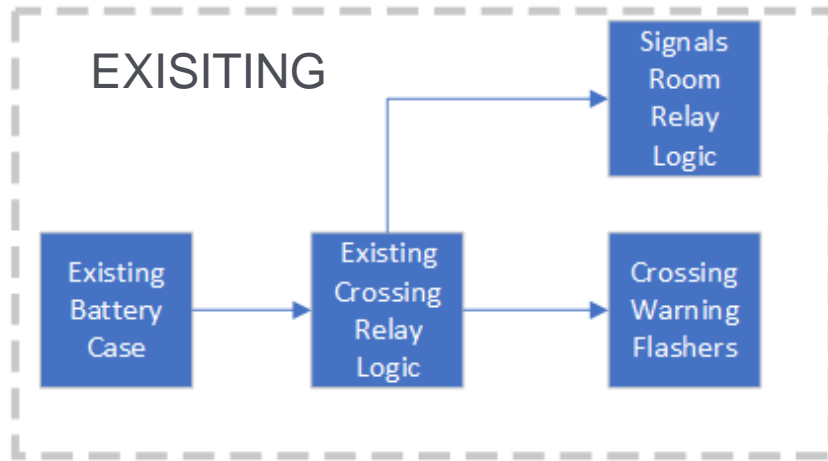


Automatic Gate Arms Installation Whitehorn PedX

- ❖ Operational challenges
 - ❖ The challenge is to replace existing crossing control equipment with new equipment while keeping the existing system functional
 - ❖ Phase 1 - installation of the Battery cabinet
 - ❖ Phase 2 – installation of the new control logic case to interface with the existing configuration and operation
 - ❖ Final - Interface with the final configuration
 - ❖ The phasing strategy, although took more work, minimized the impact to operational service and thus the impact on the transit/public users.



Automatic Gate Arms Installation Whitehorn PedX (Phasing)



Automatic Gate Arms Installation Whitehorn PedX

- ❖ Construction design challenges
 - ❖ Phasing the construction to minimize the impact to the existing system and the public
 - ❖ Reusing existing conduits while also needing to move existing warning masts to new locations.
 - ❖ The need to ensure continuity of service during the construction process by using temporary cabling solutions.
 - ❖ Difficulty in coordinating the cutting and extending of existing ducts while also installing new cabling.
 - ❖ One of the challenges in phasing the construction was the limited time available for commissioning the system. This required careful planning and coordination to ensure that all necessary work could be completed within the available timeframe.



Automatic Gate Arms Installation Whitehorn PedX

❖ Collaboration

- ❖ Collaborating with other firms allows for a comprehensive, multi-modal approach to transportation projects
- ❖ By working together, we can consider the needs and impacts of all active modes of transportation, including cars, pedestrians, buses, and trains
- ❖ This holistic approach can result in improved mobility, safety and accessibility for all users
- ❖ This multi-disciplinary approach ensures that safety is considered from all angles, from the design and planning stages through to the construction and operation of the crossing warning system.

162 Ave SW Crossing Automatic Pedestrian Gates

- Add automatic pedestrian crossing gate arms for both north and south pedestrian crossings
 - Increase crossing surface due to 3-meter-wide approach path of MUP
 - Bedsteads, swing gates and signage to provide emergency exit path



