Ohio Transportation Engineering Conference
October 3, 2018
33 Smart Mobility Corridor - Automotive Cluster

The 33 Smart Mobility Corridor is home to more than 66 automotive companies.

April 2018
Approximate Locations. Map not drawn to scale.
Collaborative Group Formed to Explore Development Issues along US-33

Collaborative Group Prioritizes Fiber Connectivity along US-33

Fiber Strategy Consultant
OSU Mobility Concept
Smart Project Introduced
ODOT Commits up to $15 M for Fiber Construction
NW 33 COG Formed
USDOT Awards $5.9 M Grant

Fiber Installation Completed along US-33 (ODOT)
Ohio Announces $45 M for TRC Expansion
PROJECT GOALS

Economic Development

Global Partnerships

AV/CV Testing

Smart Infrastructure

Public Safety

Data

* Improve Congestion, Safety, and Employment Access
* Installation of Smart Mobility Infrastructure and Systems Management
* AV/CV Testing
* Contained Testing at TRC
* On-road Testing on US-33
* Truck Platooning
* Urban Testing
* Research Similar Programs Across USA & World
* Form and Foster Partnerships to Advance Smart Mobility Projects
* Exchange Data and Best Practices with Partners
* Investment in New/ Emerging Technologies
* Smart Mobility Industry Grows up to +$2 Trillion Annually by 2025
* Expansion of TRC and Other Automotive Assets
* Attraction of Businesses to Area Business Parks
Nearly $100 MILLION has been pledged by public and private partners corridor.

Over $525 M of private automotive related investment has been made since 2015.

Another ~$125 M of private automotive related investment is planned in 2018-19.
Ohio’s 33 Smart Mobility Corridor Project
- 35-mile Smart Mobility Corridor
- 432 strand redundant fiber network
- 94 RSUs
  - 62 RSUs along US 33; 32 RSUs at various intersections
  - 1,200 OBUs
- Closed and open testing in all weather conditions in rural, exurban and urban environments
- Connected Marysville and Connected Dublin
- 540-acre SMART Center at TRC
- Smart Belt Coalition effort to connect OH, PA, and MI
REGIONAL CONNECTED VEHICLE ENVIRONMENT (CVE)

- 179 Intersections:
  - 147 City of Columbus
  - 27 City of Marysville
  - 5 City of Dublin

- 3,000 cars, trucks, and buses connected in the Columbus Region by 2020:
  - 1,800 City of Columbus
  - 1,200 Marysville/US-33
CONNECTED MARYSVILLE

- 27 Traffic Signals outfitted with RSUs
- 1,200 vehicles outfitted with OBU's
- Online repository for collected data from vehicles
- Future investments:
  - Signage
  - Striping
  - Street Lighting

Smaller Town, Lower Traffic Volumes
- 10% Penetration Rate with 1,200 vehicles.
- Connected vehicles won’t get lost in the crowd.

Home of Honda’s largest manufacturing and R&D facilities in North America
- End user feedback allows for “right size” design
CONNECTED DUBLIN

Comprehensive “Smart City” Approach
• Smart Mobility is a priority
• Unique opportunities to innovate

Avery-Muirfield Corridor
• ATCMTD Grant
• Traffic Signals outfitted with RSUs

SR 161/Riverside Drive Roundabout
• Multilane roundabout within 2 signalized corridors
• CV research and operations study
• Roundabout CV Application

Bridge Park East Smart Parking
• No existing meter infrastructure
• Mobile Only Parking Management

Avery-Muirfield Corridor - Connected Signals
SR 161/Riverside – Connected Roundabout & Signals
33 Smart Mobility Corridor
Bridge Park – Smart Parking Management
USDOT ATCMTD GRANT

Planned CV Applications:
Broadband Deployment
SR 161/RIVERSIDE DRIVE ROUNDABOUT CV PILOT

Planned CV Application:

