Status Update on the Alberta Cooperative Transportation Infrastructure and Vehicular Environment (ACTIVE) Test Bed

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2017 May

Outline

- Introduction of ACTIVE-AURORA
- ACTIVE Infrastructure
- Application Development in ACTIVE
- Summary and Conclusion

ACTIVE-AURORA Project

- *Project Title:* An infrastructure to build a network of wireless communication test beds for multimodal transportation to promote commercialization and innovation, and advance education and training in the Asia-Pacific Gateway
- *University of Alberta:* ACTIVE - ***A***lberta ***C***ooperative ***T***ransportation ***I***nfrastructure and ***V***ehicular ***E***nvironment
- *University of British Columbia:* AURORA - ***AU***tomotive testbed for ***R***econfigurable and ***O***ptimized ***R***adio ***A***ccess

History of ACTIVE-AURORA

- Sponsorship
  - Infrastructure Project with support from Transport Canada, Alberta Transportation and City of Edmonton
- Project Time line
  - 2012 Mar 5 - Initial discussion, project team formed
  - 2012 Nov 8 - Official proposal submission
  - 2013 Sep 3 - Official approval
  - 2014 Apr 1 - Agreements officially signed
  - 2014 Oct 22 - ACTIVE-AURORA project official launch
  - 2016 Sep 16 - Milestone of full operation in ACTIVE
  - 2017 Sep 30 - full operation in ACTIVE-AURORA

Connected Vehicle (DSRC) Environment

On Board Equipment

Road Side Equipment

Traffic Signal Controller

Smart Phone

Smart Tablet

Traffic Management Centre

Freeway

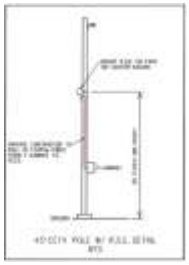
5/15/2017

ACTIVE Test Bed Coverage

- 30 RSEs installed, 60 kilometers coverage
- City of Edmonton
  - 109 St and Saskatchewan Drive
  - Whitemud Drive (10)
  - 23 Avenue Arterial Corridor (13)
- Alberta Transportation
  - Anthony Henday Drive (6)

