UNITED STATES
DEPARTMENT OF TRANSPORTATION

Intelligent Transportation Systems Joint Programs Office

Dynamic Mobility Applications (DMA) Program Update Webinar

DCM/DMA 2013 Winter Webinar Series

Kate Hartman, RITA JPO

Ben McKeever, FHWA
Bob Ferlis, FHWA
Linda Dodge, RITA JPO
Bob Rupert, FHWA
Ron Boenau, FTA
Randy Butler, FHWA

March 6, 2013

Overview of Webinar

Purpose

- Provide an update on DMA program status, key program priorities, and next steps

Agenda

- Introduction to the DMA Program
  Kate Hartman

- Overview and Status of DMA Bundles
  USDOT DMA Bundle Leads

- Open Source Portal
  Randy Butler

- DMA Program Next Steps
  Kate Hartman

- Q&A

ITS Research Program Components

Applications

Safety			Mobility		Environment	
V2V	V2I	Safety Pilot	Real Time Data Capture & Management	Dynamic Mobility Applications	AERIS	Road Weather Applications

Technology

- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Certification
- Test Environments

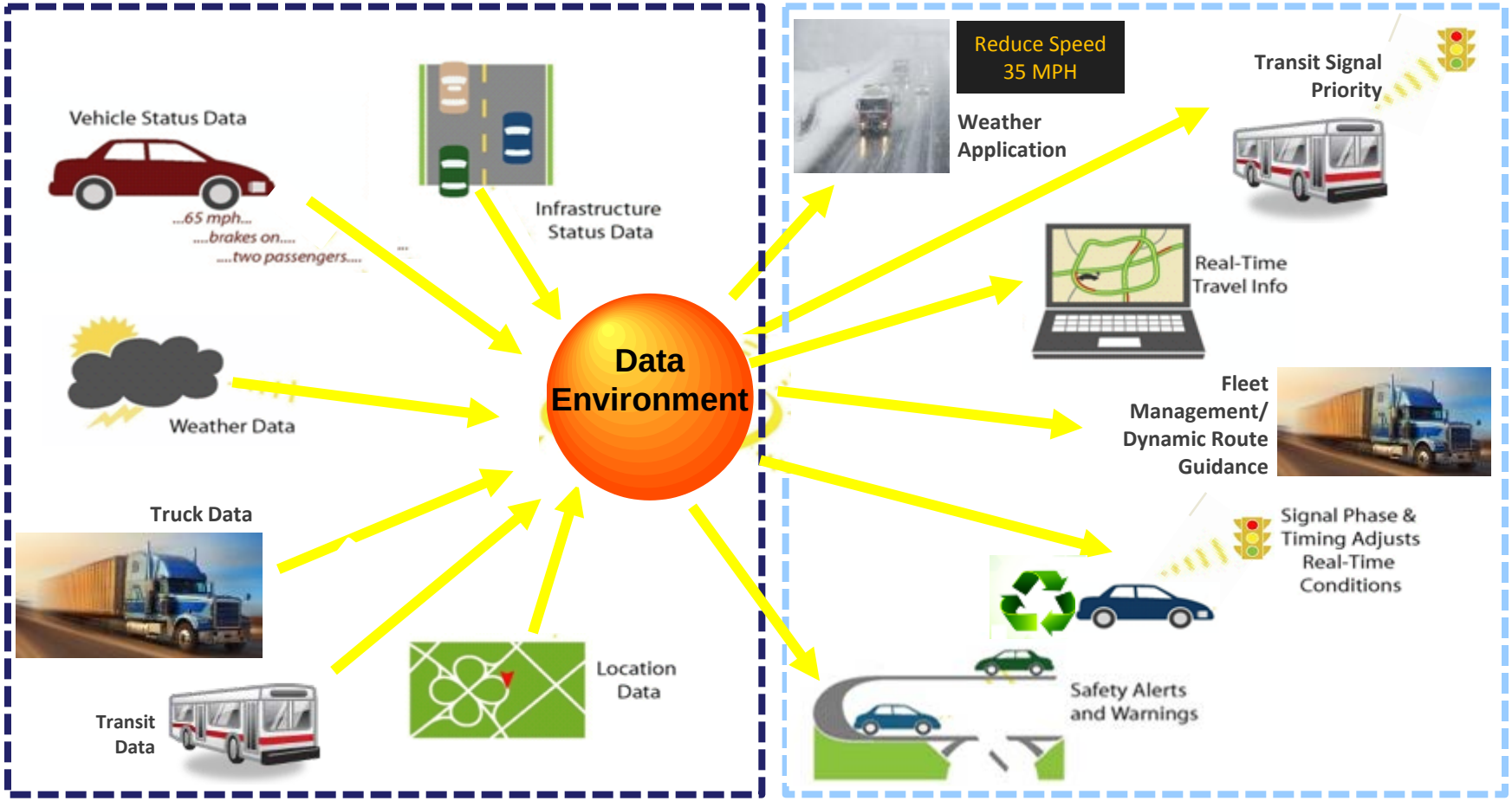
Policy

- Deployment Scenarios
- Financing & Investment Models
- Operations & Governance
- Institutional Issues

Mobility Program

Real-time Data Capture and Management

Dynamic Mobility Applications



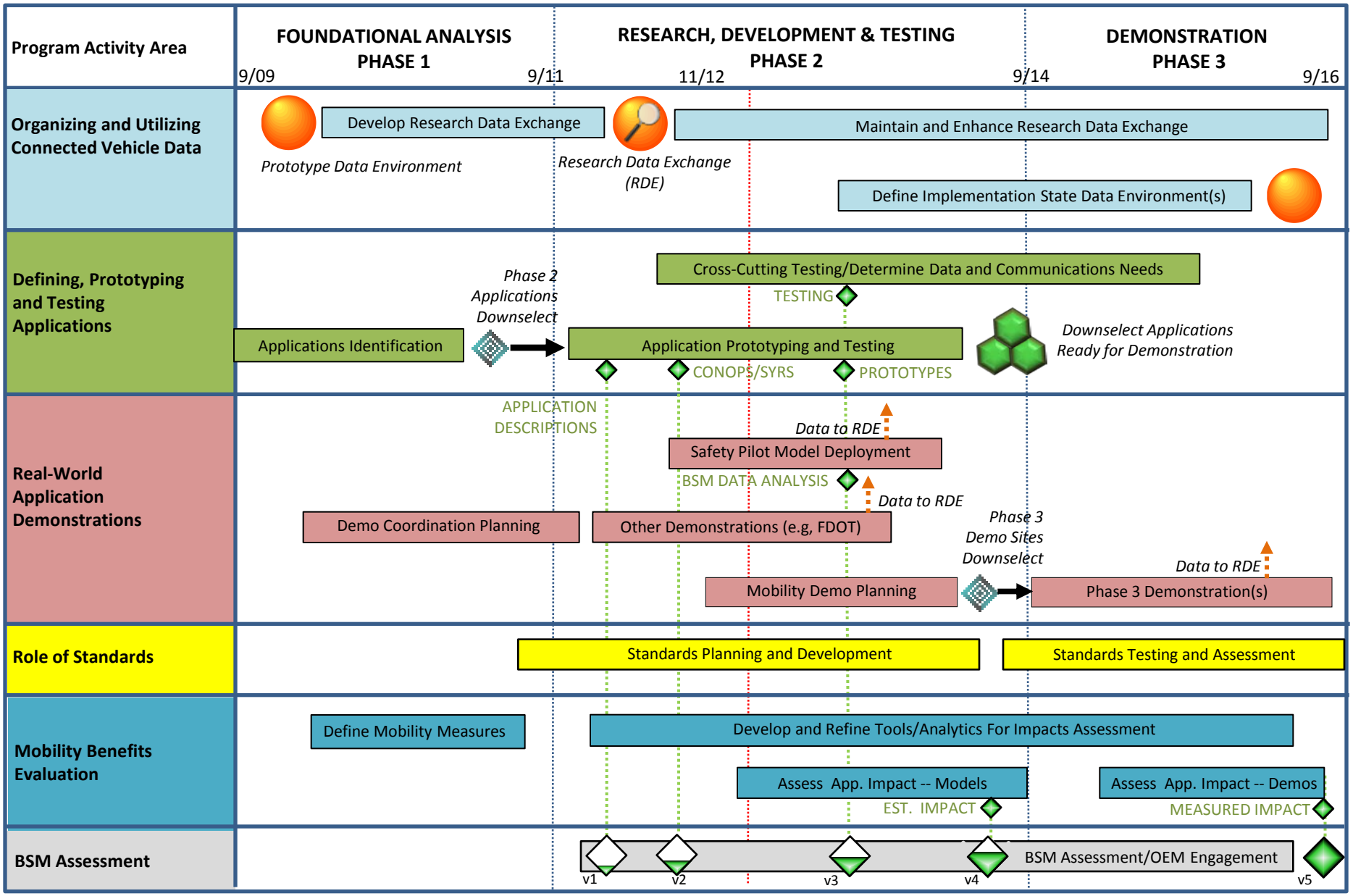
Dynamic Mobility Applications

- The Dynamic Mobility Applications (DMA) Program seeks to create applications that fully leverage frequently collected and rapidly disseminated multi-source data gathered from connected travelers, vehicles and infrastructure, and that increase efficiency and improve individual mobility while reducing negative environmental impacts and safety risks

Key Research Questions for the Mobility Program

- What are the benefits of applications enabled by connected vehicle and connected traveler data?
- What testing is required to prepare applications for eventual demonstration and deployment?
- What are the cross-cutting data and communication needs among DMA bundles?
- What is the role of Basic Safety Message (BSM)?
- How do we successfully implement Open Data and Open Source concepts within the program?

Data Capture and Management and Dynamic Mobility Applications Programs: Integrated Roadmap

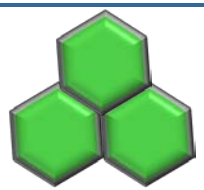


DCM/DMA Integrated Roadmap v1.1 (11/26/2012)

Dynamic Mobility Applications Program

Vision

- Expedite development, testing, commercialization, and deployment of innovative mobility application
  - Maximize system productivity
  - Enhance mobility of individuals within the system



Transformative Mobility Applications

(May have more impact when BUNDLED together)

Objectives

- Create applications using frequently collected and rapidly disseminated multi-source data from connected travelers, vehicles (automobiles, transit, freight) and infrastructure
- Develop and assess applications showing potential to improve nature, accuracy, precision and/or speed of dynamic decision
- Demonstrate promising applications predicted to significantly improve capability of transportation system
- Determine required infrastructure for transformative applications implementation, along with associated costs and benefits

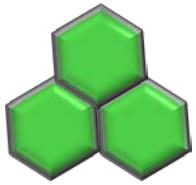
Project Partners

- Strong internal and external participation: ITS JPO, FTA, FHWA R&D, FHWA Office of Operations, FMCSA, NHTSA, FHWA Office of Safety

Dynamic Mobility Applications Program: Application Development Process

- **Current Focus:**
  - Prototype and test applications utilizing multi-source data

- **Transformative Application Bundles**



  - Extensive stakeholder outreach effort to develop potential concepts
    - collected innovative, transformative ideas
    - prioritized stakeholder and federal interest
  - Identified the most promising applications to pursue in Phase 2
  - Concept of Operations and System Requirements development efforts - completed in early 2013
  - In September 2012, prototyping phase initiated with freight-related bundle, FRATIS

- **Open Source Portal**
  - Foundational capability to share and coordinate application development
  - Concept of Operations and Systems Requirements completed
  - Prototype implementation nearly complete, expect launch March 2013

