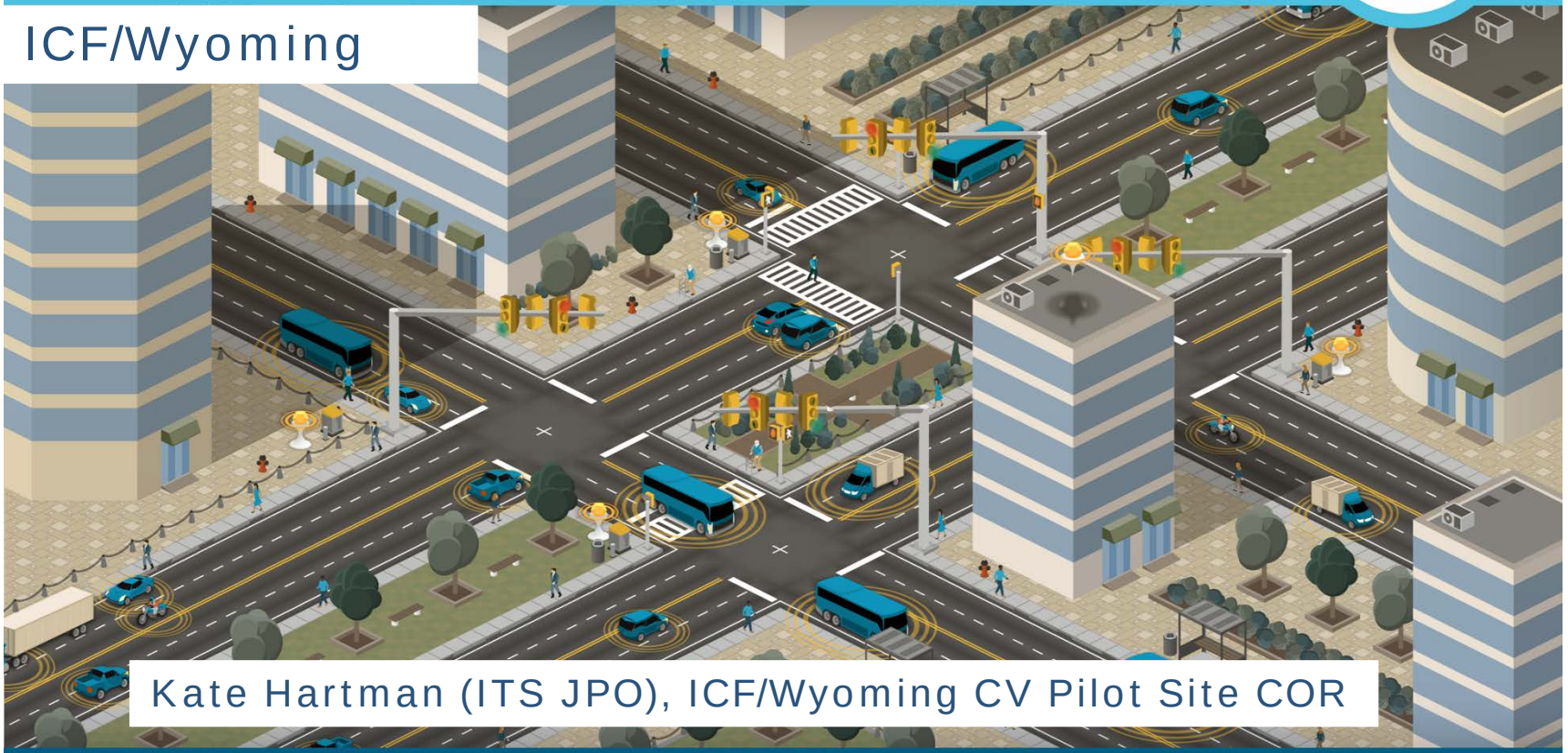
CONNECTED VEHICLE PILOT
Deployment Program