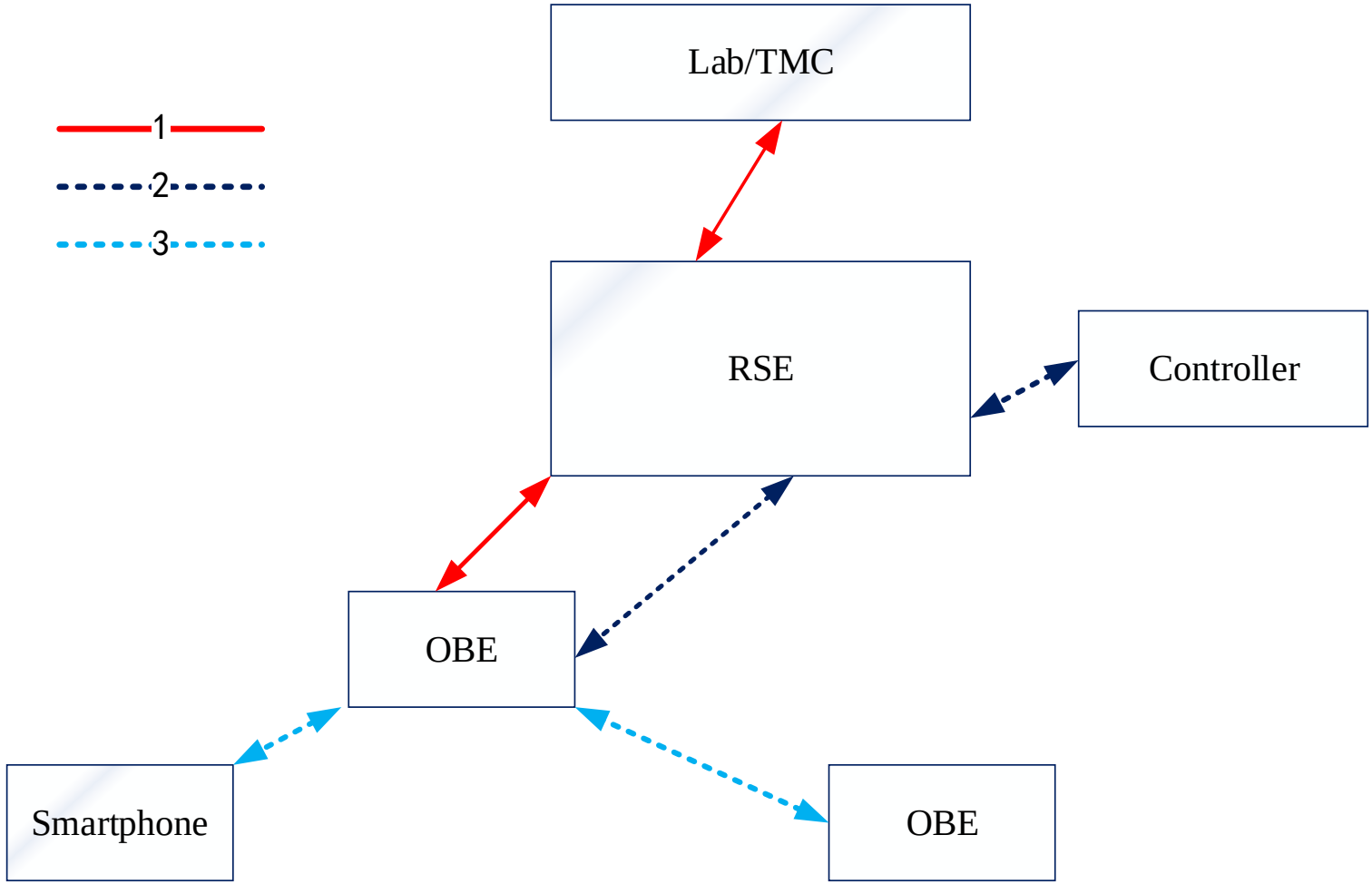
ACTIVE Installation Process

- Scope & Designs

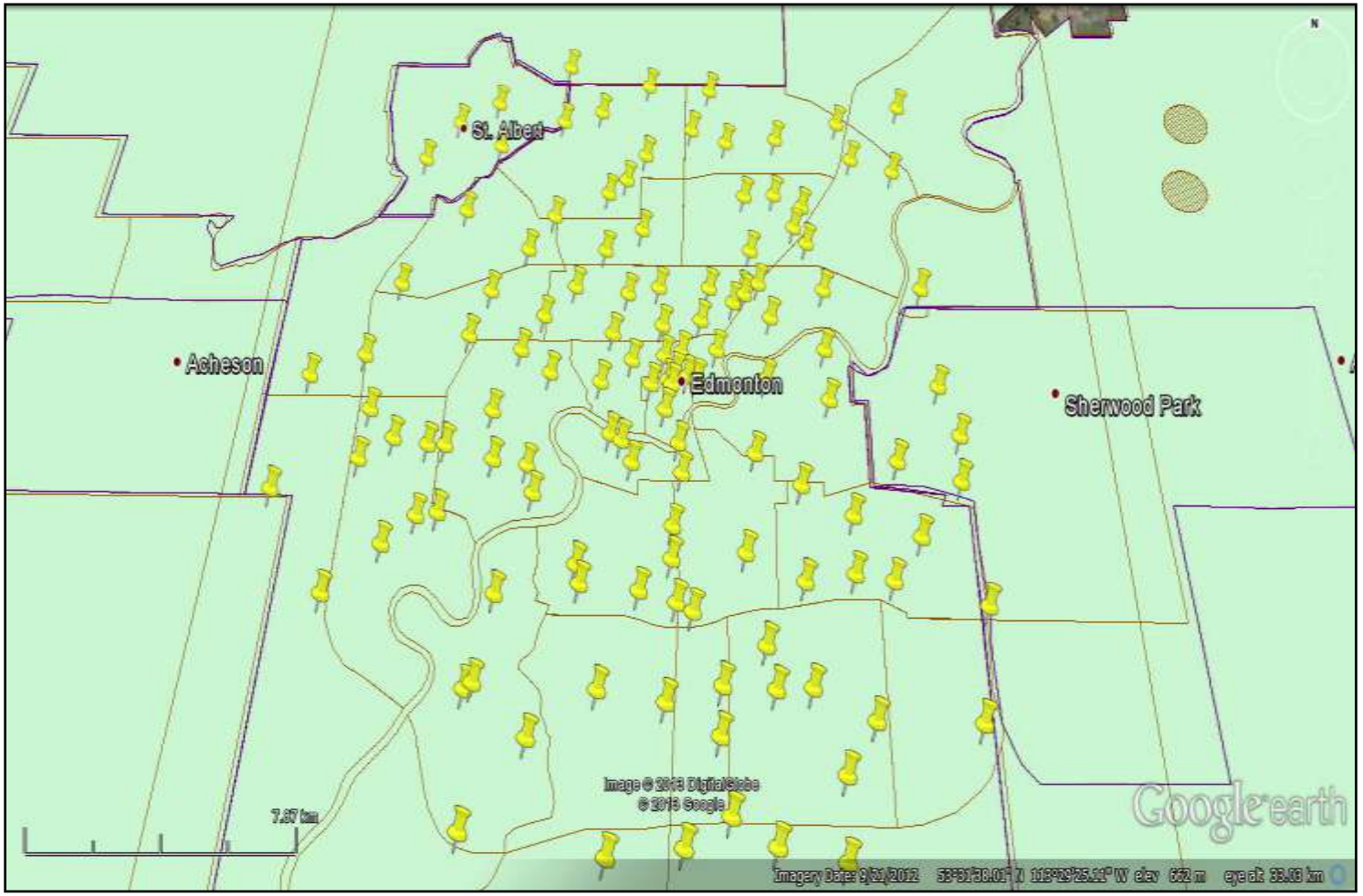


- TC Finance Process Audit done.
- Stantec engaged for:
  - PM, Electrical Design
- City of Edmonton
  - Revising Electrical Designs
  - Procured Switch for testing
- Installation Contractor selection going to RFP
- Wireless backhaul modem in testing
- Received Developmental Radio Licenses
- CSA Exemption acceptance

