



U.S. Department of Transportation
Federal Highway Administration



NATIONAL DIALOGUE ON
HIGHWAY AUTOMATION

FHWA National Dialogue on Highway Automation

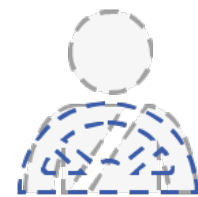
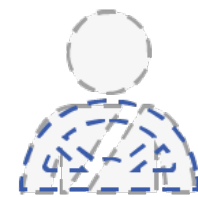
Digital Infrastructure and Data
DoubleTree Hilton Seattle Airport, Seattle, WA

August 1-2, 2018

Levels of Automation

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation



0

No Automation

Zero autonomy; the driver performs all driving tasks.

1

Driver Assistance

Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.

2

Partial Automation

Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.

3

Conditional Automation

Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.

4

High Automation

The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.

5

Full Automation

The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.



USDOT Modal Agencies and Roles



Federal Highway Administration (FHWA) is responsible for providing stewardship over the construction, maintenance, and preservation of the Nation's highways, bridges, and tunnels.



The **Federal Motor Carrier Safety Administration's (FMCSA)** partners with industry, safety advocates, and State and local governments to keep the Nation's roads safe and improve commercial motor vehicle (CMV) safety through regulation, education, enforcement, research, and technology.



The **Federal Transit Administration (FTA)** provides financial and technical assistance to local public transit systems, including buses, subways, light rail, commuter rail, trolleys, and ferries.



The **National Highway Traffic Safety Administration's (NHTSA)** mission is to save lives, prevent injuries, and reduce the economic costs of road traffic crashes through education, research, safety standards, and enforcement activity.



MARAD's mission is to promote the development and maintenance of an adequate, well-balanced United States merchant marine.



PHMSA's mission is to protect people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential to our daily lives



FRA develops and enforces safety regulations and invests in passenger and freight rail services and infrastructure, and research into and development of innovations and technology solutions.

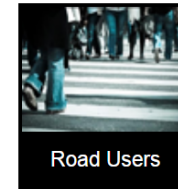


FHWA Authority and Role

FHWA has many roles:

- Administers the Federal-Aid Program
- Develops standards for infrastructure and traffic control devices
- Provides guidance to State and local agencies
- Conducts and supports highway research
- Serves as a resource for the transportation community
- and others....

CORE HIGHWAY TOPICS



USDOT Activities in Automation

Event	Date
USDOT releases Automated Driving Systems (ADS) 2.0: A Vision for Safety	September 12, 2017
Roundtable on Data for Automated Vehicle Safety	December 7, 2017
Public Listening Summit on Automated Vehicle Policy	March 1, 2018
Automated Vehicles 3.0 announced	Late Summer 2018
Work Zone Data Exchange Project	<i>Ongoing</i>
V2X Mapping Stakeholder Input	<i>Ongoing</i>



