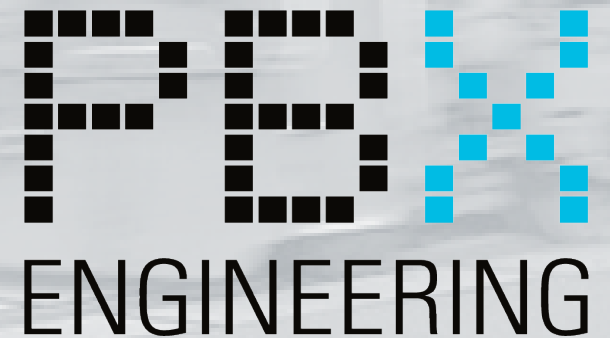


Railway Crossing Information System (RCIS)

Amy Hunter, P.Eng., PTOE

Transportation Lead
Senior Design Engineer

2023 CEA Transportation Conference



AGENDA

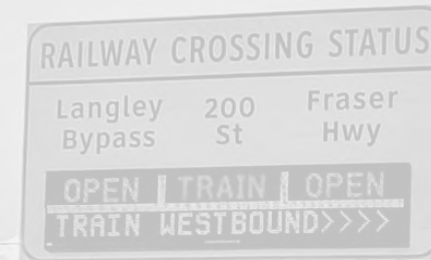
1. Project Scope/Background
2. Design
 - Concept Operations
 - Detection
 - Messaging
 - Central System
3. Post Analysis