ICF/Wyoming



Kate Hartman (ITS JPO), ICF/Wyoming CV Pilot Site COR

ITS Joint Program Office

OVERVIEW

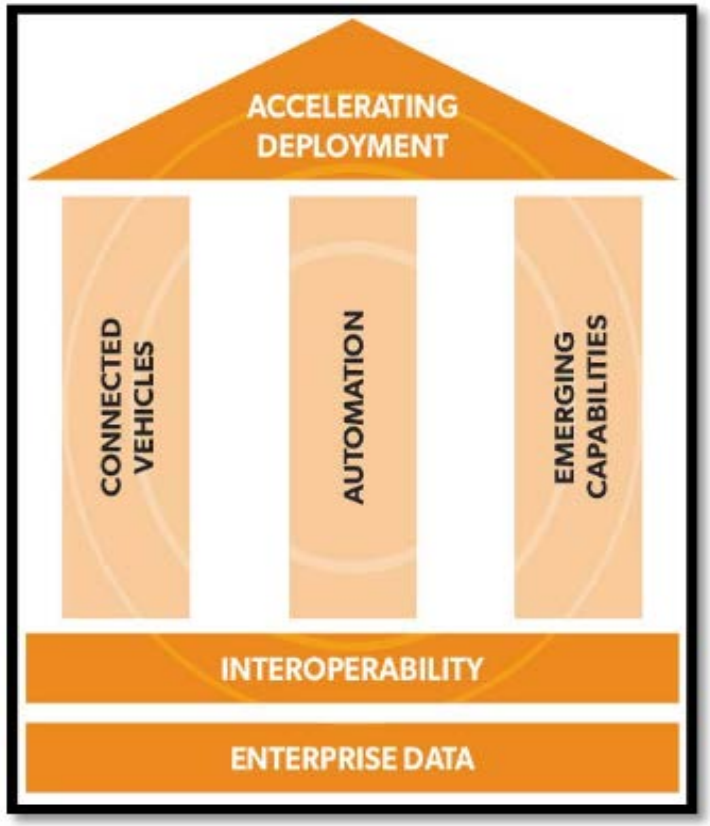
- Connected Vehicles Pilot Deployment Program Overview
  - Goals
  - Organizing Principles
  - CV Applications
  - Program Schedule and Future Milestones
  - CV Pilots Wave 1 Sites:
    - ICF/Wyoming, New York City, Tampa (THEA)
- ICF/Wyoming CV Pilot Deployment Overview
  - Pilot Objective
  - Pilot Deployment Site
  - Pilot Site Needs, CV Applications and Performance Measures
  - Fleet Distribution
  - Pilot Deployment Vision
  - Timeline and Phase 1 Deliverable Schedule
- How to Stay Connected

CV Pilot Deployment Program Within The USDOT ITS Strategic Plan

- The Connected Vehicle (CV) Pilot Deployment Program
  - Keystone effort in connected vehicle area
  - Also plays a key role in other strategic areas, including accelerating deployment, promoting interoperability, and enterprise data

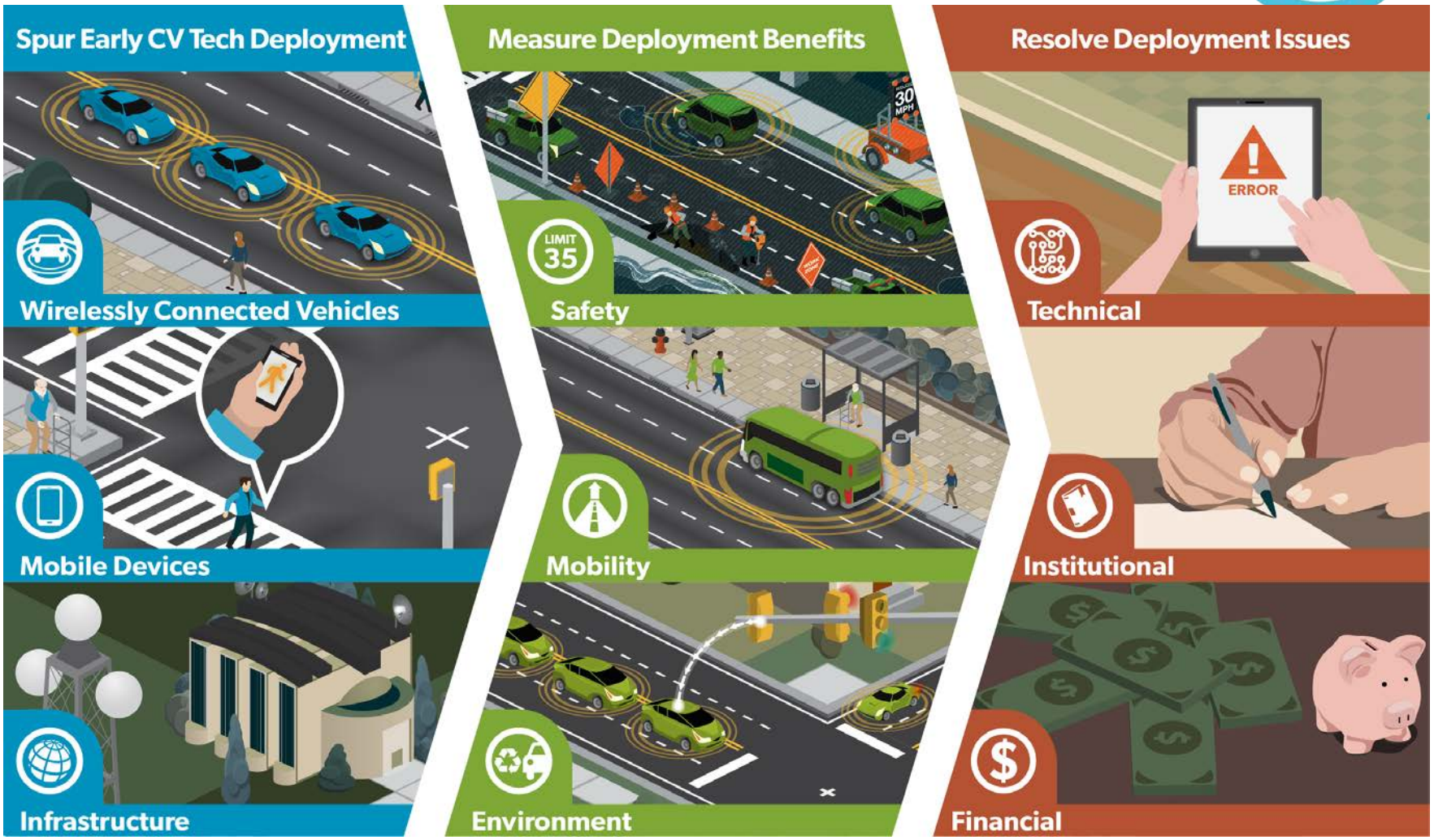
- CV Pilot Deployments offer a unique opportunity related to getting CV technology to the field and making a difference in many areas, including:
  - Needs-driven planning and investment
  - Integrated performance measurement
  - Lowering barriers to deployment