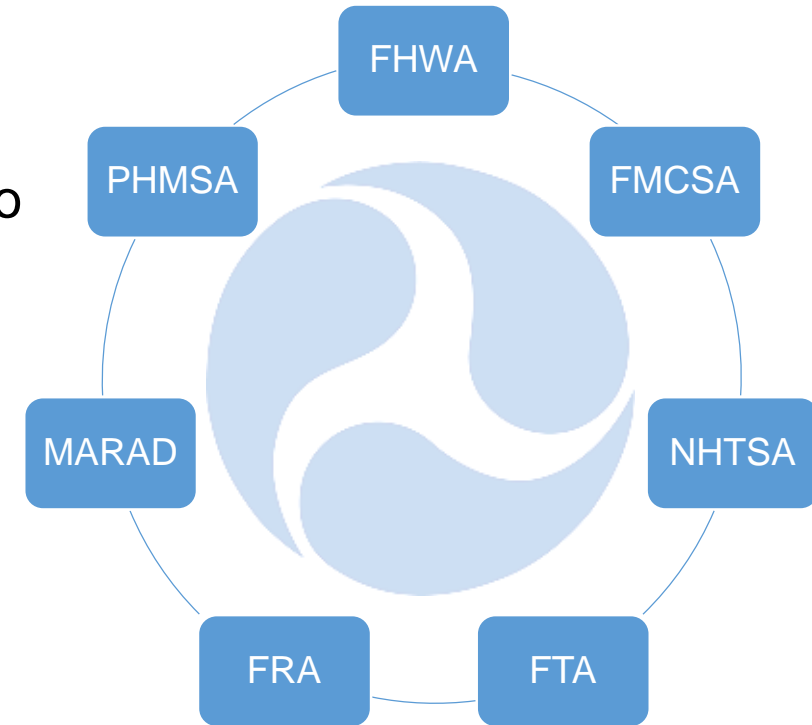
AUTOMATED DRIVING SYSTEMS 2.0



USDOT RFIs in March 2018

FHWA RFI Themes

- Greater **Uniformity and Quality** in road markings and traffic control devices would enable automation.
- FHWA should take a **Leadership** role in convening stakeholders to encourage collaboration.
- Certain **Data Elements** around the roadway environment are useful for industry, State, and local DOTs to share and could improve automation operations.
- Conducting **Pilots** and supporting pilot testing are important for facilitating learning and collaboration.
- **Uncertainty** in infrastructure investment and allocation of limited resources are key concerns for State and local agencies.



Automation Has Implications for Roadways



The National Dialogue on Highway Automation

What is the National Dialogue?

- The Federal Highway Administration (FHWA) is initiating a national conversation with diverse stakeholders to discuss automated vehicles.
- The National Dialogue on Highway Automation is a series of meetings held across the country to facilitate information sharing, identify key issues, and support the transportation community to safely and efficiently integrate automated vehicles into the road network.



What are Desired Outcomes?

FHWA may use inputs to:

1. Assess National issues and priorities
2. Develop guidance, best practices, standards
3. Support necessary research
4. Adapt programs and policies
5. Create a National community or coalition