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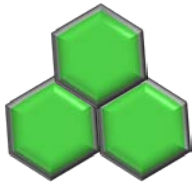

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Live demo at next webinar

March 20 at 1 PM

DMA Recent Key Accomplishments

- Completed all application bundle Concepts of Operations and System Requirements

- Initiated FRATIS prototyping effort, 9/12
  - Three sites developing FRATIS prototypes (Miami, Los Angeles, Dallas)
  - Independent Impact Assessment effort launched
  - Shared drayage optimization algorithm under development

- Continued program of extensive stakeholder engagement
  - 100+ participants at Mobility Workshop, National Harbor MD, 5/12
  - 12 bundle-specific stakeholder workshops and other events

- Completed 2 white papers:
  - DMA Impacts Assessment white paper Ver. 1, 11/12
  - Role of BSM Ver. 2, 8/12

Available at www.its.dot.gov/dma

Dynamic Mobility Application Bundles

MMITSS:
Multimodal Intelligent Traffic Signal System

Ben McKeever

INFLO:
Intelligent Network Flow Optimization

Mohammed Yousuf

R.E.S.C.U.M.E.:
Response, Emergency Staging and Communications, Uniform Management, and Evacuation

Linda Dodge

Enable ATIS:
Enable Advanced Traveler Information Systems

Bob Rupert

IDTO:
Integrated Dynamic Transit Operations

Ron Boenau

FRATIS:
Freight Advanced Traveler Information Systems

Randy Butler

Other Programs: **ICM** **ATDM**

Weather

MMITSS: Multi-Modal Intelligent Traffic Signal System

Ben McKeever

FHWA Office of Operations R&D

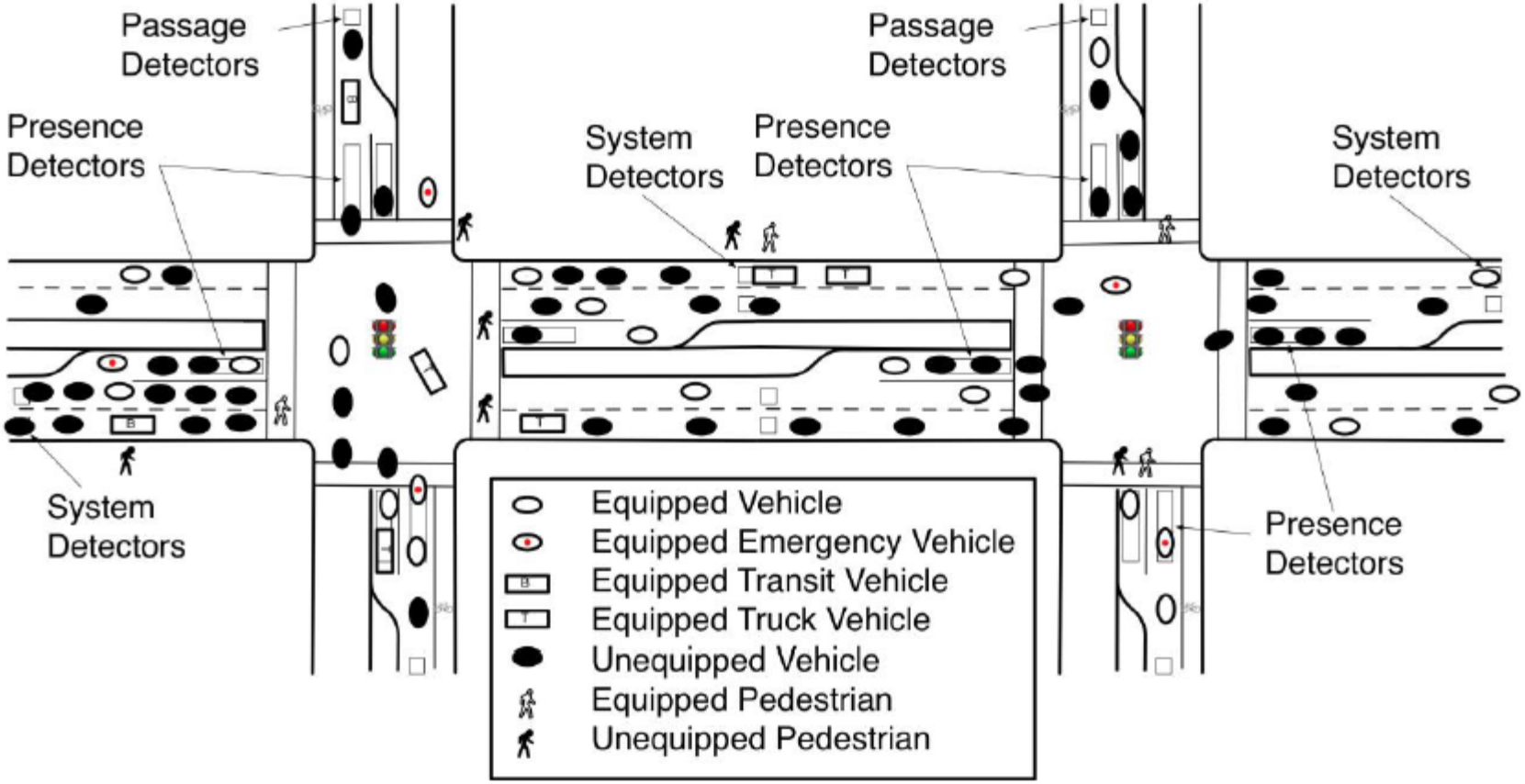
Next generation of traffic signal systems that seeks to provide a comprehensive traffic information framework to service all modes of transportation:

- Intelligent Traffic Signal System (I-SIG)
- Transit Signal Priority (TSP)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Freight Signal Priority (FSP)
- Emergency Vehicle Preemption (PREEMPT)

- Jointly funded by Cooperative Transportation System Pooled Fund Study (CTS PFS) and the DMA Program

  CTS PFS includes FHWA, VDOT as the lead state, and 12 state/local members

MMITSS Operational Environment



M-ISIG Potential Impacts

10-year transformative impact targets:

- Reduce overall vehicle delay by 25%
- Increase throughput by 15%
- Reduce queue length by 15%
- Reduce average pedestrian wait time by 20%
- Reduce average delay for transit (35%), commercial vehicle (15%), and emergency vehicle (40%)
- Reduce extent and duration of system-wide congestion by 25% and 40% respectively

MMITSS Status

- ConOps, completed 10/12
- System requirements, completed 1/29/13
- Test Planning will carry forward to Spring 2013
- Prototyping in Arizona and California test beds: late 2013-2014

INFLO: Intelligent Network Flow Optimization

Bob Ferlis

FHWA

Office of Operations (R&D)

A collection of high-priority, transformative applications that aim to maximize roadway throughput, reduce crashes, and reduce fuel consumption through the use of frequently collected and rapidly disseminated multisource data drawn from connected vehicles, travelers' mobile devices, and infrastructure.

- *Dynamic Speed harmonization (SPD-HARM)*
- *Queue Warning (Q-WARN)*
- *Cooperative Adaptive Cruise Control (CACC)*

INFLO Vision

Near – Term
(Today – 2020)

Mid – Term
(2020 – 2030)

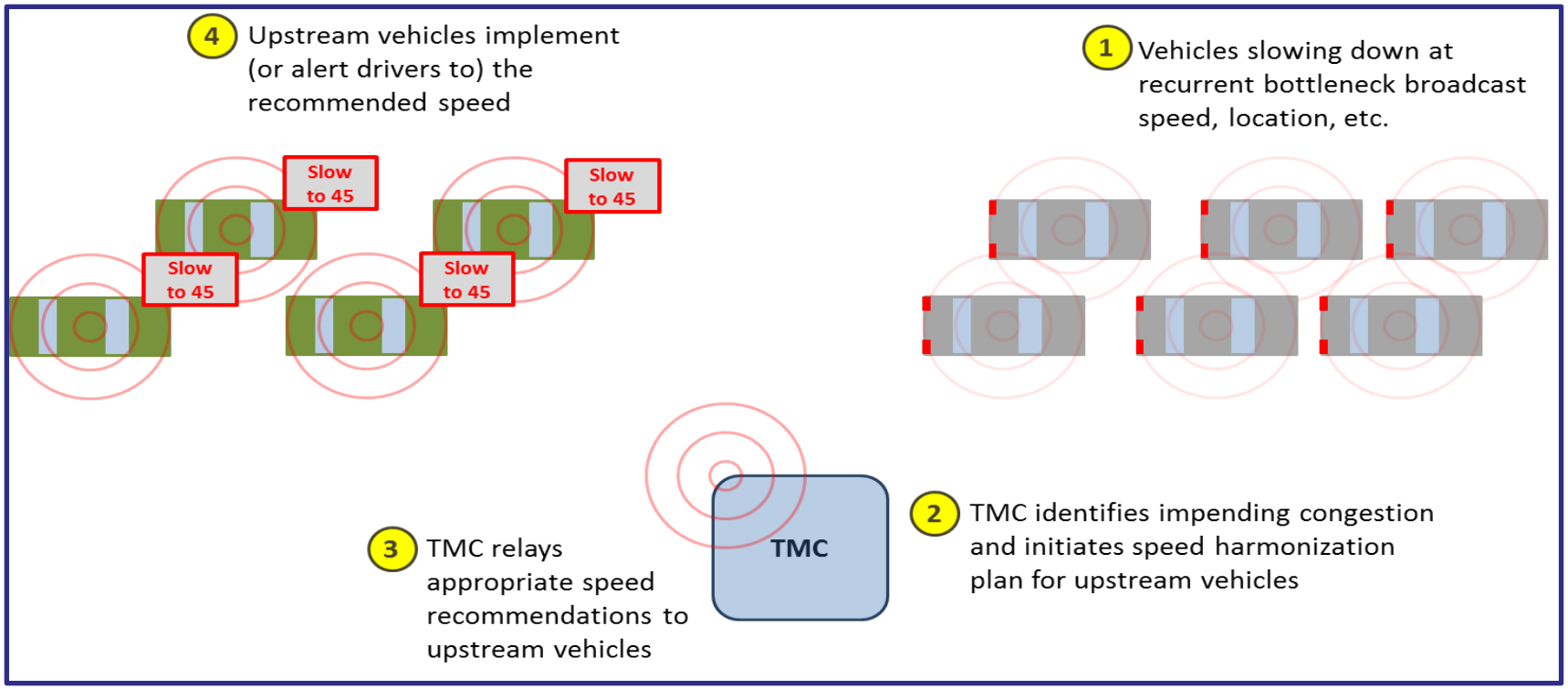
Ultimate
(2030 +)

Dynamic Speed Harmonization (SPD-HARM)

Dynamically adjust and coordinate vehicle speeds in response to congestion, incidents, and road conditions to maximize throughput and reduce crashes.

