California Department of Transportation
Preparation for Connected Vehicle (CV) and Automated Vehicle (AV)

Presented to:
INSTITUTE OF TRANSPORTATION ENGINEERS

Thursday, April 27, 2017
Who we are and What we do?

• Caltrans goal is to provide a safe, sustainable, integrated and efficient transportation system to enhance California’s economy and livability
• Caltrans is the owner and operator of 6,200 traffic intersections and 51,900 lane miles of freeways (2014)
• Caltrans design areas include bridges, tunnels, safety roadside rest areas, storm water pump stations, maintenance stations, & equipment shops
• Caltrans design, operate and maintains the same
• Construction is performed by contractors
Presentation Organization

• Covered areas
  – Technical Details
  – Work completed to date
  – Applications development

• What is not covered
  – Laws
  – Regulations
  – Enforcement
INTERSECTION UPGRADES
Background

• First-in-the-nation test-bed for Dedicated Short Range Communication (DSRC) on public roads
• 2.1 mile long, 11 Consecutive Intersections
• Broadcasting Signal Phase and Timing (SPaT) and Geometric Intersection Description (GID) messages
• Ready for Application development
• UC Berkeley PATH Program is our technical consultant
• Many companies have used the test-bed for application development
California Connected Vehicle Test Bed Location

Stanford
Cambridge
California
Page
Mill Portage/Hansen
Matadero
Curtner
Ventura
Los Robles
Maybell
Charleston
Connected Vehicle Test Bed

- History and Description of the Connected Vehicle Test Bed
  - Initial Installation in 2005
  - Upgrade in 2014
  - Current State, Roles (CalTrans, PATH)
  - One of the National Affiliated Test Beds
Connected Vehicle Test Bed

• Test Bed Purpose and Objectives
  – Serves as Infrastructure “Sand Box”; Industry Brings the “Toys”
  – Available and Accessible to All Interested Parties
  – Development, Test, and Evaluation of Safety, Mobility, and Environmental Applications
  – Data Warehouse, with Links to the National CV Warehouse
Connected Vehicle Test Bed

• Available Resources
  – Broadcasts SPAT and MAP to Approaching Vehicles using DSRC
  – Receives Basic Safety Message (BSM) and Signal Request Messages from Vehicles
  – Backhaul Communications from each Intersection via Cellular Modem
  – Guidance Manual that Documents How the Test Bed Works
Example Installation

6. Matadero Avenue
RSE goes above mast arm on the vertical
Antenna on the mast arm;
Needs Bracket
Example Layout Schematic

Intersection list:
- Stanford
- Cambridge
- California
- Page Mill
- Portage / Hansen
- Matadero
- Ventura
- Los Robles

Note: Not to scale

CALTRANS®
Example Existing Installations
Actual Installation (Page Mill Road and El Camino Real)
Feature Extraction

- For GID there is a need of getting roadway features like location of stop bars, lane widths etc.
- Manual surveying is costly and not very efficient.
- Automated engineering grade surveying is needed.
Feature Extraction
Eco-Driving Application

Using SPaT and GID information, in-vehicle systems calculate and provide speed advice to the driver of the vehicle, enabling the driver to adapt the vehicle’s speed to pass through the upcoming signal on green or to decelerate to a stop in the most environmentally efficient manner.
CV Application

• Intelligent Traffic Signal System (ISIG)
  – Signal actuation
  – Coordinated section of signals
  – Congestion control
• Transit Signal Priority (TSP)
• Freight Signal Priority (FSP)
• Emergency Vehicle Priority (EVP)
• Pedestrian Mobility
CV Applications

Wifi, Bluetooth

DSRC 5.9GHz
So What’s New

- Upgrading the existing 11 intersections to latest DSRC standard.
- Addition of six new intersections to the north of existing test-bed.
- Plan of upgrading the remaining 129 intersections on the test-bed.