Initial conditions at 162 Avenue SW

162 Ave SW Crossing Automatic Pedestrian Gates

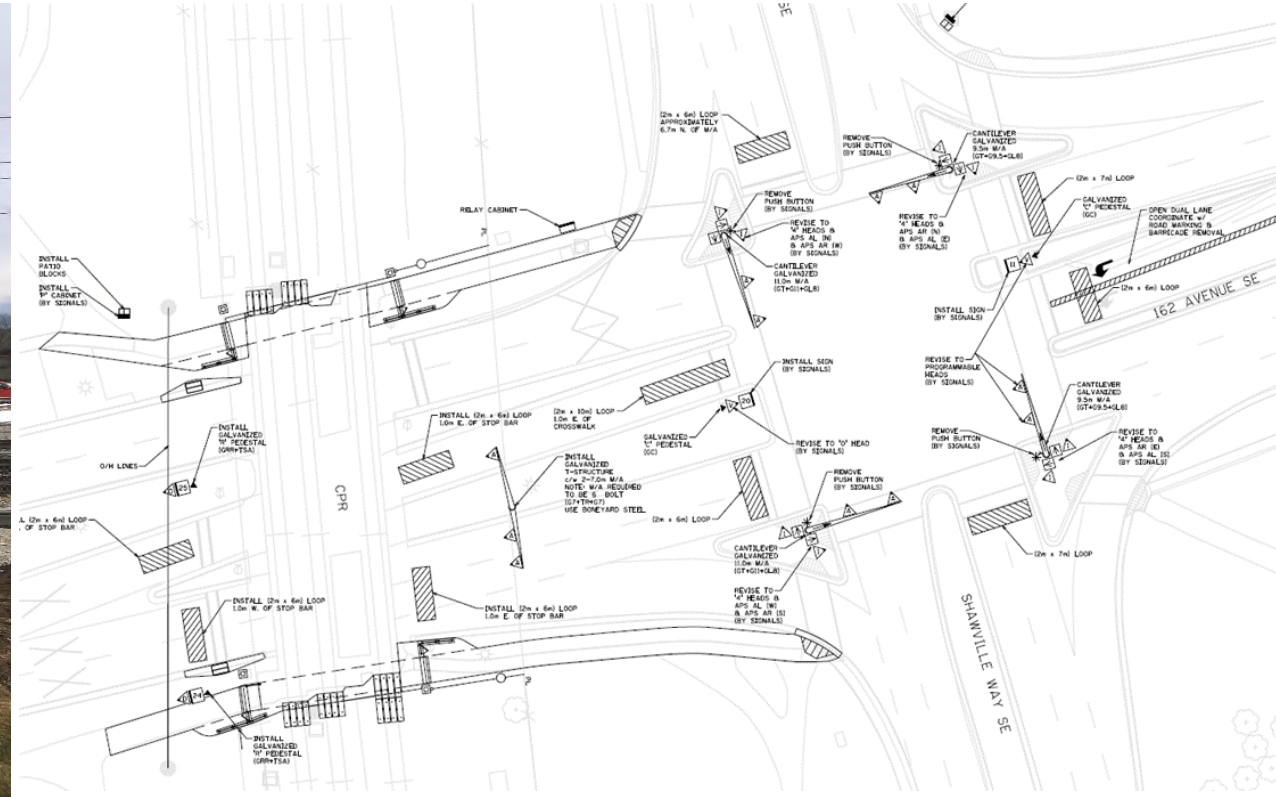
- Due to changes, compliance with Transport Canada Grade Crossings Standards required
 - Crossing warning signals continue to be controlled by CP
 - Gate descent delay time increased for design vehicle (WB-20, Articulated Bus)
 - Pre-emption time increased to 61 s in advance of train's arrival at crossing



Revised conditions at 162 Avenue SW

162 Ave SW Crossing Automatic Pedestrian Gates

- Traffic signal interconnection improvements
 - Pre-signals to keep the space between the main signal and tracks clear.
 - Conditionally red during pre-emption, red when warning devices active.
 - Pre-signal queue detectors to extend eastbound and eastbound left green durations if a queue is present.





Overview of the Crossing Safety Report Findings

- Calgary Transit employs the applicable guidelines, standards and best practices in new design;
- The rate of accidents at-grade crossings of Calgary Transit's LRT system is comparable to that elsewhere in North America;
- The Calgary Transit at-grade crossing warning systems are adequate to provide for the safety of motorists, cyclists and pedestrians; and
- Calgary Transit employs a crossing assessment process for existing at-grade crossings to improve safety at-grade crossings



Opportunities for Improvements

- Install safety measures within the pedestrian’s cone of vision
- Split warning phases at Centre load stations
- Second train warning signs
- Pedestrian automatic gate arms
- Emergency notification signs





THANKS!

Questions?