Schedule

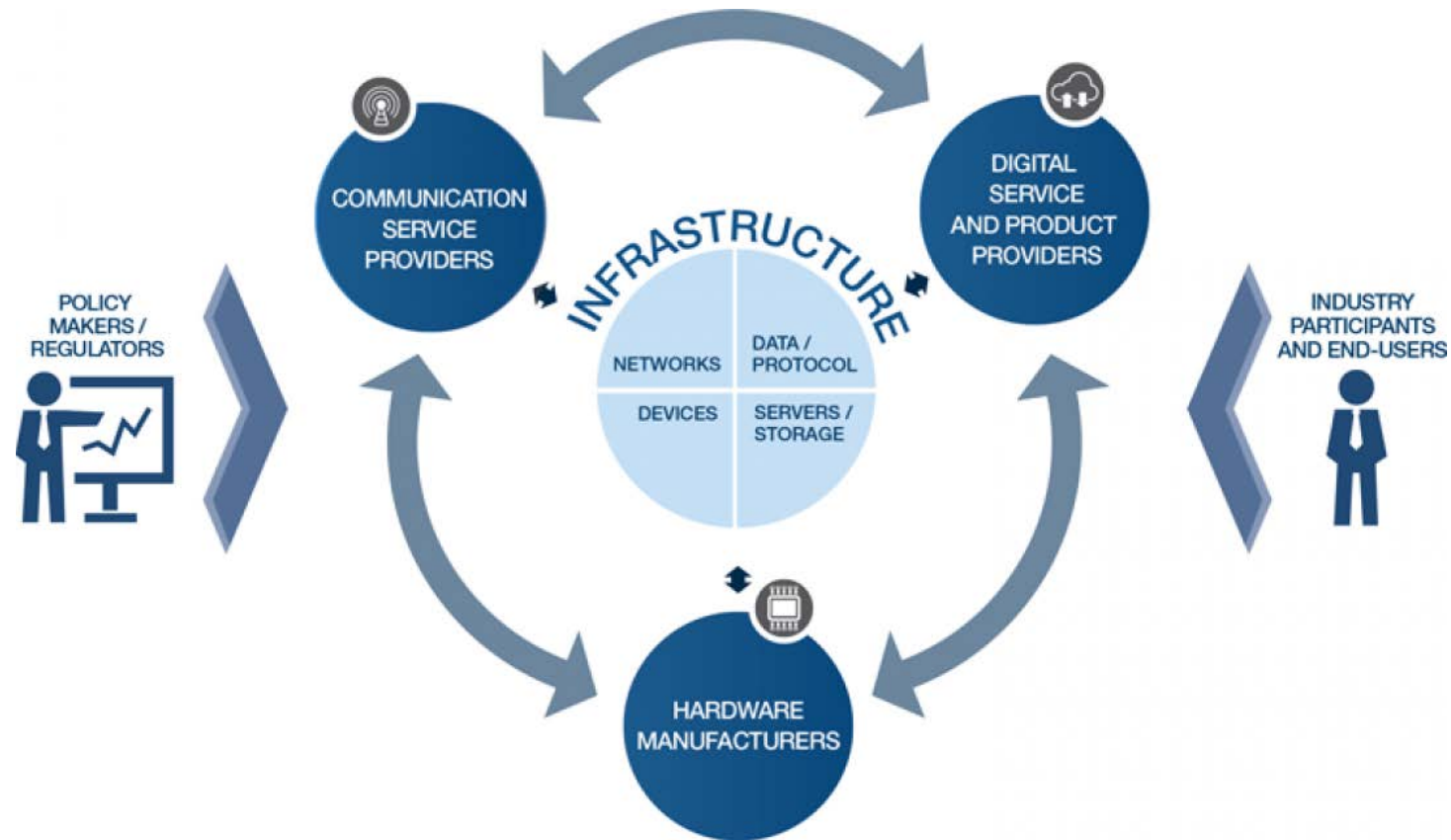
Month	Event	Location
June 7	National Dialogue Launch Workshop	Cobo Center, Detroit, MI
June 26-27	National Workshop 1: Planning and Policy	Science History Institute Philadelphia, PA
July 12	Automated Vehicle Symposium FMCSA-FHWA Truck Automation Listening Session	Hilton, San Francisco, CA
August 1-2	National Workshop 2: Digital Infrastructure and Data	DoubleTree Hilton Seattle Airport Seattle, WA
September 5-6	National Workshop 3: Freight	Hyatt Regency Chicago, Chicago, IL
October 24-25	National Workshop 4: Operations	Phoenix, AZ
Week of Dec. 3	National Workshop 5: Infrastructure Design and Safety	Austin, TX

Data and Digital Infrastructure

Today's Discussion

- Understand how components of digital infrastructure may assist in the development and safe deployment of automated driving systems.
- Discuss roles and responsibilities of government (federal, state, and local), private industry, and even road users, to provide, support, manage, or operate components of digital infrastructure in support of surface transportation.

Illustration of Digital Infrastructure



Source: World Economic Forum

<http://reports.weforum.org/delivering-digital-infrastructure/introduction-the-digital-infrastructure-imperative/>

Automation, Data, and Digital Infrastructure

- AVs process static and/or dynamic digital representations of the physical world in which they interact.
- AVs need many types of infrastructure data to safely integrate into the roadway.
- Infrastructure owners/operators need data to efficiently manage the roadway system.
- Digital infrastructure enables the efficient collection, processing, and exchange of data using components.