General Data Flow within CV

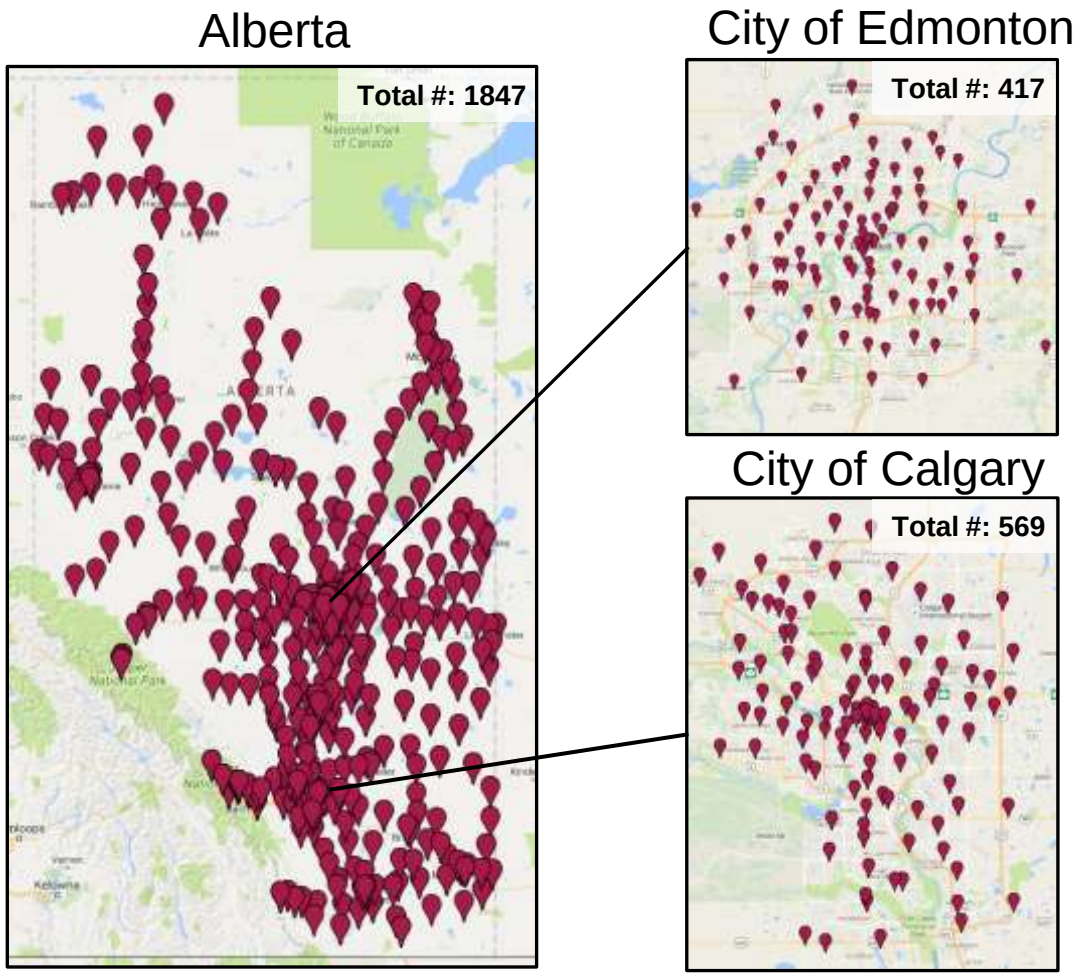


ACTIVE Test Bed – Cellular Network



Cellular Phone Data Analytics

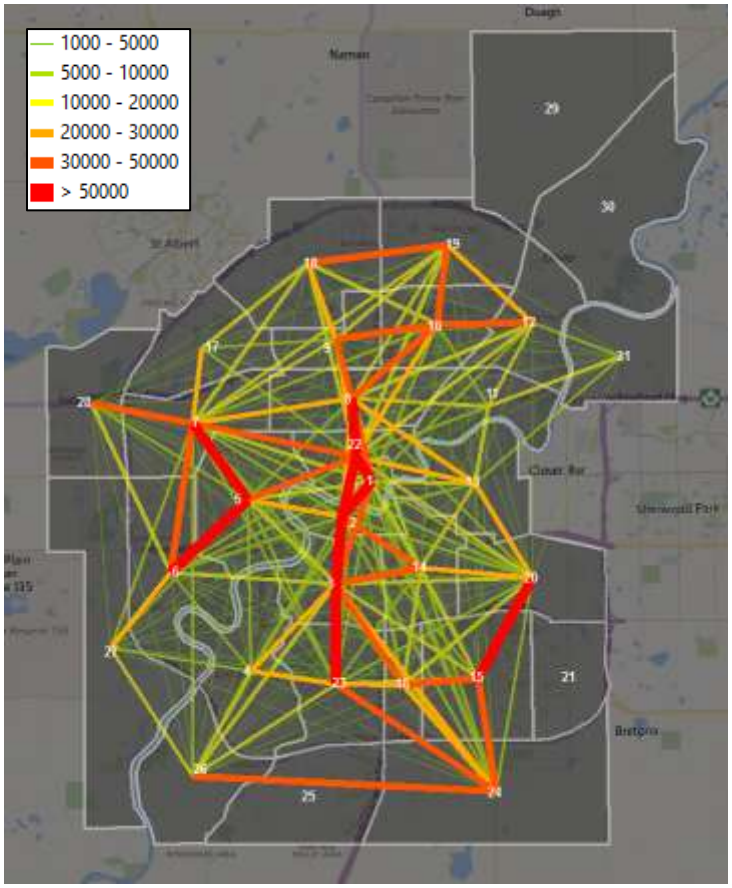
- Cell Towers Distribution in Alberta



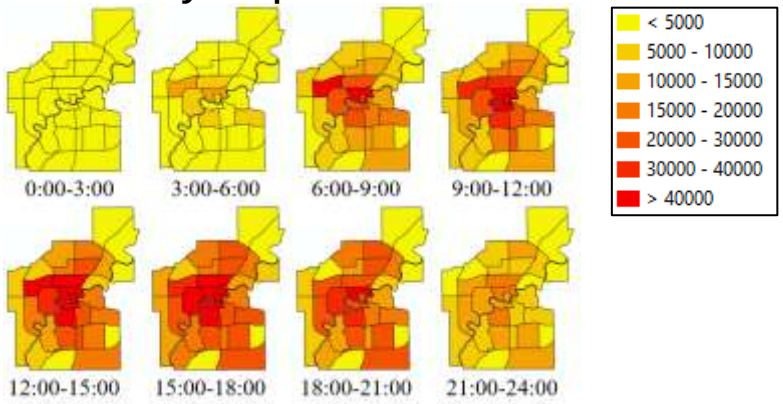
Edmonton Based Trip A & P

- O-D Distribution

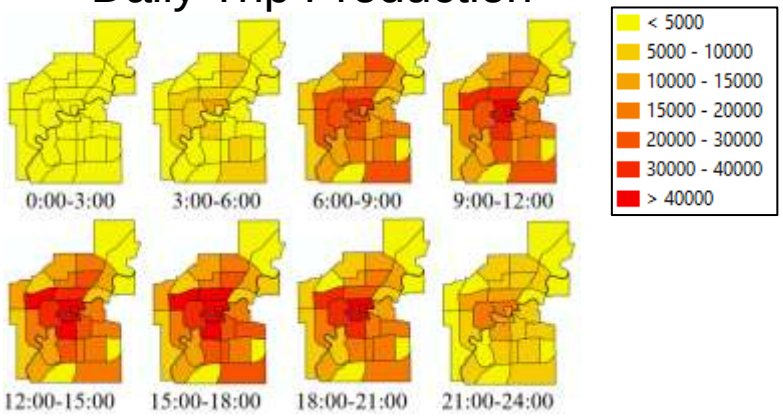
O-D Distribution (1 Day)



Daily Trip Attraction



Daily Trip Production



Application 1 – Signal Priority Control