- Reducing speed variability among vehicles improves traffic flow and minimizes or delays flow breakdown formation
- Utilize V2V and V2I communication to coordinate vehicle speeds
- Provide recommendations directly to drivers in-vehicle
- Recommend speeds by lane, by vehicle weight and size, by pavement traction

Dynamic Speed Harmonization (SPD-HARM)



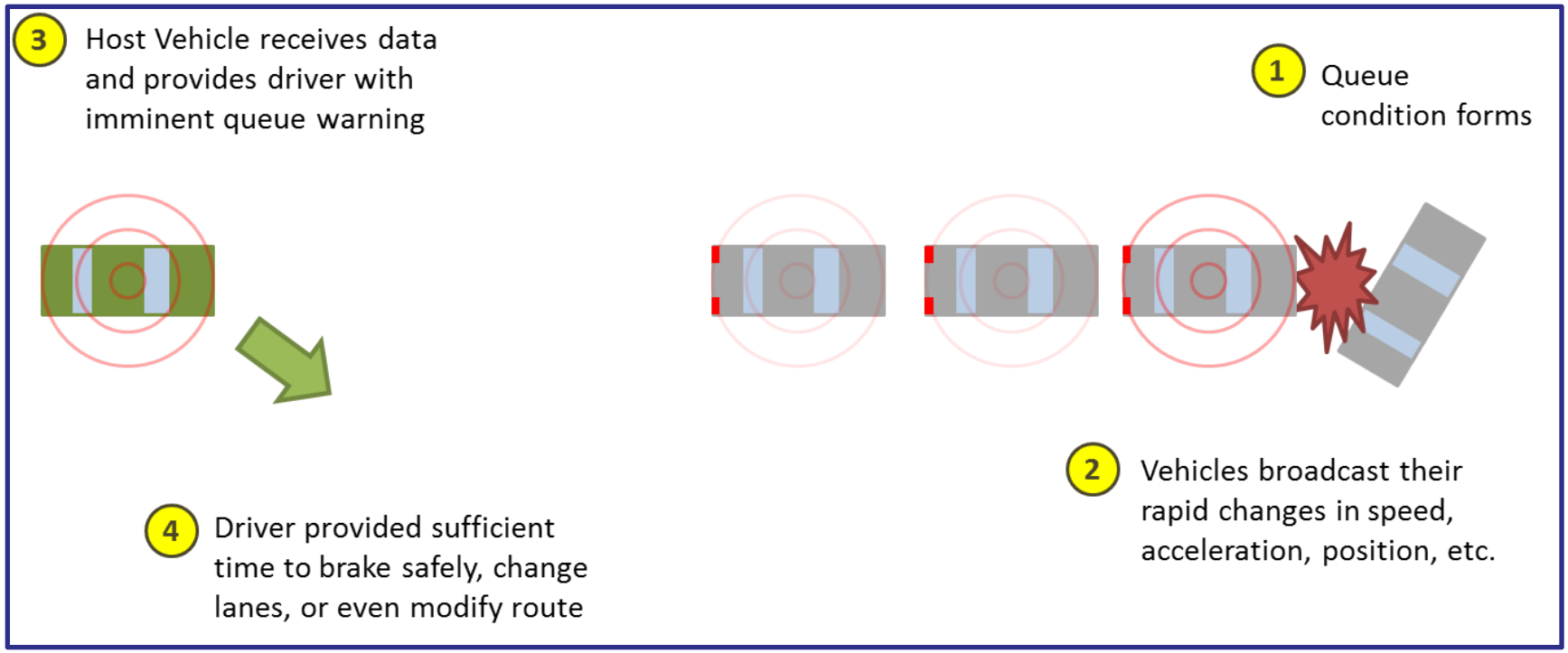
Queue Warning (Q-WARN)

Provide drivers timely warnings and alerts of impending queue backup.

- To reduce shockwaves and prevent collisions and other secondary crashes
- Predict location, duration and length of queue propagation
- Utilize V2V and I2V communication for rapid dissemination and sharing of vehicle information

- Allows drivers to take alternate routes or change lanes
- Applicable to freeways, arterials, and rural roads

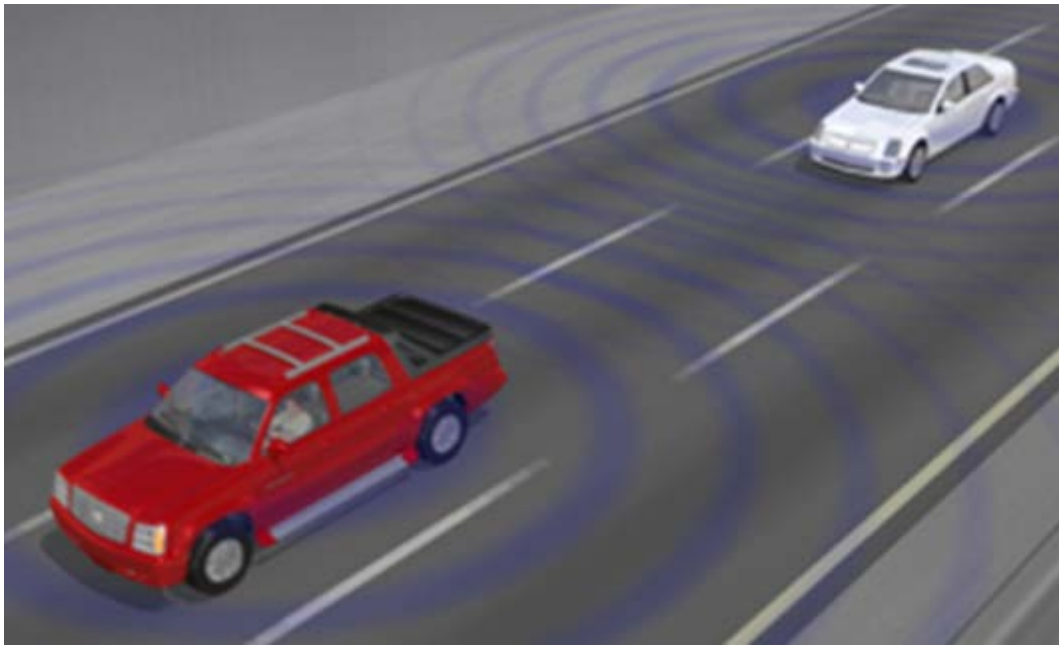
Queue Warning (Q-WARN)



Cooperative Adaptive Cruise Control (CACC)

Dynamically adjust and coordinate cruise control speeds among platooning vehicles to improve traffic flow stability and increase throughput.

- Closely linked with SPD-HARM to reduce stop-and-go waves
- Utilizes V2V and/or V2I communication to coordinate vehicle speeds and implement gap policy



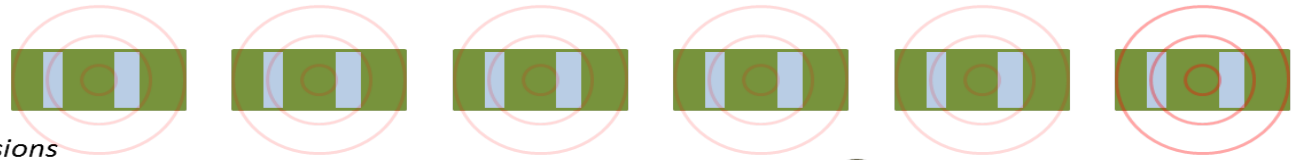
Cooperative Adaptive Cruise Control (CACC)

Without CACC:

- *Irregular braking and acceleration*
- *Longer headways*
- *Lower throughput*
- *Risk of rear-end collisions*

CACC Enabled:

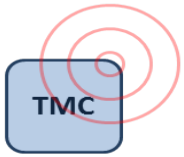
- *Coordinated speeds*
- *Minimized headways*
- *Higher throughput*
- *Reduced rear-end collisions*



1 Lead Vehicle broadcasts location, heading, and speed

2 CACC-enabled following vehicles automatically adjust speed, acceleration, and following distance

3 Any speed or acceleration perturbations by Lead Vehicle can be instantly accounted for by following vehicles utilizing V2V communication

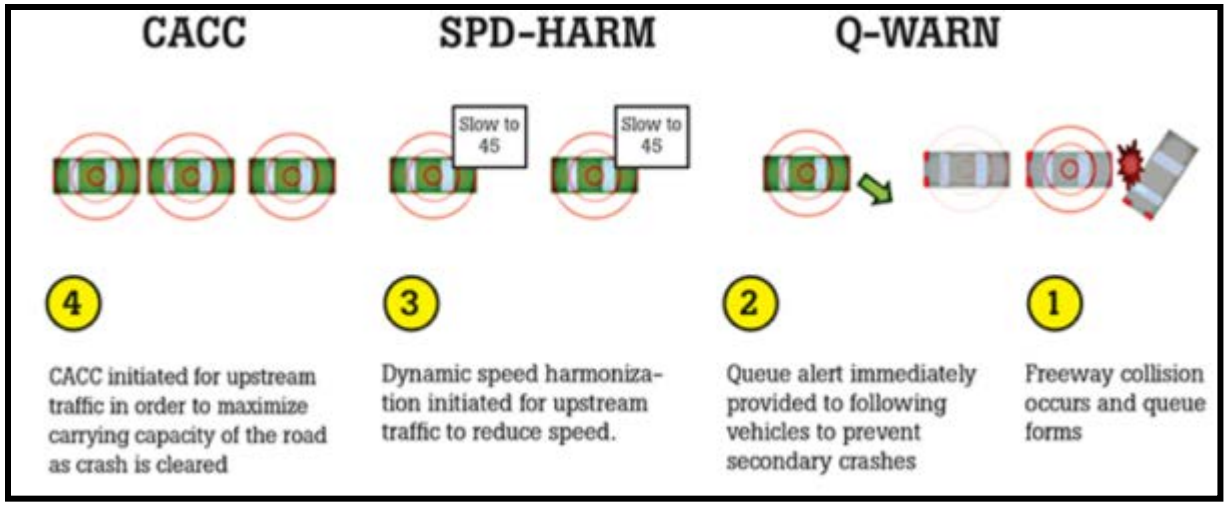


4 TMC observes traffic flow and adjusts gap policy to manage road capacity

Benefit from integration with other applications

Benefit from combining INFLO applications:

- SPD-HARM benefits Q-WARN by slowing and managing upstream traffic, thus reducing the risk of secondary collisions
- Combining all 3 INFLO applications can help minimize the impacts of a freeway incident on traffic flow.



Benefit from integrating with other applications:

- Additional benefits from integration with safety systems (ESC, CSW, FCW, etc.)
- Coordination with ramp metering provides INFLO applications a better connection with the overall transportation network.
- Integration with ATIS provides users enhanced information (state of the transportation system, pre-trip planning, route-making, and incident avoidance)

INFLO Potential Impacts

10-year transformative impact targets

- Improve throughput (veh/hr) in CACC lane by 50%
- Reduce unreliability (planning time index) by 25%
- Reduce primary crashes by 25% and secondary crashes by 50%
- Reduce severity of crashes by 25%
- Reduce fuel consumption, emissions by 25%

INFLO Project Status

- ConOps – completed June 2012
- System Requirements – completed November 2012
- Test Readiness – completed November 2012
- Prototyping Procurement
  - Expected release - Spring 2013
  - Likely to focus on Dynamic Speed Harmonization (SPD-HARM) with Queue Warning (Q-WARN)
  - Expected award - Fall 2013
- Impacts Assessment Procurement - Spring 2013
- Next steps for CACC currently being planned

R.E.S.C.U.M.E.: Response, Emergency Staging and Communications, Uniform Management, and Evacuation