Agenda Day 1

Time (PDT)	Agenda Item
12:30 PM	Registration and Sign-in
1:00 PM	Opening Remarks
1:10 PM	National Dialogue Overview
1:25 PM	Framing the Discussion
1:40 PM	Small Group Session 1: Data for Integration of AVs <i>Small Group Discussions with Facilitators and Co-Facilitators at each table</i>
2:50 PM	Small Group Session 1 Report Out
3:30 PM	Break
3:45 PM	Collaboration Corner <i>Market Square Format: Participants rotate around to different stalls to provide input on various topics</i>
5:00 PM	Wrap-up and Preparation for Day 2
5:30 PM	End of Day 1

Agenda Day 2

Time (PDT)	Agenda Item
7:30 AM	Registration and Sign-in
8:00 AM	Kick-off Day 2
8:15 AM	Instructions for Small Group Session 2
8:20 AM	Small Group Session 2: Digital Infrastructure <i>Small Group Discussions with Facilitators and Co-Facilitators at each table</i>
9:30 AM	Small Group Session 2 Report Out
10:00 AM	Break
10:20 AM	Preparing for Automated Vehicles: Digital Infrastructure and Data Perspectives
11:30 AM	Lunch (not included)
1:00 PM	Small Group Session 3: What's Next? <i>Each table selects a primary and secondary topic to address</i>
2:30 PM	Wrap-up and Next Steps
3:00 PM	End of Day 2

Contact:
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NATIONAL DIALOGUE ON
HIGHWAY AUTOMATION

Data for Automated Vehicle Integration

Ariel Gold

Data Program Manager

US Department of Transportation (USDOT)

Intelligent Transportation Systems Joint Program Office (ITS JPO)

August 1-2, 2018

How to Take on a Cross-cutting Issue Like Data?



Graphic credit: <https://xkcd.com/1429/>

Access to data is a limiting factor for AV deployment. (It's also a sensitive topic.) One solution: *data exchanges*.

USDOT is using our *convening power* to understand critical use cases for data exchange and the appropriate federal role to enable them.



Bringing Stakeholders Together for Meaningful Conversations on Data

(IT'S REALLY HARD TO DO)

AV Data Guiding Principles (Beta)

1

Promote proactive, data-driven safety, cybersecurity, and privacy-protection practices.

2

Act as a facilitator to inspire and enable voluntary data exchanges.

3

Start small to demonstrate value, and scale what works toward a bigger vision.

4

Coordinate across modes to reduce costs, reduce industry burden, and accelerate action.

<https://www.transportation.gov/AV/Data>

AV Data Framework (Beta)

Category*	Goals	Specific Data to Exchange	Real-World Examples
Business-to-Business (B2B)	<ul style="list-style-type: none"> Mitigate known and emerging cyberthreats Improve industry-wide safety through shared learning in safety-critical and edge case scenarios Inform future insurance policies Accelerate the resolution of legal liability claims 	<ul style="list-style-type: none"> Cybersecurity incidents Edge cases Near-miss events Performance in safety-critical scenarios Post-accident data 	<ul style="list-style-type: none"> Automotive Information Sharing and Analysis Center ClinicalStudyDataRequest.com (CSDR) PEGASUS TNO Streetwise
Business-to-Government (B2G)	<ul style="list-style-type: none"> Understand performance of rapidly evolving technology during testing phases Inform policies and investments to improve system safety and efficiency 	<ul style="list-style-type: none"> Cybersecurity incidents Near-miss events Performance in safety-critical scenarios Crash reconstruction 	<ul style="list-style-type: none"> Aviation Safety Information Analysis and Sharing Voluntary Safety Self-Assessments (Part of ADS 2.0)
Business-to-Infrastructure (B2I)	<ul style="list-style-type: none"> Help vehicles navigate safely around obstacles and in adverse weather conditions Reduce system congestion Help optimize infrastructure maintenance 	<ul style="list-style-type: none"> Work zone activities and geometrics Road weather information Missing signage or broken infrastructure Curb use rules and availability 	<ul style="list-style-type: none"> National Transit Map Waze Connected Citizens Program Meteorological Assimilation Data Ingest System
Open Training Data (X2X)	<ul style="list-style-type: none"> Improve ADS performance in common safety-critical scenarios Support basic research and education 	<ul style="list-style-type: none"> Road, signage, and other infrastructure imagery Edge cases Bike/ped near misses Truck platooning pilot data 	<ul style="list-style-type: none"> ImageNet Multimedia Commons Nexar NEXET BikeMaps.org FHWA Platooning POC

