Railway Crossing Information System

ITS Canada Presentation

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Agenda

- RBRC Program
- Project Background
- Concept of Operations
- Design Process
- Design Challenges
- Status

RBRC Program

- Roberts Bank Rail Corridor Program
  - An integrated package of nine road-rail improvement projects and a railway crossing information system (RCIS)
  - a $307 million investment funded by an unprecedented collaboration of 12 partners
  - Will improve the safety and add efficiencies to the road and rail networks in four municipalities

Project Partners

PBX ENGINEERING

CANADA'S PACIFIC GATEWAY

Transport Canada / Transports Canada

CANADIAN PACIFIC

Delta

BRITISH COLUMBIA | Canada's Pacific Gateway

CN

CITY OF LANGLEY

Township of Langley Est. 1873

TRANS LINK

BNSF

PORT METRO vancouver

BRITISH COLUMBIA RAILWAY COMPANY

CITY OF SURREY the future lives here.

RBRC Program

- RCIS
  - Initiated by Port Metro Vancouver
  - Significant potential benefits to the region
    - Travel time improvements
    - Environmental benefits
    - Infrastructure capacity improvements
    - Transparency in rail community activity

Background: Rail Operation

- Problem Definition: Increased rail traffic significantly impacts vehicle traffic
  - Average train length = 2200m (7200')
  - Max train speed = 56km/h (35 mph) [16m/s]
  - Corridor length = 4.4 km
  - Average rail transits through corridor = 22/day (Approximately 1 event/hr, 6:00am – 6:00pm)
- Based on RBRC study, by 2021:
  - Train length predicted to increase approx. 10%
  - Number of transits predicted to increase by 40%

Traffic Impact

- Based on 200th St traffic signal pre-emption data
  - Crossing currently occupied between 1-4 minutes
- Significant queuing can occur at all crossings, with 200th St. southbound often the worst
- Can take 10 minutes or more to clear the resultant queues and congestion
- City of Langley's rule of thumb – 5:1 ratio
  - 3 minute blockage = 15 minutes of congestion/disruption

Project Objective

- To mitigate the impact of increased rail traffic by providing information that encourages timely diversion of motor vehicle traffic to grade-separated overpasses
- Solution: implement **Rail Crossing Information System** (RCIS) to detect trains and notify motorists of crossing status

Project Scope

- Scope
  - Four major at-grade crossings
  - 7 Train Detector (TD) stations
  - 9 Motorist Advisory Signs (MAS)
  - No Left Turn signs
  - Central control system
- Design
  - Concept of operations
  - Traffic modelling and sign priority analysis
  - Detector functionality and pilot project
  - MAS human factors analysis

Key Plan


MAS03
MAS04
MAS02
MAS01
MAS07
MAS05
MAS08
MAS06
MAS09
TD08
TD07
TD05
TD06
TD04
TD03
TD01
232nd St Project
Mufford / 64th Ave Project
196th St Project
54th Ave Project
192nd St Project
TOWNSHIP OF LANGLEY
CITY OF SURREY
CITY OF LANGLEY
72 AVE
64 AVE
56 AVE / HWY 10
56 AVE
FRASER HWY
LANGLEY BYPASS
MUFFORD
ALEXANDER RD
CRUSH CRES
GLOVER RD
HWY 10
216 ST
224 ST
232 ST
OWNERSHIP LEGEND
MINISTRY OF TRANSPORTATION
TOWNSHIP OF LANGLEY
CITY OF LANGLEY
CITY OF SURREY

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
- Have 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

- Train detection
  - Detectors located along RBRC corridor
  - Provide data on train speed, direction, and length
  - Positioned in advance of crossings to provide sufficient notification, taking into account train lengths and advance notification to users of pending closures
  - Located off rail ROW