BACK- GROUND



- Location
- Objectives
- System Overview



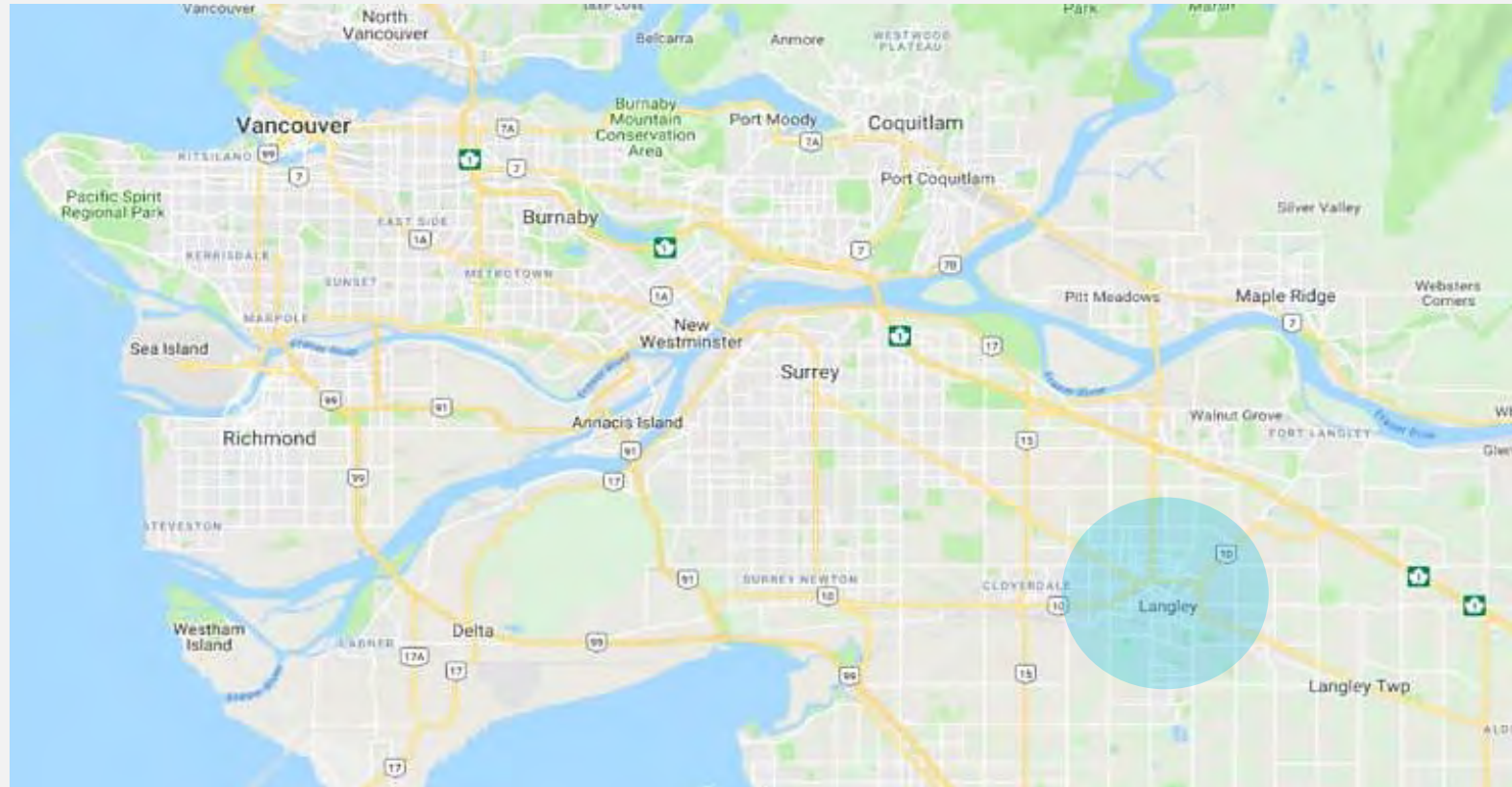
+ **FOCUSED.
RELIABLE.
INNOVATIVE.**

Project Scope

**Located along Roberts
Bank Rail Corridor (RBRC)
- City of Langley, BC**

**Four major at-grade
crossings affecting:**

- City of Langley
- Township of Langley
- City of Surrey



Rail Operations on RBRC

- Average train length = 2200m (7200')
- Max train speed = 56 km/h (35 mph) [16m/s]
- Corridor length = 4.4 km / 11 km
- Average rail transits through corridor = 22 / day
- Train length predicted to increase by apx. 10%
- Number of transits predicted to increase by 40%



DESIGN

- Concept of Operations
- Detection
- Messaging
- Central Control System

CONCEPT OF OPERATIONS



Detect Train

- Detect train
- Track the train through the rail corridor
- Identify length of train
- Predict the time and duration of intersection blockages for each train



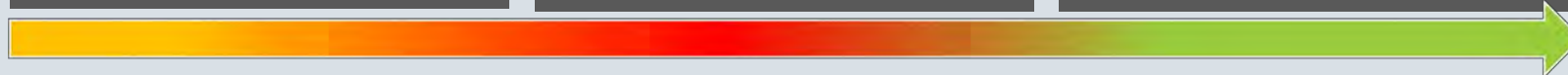
Activate Signs

- Activate motorist advisory signs to provide advance notice to drivers who are approaching the at-grade rail crossings
- Activate temporary turn restriction signs as part of applicable rail event timing plans