USDOT ITS Strategic Plan, pg. 14



http://ntl.bts.gov/lib/54000/54400/54481/Strat_Plan_Final_Version.pdf

CV Pilot Deployment Program Goals



CV Pilot Organizing Principles

- CV Pilots are *pilot deployments*, that is, real-world environment deployments
  - The successful, deployed technologies are expected to remain as permanent operational elements

- Deployment concepts are needs-driven
  - Each site has different needs, focus and applications
    - That is, each pilot deployment will address critical problem(s)
    - The needs of each site will drive the deployment process

- Pilot deployments are expected to be both *large-scale with multiple applications*
  - *Large-scale* implies pilot deployments will have measureable impact, not a specific minimum geographic or vehicle fleet size
  - Sites will deploy *multiple applications* drawing on the products of USDOT and other connected vehicle research

CV Pilot Deployment Requirements

- Multiple connected vehicle applications will be deployed together
- Pilot deployments should leverage USDOT-sponsored research
- Pilot deployments include the capture of data from multiple sources
  - Integrated or carry-in devices for connected vehicles capable of generating an SAE J2735 Basic Safety Message (BSM)
  - Look to pilot deployment data while protecting privacy and intellectual property
- Dedicated Short Range Communications (DSRC) 5.9 GHz will be utilized as the communications technology
- Well-defined, focused, quantitative performance measures
  - Support an independent evaluation effort
- Security and credentialing management system

CONNECTED VEHICLE APPLICATIONS

- The USDOT has made a significant investment in foundational research and initial development of 50+ connected vehicle applications
  - Concepts of Operations
  - System Requirements
  - Prototype Design and Testing
  - Prototype Impacts Assessment
  - Analytics, Modeling and Simulation to Assess Potential Long-Term Impacts

- Not all CV Application efforts are in the same state of maturity, few are complete
  - But a large number of application development efforts across multiple programs have been completed
  - GOAL: move deployment-ready application concepts forward into integrated deployments addressing key performance concerns

USDOT Sponsored CV Applications

V2I Safety

- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

Environment

- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

USDOT Sponsored CV Applications (cont.)

Mobility

- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance Measurement (F-ATIS)
- Drayage Optimization (DR-OPT)