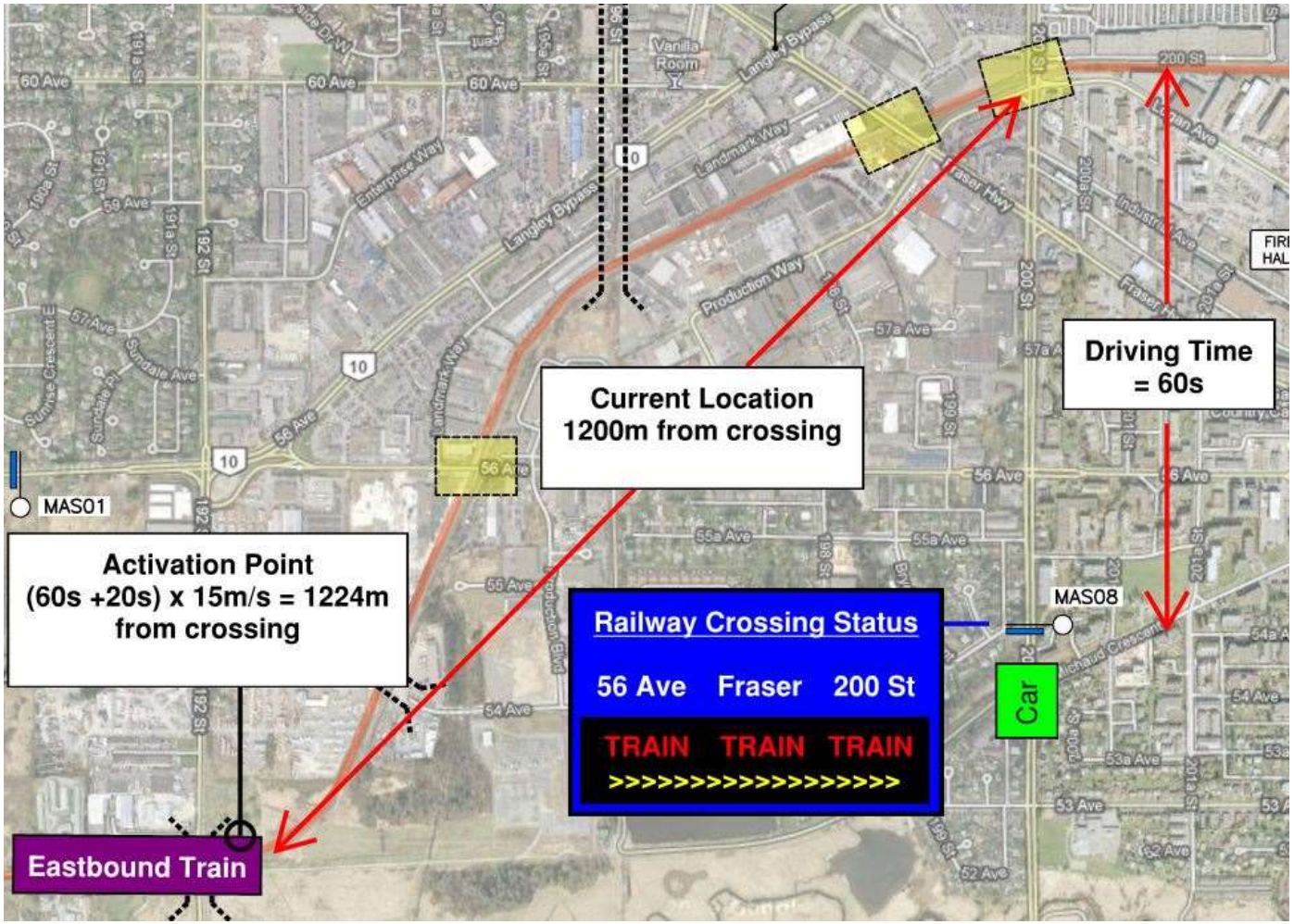
Concept of Operations

- 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
  - Data will be collected for all key inputs