De-Activate Signs

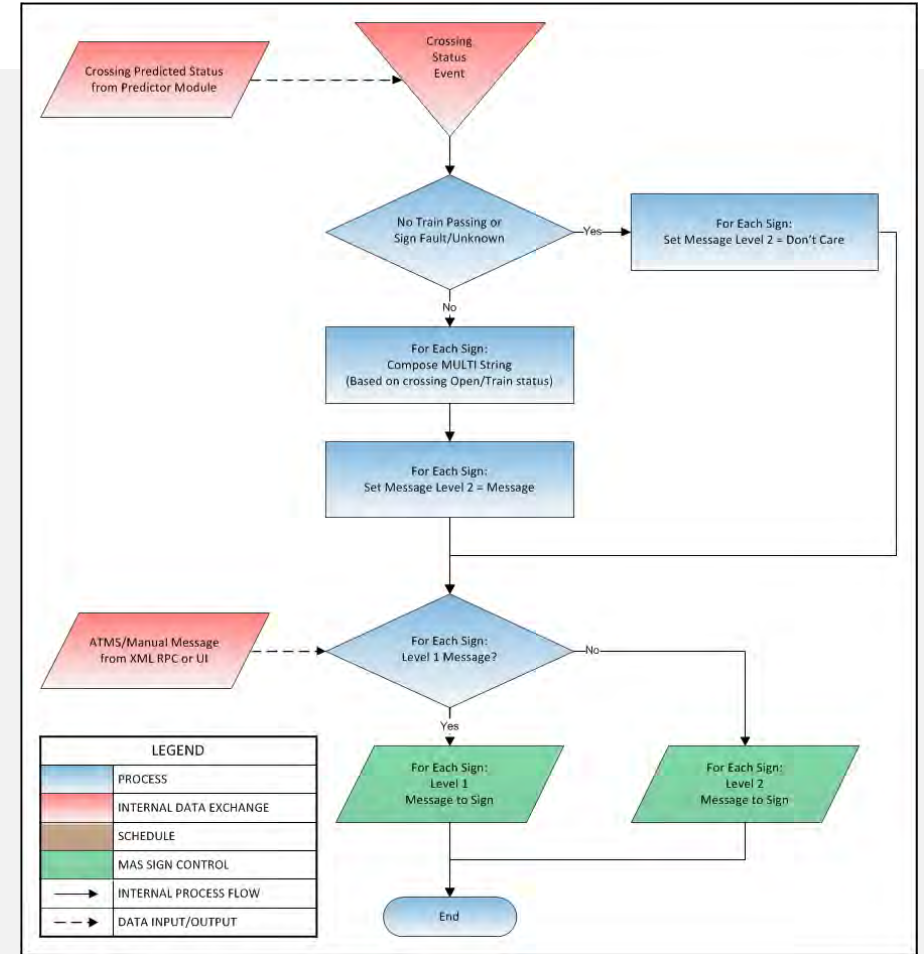
- Confirm when the train has cleared the at-grade crossings
- Capability to keep the motorist advisory signs active for a configurable period of time to advise drivers of any residual traffic congestion