Road Weather

- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

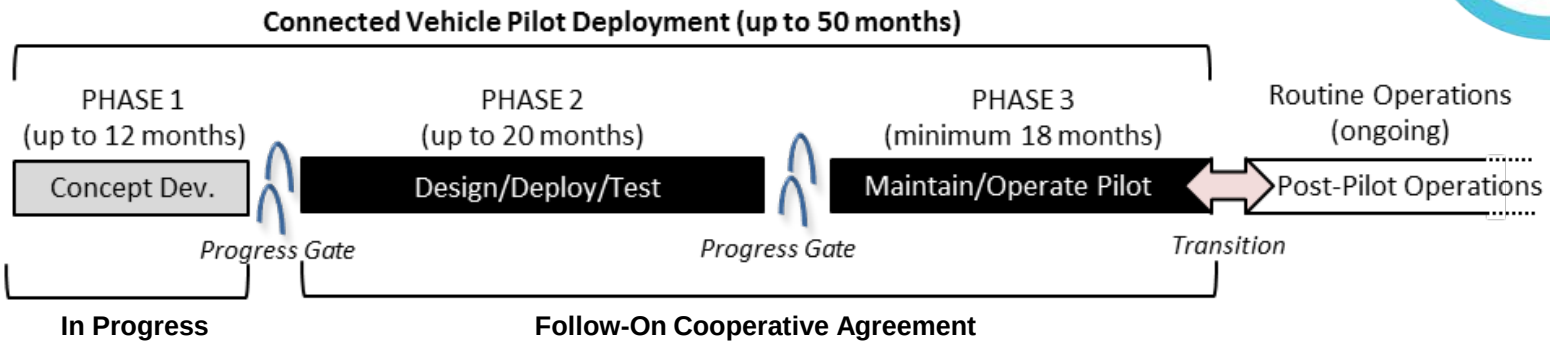
Smart Roadside

- Wireless Inspection
- Smart Truck Parking

Agency Data

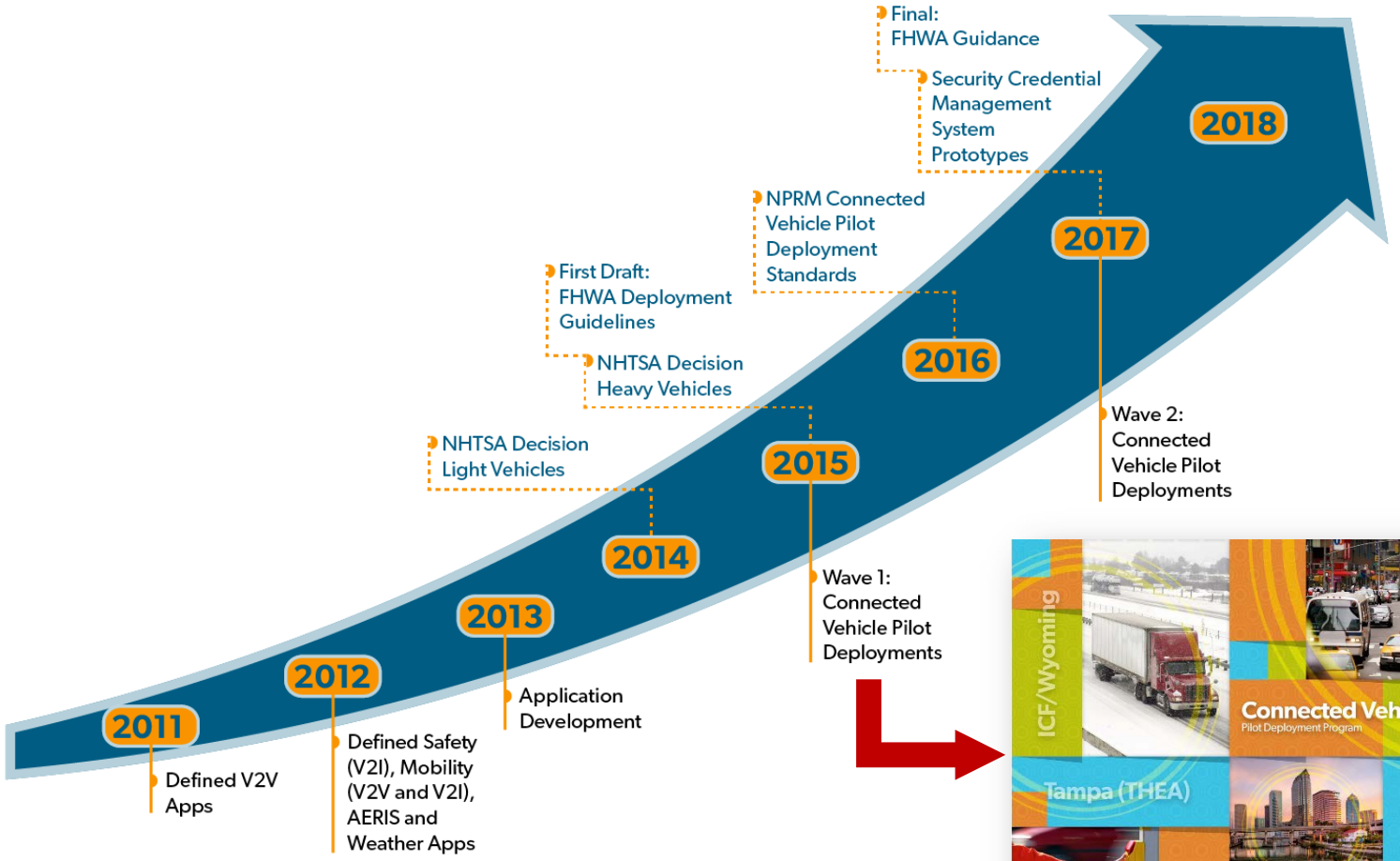
- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

CV Pilot Deployment Program Schedule: Wave 1 (Phases 1-3)



- Phase 1: Concept Development (Current Phase)
  - Creates the foundational plan to enable further design and deployment
  - **Progress Gate: Is the concept ready for deployment?**
- Phase 2: Design/Deploy/Test
  - Detailed design and deployment followed by testing to ensure deployment functions as intended (both technically and institutionally)
  - Progress Gate: Does the system function as planned?
- Phase 3: Maintain/Operate
  - Focus is on assessing the performance of the deployed system
- Post Pilot Operations (CV tech integrated into operational practice)

Moving Forward: Additional Milestones



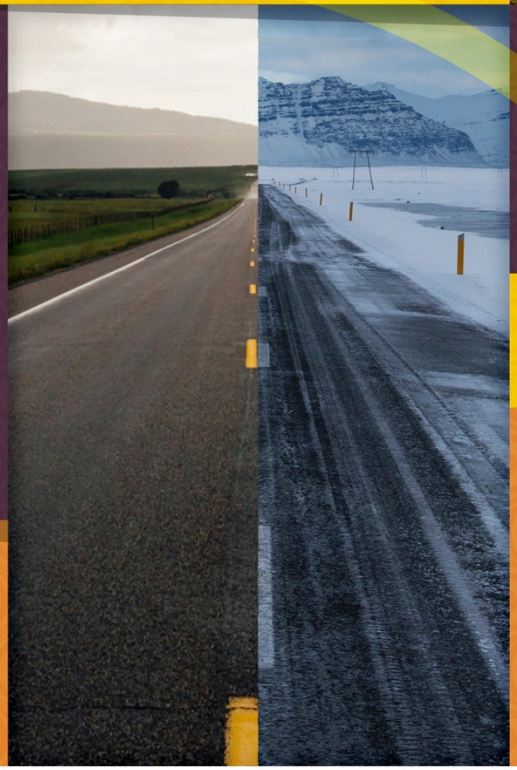
Connected Vehicle
Wave 1 Phase 1 Sites Selected