*represents two-way data exchange

<https://www.transportation.gov/AV/Data>



Roundtable on Data for AV Safety

Outcomes

- Clarity on value of federal government as convener and facilitator
- Priority use cases for data exchange: work zones, scenarios, cybersecurity, others

Next Steps

- Enable voluntary data exchanges as “One DOT” via pilot projects
- Incorporate into AV policies
- Continue conversations



Photo credit: Dan Morgan



Summary Report available via:
<https://www.transportation.gov/AV/Data>

Work Zone Data Exchange Project

THE LOCAL DATA CHALLENGE

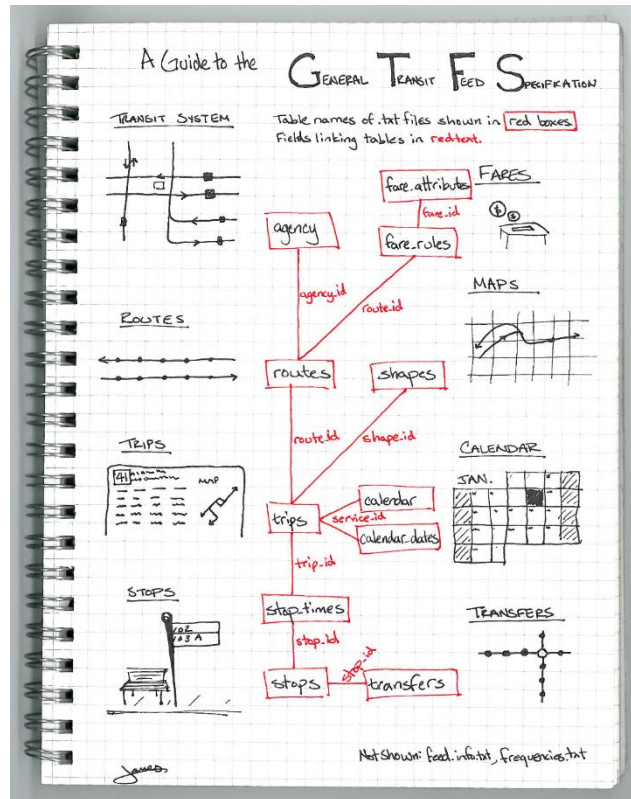
The Local Data Challenge

Up-to-date information about dynamic conditions occurring on the roads – such as construction events – can help AVs navigate safely and efficiently.

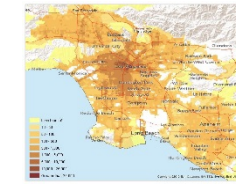
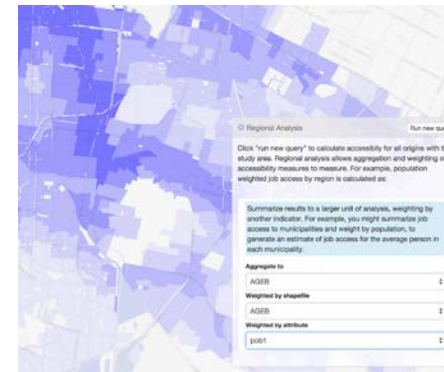
Many infrastructure owners and operators (IOOs) maintain data on work zone activity, but lack of common data standards and convening mechanisms makes it difficult and costly for third parties – including original equipment manufacturers (OEMs) and navigation applications – to access and use these data across various jurisdictions.

Learning from the Open Transit Data Story

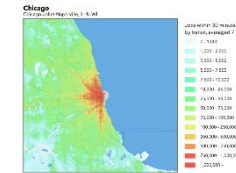
A simple specification...