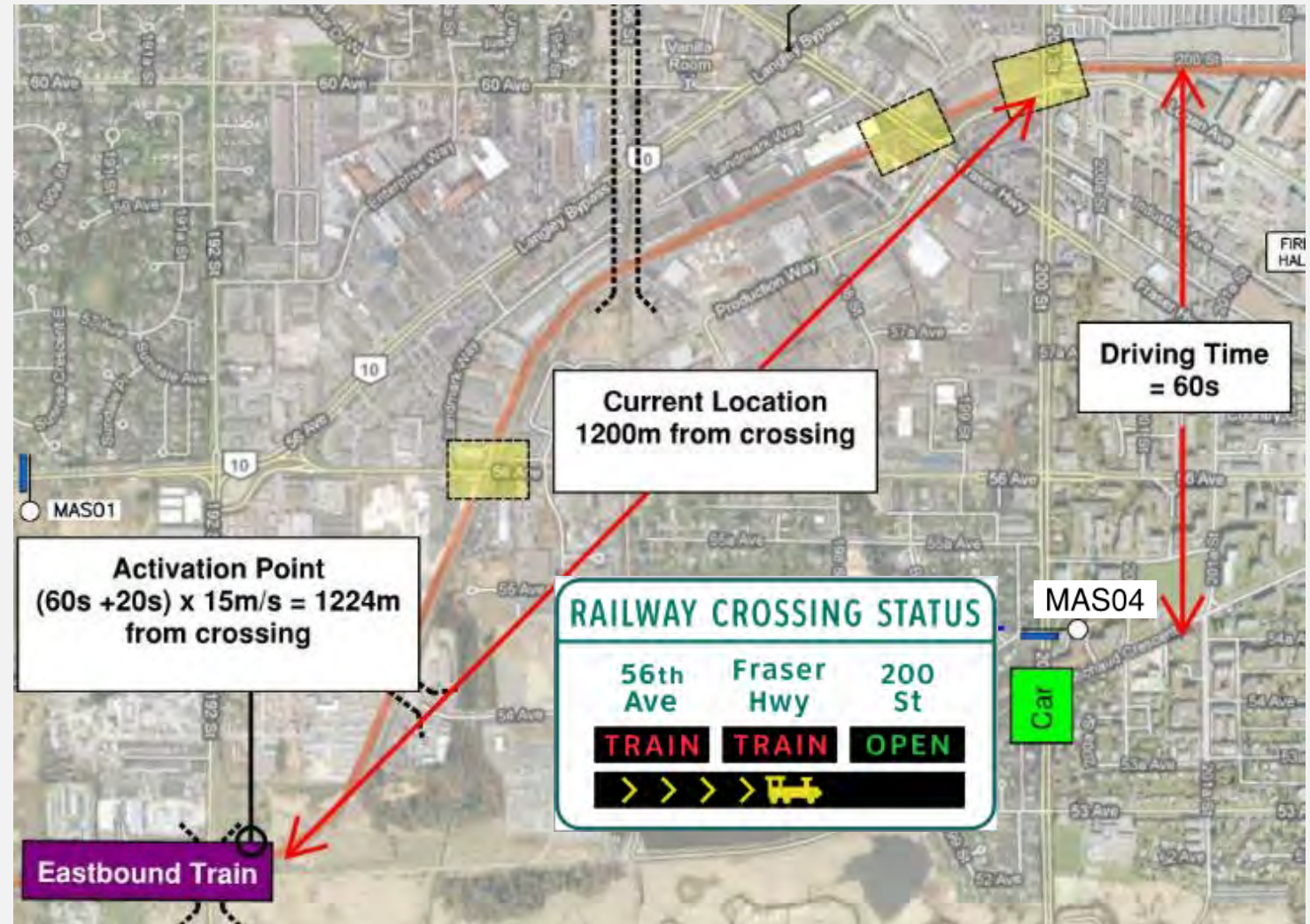
Concept of Operations

Prediction Algorithm

- Train movement tracked along corridor
- Based on train speed, direction, and length data, the following are calculated:
 - Train arrival time at each crossing
 - Estimated crossing blockage duration
- Train position confirmed using:
 - Mid-corridor train detectors
 - Crossing pre-emption signals, where available



CONCEPT OF OPERATIONS



DETECTION





Detection Technology Testing

- Pilot project conducted to test various detectors
- Complex sensors did not perform well in pilot project
- Radar detector and beam sensor configuration has proven to reliably and accurately detect train characteristics
- Integrated suite of sensors at each TD to provide resiliency
- Highly accurate detection:
 - Presence: near 100%
 - Speed: +/- 2-5%
 - Direction: near 100%
 - Length: +/- 3-9%

Rail Operations



Most **trains** were long intermodal trains but there were also occasionally short trains that were only a few locomotives long

► Identifies the need to detect shorter trains and treat them differently in system design



Significant **variation** in rail car types

► Chosen detection technology must be capable of detecting all car configurations



Trains do not maintain a constant speed during their travel and may accelerate or decelerate significantly

► Regular monitoring of train velocity required

Exception Processing

System had to effectively address complicated scenarios

Wide variation in train configurations

- ✓ Length
- ✓ Speed
- ✓ Car type and configuration

Large number of possible exceptions

- ✓ Short trains
- ✓ Maintenance vehicles
- ✓ More maintenance vehicles
- ✓ Siding tracks
- ✓ Varying train operations
- ✓ Varying train speeds while transiting corridor

MESSAGING SIGN DESIGN



Motorist Advisory Sign Design

- Message purpose:
 - Notify drivers of rail crossing status to make informed route choice decisions
 - Appropriate messaging content is critical to guiding driver behavior
- Info needed by motorists:
 - Which crossings are blocked? ▶
 - How long will they be blocked? ▶
 - Which route should I divert to? ▶

OPEN - TRAIN

TRAIN LOCATION INDICATOR

TRAIN DIRECTION INDICATOR

Motorist Advisory Sign Design

Survey Summary:

- 544 valid participants for a completion rate of 39%
- All signs scored relatively high with over three-quarters rating the signs as “somewhat” or “very effective”.
- Option 2b had both the highest combined effectiveness score as well as the highest % of ‘very effective’.