Concept of Operations

- Sign Activation
  - Motorist advisory signs activated to provide notification to drivers
  - Temporary turn restriction signs activated as part of the applicable rail event (by rail pre-emption)
  - Status of signs set based on data provided by detectors and calculated by algorithm
  - Status of signs updated at regular intervals, based on progression of train along corridor

Concept of Operations



Concept of Operations

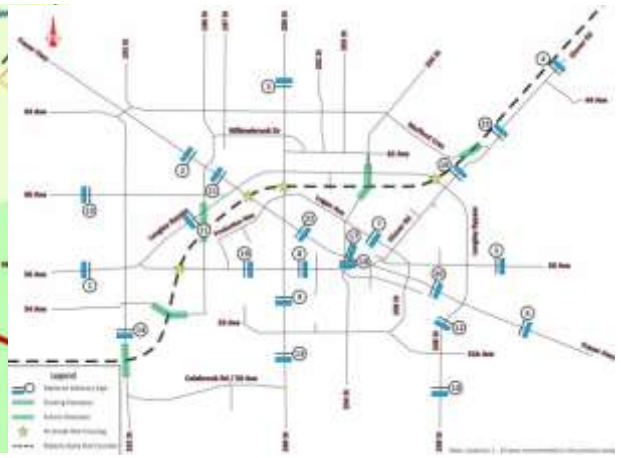
- Driver Diversion
  - Drivers respond to sign status information and make appropriate route decisions
  - Appropriate messaging content is critical to guiding driver behavior
  - 10% diversion required to achieve project cost-benefit threshold

Concept of Operations

- Central Control System
  - Utilizes ATMS at MoTI's RTMC
  - Control and monitoring of all sub-systems
    - PLC
    - Detection sensors
    - CCTV
  - Will operate largely autonomously

Sign Location Analysis

- Conceptual design report looked at travel times and route diversions
- VISSUM macro-simulation model to assess diversion potential and number of cars served for each sign
- Sign locations re-evaluated during design phase to assess cost-benefit, develop optional cost items, and respond to budget constraints



Train Detector Testing

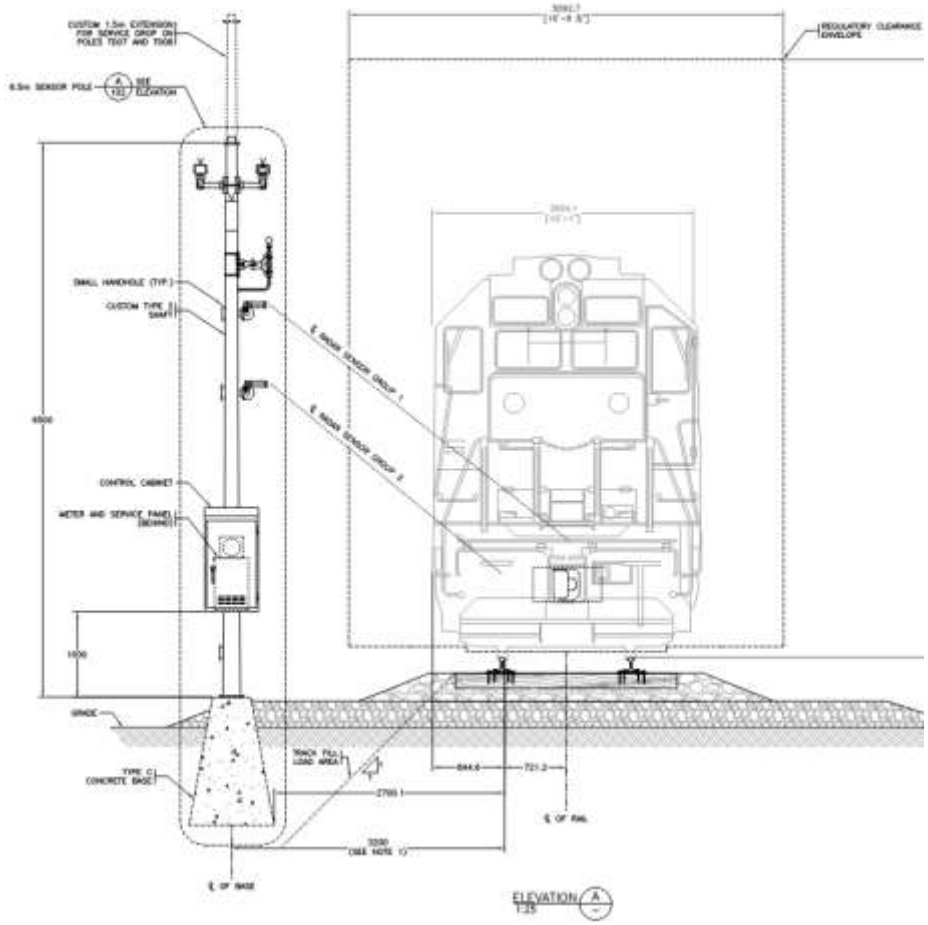
- Accurate and reliable train detection information is pivotal for project operation
- A number of candidate technologies were investigated during the preliminary design phase
- Pilot test was recommended due to unknown performance of candidate technologies when used for train detection
- Off-ROW train detection is a difficult problem:
  - Non-contact measurement
  - Varying length, speed, and direction
  - Varying car configurations
  - Use of siding tracks