Traffic light Status

SPaT

DSRC

Signal Request message

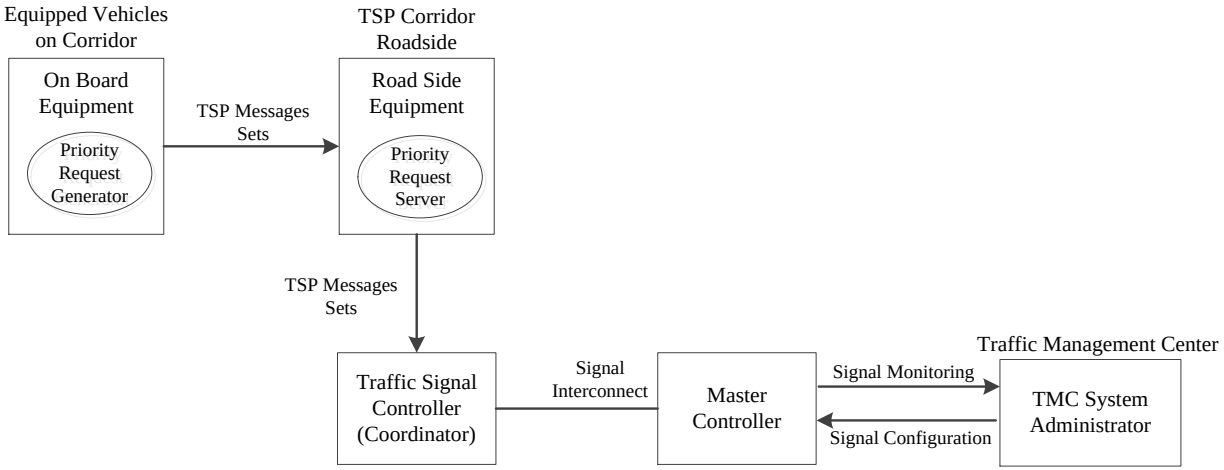
NTCIP

Hold
Omit
Force off

Application 1 – Signal Priority Control

Transit Signal Priority Control

- This project will demonstrate the application of the distributed, active TSP system along a 4.5 km-long corridor and one intersection on campus that will fully realize the connected vehicle technology based wireless communications among transit buses and traffic signal.