Option 1:



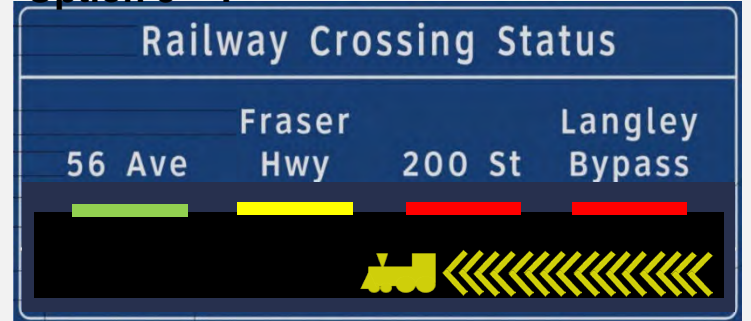
Option 2b:



Option 2a:



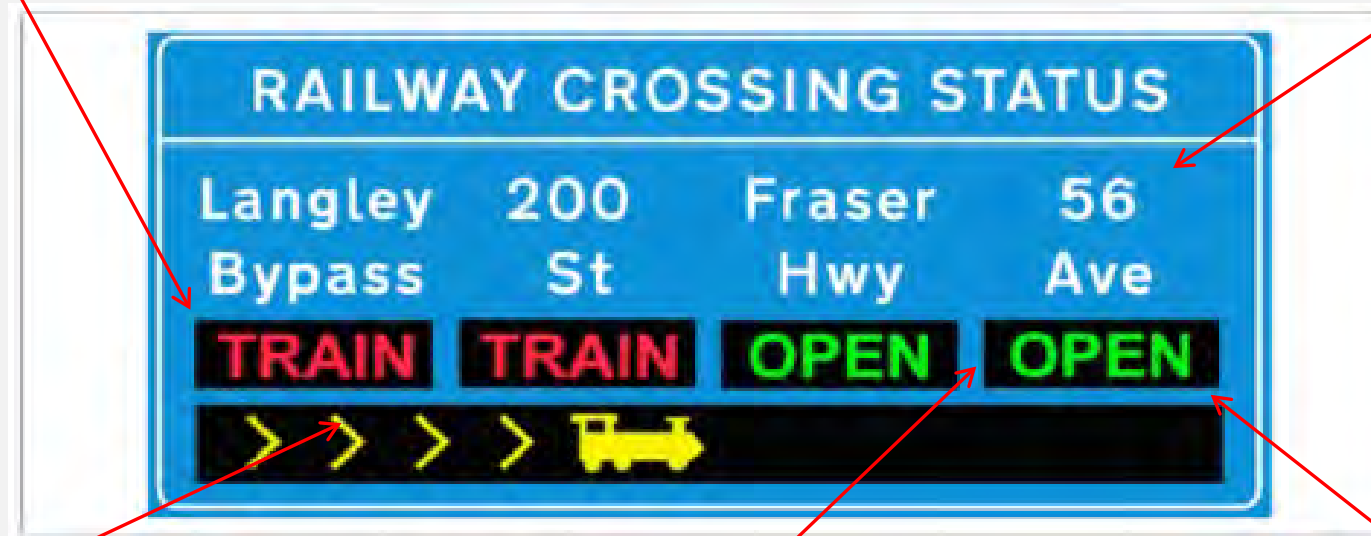
Option 3***:



Human Factor Analysis Results

Crossing names centered above status

Vertically stacked crossing names

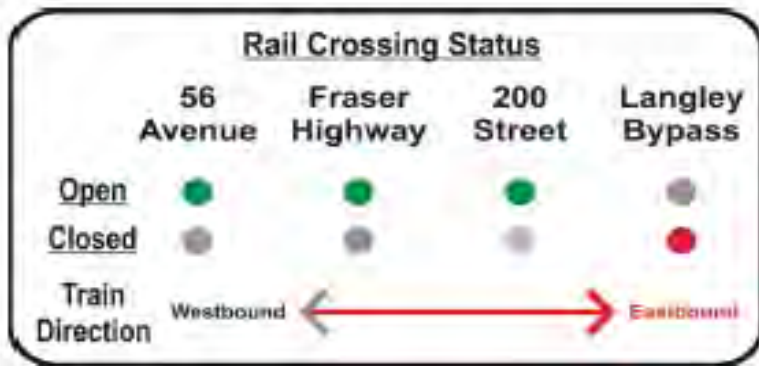


50% reduction in the number of chevrons

Vertical dividers between status readings

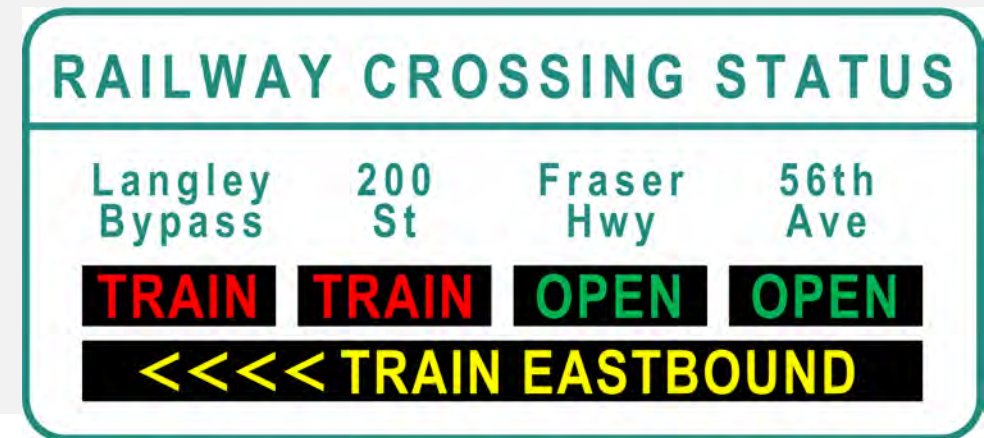
Horizontal divider between status readings and train