- Multilane roundabout within 2 signalized corridors
- CV research and operations study
- Collect data of circulating vehicles in roundabout to inform approaching vehicle decision-making
- Integrate information with data collected at adjacent signalized intersections
Interesting opportunity…

- New parking inventory
  - Garage
  - Surface
  - On-street
- Demand increasing
- No existing meter infrastructure
SMART PARKING MANAGEMENT

Smart Parking Pilot - **Mobile Only**

- No capital investment
- No clutter
- No disruption of infrastructure
- Simplest route to self-financing parking program
- Ample off-street parking for those unable/disinclined to pay by phone
WHY ARE WE DOING THIS?

Source: Insurance Institute for Highway Safety
ERAS OF VEHICLE SAFETY IMPROVEMENT

1950 – 2000
Safety/Convenience Features
✓ Cruise Control
✓ Seat Belts
✓ Antilock Brakes

2000 – 2010
Advanced Safety Features
✓ Electronic Stability Control
✓ Blind Spot Detection
✓ Forward Collision Warning
✓ Lane Departure Warning

2010 – 2016
Advanced Driver Assistance Features
✓ Rearview Video Systems
✓ Autom Emergency Braking
✓ Ped. Auto Emerg. Braking
✓ Rear Auto Emerg. Braking
✓ Rear Cross Traffic Alert
✓ Lane Centering Assist

94% of serious crashes are due to human error!!!
HOW DO WE MAKE MOBILITY SAFER?

✔ V2V and V2I vehicle technology could address **80%** of the crash scenarios.

✔ V2I technology alone could reduce **26%** of all target crashes annually.

✔ Left Turn Assist (LTA) and Intersection Movement Assist (IMA) could prevent 592,000 crashes and **save 1,083 lives** per year.
PLANNED CVE APPLICATIONS

- Pedestrian Crosswalk Warning
- Red Light Violation Warning
- Road Weather Sensor System
- Ramp Wrong Way Warning
- Curve Speed Warning at Interchange Ramps
- Signal Phasing & Timing
- Reduce Speed Zone Warning/Lane Closure
- Railroad (potential)
PEDESTRIAN CROSSWALK WARNING

- Cameras detect all crossing pedestrians
- Assigns location, speed, and direction to pedestrians.
- Using V2I, sends alert to turning connected vehicles.
RED LIGHT VIOLATION WARNING

- Cameras detect all approaching vehicles
- Assigns location, speed direction, and vehicle type.
- Using V2I, sends alert to connected vehicles.
Wrong way vehicles are detected.

Warning is sent to officials and TMC to react and respond.

Using V2I, sends alert to vehicles that could be impacted.
ALIGNMENT WITH FHWA/USDOT STRATEGIC GOALS

Reduction in the number and severity of traffic crashes and an increase in driver, passenger, and pedestrian safety;

- PCW
- SWIW
- Curve Speed Warning
- (at interchange ramps)
- Q-WARN
- RRSZW/LC
- RLVW
- Ramp Wrong-Way

Collection, dissemination, and use of real time transportation related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation,

- SWIW
- Q-WARN
- RLVW
- PCW

Accelerated deployment of vehicle-to-vehicle, vehicle-to-infrastructure, and automated vehicle applications, and autonomous vehicles and other advanced technologies;

- All of the Applications
ALIGNMENT WITH FHWA/USDOT STRATEGIC GOALS

Demonstration, quantification, and evaluation of the impact of these advanced technologies, strategies, and applications towards improved safety, efficiency, and sustainable movement of people and goods.