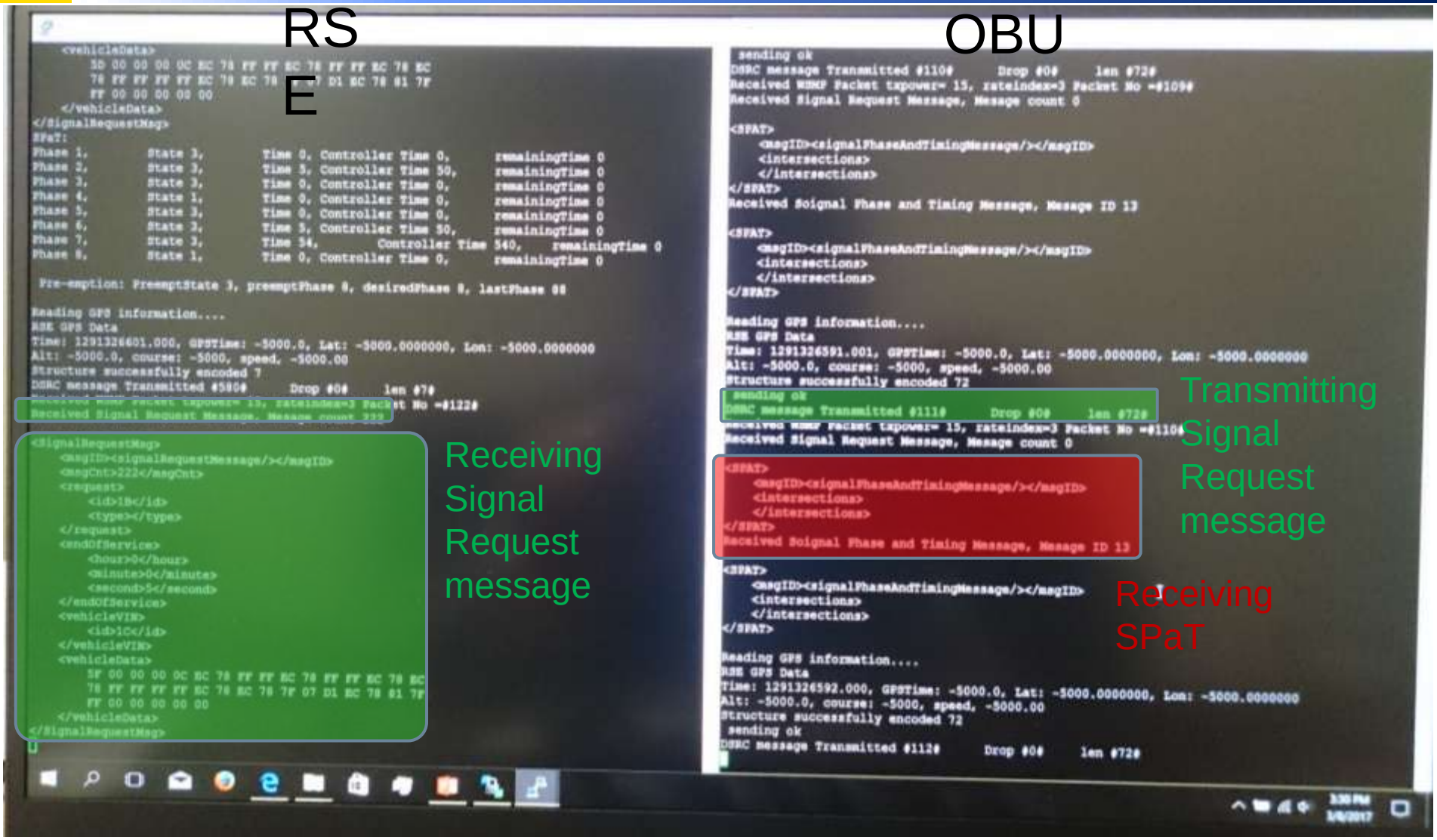


Application 1

- Evaluate the performance of several TSP strategies on four corridors in the City of Edmonton
- Passive, Active and Adaptive