Linda Dodge

Chief of Staff and ITS Public Safety Program Manager

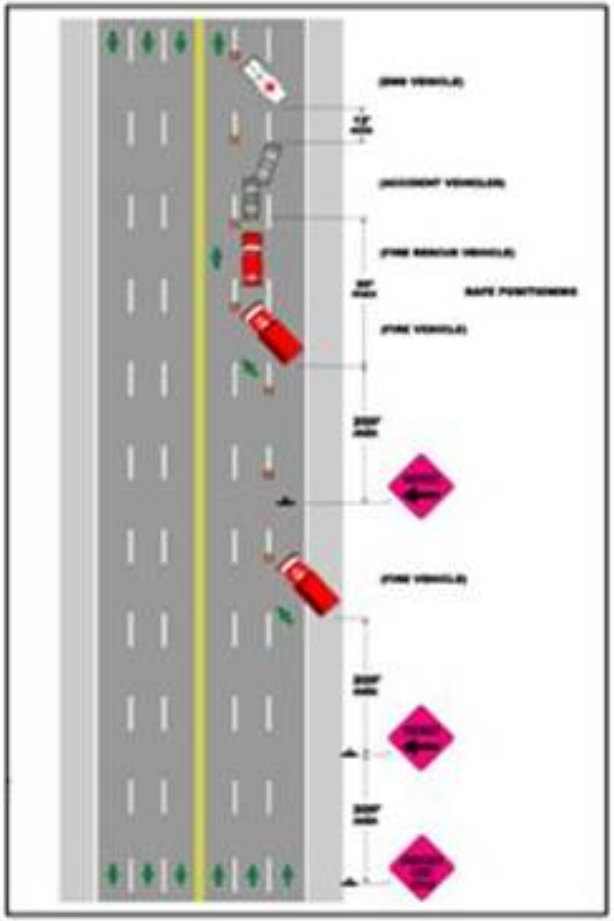
ITS JPO

Next generation of applications that transform the response, emergency staging and communications, uniform management, and evacuation process associated with incidents:

- ***Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)***
- ***Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)***
- ***Advanced Automatic Crash Notification (AACN)***
- ***Emergency Communications and Evacuation (EVAC)***

Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)

- Situational awareness info to responders while en route
- Input to responder vehicle routing, staging and secondary dispatch decisions
  - Staging plans
  - Satellite imagery
  - GIS data
  - Current weather data
  - Real-time modeling outputs



Source: Oconto County, WI

Incident Scene Work Zone Alerts for Drivers and Workers (INC−ZONE)

- Two components

1. Alerts drivers of lane closings and unsafe speeds for temporary work zones
   - Could be augmented with merging and speed guidance to drivers.
2. Warns on-scene workers of vehicles with trajectories or speeds that pose a high risk to their safety

Advanced Automatic Crash Notification Relay (AACN Relay)

- Sends a crash notification message a roadside DSRC hot spot, likely relayed via a properly-equipped passing vehicle
- This information is then forwarded to the appropriate PSAP based on the crash location.

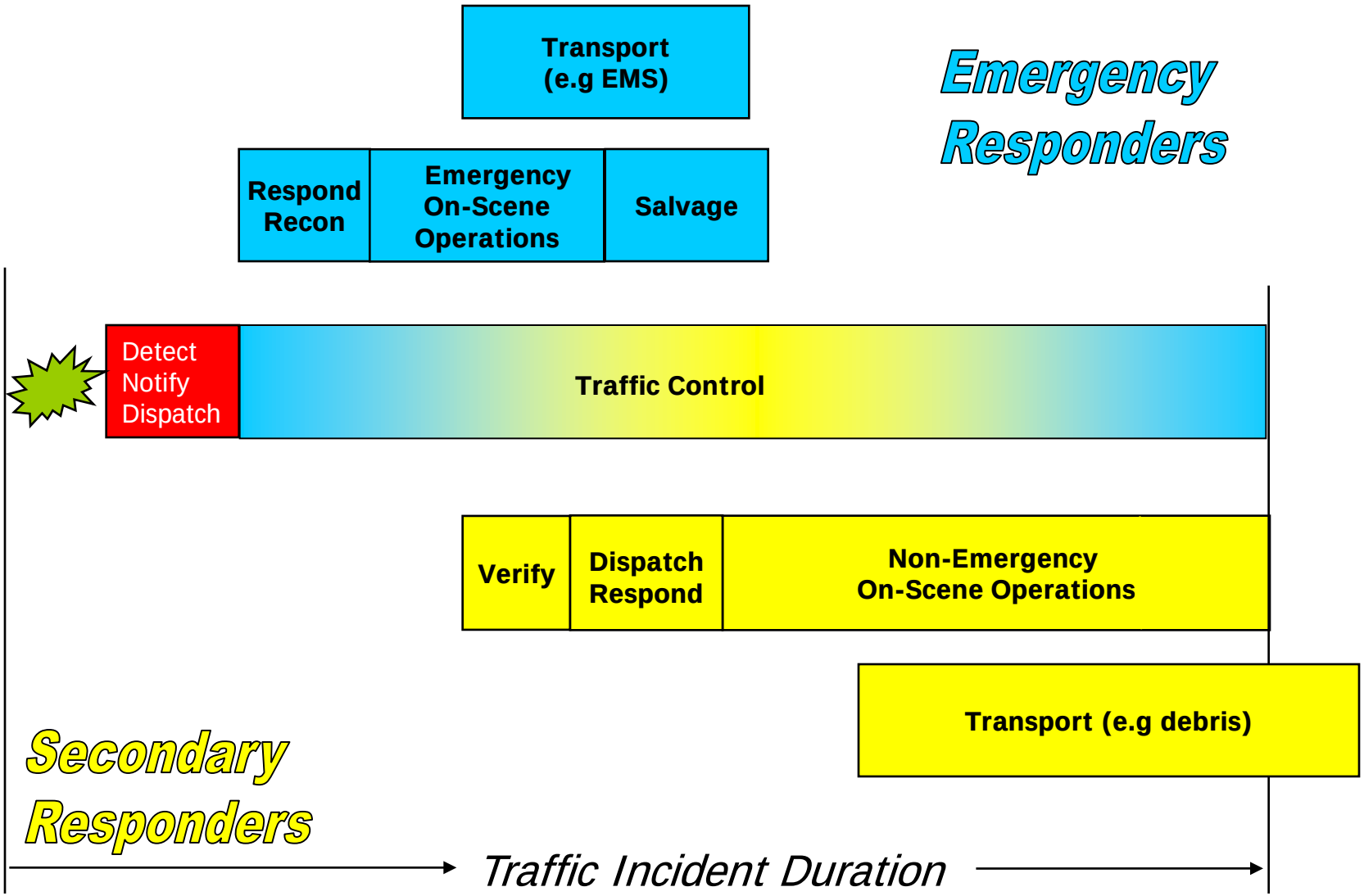
Source: Greg Carter Herald Sun

Emergency Communications & Evacuation (EVAC)

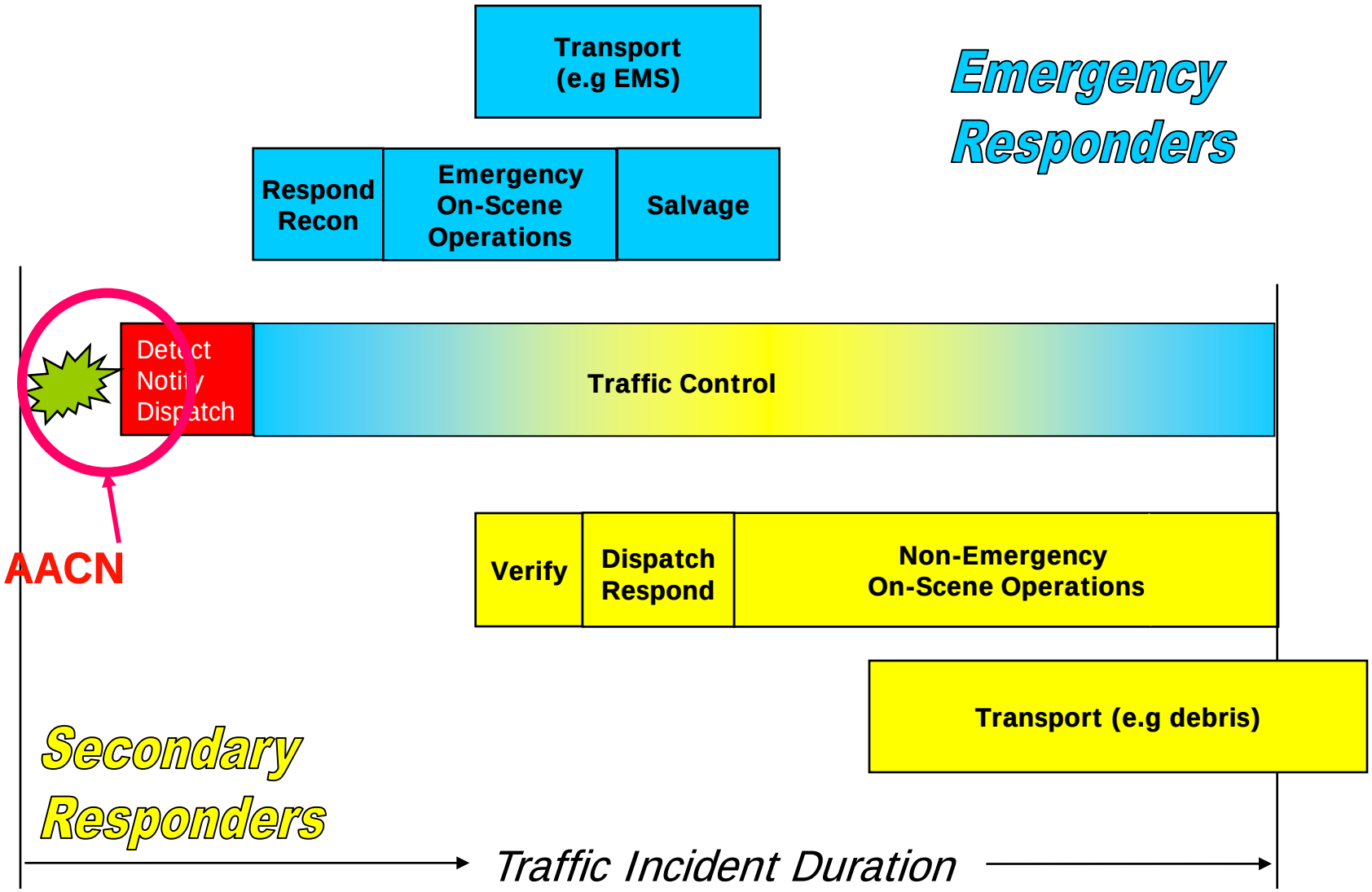
- Addresses the needs of two different evacuee groups:

1. Those using their own transportation
   - Dynamic route guidance information
   - Current traffic and road conditions
   - Location of available lodging
   - Location of fuel, food, water, cash machines and other necessitates
2. Those requiring assistance
   - Identify and locate people who are more likely to require guidance and assistance
   - Identify existing service providers and other available resources

