The Future of Smart Mobility

October 2019

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DriveOhio
Interim Executive Director
294,789
DriveOhio

The Future of Smart Mobility

Safety

Mobility

Access

Reliability

Talent
DriveOhio
The Future of Smart Mobility

2019 Statewide Projects
Automated Vehicles
Urban Deployment
Northeast Ohio
DEPLOYING AUTOMATED TECHNOLOGY ANYWHERE

Data-Sharing Partnerships
- US 33 Smart Mobility Corridor
- Youngstown SMART2
- Smart Circulator
- Linden AV Deployment

ADS Rural Ride-hail & ParaLift™
- Athens to McArthur route
- Ervin Rd (rolling terrain, no edge lines)
- OH 356 between US 50 and OH 56 (winding alignment, narrow lanes, limited shoulders)
- OH 278 between US 50 and Twp Highway F1
- Township Highway F1 (gravel road, rolling terrain)
- Old State Road (faded pavement markings, limited shoulders, rolling terrain)

ADS Highway Truck Platooning
- US 50
- US 33
- OH 32

OhioHealth O’Bleness Hospital
Kroger
Heritage Community Clinic and Mobile Clinic

Athens Detail

McArthur to Athens to Route Roadside Units

DriveOhio
DEPLOYING AUTOMATED TECHNOLOGY ANYWHERE

Partners

Lead Applicant

The Future of Smart Mobility

Industry

BOSCH

Community

AUTOMOTIVE TUFF

HONDA

ROBOTIC RESEARCH

YELLOW CAB COLUMBUS

tu simple

DENSO

Crafting the Core

FOUNDATION FOR APPALACHIAN OHIO

GREATER OHIO POLICY CENTER
Driving Our AV Future: Ohio
A Discussion on Automated Vehicles and the Future Workforce
“IT’S LIKE BEING BORN ON AN ISLAND WITHOUT BRIDGES OR BOATS AND EVERYTHING YOU NEED IS ACROSS THE WATER.”
ODOT Statewide Framework for Connected and Autonomous Vehicle (AV/CV) Deployments
Goal: Create Statewide Framework

- This Framework is first of its kind in U.S.
- DriveOhio’s first initiative: Coordinate statewide CV/AV technology deployments
**Framework Outcome: Guidebook**

Completed or underway: tools needed to **plan**, **deploy** and **monitor** AV/CV projects that will work together

<table>
<thead>
<tr>
<th>PLANNING TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CV/AV Architecture</strong> illustrates the integration of CV/AV and ITS projects</td>
</tr>
<tr>
<td><strong>Concept of Operations</strong> describes the suite of need-based CV/AV applications for potential implementation</td>
</tr>
<tr>
<td><strong>Communications Master Plan</strong> evaluates communications capacity and projected demand</td>
</tr>
<tr>
<td><strong>P3 Approach</strong> explores cost and effort sharing opportunities</td>
</tr>
<tr>
<td><strong>Program Plan</strong> identifies CV/AV deployment opportunities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPLOYMENT &amp; MONITORING TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Requirements</strong> specifies what the systems and applications shall do</td>
</tr>
<tr>
<td><strong>Communication Requirements</strong> specifies the communications requirements for specific CV applications</td>
</tr>
<tr>
<td><strong>Software &amp; Data Requirements</strong> specifies what the applications supporting software shall do</td>
</tr>
<tr>
<td><strong>High Level System Design</strong> describes how components and systems will interact</td>
</tr>
<tr>
<td><strong>Detailed System Design</strong> provides construction drawings for infrastructure components</td>
</tr>
<tr>
<td><strong>Verification Plan</strong> provides test plans to verify each application's requirements</td>
</tr>
</tbody>
</table>
Identified Top Challenges that May Be Addressed by Technology

Vehicle crashes at intersections
Lack of traffic data collection capability
Provision of real-time travel information (congestion/incident/weather/construction) to the public
Congestion on freeways/expressways
Congestion on arterial roadways
Congestion caused by roadway construction/maintenance
Roadway crashes due to weather conditions
Rear-end collisions due to traffic backup/queues
Crashes in and around roadway work zones
Lack of real-time traffic monitoring capability
Conflicts and safety incidents between pedestrians/cyclists and transit vehicles
Conflicts and safety incidents between transit vehicles and other vehicles
Transit on-time performance
Conflicts and safety incidents between pedestrians/cyclists and non-transit vehicles
Stakeholder Engagement

Determined Top, Statewide User Needs

1. Traffic signal timing optimization and coordination
2. Multi-agency/jurisdictional information exchange/sharing
3. Ped/bike safety at/near intersections or along roadway
4. Staffing skills, knowledge and resources to support technology
### Identified Readiness Status of AV/CV Applications

- Assessed applications being used across U.S.
- Identified ready-, near-ready and future deployment applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Deployment Ready</th>
<th>Deployment Near Ready</th>
<th>Further Development Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Electronic Brake Light</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Collision Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do Not Pass Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersection Movement Assist</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle Turning Right in Front of a Transit Vehicle</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blind Spot Warning + Lane Change Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Turn Assist (LTA)</td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>
Developed Concept of Operations

- Described target system and desired operation
- Includes applications, core systems and infrastructure
Identified 109 CV/AV Applications to Include in the Ohio Framework

