Early Opportunities for AV Deployment in California Managed Lanes

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Background

- Automated Vehicles (AVs) are coming!
  - Level 1 and 2 systems are already on the road
  - Level 3-5 systems being tested but deployment timeline is uncertain
- Driver comfort and convenience benefits are understood but transportation system benefits are unknown
- Connected AVs (or CAVs) are better
  - V2V provides redundancy for safety
  - V2I provides infrastructure support
- Managed Lanes are ideal testbeds for CAVs
  - Opportunity to concentrate CAVs together
  - Separate CAVs from general traffic for safety

Project Goals and Objectives

- Explore Opportunities for AV testing and deployment in California Managed Lanes (Express Lanes, HOV, etc.)
  - Identify best candidate sites
  - Assess CAV applications for MLs
  - Define CAV deployment concepts
- Position California for future funding and economic development opportunities
- ITS World Congress 2020?

Survey of Managed Lanes in CA

- Site Selection Criteria
  - Should have at least 10 miles of continuous lane
  - Should have enough congestion in general purpose lanes to provide incentive but not too much congestion in Managed Lanes
  - Should be active during both morning and evening peak hours in both directions
  - Should be in existence already, under construction, or expected to be available for public use no later than 2020
  - Ideally should include some diversity of physical configurations
    - physically segregated lanes
    - lanes with discrete access points
    - lanes with continuous access

Survey of Managed Lanes in CA (cont.)

- Sites Selected for Further Investigation

  1. I-80 HOV lanes near San Francisco
  2. I-680 Express lanes near San Francisco
  3. I-580 Express lanes near San Francisco
  4. I-210 HOV lanes near Los Angeles
  5. I-10 Express Lanes near Los Angeles
  6. I-110 Express Lanes near Los Angeles
  7. SR-91 Express Lanes near Los Angeles
  8. I-15 Express Lanes near San Diego
  9. SR-125 (Southbound) Expressway near San Diego

Survey of Managed Lanes in CA (cont.)

- Sites Selected for CAV Testing and Early Deployment

    1. I-80 HOV lanes near San Francisco
    2. I-680 Express lanes near San Francisco
    3. I-580 Express lanes near San Francisco
    4. I-210 HOV lanes near Los Angeles
    5. ***I-10 Express Lanes near Los Angeles***
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    8. ***I-15 Express Lanes near San Diego***
    9. SR-125 (Southbound) Expressway near San Diego

I-15 Express Lanes
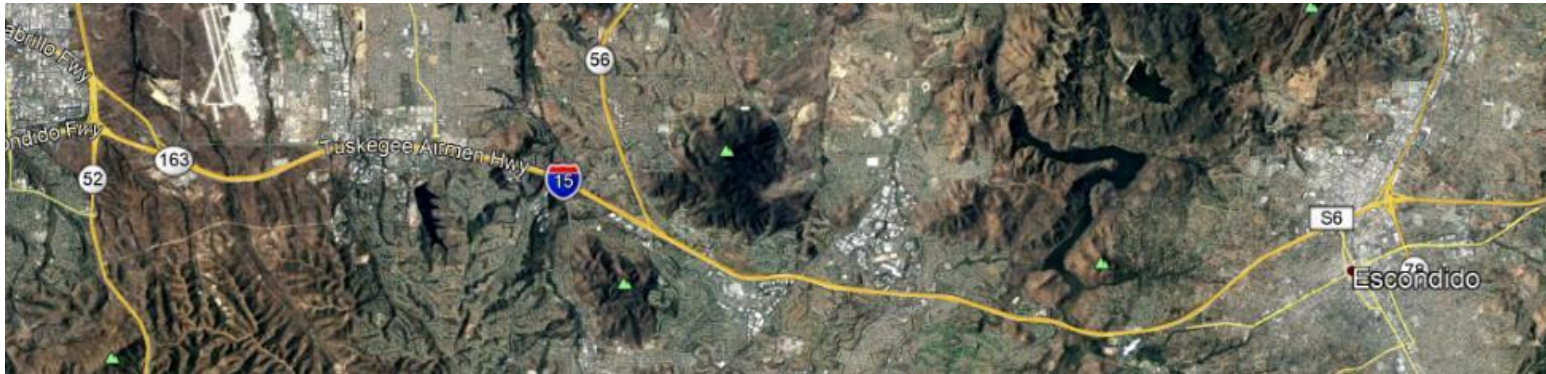
- *Location:* north of San Diego; commuter route
- *Length of corridor:* 20 miles
- *Number of managed lanes:* 4 (configurable to 1, 2 or 3 per direction)
- *Type of managed lane(s):* express lane
- *Segregation:* double white line (4 miles), physical barrier and grade segregation (16 miles)
- *User requirements:* HOV or single-occupied vehicles with FasTrak transponder, no trucks allowed

I-15 Express Lane (Cont.)