Traffic Incident Management and R.E.S.C.U.M.E



Traffic Incident Management and R.E.S.C.U.M.E



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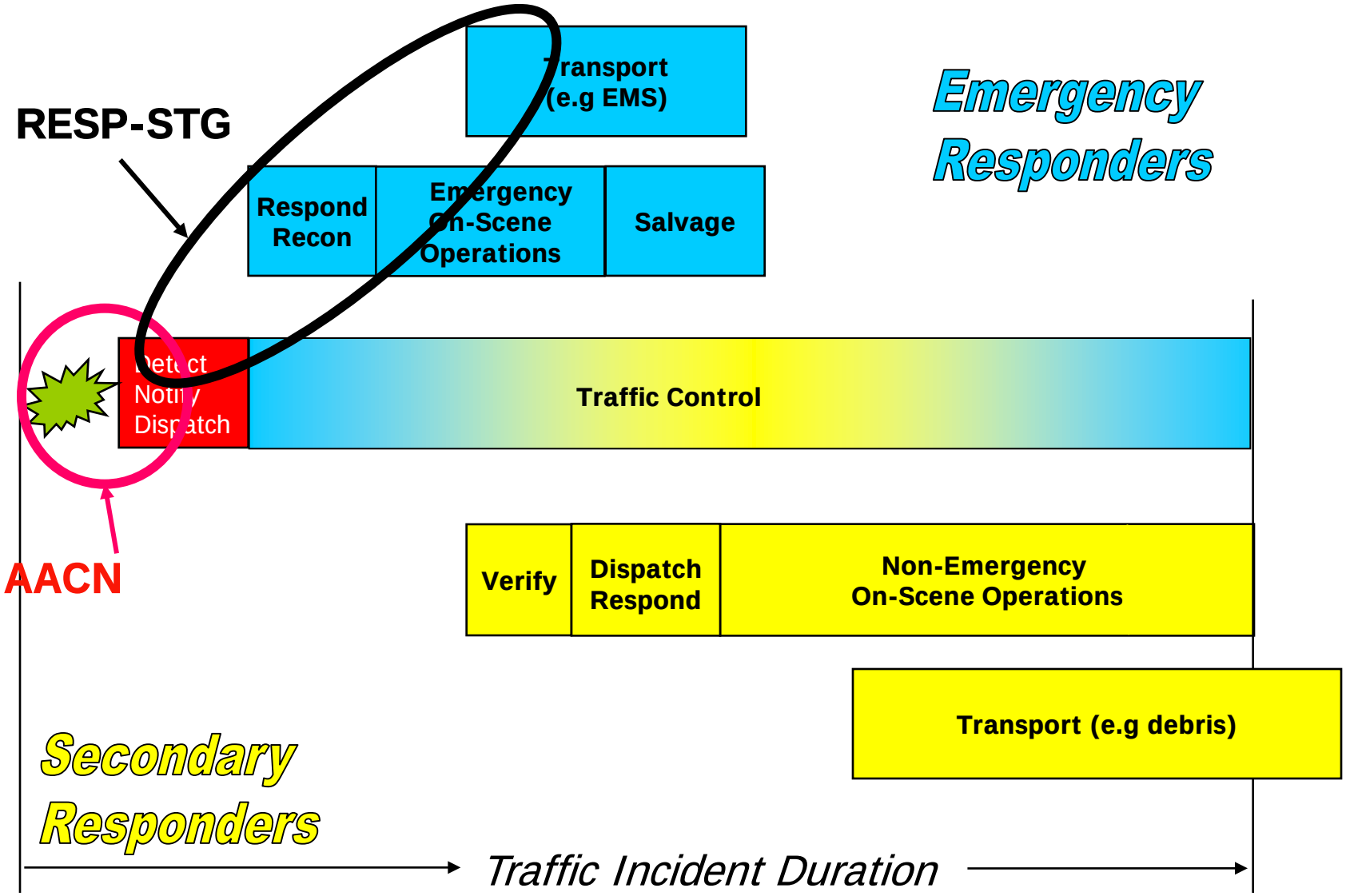
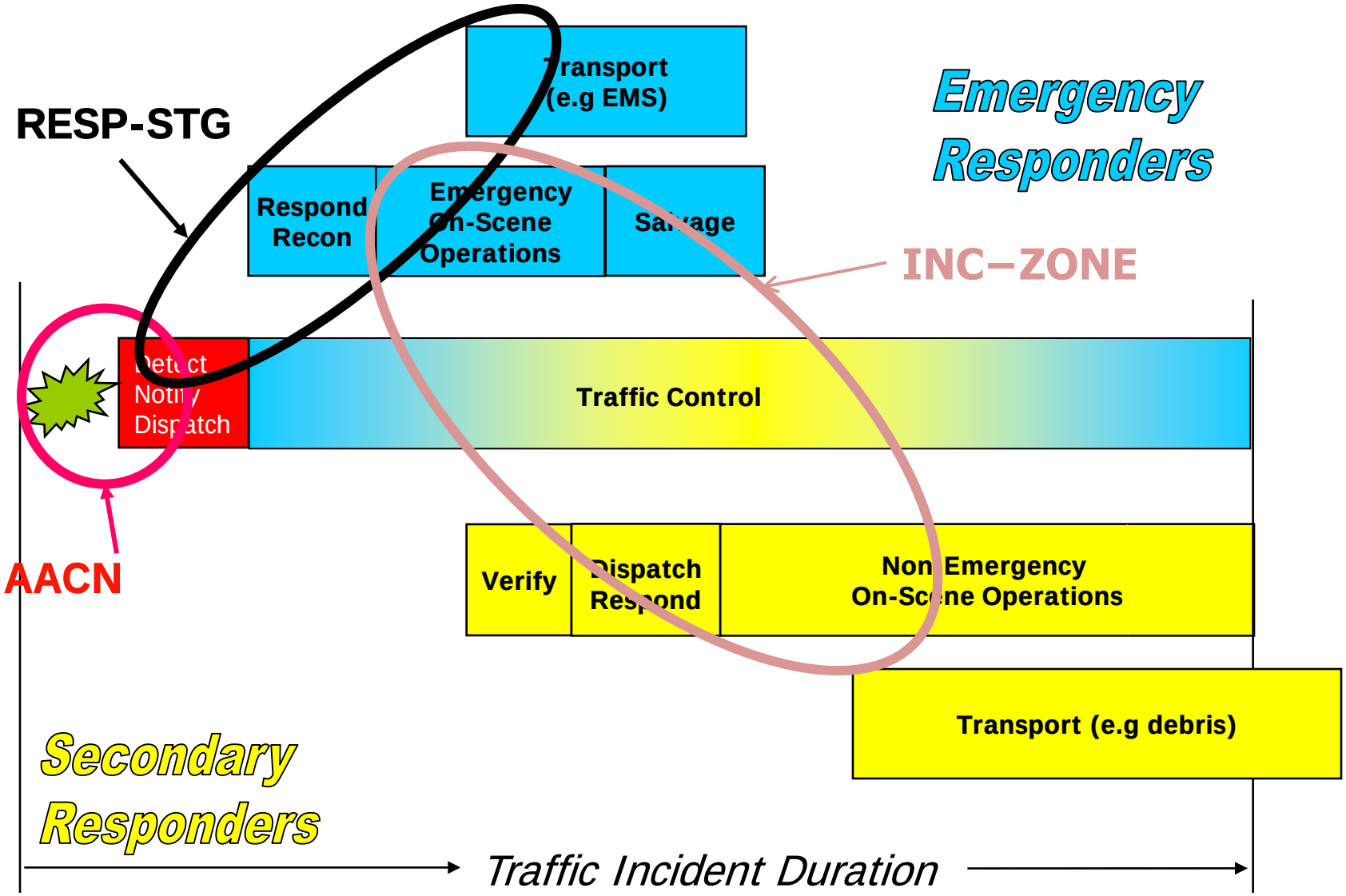


Traffic Incident Management and R.E.S.C.U.M.E



R.E.S.C.U.M.E. Potential Impacts

10-year transformative impact targets:

- Reduce total response time by 30%
- Reduce congestion as measured by throughput and delay times by 20%
- Improve En-Route travel times by 10%
- Secondary incidents will be reduced by 15%
- Use of mixed agency vehicles for evacuation of special needs population will be widespread

R.E.S.C.U.M.E. Project Status

- ConOps – completed November 2012
- System Requirements – completed February 2013
- Test Readiness – completed February 2013
- Prototyping – Summer/Fall 2013
  - Likely to focus on temporary work zone management (INC-ZONE) and incident response staging (RESP-STG) applications, including their roles in an evacuation (EVAC) framework
  - Build off of cross-cutting device development, particularly BSM generating mobile device for responders
- Impacts Assessment – Fall 2013

EnableATIS: Enable Advanced Traveler Information System

Bob Rupert
FHWA

Represents framework around a desired end state for a future traveler information network, with a focus on:

- multimodal integration
- facilitated sharing of data
- end-to-end trip perspectives
- use of analytics and logic to generate predictive information specific to users.

EnableATIS Concepts

- EnableATIS Operational Concept identified high-value federal roles and activities (not applications, as in other bundles)

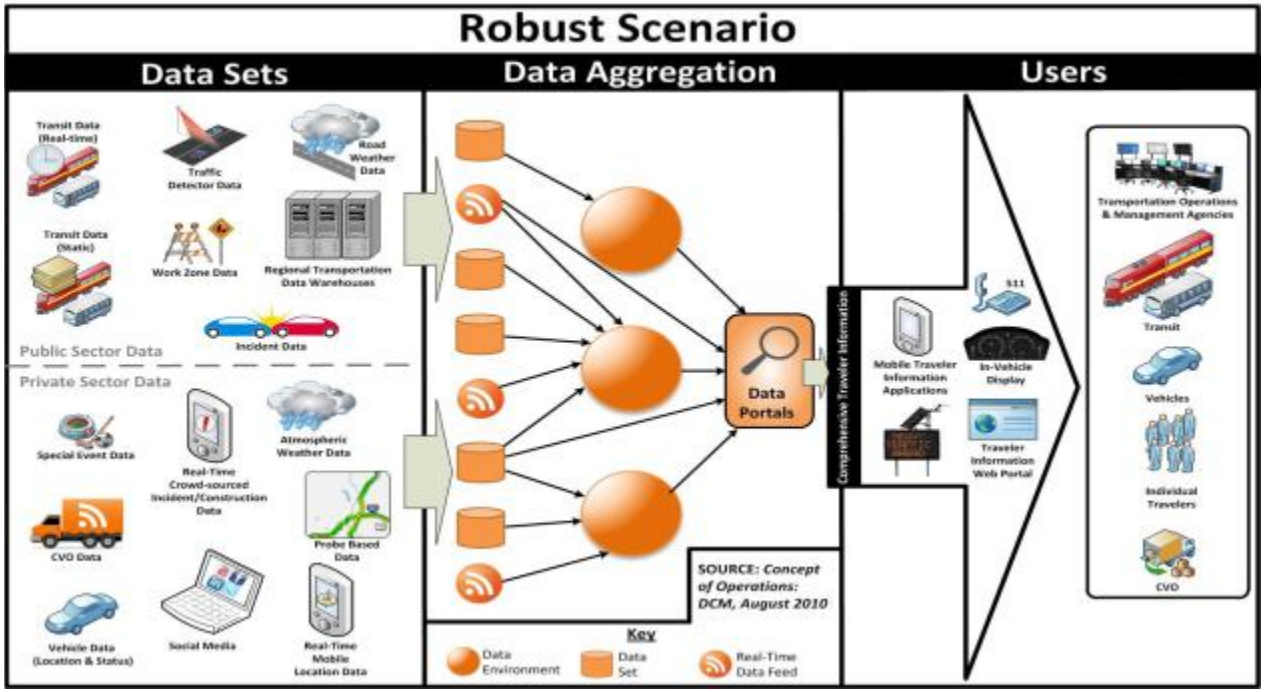
- Two possible operational scenarios:

  1. A laissez-faire approach to an incremental build out and enhancement of traveler information services over time and with limited influence on the market from US DOT

  2. A desired end-state of a robust, multimodal, multisource traveler information environment that leverages new data sources and generates transformative uses of that information to benefit travelers as well as system operations and management by agencies.

Federal Role

- Facilitate vision and coalition building
- Lead and support for public/private partnering
- Sponsor fundamental research and research initiatives
- Encourage and demonstrate technology innovation and implementation



EnableATIS Potential Impacts

10-year transformative impact targets

- Widespread availability of end-to-end trip planning and management applications (integrating time of departure, cost, mode, route, and parking decisions)
- Emergence of at least one state-of-the-art corridor or regional transportation management systems utilizing systematically obtained traveler trip data
- Improve predictability and reliability of travel, with 50% reduction of unanticipated late arrivals.