...with a wide range of uses

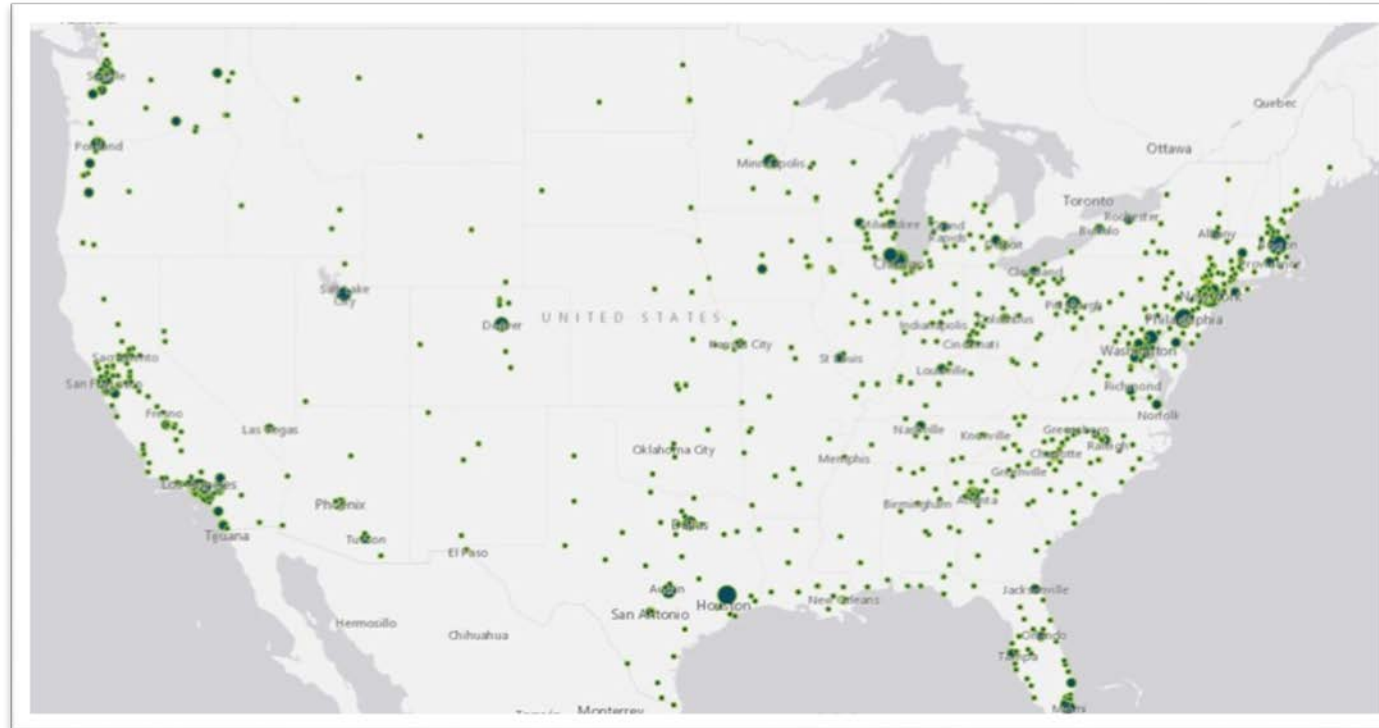


Station	Line	Color	Count
Depot Red Line (Westbound)	3	Red	12
Depot Red Line (Eastbound)	3	Red	3
Depot Blue Line (Westbound)	4	Blue	4
Depot Blue Line (Eastbound)	4	Blue	4
Depot Green Line (Westbound)	5	Green	3
Depot Green Line (Eastbound)	5	Green	3
Depot Yellow Line (Westbound)	6	Yellow	9
Depot Yellow Line (Eastbound)	6	Yellow	6
Depot Silver Line (Westbound)	7	Silver	7
Depot Silver Line (Eastbound)	7	Silver	7
Depot Orange Line (Westbound)	8	Orange	3
Depot Orange Line (Eastbound)	8	Orange	3
Depot Purple Line (Westbound)	9	Purple	14
Depot Purple Line (Eastbound)	9	Purple	14
Depot Brown Line (Westbound)	10	Brown	8
Depot Brown Line (Eastbound)	10	Brown	8
Depot Grey Line (Westbound)	11	Grey	1
Depot Grey Line (Eastbound)	11	Grey	1
Depot Pink Line (Westbound)	12	Pink	3
Depot Pink Line (Eastbound)	12	Pink	3
Depot Light Blue Line (Westbound)	13	Light Blue	8
Depot Light Blue Line (Eastbound)	13	Light Blue	8
Depot Light Green Line (Westbound)	14	Light Green	14
Depot Light Green Line (Eastbound)	14	Light Green	14
Depot Light Orange Line (Westbound)	15	Light Orange	14
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Depot Light Grey Line (Eastbound)	18	Light Grey	14
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Depot Light Pink Line (Eastbound)	19	Light Pink	14
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Depot Light Pink-Blue Line (Eastbound)	26	Light Pink-Blue	14
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Depot Light Blue-Purple Line (Eastbound)	99	Light Blue-Purple	14
Depot Light Purple-Orange Line (Westbound)	100	Light Purple-Orange	14
Depot Light Purple-Orange Line (Eastbound)	100	Light Purple-Orange	14