TSP Corridor VISSIM Model with ASC/3 Signal Controller

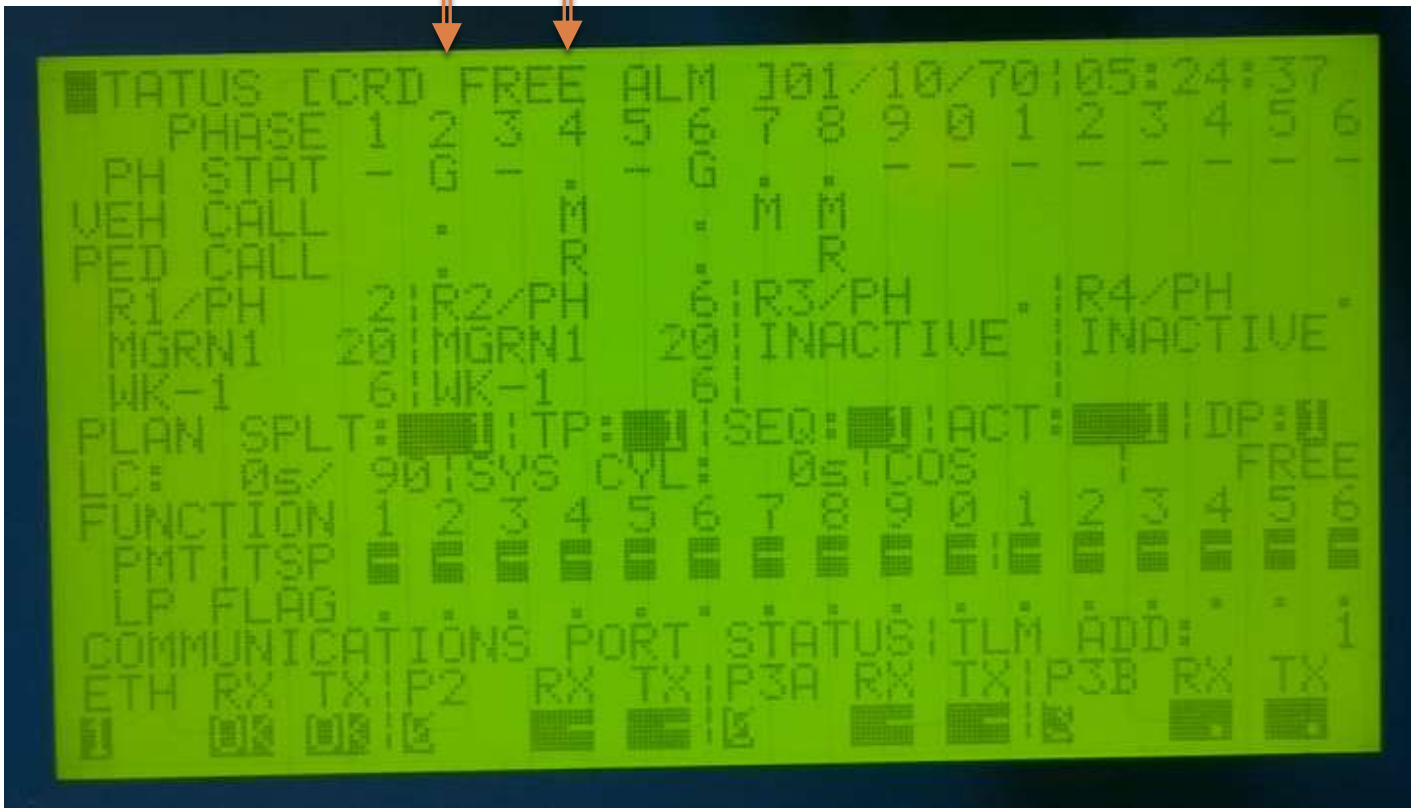
RSE and OBE Interface



The Controller Interface

Active Phase

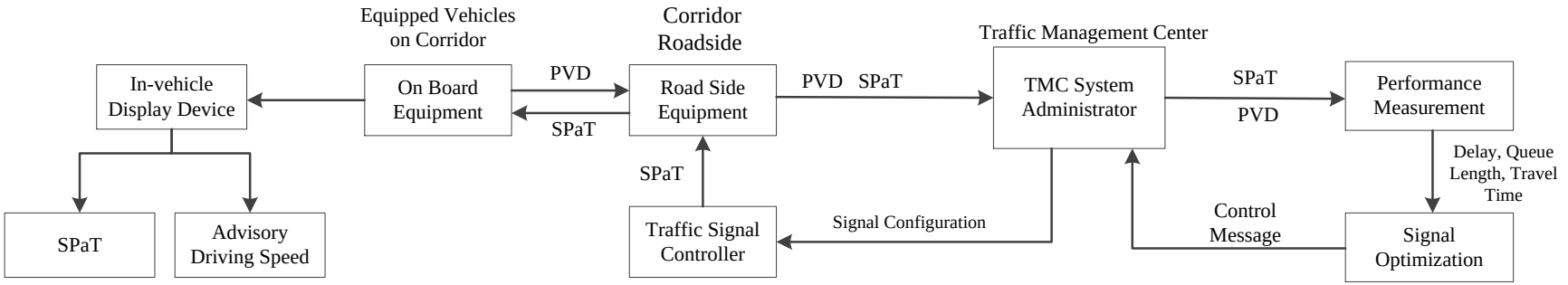
Remaining Time



Application 2 – Corridor Signal Control

Arterial Corridor Management

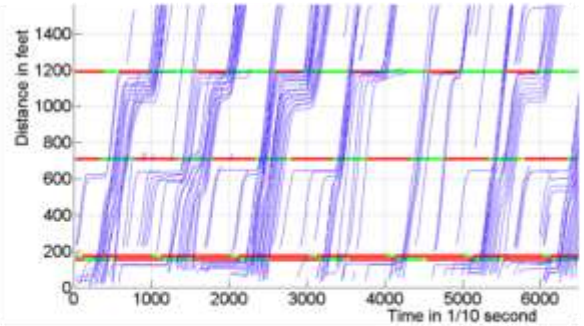
- This project will demonstrate the application of receiving Signal Phrase and Timing Data (SPaT) along the arterial corridor, advisory driving speed control, performance measurement, and signal timing optimization.