Nomadic Device Phased BAA

- ***Concept**:* What innovations in mobile devices can be used to capture mobility data regarding travel decisions and travel conditions? In the Nomadic Device Phased BAA, competitors propose to create nomadic platforms (one or many connected devices) that can infer travel decisions or conditions
- ***Purpose**:* This challenge is intended to provide USDOT with multiple device prototypes that can be ordered in larger numbers in 2013 for cross-cutting testing
- ***Submissions**:* Abstracts were due December 3, 2012. Selected Full Proposals were due February 2013. Winners will be announced in early April 2013.
- ***Judging Criteria**:*
  - Ability to measure or infer the physical environmental context
  - Ability to measure or infer travelers' plans/itineraries
  - Ability to select a wireless transmission mode intelligently, based on communication network congestion or availability
- ***Next Steps:*** Prototype development proposals funded through BAA. Selected prototypes may be purchased in larger numbers to support cross-cutting tests

Possible Future EnableATIS Activities

- Exercise Multi-modal Data in Development of Open Source Traveler Information Applications
- Leverage Private Firms' "Crowd-Sourced" Behavior Information with Multi-Modal Travel Information into Transformative Applications
- Combined Deployment with other DMAs in Regional Demonstrations

IDTO: Integrated Dynamic Transit Operations

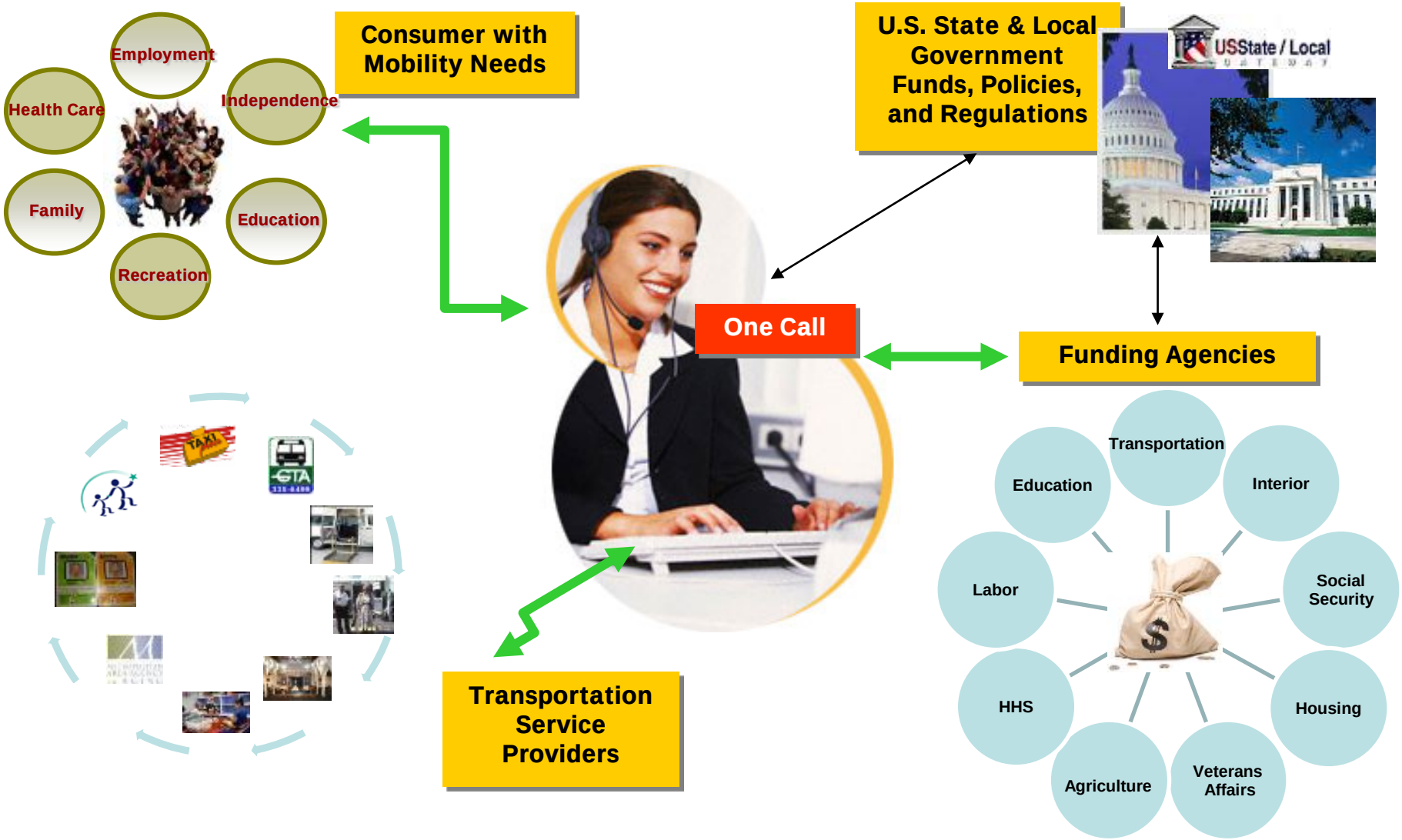
Ron Boenau

FTA Office of Mobility Innovation

Integrated transit operations that provide dynamic scheduling, dispatching, and routing of transit vehicles, and facilitate passenger connection protection and dynamic ridesharing:

- ***Connection Protection (T-CONNECT)***
- ***Dynamic Transit Operations (T-DISP)***
- ***Dynamic Ridesharing (D-RIDE)***

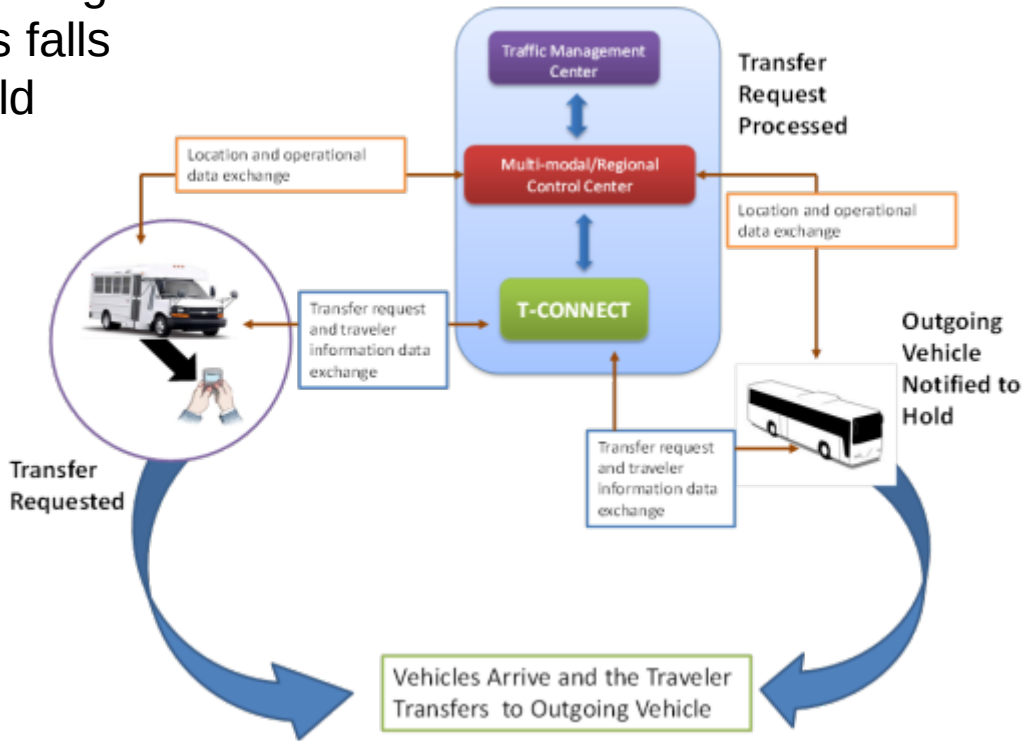
Integrated Vision of Mobility Management



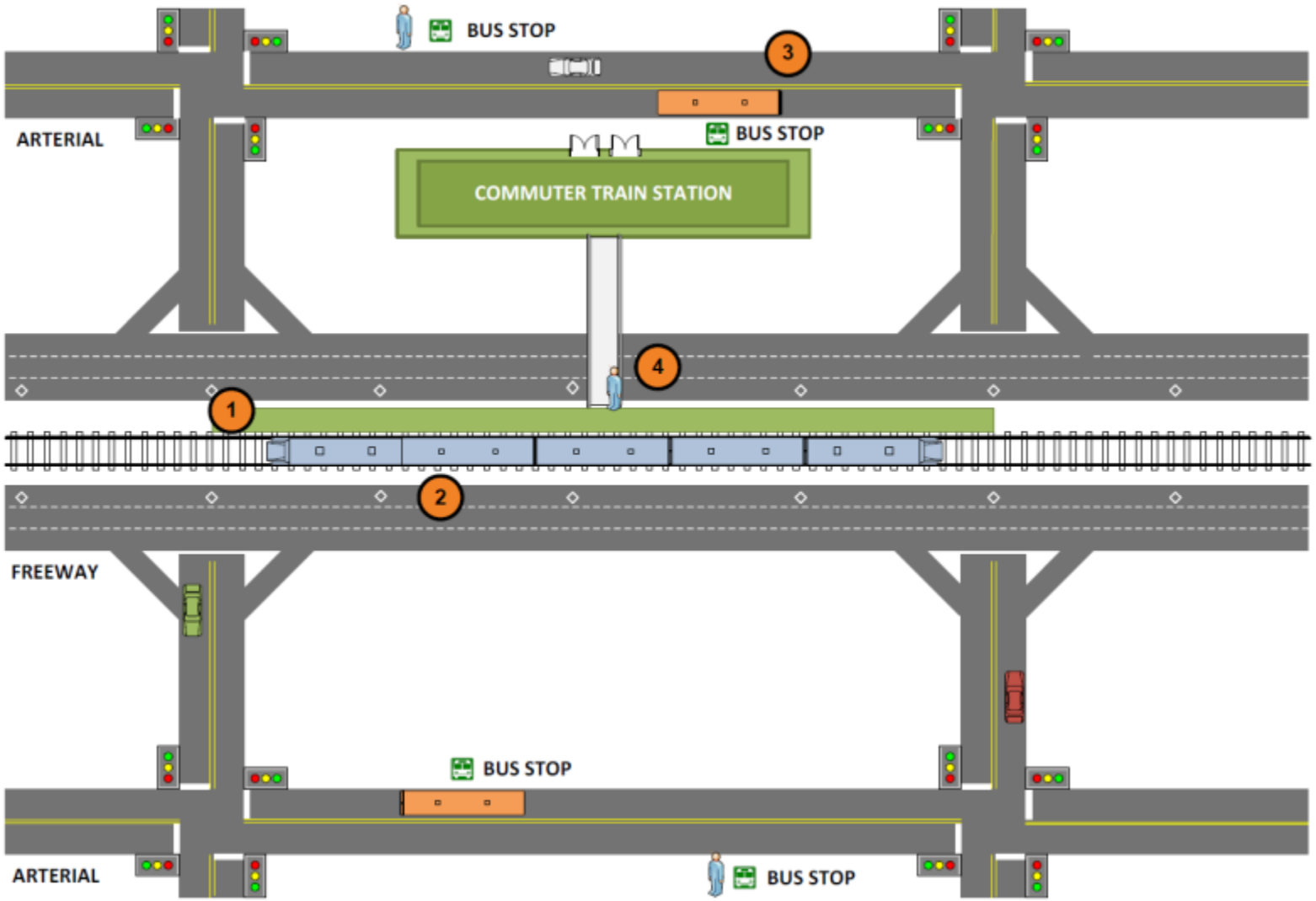
Connection Protection (T-CONNECT)