Motorist Advisory Sign Design



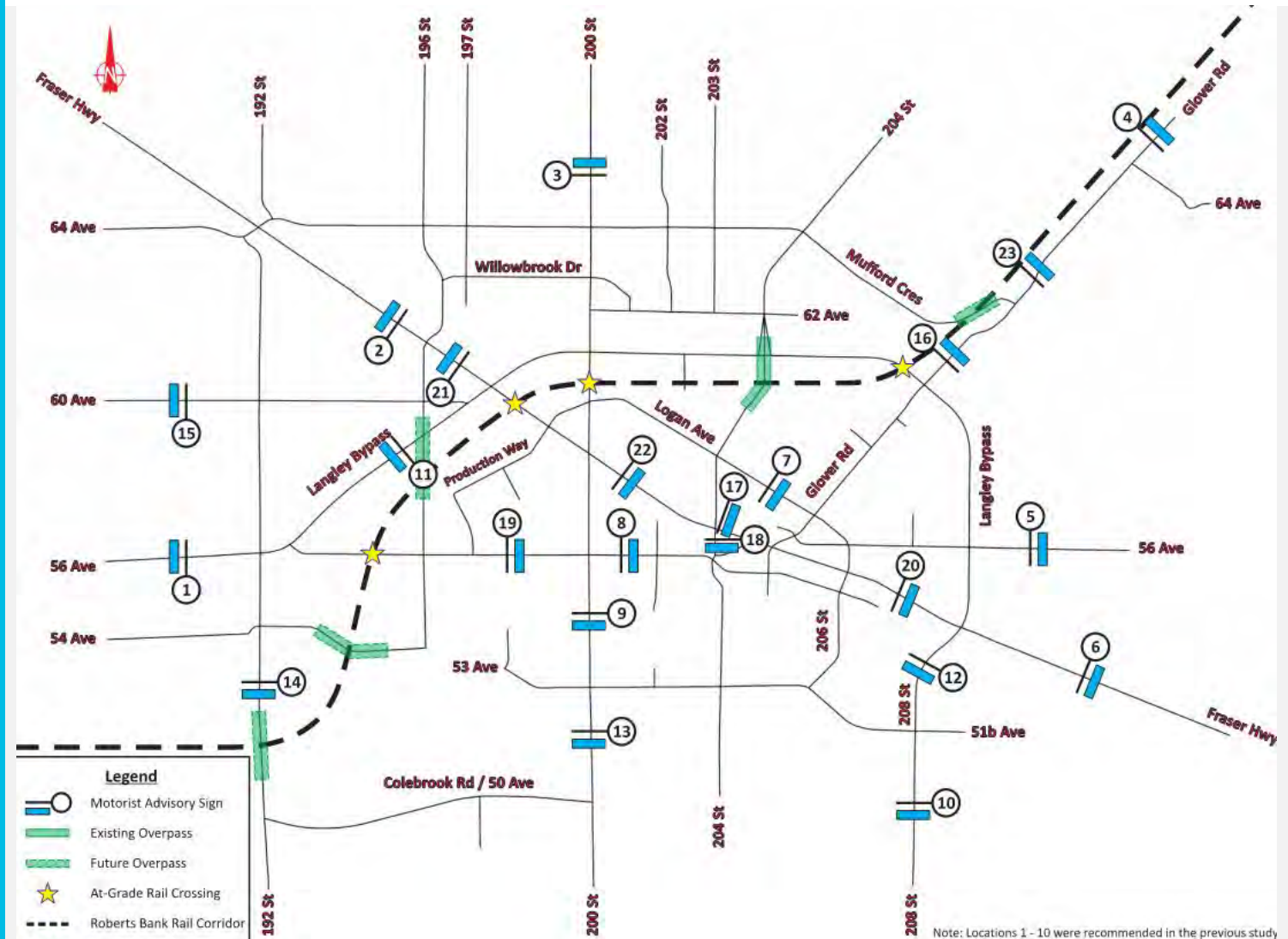
SIGN DESIGN EVOLUTION

- Human factors analysis undertaken
- Public survey conducted to test comprehension
- Sign design refined during detailed design