Train Detector Testing

- Simple radar detector configuration has proven to reliably detect trains
- System will use pair of radar units per TD
- Approximate accuracy is as follows:
  - Presence: near 100%
  - Speed: +/- 3-9%
  - Direction: near 100%
  - Length: +/- 3-9%

Train Detector Station

- TD station configuration
  - 4 x presence radar
  - 1 x speed radar
  - 3 x digital cameras
  - Control cabinet



Motorist Advisory Sign Design

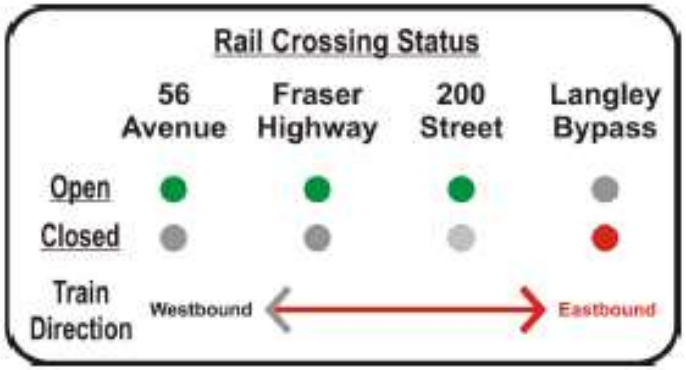
- Message purpose
  - Notify drivers of rail crossing status to inform route choice
  - Clear messaging is critical to effective system operation
- Design Assumption
  - Target audience is a motorist who is familiar with the area and knows the route options (location of overpasses)

Motorist Advisory Sign Design

- Extensive design exercise to develop and refine the sign and messaging
  - Technical committee workshops
  - Public consultation
  - Message comprehension survey. Results showed high comprehension and rated the messaging as “very effective” → these were first time users
  - Human factors analysis

Motorist Advisory Sign Design

- Layout
  - Static and dynamic graphical elements
  - All signs will display 3 crossings, except Sign #1
  - Crossing order is specific to the sign location



Sign Rendering- MAS05

Design Challenges

- Detector technology
  - Unique requirements necessitated extensive research and field testing
- Budget constraints
  - Necessitated prioritization of signs
- Construction in an evolving urban environment
  - Utility conflicts
  - Property constraints
  - Impact to visual appearance of roadway

Status

- Construction tender closed.
- Tender evaluation in progress.
- Working with stakeholders to finalize agreements and permitting
- Project completion date: September 2015