Solicitation Date:
1/30/2015

Award Date:
09/14/2015

Period of Performance:
09/14/2015 – 09/13/2016

ICF/Wyoming



ICF/Wyoming Pilot Deployment Objective and Approach

Objective:

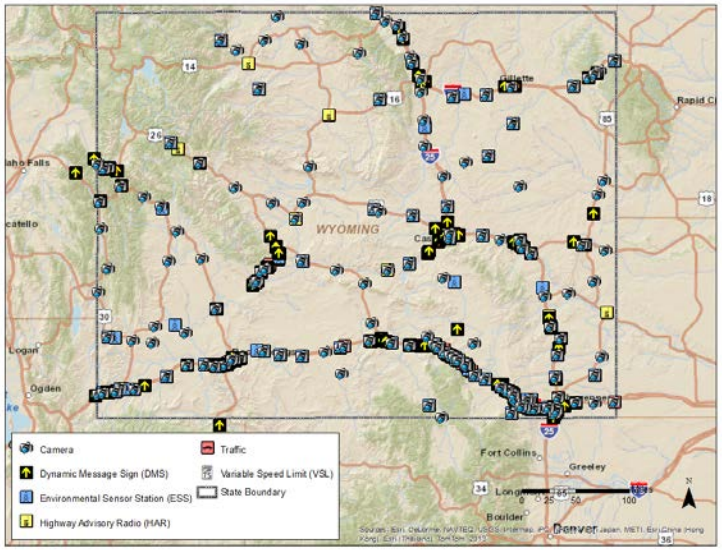
- Reduce the number and severity of adverse weather-related incidents (including secondary incidents) in the I-80 Corridor in order to improve safety and reduce incident-related delays.
  - Focused on the needs of the commercial vehicle operator in the State of Wyoming

Approach:

- Equip fleet vehicles (combination of snow plows, maintenance fleet vehicles, emergency vehicles, and private trucks) that frequently travel the I-80 corridor to transmit basic safety messages (BSMs), collect vehicle and road condition data and provide it remotely to the WYDOT TMCs
- Deploy DSRC roadside equipment (RSE) to supplement existing assets and initiatives
- Road weather data shared with freight carriers who will transmit to their trucks using exiting in-vehicle systems

Status:

- Kickoff conducted on 9/29-10/1
- ConOps under development



Source: Wyoming DOT

ICF/Wyoming Pilot Deployment Objective and Approach

Phase 1

Led By ICF

Partners
- Wyoming DOT
- Trihydro
- NCAR
- Univ of Wyoming
- CATT Lab
- McFarland Mgmt

Phase 2

Led By Wyoming DOT

Partners
- Wyoming DOT
- Trihydro
- NCAR
- Univ of Wyoming
- CATT Lab
- McFarland Mgmt

New Partners
- DSRC Radio Vendors
- On-board equipment vendors
- Data providers
- Weather Sensor Developers
- Fleet Operators

Phase 3

Led By Wyoming DOT

Partners
- Wyoming DOT
- Trihydro
- NCAR
- Univ of Wyoming
- CATT Lab
- McFarland Mgmt