Reproducibility of successful systems and services for technology and knowledge transfer to other locations facing similar challenges.
KEY ELEMENTS OF THE PROJECT

- ATCMTD Grant Project
  - ($6 Million grant + $6 Million matching funds)

- Local Loop Fiber Installation
  - Infrastructure (94 RSUs)

- Vehicles (OBUs)

- Connected Vehicle Applications

- Local Smart Network

- Multiple public and private partners
WHERE WE ARE NOW

Systems Engineering – an interdisciplinary approach and means to enable the realization of successful systems.
RSU PILOT DEPLOYMENT

Purpose:
The purpose of the RSU Pilot Deployment is to verify the ability to use and identify any gaps in the Ohio Department of Transportation’s (ODOT) Connected Vehicle Purchase Contract (Invitation 111-18) for the procurement, installation and testing of the roadside devices.
RSU PILOT DEPLOYMENT

Site Selection Requirements:
(Based on suggested criteria from the National Connected Vehicle SPaT Deployment Challenge)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-of-Sight to RSU</td>
<td>Ability to position the RSU radio in a good location that can provide a clear line-of-sight to vehicles approaching the intersection from all approaches and for a significant distance. Geometry of approach roadways was considered.</td>
</tr>
<tr>
<td>Controller</td>
<td>Modern controllers and software capable of outputting the SPaT message</td>
</tr>
<tr>
<td>GPS Signal</td>
<td>Sufficient GPS signal to the RSU that is not blocked by buildings or other “urban canyons”.</td>
</tr>
<tr>
<td>Signal Cabinet</td>
<td>Sufficient space in the cabinet for additional hardware, wiring and power connections</td>
</tr>
<tr>
<td>Conduit fill</td>
<td>Sufficient space within existing conduits to run the ethernet cables to the proposed mounting location. Ethernet cable runs should be limited to 300 ft or less.</td>
</tr>
</tbody>
</table>
RSU PILOT DEPLOYMENT

City of Marysville Locations

- 4th Street and Main Street
- 5th Street and Plum Street
- 6th Street and Main Street
- 5th Street and Court Street

Pre-timed Signals Econolite Cobalt Controllers
RSU PILOT DEPLOYMENT

City of Dublin Locations

- Avery-Muirfield Drive and Hospital Drive/Perimeter Loop Road
- Avery-Muirfield Drive and Perimeter Drive

Actuated Signals
EAGLE Controllers
RSU PILOT DEPLOYMENT

Field Investigations

- Line of Sight
- Controllers
- GPS Signal
- Signal Cabinet
- Conduit Fill
RSU PILOT DEPLOYMENT

Systems Engineering Analysis

Pilot System Architecture
RSU PILOT DEPLOYMENT

Systems Engineering Analysis

System Requirements

1Source: National Operation Centers of Excellence (www.transportationops.org) – SPaT Implementation Guide
RSU PILOT DEPLOYMENT

Expected Outcomes

• Pilot Deployment is expected to be installed in early November.
• Testing and validation will occur.
• Identify gaps in procurement.
• ODOT to advertise new Connected Vehicle Purchase Contract
ON-BOARD UNITS

Status

- Compiled lists of available fleet vehicles
- Establishing criteria to select vehicles for installation of OBUs
- Considering a simple test deployment, similar to RSU Pilot Deployment
**APPLICATION DEVELOPMENT**

**Status**

- Detailed Systems Engineering/Requirements for Applications will occur after High-level SEA is complete.
ENGAGEMENT

Status

- Draft Engagement Plan recently completed
- Focus on Industry
FUTURE PROJECT TIMELINE

2018
- Phase II Fiber Installation along Industrial Parkway and Northwest Parkway for Redundant Loop
- System Engineering Completed
- TRC Begins Construction of SMART Center
- Corridor Named as Proving Ground for UAT

2019
- DriveOhio Established by State of Ohio
- NW 33 COG Hires Project Manager
- Executive Order Establishes Statewide AV/CV Testing Protocol
- DSRCs with RSUs are Installed
- OBUs Installed in Vehicles
- Statewide Data Exchange Implemented

2020
- 33 Smart Mobility Ecosystem Operational
- CV Application Fully Operational

2021
- DSRCs are Required in all New Vehicles