Enable public transportation providers and travelers to communicate in order to improve the probability of successful transit transfers

- Requires transit inter-modal and inter-agency coordination
- Uses real-time and historical data to examine the arrival status of a transit vehicle and transmit a “hold” message to another vehicle if the lateness falls within a pre-determined threshold
- Transfer requests may be initiated by transit riders
- Monitors the situation and provides connection protection status to travelers



T-CONNECT

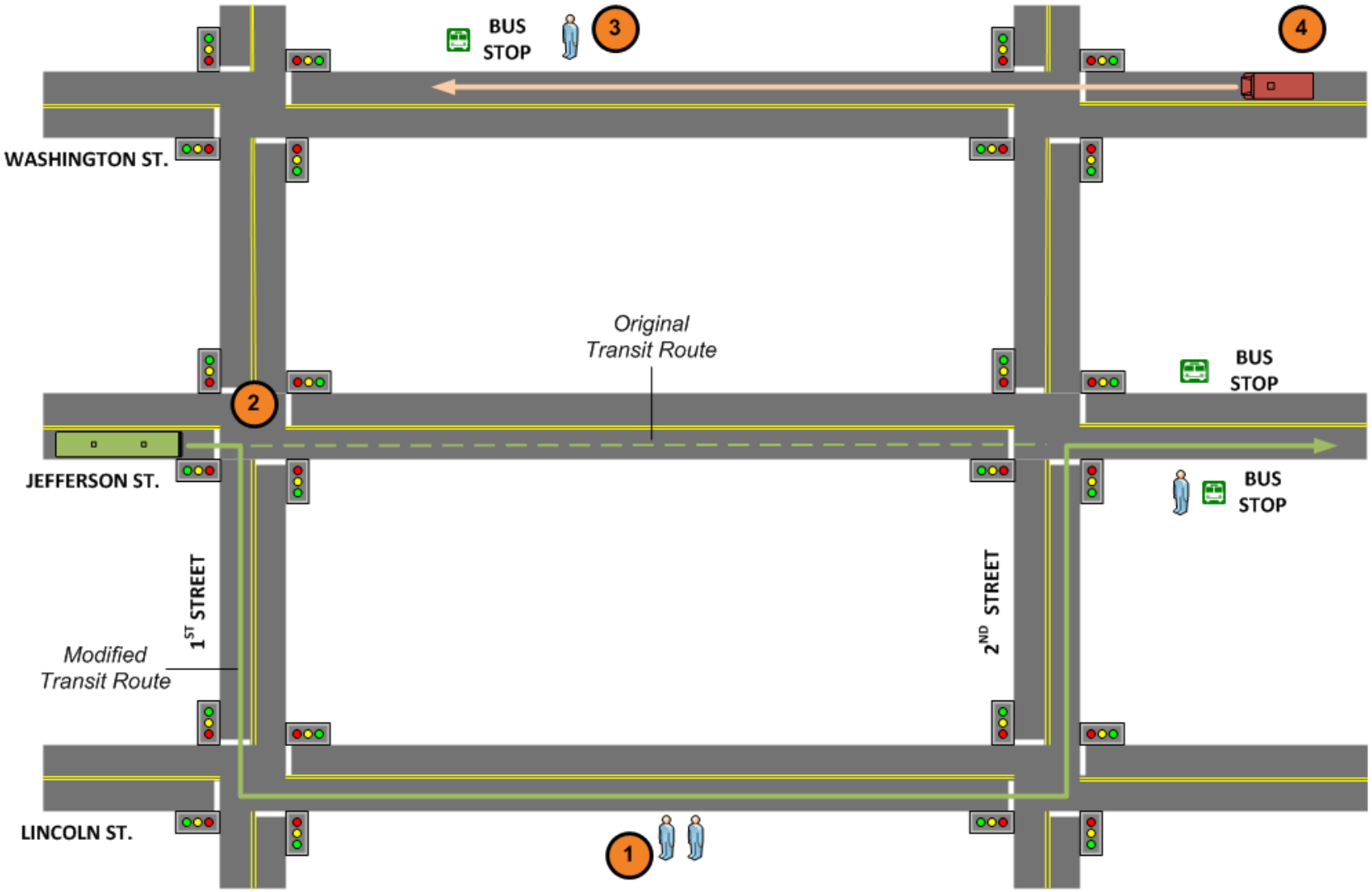

BUS STOP
3
ARTERIAL
BUS STOP
COMMUTER TRAIN STATION
4
1
2
FREEWAY
BUS STOP
ARTERIAL
BUS STOP

Dynamic Transit Operations (T-DISP)

Links available transportation service resources with travelers through dynamic transit vehicle scheduling, dispatching and routing capabilities

- Dynamic scheduling, dispatching and routing of a vehicle by matching compatible trips
- Traveler provides desired destination & departure time tagged with their current location through personal mobile devices
- Considers various modal options, including demand responsive service, fixed-route service and private service, such as taxi
- Considers real-time traffic conditions and vehicle capacity
- May replace some late night or mid-day fixed-route service

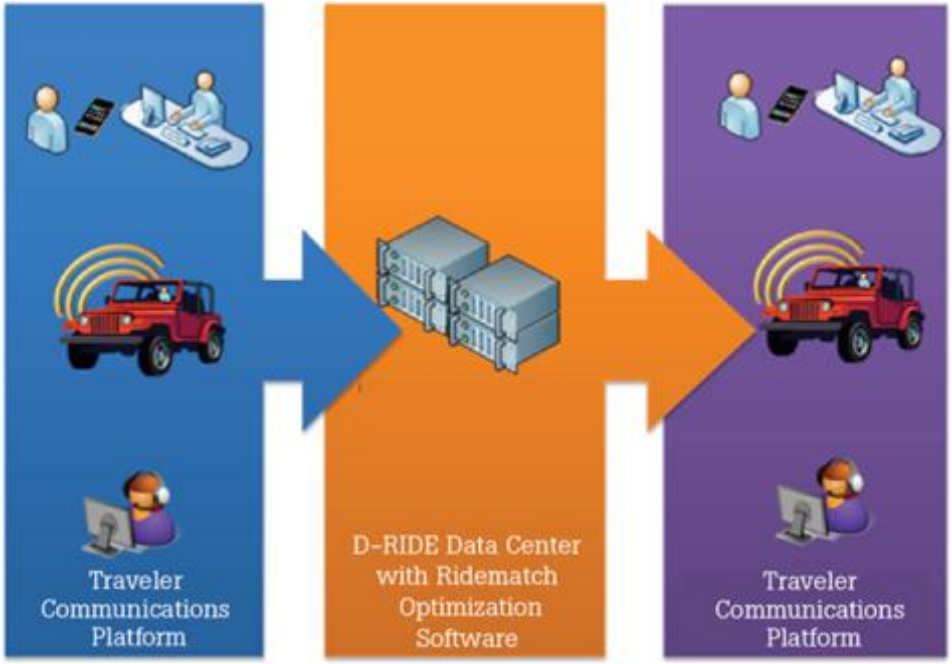
T-DISP


BUS STOP
3
4
WASHINGTON ST.
Original Transit Route
BUS STOP
2
JEFFERSON ST.
BUS STOP
1ST STREET
2ND STREET
Modified Transit Route
LINCOLN ST.
1

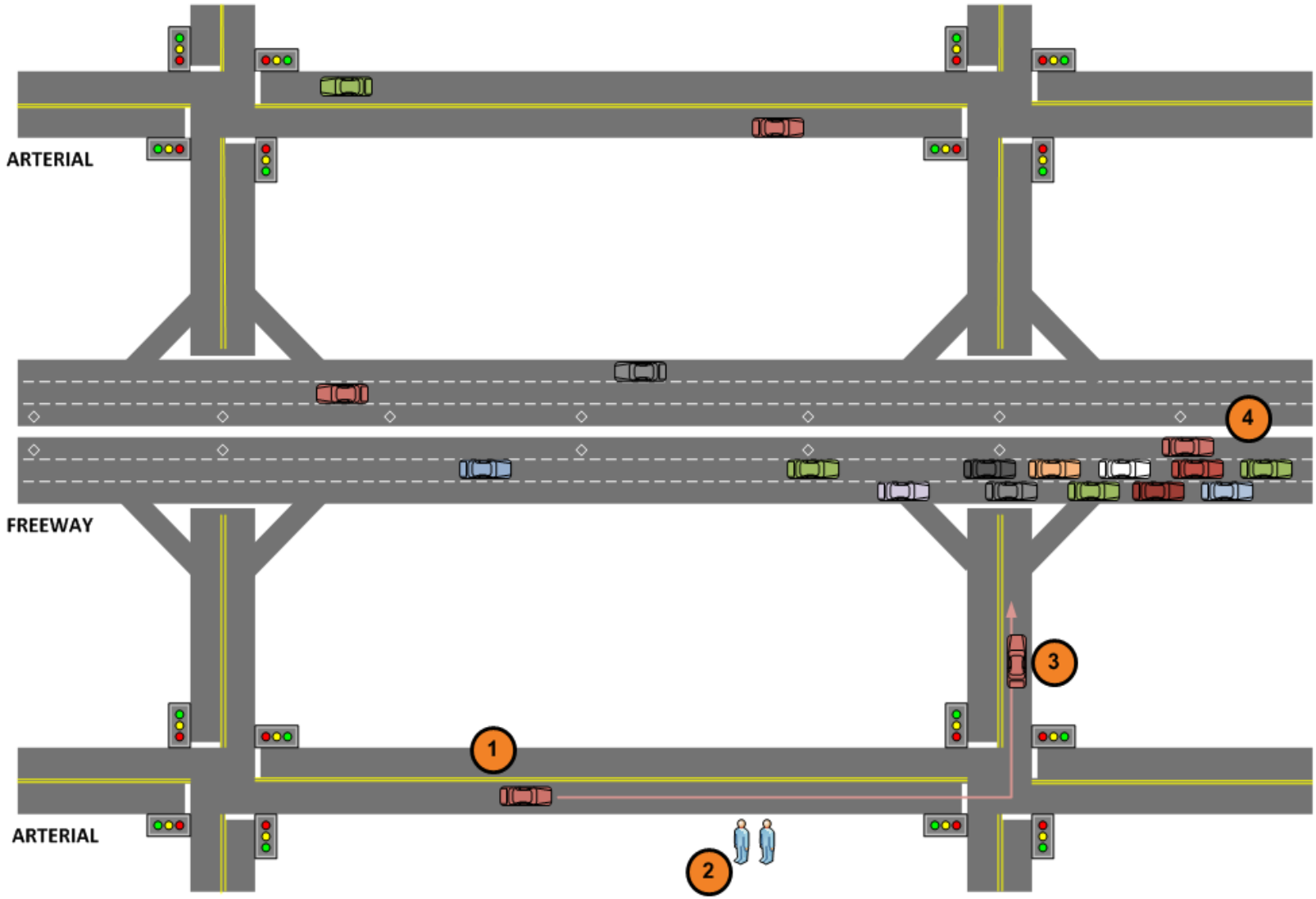
Dynamic Ridesharing (D-RIDE)

Makes use of in-vehicle (drivers) and hand-held devices (riders) to dynamically identify and accept potential ridesharing opportunities along the travel route.