- Physical barriers and grade separation from general traffic
- Express lanes are 14 feet wide with wide shoulder
- Movable barriers to account for the directional traffic
- Restricted access (12 distinct ingress/egress points)
- 5 direct access ramps in each direction

I-15 Express Lane (Cont.)

- Good interagency coordination b/t Caltrans and SANDAG
- Advanced ITS infrastructure including an integrated corridor management (ICM) system
- Named official CAV Proving Ground by the USDOT; established protocol for users to apply for on-road CAV testing
- The South Control Yard on the southern end of the corridor can be used as a staging area

I-10 Express Lanes
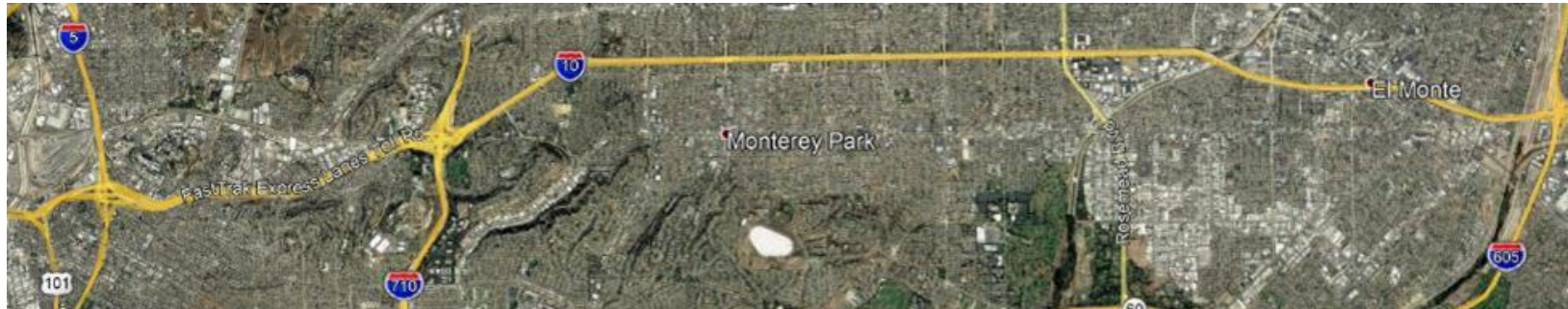
- *Location:* just east of downtown Los Angeles
- *Length of corridor:* 13 miles
- *Number of managed lanes:* 4 (2 in each direction)
- *Type of managed lane(s):* express lane
- *Segregation:* double white line and physical segregation
- *User requirements:* vehicles equipped with FasTrak transponder, vehicles with 2 people or 3+ people get different levels of discount, no trucks allowed

I-10 Express Lanes (cont.)

- East end of the section has 1 physically separated lane with a wide shoulder
- Middle portion has two lanes with double white line for separation

I-10 Express Lanes (cont.)

- West end (b/t I-5 and I-710) operates next to a dedicated bus lane with bus stops integrated into the facility
- Continuous rapid bus line along corridor provides opportunity to test CAV Transit applications

Assessment of CAV Applications

- Assessed a list of 11 CAV applications (from USDOT list of likely CAV applications)

- Application selection criteria
  - Technological readiness of the application
  - Suitability for operating in Managed Lanes environment
  - Likelihood of having significant early impact
  - Importance to stakeholders
  - Availability of enabling ITS infrastructure and data
  - Availability of equipped test vehicles

Assessment of CAV Applications

- 4 applications selected
  - Highway cooperative adaptive cruise control (CACC) for light-duty vehicles
  - V2I freeway speed harmonization/variable speed limit
  - Highway merge coordination (V2V and V2I)
  - Automated bus rapid transit on busways