New Partners
- Fleet Operators

Stakeholders Engaged throughout Pilot

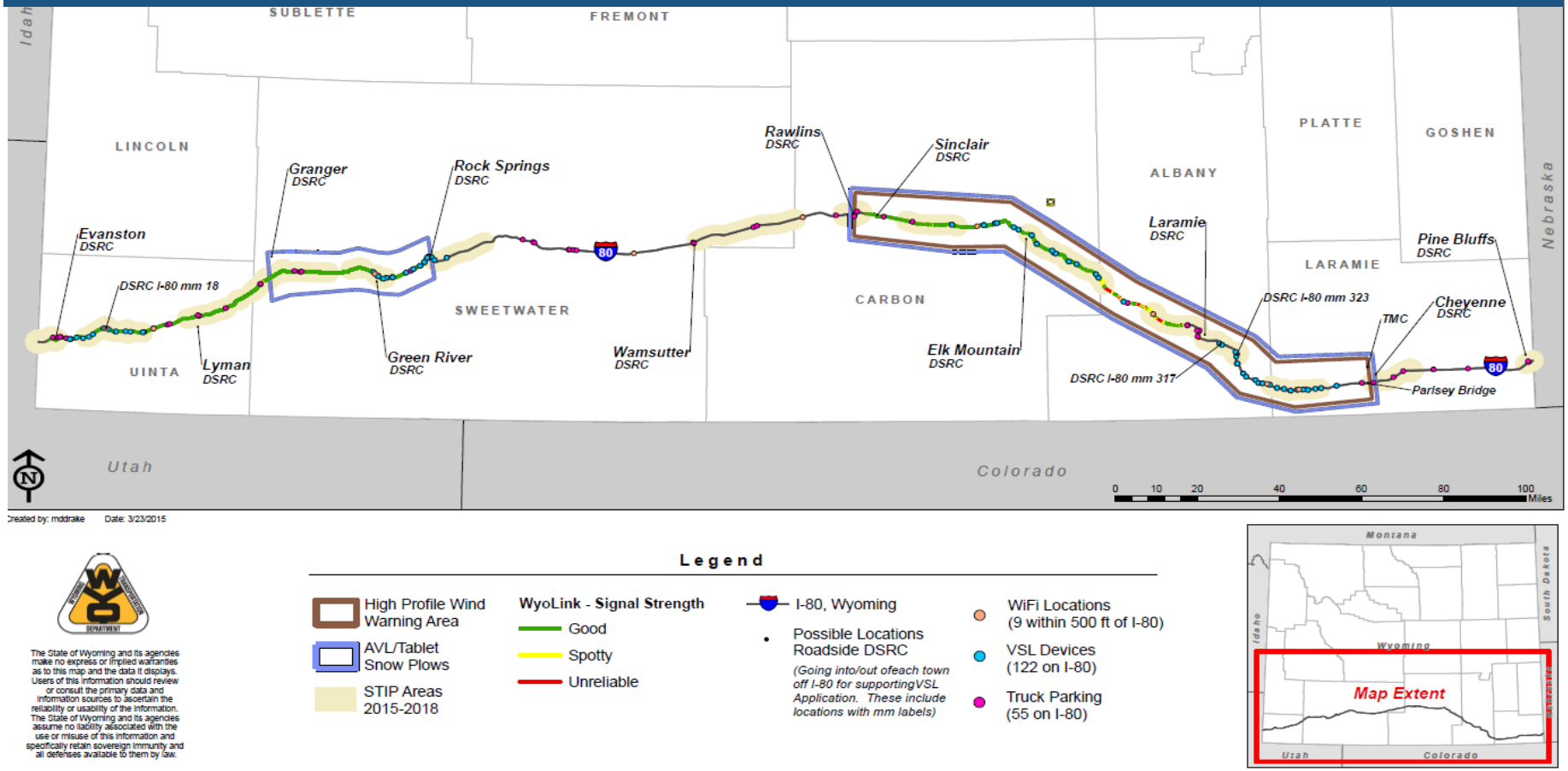
- Wyoming Trucking Association
- Wyoming Highway Patrol
- Wyoming Workforce Development
- Wyoming Chamber of Commerce
- Freight Operators
- Oil and Gas Industry Representatives

ICF/Wyoming Pilot Deployment Team

Project Sponsor	U.S. Department of Transportation	ITS Joint Program Office
Prime Consultant	ICF INTERNATIONAL	ICF International
Partner State	WYOMING DEPARTMENT of TRANSPORTATION	Wyoming DOT
Sub Consultants	Trihydro	Trihydro Corporation
	NCAR NATIONAL CENTER FOR ATMOSPHERIC RESEARCH	National Center for Atmospheric Research
	UW	University of Wyoming
	CATT LABORATORY	Catt Laboratory
	McFARLAND MANAGEMENT, LLC	McFarland Management

ICF/Wyoming Pilot Deployment Site: High Priority Corridor

Wyoming I-80 Corridor – Connected Vehicle Map



Created by: mddrake Date: 3/23/2015

The State of Wyoming and its agencies make no express or implied warranties as to this map and the data it displays. Users of this information should review or consult the primary data and information sources to ascertain the reliability or usability of the information. The State of Wyoming and its agencies assume no liability associated with the use or misuse of this information and specifically retain sovereign immunity and all defenses available to them by law.

Legend

- High Profile Wind Warning Area
- AVL/Tablet Snow Plows
- STIP Areas 2015-2018

WyoLink - Signal Strength

- Good
- Spotty
- Unreliable

- I-80, Wyoming
- Possible Locations Roadside DSRC *(Going into/out ofeach town off I-80 for supportingVSL Application. These include locations with mm labels)*
- WiFi Locations (9 within 500 ft of I-80)
- VSL Devices (122 on I-80)
- Truck Parking (55 on I-80)