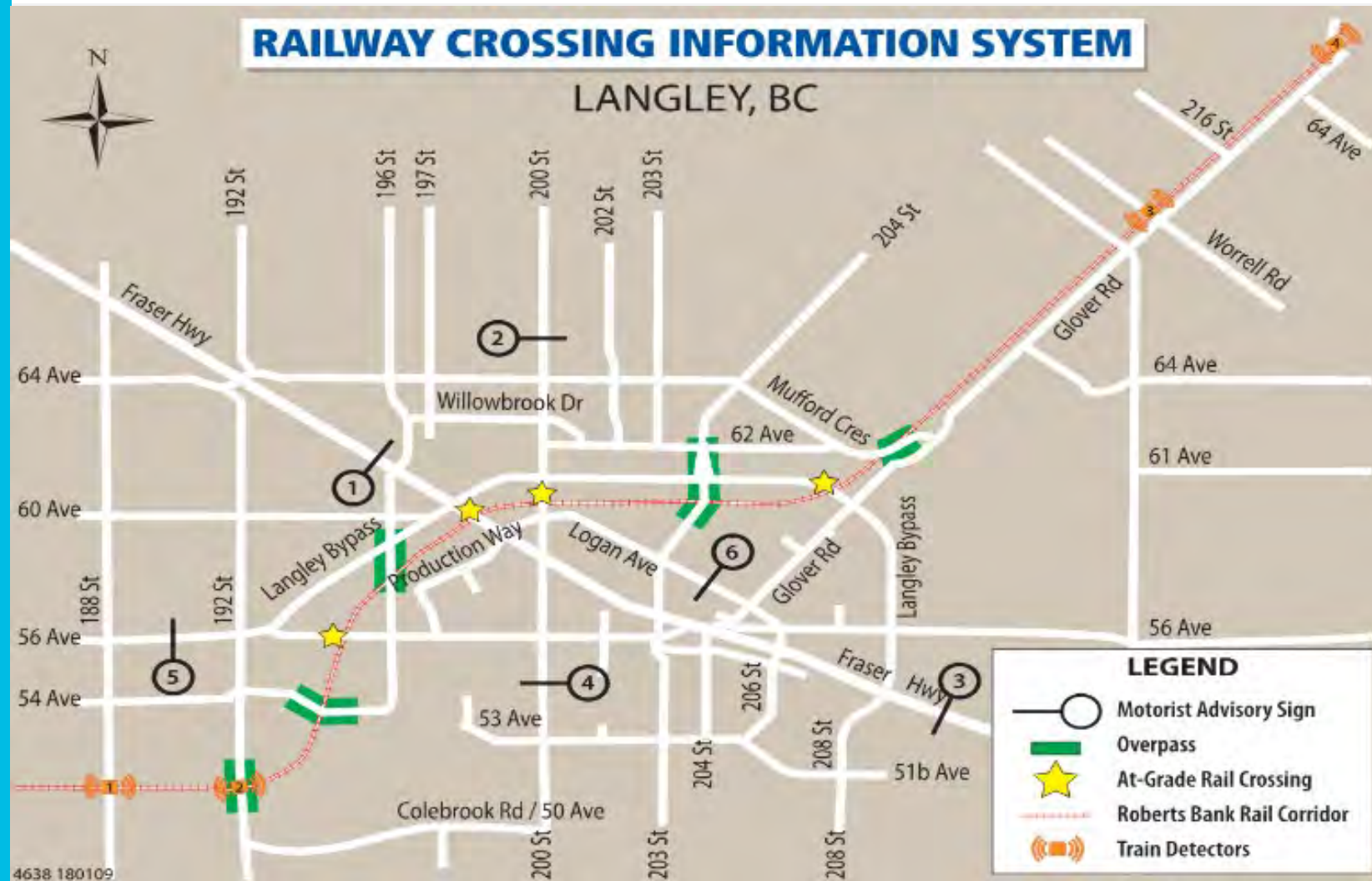
Sign Location Analysis

- Conceptual design report looked at travel times and route diversions
- 21 Motorist Advisory Sign locations considered



Sign Location Analysis

- VISSIM macro-simulation model to assess diversion potential and number of cars served for each sign
- Short list to 6 high priority signs that serve the most drivers



RCIS Workstation Display

The screenshot displays the RCIS Workstation interface with the following components:

- Top Bar:** Includes navigation icons, a search bar, and a 'Sign Out' button.
- Left Panel:**
 - Device List:** Shows 'Idle - No Trains'.
 - RCIS Status:** Lists train identifiers (TD01, TD02, TD07, TD08) and their status (Idle) with speed and length information.
 - MAS01-MAS08:** A vertical list of monitoring areas.
- Central Map:** Titled 'RCIS Key Map', showing a geographical map with a highlighted train route and various station markers.
- Right Panel:**
 - Video Feeds:** Displays two camera views: 'TD07-CAM2' (02:07:31 AM) and 'TD07-CAM1' (02:07:31 AM), both showing a train at a station.
 - Timeline:** A horizontal timeline for the video feeds with play/pause controls.
 - Time/Scale:** Shows the current time as 2:07:04 AM on Tue, Jan 29, 2019, and a scale of 38.4 Minutes.
- Bottom Panel:**
 - Event Log Table:**

Created	Server	Category	Description	Priority	User	Acknowledged
2019-01-29 2:07:37 AM	RC-ATIS	RCIS Train Event	TD07 final speed/len: 15/510	50	[RC-ATIS]	2019-0...
2019-01-29 2:07:36 AM	RC-ATIS	RCIS Train Event	Train departed TD07	50	[RC-ATIS]	2019-0...
2019-01-29 2:07:04 AM	RC-ATIS	RCIS Train Event	Train arrived TD07	50	[RC-ATIS]	2019-0...
2019-01-29 2:07:04 AM	RC-ATIS	RCIS Train Event	TD07 initial speed: 15	50	[RC-ATIS]	2019-0...
2019-01-29 2:05:22 AM	RC-ATIS	RCIS Train Event	Train departed TD08	50	[RC-ATIS]	2019-0...
2019-01-29 2:05:22 AM	RC-ATIS	RCIS Train Event	TD08 final speed/len: 2/314	50	[RC-ATIS]	2019-0...
2019-01-29 2:04:39 AM	RC-ATIS	RCIS Train Event	Train ID: 2019-02:04:36-WB, Westbound, Speed: 30.4km/h	50	[RC-ATIS]	2019-0...
 - Timeline:** A horizontal timeline for the event log with play/pause controls.
 - Time/Scale:** Shows the current time as 3:27:53 AM on Tue, Jan 29, 2019, and a scale of 3.0 Days.
 - Summary:** 'Total records: 493'.

Implementation Status

- Rigorous testing methodology followed
- System is live – Early March 2020
- Performance metrics
 - Pre- and post-implementation data gathered to assess diversion rate effectiveness
 - Travel time/O-D data collection – Bluetooth Sensors
- Significant support and excitement from local municipalities



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2023 CEA Alberta Transportation Conference

Thank you.

QUESTIONS?

pbxeng.com