Application 2 – Corridor Signal Control

Connected Vehicle Environment
(FHWA, 2013)

V2V, V2I, V2VI



New Data Source

New Performance Measurements

NTCIP and DSRC

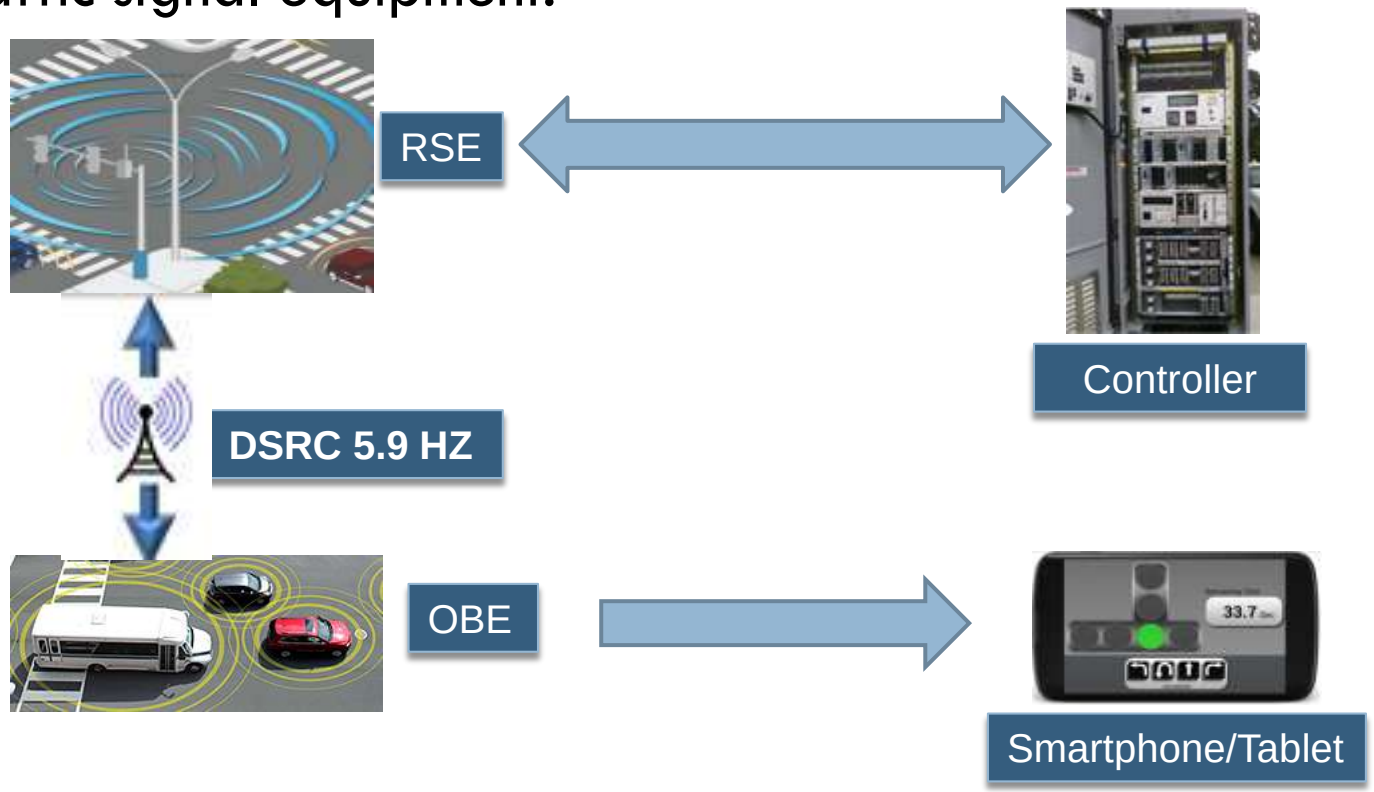
Controller Health Monitoring

Road Weather CV applications
(Paul Pisano, 2013)