Source: Wyoming CV Pilot Deployment Team

ICF/Wyoming Pilot Deployment Site: High Priority Corridor

Transportation Issues Along the Wyoming I-80 Corridor

- Truck blow overs of high profile freight vehicles with wind speeds frequently exceeding 30 mph and wind gusts of 70+ mph
  - 2002-2012 over 3,472 high-wind crashes were observed
  - Over five years, 86 road closures averaging over 8 hours long with estimated $11.7 million economic cost due to each closure
  - In the past four years, 200 truck blow overs reported related to high-wind events
- Mix of passenger and commercial vehicles can result in catastrophic crashes, most recently in two separate 65-vehicle pileups in 2015
- Between 2009-2013, a total of 94 fatalities were observed
  - 11 fatalities as a result of snow (11.70%)
  - 2 fatalities as a result of rain (2.13%)
  - 5 fatalities as a result of other weather conditions (5.32%)
- Risky, aggressive passenger vehicle driving behavior (driving too closely, cutting off other vehicles to pass, or driving excessively fast to make up for lost time) due to slow moving commercial vehicles through areas of elevation changes
- Major truck corridor with the highest elevation along the entire length of transcontinental I-80
- Distance between towns range from 50 to 115 miles
- Limited parking and no alternate routes

ICF/Wyoming Pilot Deployment Site Needs: Road Weather Information

Reduce Truck and Vehicle Crashes

Road Weather Advisories for Trucks and Vehicles

Performance Measures

- Number of truck crashes due to weather
- Number of passenger vehicle secondary crashes due to weather

Improve Operational Effectiveness of Emergency Responders

Automated Notification of Emergency Responders

Performance Measures

- Average response times

ICF/Wyoming Pilot Deployment Site Needs: Road Weather Information

Improve Traveler Safety By Reducing Speed Variance

CV-enabled Weather-Responsive Variable Speed Limits

Performance Measures

- Speed variance
- Number of crashes
- Adherence to recommended speeds

Improve Truck Safety and Productivity

Truck Parking Availability for Freight Carriers*

Performance Measures

- Driver hours of service compliance
- Truck parking utilization
- Fleet operation efficiency

**Both a truck safety and road weather application*

ICF/Wyoming Pilot Deployment Site Needs: V2I Safety

Improve Driver Decision Making

Spot Weather Impact Warning

Performance Measures

- Number of crashes

Improve Work Zone Safety

Work Zone Warnings

Performance Measures

- Number of work zone crashes
- Adherence to posted speeds

ICF/Wyoming Pilot Deployment Site Needs: V2V Safety

Increase Awareness of Road Conditions

Situational Awareness

Performance Measures

- Number of crashes
- Adherence to speed advisories from vehicle

ICF/Wyoming Pilot Deployment Site Needs: Truck Safety

Improve Truck Safety

Freight-Specific Dynamic Travel Planning

Performance Measures

- Fleet management centers usage of CV data

ICF/Wyoming Pilot Deployment Proposed CV Applications: Summary

V2I Safety

- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning

Road Weather

- Motorist Advisories and Warnings (MAW)
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

Mobility

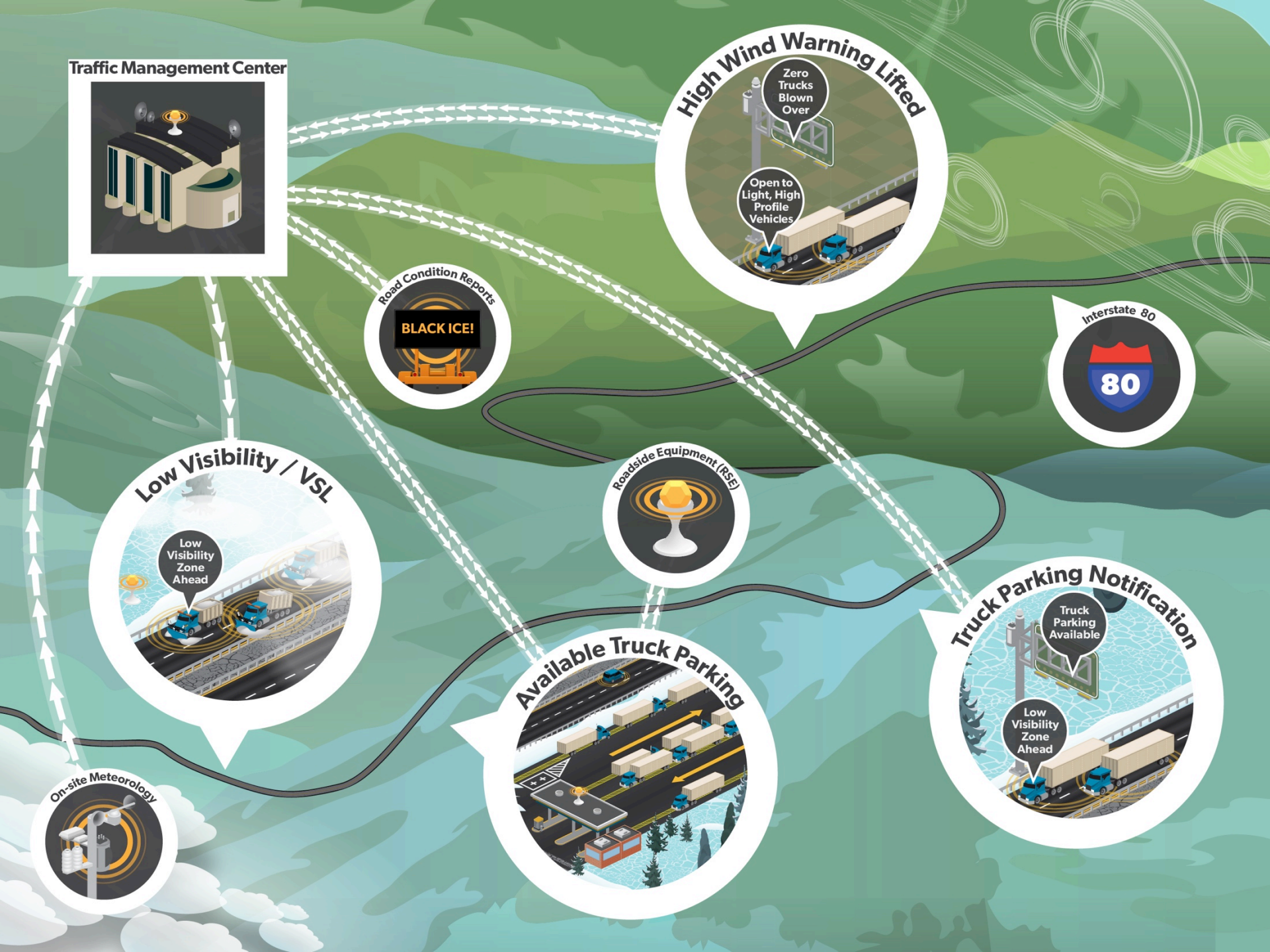
- Advanced Traveler Information System
- Freight-Specific Dynamic Travel Planning and Performance Measurement (FRATIS)