A Federated “Front Door” to Transit Data

Now, **basic transit data** is easy to find and use nationwide;
transit agencies and their users **continue to collaborate** on the spec



Work Zone Data Exchange Project (Overview)

Purpose

- To jumpstart voluntary adoption of a basic work zone data specification
- To enable collaborative maintenance and expansion of the spec

Outcomes within 6 months

- **Data producers** make available an active work zone data feed using a common, non-proprietary specification
- **Non-government developers** use that data in a meaningful way – thus establishing a minimum viable product of voluntary data exchange for work zone data

Big Picture Outcome

- Repeatable approach to accelerate harmonization of local data sources

Work Zone Data Exchange Project

(Notional timeline)

Feb 2018:

Charter project

May 2018:

USDOT synthesizes inputs from data providers and produces strawman data dictionary based on existing data sources

July 2018:

Users validate sample data; lock in data dictionary v1

Aug 2018:

Promote broadly; Start process of adding new fields for v2

Mar 2018:

Kick off

June 2018:

Reach consensus on data dictionary (common core, extensible fields for future) and encoding spec

July 2018:

Data providers implement the common spec; data users demonstrate use of the data

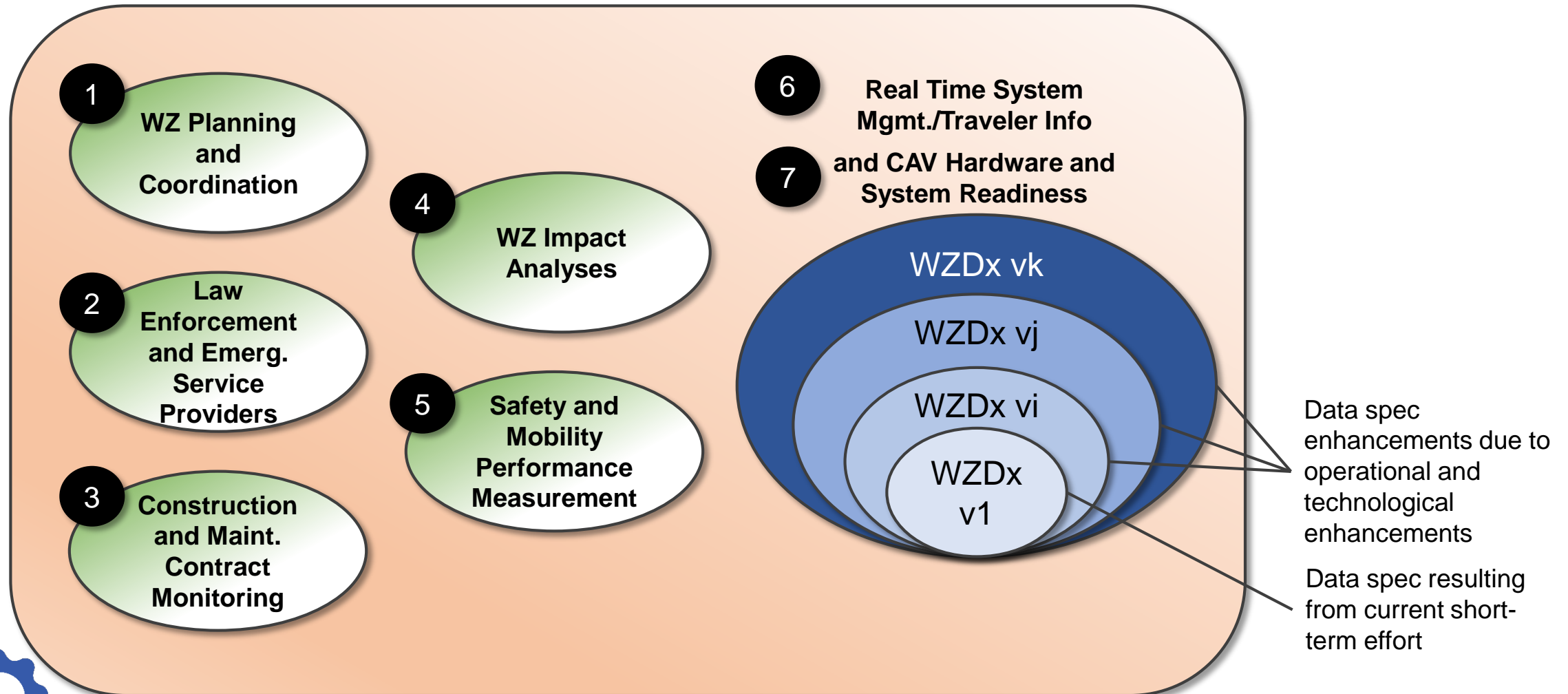
Technical assistance (immediate, and TBD longer term)