- Uses dynamic ridesharing technology, personal mobile devices, and voice activated on-board equipment to match riders and drivers along their route
- Allows trip-by-trip ridesharing (dynamic as opposed to preset carpooling).
- Can take into account individual ridesharing preferences and constraints
- May include technology to verify the number of people in a vehicle for HOV enforcement and toll discounts



D-RIDE



IDTO Potential Impacts

10-year transformative impact targets:

- Increase to 90% the percentage of connections requested and made that involve fixed and flexible modes
- Reduce duration of time from making a request to receiving a trip confirmation to 45 seconds
- Reduce passenger wait time to less than 10 minutes

IDTO Project Status

- ConOps and System Requirements – completed, mid 2012
- Test Readiness – completed, October 2012
- Prototype Procurement – released, January 2013
- Proposals from IDIQ , February 2013
- Impacts Assessment Procurement, Spring 2013
- Prototype Demonstrations, expected 2013-2014
- Evaluation Results, expected Fall 2014

FRATIS: Freight Advanced Traveler Information System

Randy Butler

FHWA Freight Operations and Technology

Freight traveler information system that provides freight-specific route guidance and optimizes drayage operations so that load movements are coordinated between freight facilities to reduce empty-load trips:

- ***Freight-Specific Dynamic Travel Planning and Performance***

  Note: combines the two formerly separate DMA program areas of:
  - Freight Dynamic Route Guidance
  - Freight Real-Time Traveler Information with Performance Monitoring

- ***Drayage Optimization***

Freight-Specific Dynamic Travel Planning and Performance

This application bundle seeks to include all of the traveler information, dynamic routing, and performance monitoring elements that users need.

- Enhances traveler information systems to address specific freight needs
- Provides route guidance to freight facilities, incident alerts, road closures, work zones, routing restrictions (hazmat, oversize/overweight), and performance monitoring
- Builds on the Cross-Town Improvement Project (C-TIP) Real Time Traffic Monitoring (RTTM) and Dynamic Route Guidance (DRG) applications for best route between freight facilities.
- Provides intermodal connection information, container disposition and schedule
- Leverages existing data in the public domain, as well as emerging private sector applications to provide benefits to both sectors.

Drayage Optimization

This application bundle seeks to combine container load matching and freight information exchange systems to fully optimize drayage operations, thereby minimizing bobtails/dry runs and wasted miles, as well as spreading out truck arrivals at intermodal terminals throughout the day.

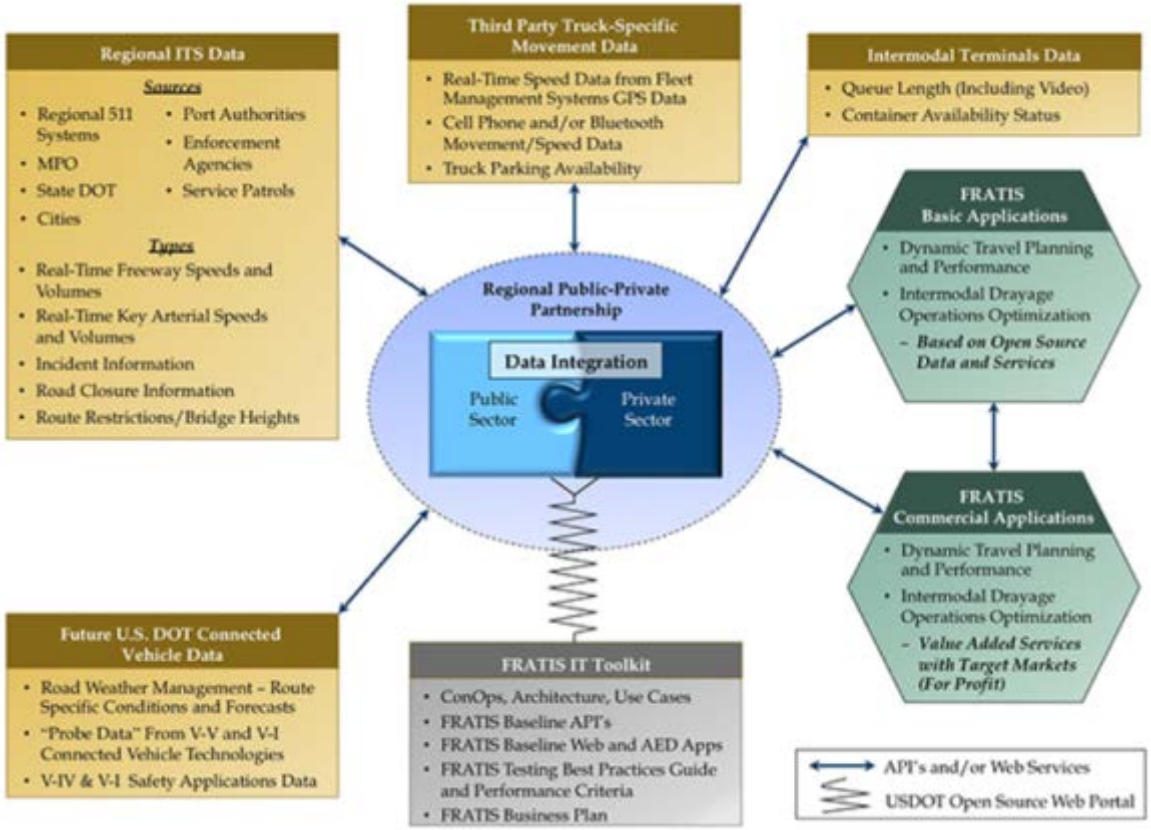
- Reduces freight delays at key facilities that overbook their capacity to ensure uninterrupted operations within the terminal/warehouse
- Optimize drayage operations so that load movements are coordinated between freight facilities
- Individual trucks are assigned time windows within which they will be expected to arrive at a pickup or drop-off location

- Early or late arrivals to the facility are dynamically balanced
- Web-based forum for load matching provided to reduce empty moves

FRATIS – High-Level System Concept

Bundles will consist of two application levels:

- Basic application, developed from open-source data and services and available in the public realm
- "Value-added" commercial application, targeted at existing, subscriber user groups.



FRATIS Prototypes

- **Los Angeles-Gateway Region:**
  - Developing the FRATIS applications to address the dynamic travel planning around the marine terminals and queues to move cargo out of the port more efficiently.

- **Dallas-Fort Worth, Texas:**
  - Incorporate the integrated corridor management capability along with size and weight permitting.
  - This site is also testing the Connected Vehicle Basic Safety Message (SAE Standards J2735-2009)
  - Optimize drayage opportunities in coordination with rail and local truck drayage companies.

- **South Florida:**
  - Similar focus as the other two sites, but includes emergency response capability to FRATIS that would realign the purpose of freight transportation to bring in supplies during an emergency such as a hurricane.

VIDEO

- http://www.youtube.com/watch?v=c71Qm6HxVTY

FRATIS: Potential Impacts

10-year transformative impact targets:

- Reduce truck travel times, 17%
- Reduce bobtail (empty) trips, 15%
- Reduce terminal wait times, 35%
- Reduce freight-involved incidents, 35%
- Reduce fuel consumption/emissions, 10%

FRATIS Impacts Assessment

Scope

- Conduct impact assessment of the FRATIS Prototypes in Dallas/Ft. Worth, Los Angeles-Gateway Region, and South Florida
- Estimate effectiveness and impact of a full FRATIS operational deployment in the three prototype regions

Key Activities

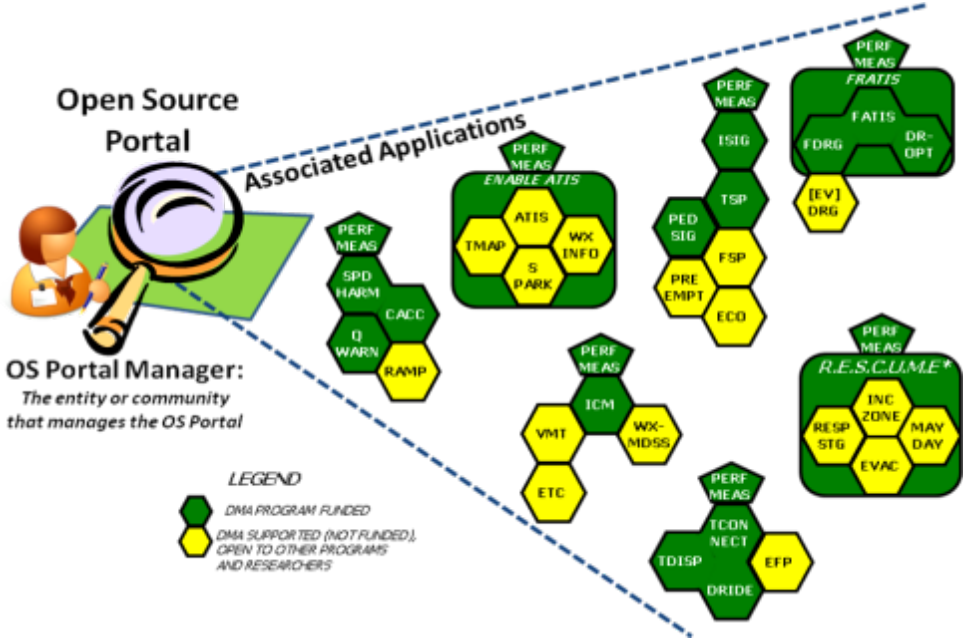
- Analyze before and after transformative benefits
- Survey/interview FRATIS and potential stakeholders
- Extrapolate observed findings to estimate effectiveness and impacts of regional deployment
- Assess costs and benefits of FRATIS implementation

FRATIS – Phase 2 Status

- Prototype Site Selection - completed Summer 2012
- Data collection to establish baseline – Spring/Summer 2013
- Software development – Spring/Summer 2013
- Prototype Demonstrations (6 months) – Summer 2013
- Evaluation Results – 2014

Open Source Applications Portal

- **Purpose**: Develop, operate, and maintain an open source portal that will enable multiple stakeholders to collaborate on application development
- **Coordination:** Application bundles require concurrent, collaborative development
  - E.g., in the M-ISIG bundle, pedestrian signal phases in the PED-SIG application must be coordinated with applications providing priority or pre-emption services
  - This coordination extends to both DMA-funded application development and research conducted at UTCs, other organizations



- **Transparency**: the Open Source Portal provides the mechanism to ensure application development is transparent and broadly available

Open Source Applications Portal Launch

Please join us for the OS Portal demonstration

Where: Next webinar in the series: ***Using the OSADP***

When: March 20, 2013 at 1 PM

How to register: www.itsa.org/dmawebinar

FY13 Focus: Application Development and Testing

- **Launch Remaining Bundle Prototyping Efforts**
  - Demonstrate technical feasibility, estimate localized benefits
  - FRATIS (underway), launch IDTO, INFLO, M-ISIG, R.E.S.C.U.M.E prototyping
  - Assess need to standardize or modify existing standard message protocols

- **Test Feasibility of Innovative Concepts**
  - Prototype new mobile devices
  - Engage OEMs and the private sector
  - Characterize role of BSM in DMA prototypes

- **Develop Analysis, Modeling and Simulation Testbeds**
  - Estimate impacts of integrated multi-application deployments utilizing standardized messages and shared communication networks

Outlook for Phase 3 Demonstrations

- **Key Assumptions/Expectations**
  - Overall market penetration of connected vehicles will be relatively low
  - Market penetration of connected travelers with mobile devices may be higher
  - New forms of data capture must be integrated with legacy systems
  - Private sector likely to play an important role
- **Demonstrations Should Showcase Promising Integrated System Alternatives Identified in Prototyping, Cross-Cutting Tests, and AMS Testbed Activity**
  - Well-defined applications with associated operational data environments
  - Proven messaging protocols with associated communications media
- **All DMA Bundles are Deployable Near-Term in Some Form**
  - Impact may be limited in some cases because of small market penetration
  - Not every demonstration will contain every bundle or application, deployment concepts may be tailored according to local interest
  - DMAs can be deployed alongside complementary Weather, V2I, AERIS applications

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