Testing and Deployment Concepts

- Detailed descriptions of each concept

- Possible testing scenarios

- Deployment readiness

- Expected benefits

Example Deployment Concept: V2I Speed Harmonization

- Test Scenario 1: Universal Speed Advisories over cellular network – Level 0 automation (1-2 years to deploy)
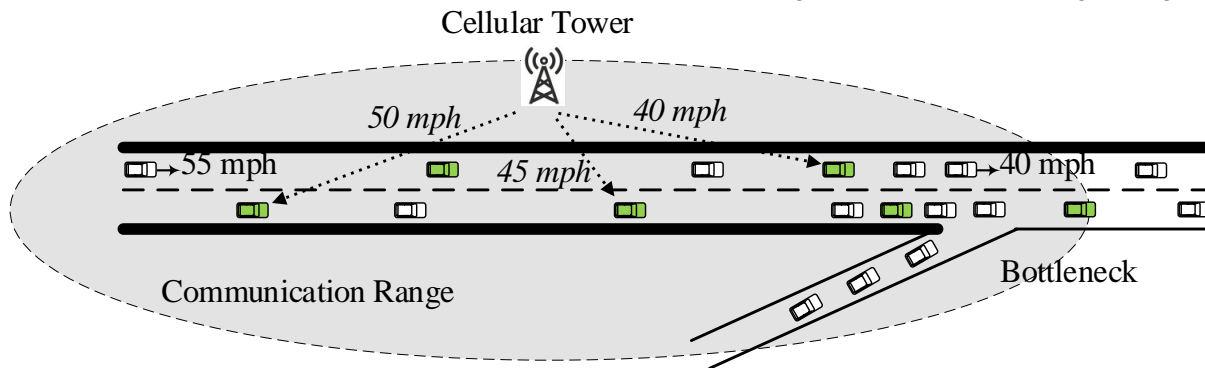
- Test Scenario 2: Customized Speed control over DSRC – Level 1 automation (2-4 years to deploy)
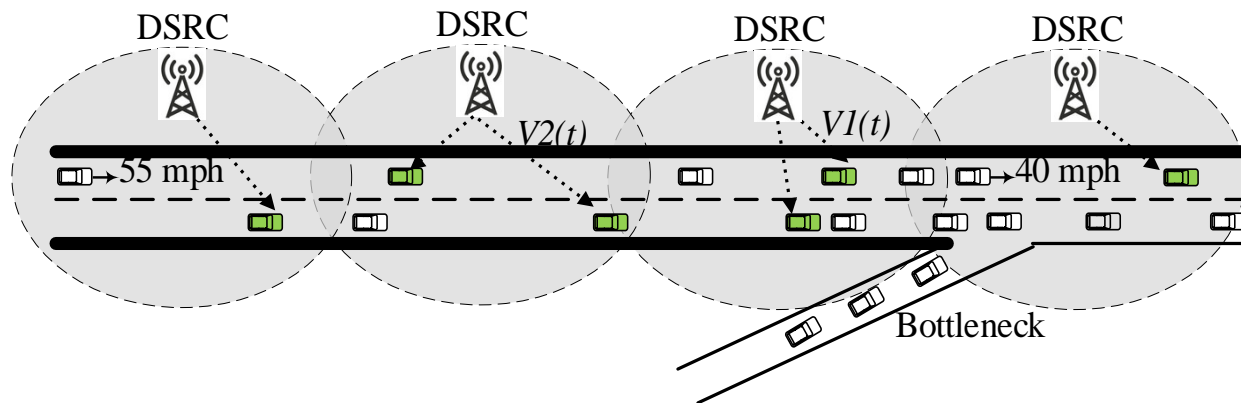
Example Deployment Concept: V2I Speed Harmonization (cont.)

- Performance Measures
  - Mobility - throughput, avg. speed, and travel time
  - Surrogate safety - rear-end conflicts and time to collision
- Deployment Readiness
  - Scenario 1 can leverage existing cellular network and ITS. Requires 20-50 level 0 vehicles with in-vehicle devices.
  - Scenario 2 requires V2I infrastructure and more sophisticated algorithms. Requires 20-50 level 1 vehicles.
- Expected Benefits
  - Eliminates or delays the traffic breakdown at bottleneck areas by limiting flow into bottleneck areas
  - Reduces likelihood of rear-end collisions

Next Steps

- Explore opportunities for funding of CAV testing on I-15 and I-10 Express Lanes

- Build partnerships with local stakeholders

- Leverage these CAV concepts for 2020 ITS World Congress in LA

- Develop more detailed test plans
  - Bundling of applications
  - Consider geometry and traffic patterns
  - Microscopic simulation experiments

Comments & Questions?

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