Smart Roadside

- Smart Truck Parking

ICF/Wyoming Pilot Deployment Proposed CV Applications: Summary

CV Application	WYDOT Snow Plows	WYDOT Maintenance Fleet Vehicles	Emergency Vehicles	Private Trucks/ Commercial Vehicles
1. Road Weather Advisories for Trucks and Vehicles	✔	✔	✔	✔
2. Automatic Alerts for Emergency Responders			✔	
3. CV-enabled Weather-Responsive Variable Speed Limits	✔	✔	✔	✔
4. Spot Weather Impact Warning	✔	✔	✔	✔
5. Work Zone Warnings	✔	✔	✔	✔
6. Situational Awareness	✔	✔	✔	✔
7. Truck Parking Availability for Freight Carriers				✔
8. Freight-Specific Dynamic Travel Planning				✔


Traffic Management Center
High Wind Warning Lifted
Zero Trucks Blown Over
Open to Light, High Profile Vehicles
Road Condition Reports
BLACK ICE!
Interstate 80
80
Low Visibility / VSL
Low Visibility Zone Ahead
Roadside Equipment (RSE)
Truck Parking Notification
Truck Parking Available
Low Visibility Zone Ahead
Available Truck Parking
On-site Meteorology

TIMELINE – ICF/WYOMING

Task	Sep 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
Task 1 – Program Mgt.													
Task 2 – Concept of Operations						●							
Task 3 – Security Concept													
Task 4 – Safety Plan													
Task 5 – Performance Measurement										●			
Task 6 – System Requirements													
Task 7 – App Planning													
Task 8 – Human Use Approval													
Task 9 – Training Plan													
Task 10 – Partnership													
Task 11 – Outreach Plan													
Task 12 – Deployment Plan												●	
Task 13 – Readiness Summary													

● Public Webinar

CV Pilots Phase 1 Deliverable Schedule

Task Name	Deliverables	Due Date
Task 1: Project Management	Kickoff Briefing to USDOT	9/30/2015
	Program Management Plan (Final)	10/26/2015
Task 2: Concept of Operations	Stakeholder ConOps Review Panel Roster (Final)	11/23/2015
	ConOps (Final)	1/18/2016
	ConOps Webinar (Public)	2/8/2016
Task 3: Security Management Concept	Security Management Operating Concept (Final)	3/14/2016
Task 4: Safety Plan	Safety Management Plan (Final)	3/14/2016
Task 5: Performance Measurement	Performance Measurement Plan (Final)	5/16/2016
	Performance Plan Measurement Webinar(Public)	6/6/2016
Task 6: System Requirements	Stakeholder SyRS Review Panel Roster (Final)	3/21/2016
	SyRS (Final)	5/16/2016
Task 7: Application Planning	Application Deployment Plan (Final)	6/6/2016
Task 8: Human Use Approval	Human Use Approval Summary (Final)	7/18/2016
Task 9: Training Plan	Training and Education Plan (Final)	7/25/2016
Task 10: Partnership	Partnership Status Summary (Final)	8/1/2016
Task 11:Outreach Plan	Outreach Plan (Final)	7/18/2016
Task 12: Deployment Plan	Comprehensive Deployment Plan (Final)	8/1/2016
	Deployment Plan Webinar (Public)	8/22/2016
Task 13: Readiness Summary	Deployment Readiness Briefing to USDOT	8/22/2016
	Deployment Readiness Summary (Final)	9/12/2016

STAY CONNECTED

- **Join us for the *Getting Ready for Deployment* Series (link to webinars)**
  - Discover more about the Wave 1 CV Pilot Sites
  - Learn the Essential Steps to CV Deployment
  - Engage in Technical Discussion

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