<table>
<thead>
<tr>
<th>Application</th>
<th>Need-Based</th>
<th>Project-Based</th>
<th>Future Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve Speed Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Ramp Deceleration Warning (ERDW)</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced Speed Zone Warning/Lane Closure</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrian in Signalized Crosswalk Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Light Violation Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPaT MAP Display Signal Timing, Time to Green</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Wrong Way Entry (WWE)</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed Limit Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spot Weather Impact Warning</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Restricted Lane Warnings</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oversize Vehicle Warning</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop Sign Violation Warning</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Stop Sign Gap Assist</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>
Convened Concept of Operations Workshop

Discussed 8 operational scenarios:

- Traffic signal operation
- Rail crossing issues
- Unplanned incidents
- Work zones
- Trucker parking information
- Mobility support
- Disruption to mobility ecosystem
- Safety across transportation modes
Living doc to be updated as apps develop and deploy!
Prepared Standard Drawings

- Dedicated Short Range Communications
- Closed Circuit TV Assembly
- Vehicle Detector
- Highway Advisory Radio and Beacon Sign
- Dynamic Message Sign
- Destination Dynamic Message Sign
- Ramp Meter
CV/AV Project Deployment Process

1. Identify primary needs
2. Map needs to CV/AV apps
3. Pull CV/AV requirements for chosen apps
4. Confirm functional requirements meet project goals
5. Select standard design drawings
6. Complete SERF to obtain project approval
7. Use compiled package for procurement
8. Update document set with local/project-specific requirements & drawings
9. Update statewide docs & drawings to assist future users
The Guidebook is Meant to be Used

- Use tools as a resource for planning and deploying of future projects
- Contribute updates that may assist future uses
PLANNING FOR CAVS
Long Range Transportation Plan
AO45 SCENARIO PLANNING

- Long Range Transportation Plan needed to consider CAV and emerging tech impacts
- Needed resilient strategy and policy recommendations
- Used scenario planning approach
AO45 SCENARIO PLANNING

- Both Innovation and Ohio Renaissance Alternatives included significant CAV penetration

**Changes to Analysis Inputs**

- Assumed a future driven by technology and innovation
  
  *(including impacts on demographics, economy, workforce, quality of life)*

- Adjusted Statewide Travel Demand Model estimates
  
  *(50% increase in capacity on major roads, 15% increase in travel speeds)*

**Impacts on Strategic Outputs**

- Lower highway capacity needs anticipated
- Fewer congested roadways anticipated
- More demands for technology-supported multimodal travel
- Strategies to leverage technology and data to improve transportation safety, efficiency and reliability
Anticipated future needs vary across future alternatives, driven by CAV and other tech.

**Significant Changes**
- Overall Needs
- Operations
- Capacity

**Modest Impacts**
- Active
- Aviation
Travel Demand Modeling
CAVS IN THE TRAVEL DEMAND MODEL
2 DESIGN MODIFICATIONS

○ How People View Travel
  ○ Cars become available at any location at any time
  ○ In-Vehicle Time Productivity in Mode Choice - AVs allow “drivers” to use travel time productively (working, reading, texting, ...)
  ○ HH AVs are convenient for transit access

○ How Vehicles are Used
  ○ Older adults, youth, disabled and others without a driver’s license will have access to AVs (can make independent car trips)
  ○ Empty repositioning trips made by AVs to accommodate other HH members’ travel
  ○ Availability of cheap, driverless taxi/TNC
CAVS IN THE TRAVEL DEMAND MODEL
UPDATED MODEL CONSTRAINTS & EXAMPLE

- Market Penetration Rates
- Age for traveling alone
- Productivity time bonus
- Capacity and Speed bonuses by penetration rate and facility type
- Transit accessibility
- CAVs for HH
- CAVs for taxi

### Scenarios

<table>
<thead>
<tr>
<th>Parameters</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low productivity bonus, high roadway capacity improvement</td>
<td>High productivity bonus, high roadway capacity improvement</td>
<td></td>
</tr>
<tr>
<td>Analyze sensitivity to productivity bonus</td>
<td>Analyze sensitivity to productivity bonus</td>
<td></td>
</tr>
<tr>
<td>AVs proportion in market</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Auto in-vehicle productivity bonus for AV</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>“No escort” promotion for AV households</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Minimum age for traveling alone in AV</td>
<td>10 years</td>
<td>10 years</td>
</tr>
<tr>
<td>K^TN^R promotion factor</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Interstate: 80%</td>
<td>Interstate: 80%</td>
<td></td>
</tr>
<tr>
<td>Arterial: 60%</td>
<td>Arterial: 60%</td>
<td></td>
</tr>
<tr>
<td>Vehicle spacing reduction due to single AV</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Zonal parking cost</td>
<td>No change</td>
<td>No change</td>
</tr>
</tbody>
</table>
Impact on Accessibility: Scenario 1 and 2
PROJECT LEVEL TRAFFIC MICROSIMULATION GOALS

- Determine how effective different CV/AV applications are in reducing traffic congestion and improving safety, traffic speeds, capacities and reliability
- Determine which locations and traffic conditions are most amenable to these applications
- Synthesis noted uncertainties with:
  - CAV Penetration Rates
  - Impacts of CAV Technologies
  - How the public perceives and experiences travel
QUESTIONS

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