Weather Effect on Arterial Operation

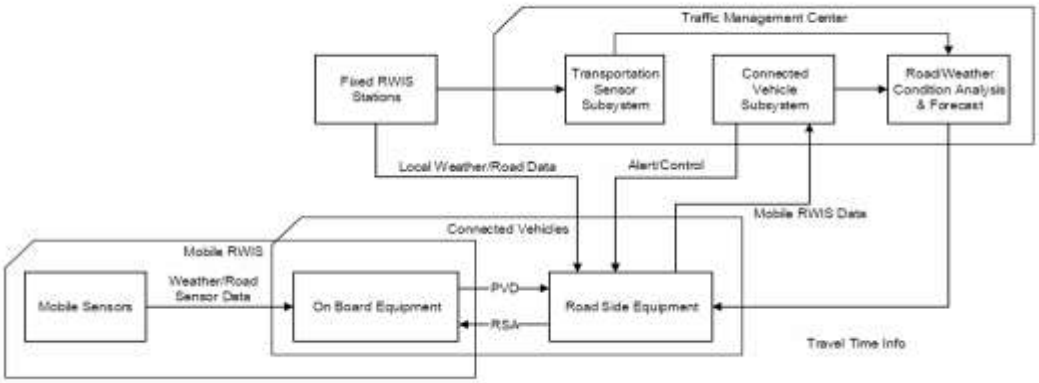
Application 2 – Corridor Signal Control

- CV provides a communication method to retrieve the real-time status of traffic signal controllers to diagnose the health of traffic signal equipment.

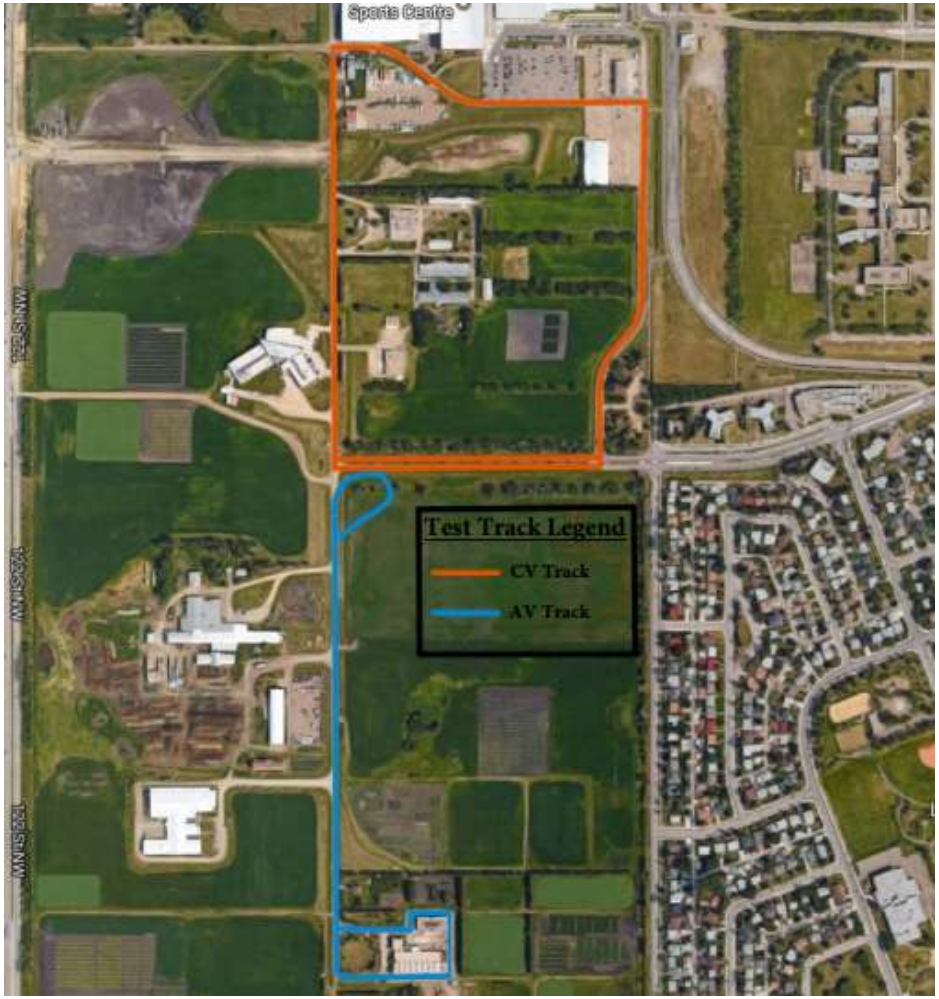


Application 3 – CV-Enabled RWIS

- **RWIS Information Broadcast and Mobile RWIS**
  - To facilitate road weather information access as well as augment fixed RWIS stations by introducing mobile weather sensors on vehicles using CV technology



ACTIVE CAV Test Track (U of A)



- Support from U of A executives, and build a smart campus
- CAV Tracks:
  - CV track – 2 km
  - AV Track – 1 km
- CV RSEs for V2I
- CV OBEs for
  - Test vehicles
  - Fleet vehicles
- **LTE-V / 5G Base Station**
- **D-GPS Base Station**
- Camera Video Coverage

Summary and Conclusion

- What vehicle will be connected?
  - Corporate fleets: fire, ambulance, transits.
  - Partnership development with vehicle manufacturers.
- Security and Credential Management System (SCMS) is missing in our existing infrastructure.
  - Potential attack to signal controller, system and DMS.
- Real-time and historical data achieving and management to support different purposes.
- Understand the added value brought by the evolving technology.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Research Innovation will make Transportation Safer, Smarter and Greener!