Discover AV-specific needs that go beyond current data feeds

Establish mechanism to maintain and expand spec in future



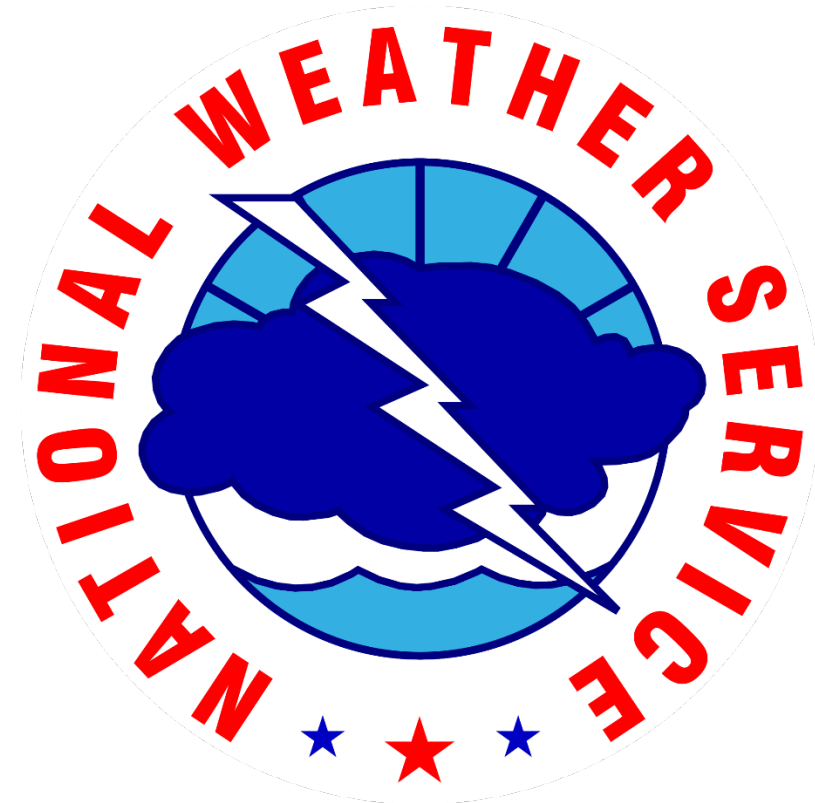
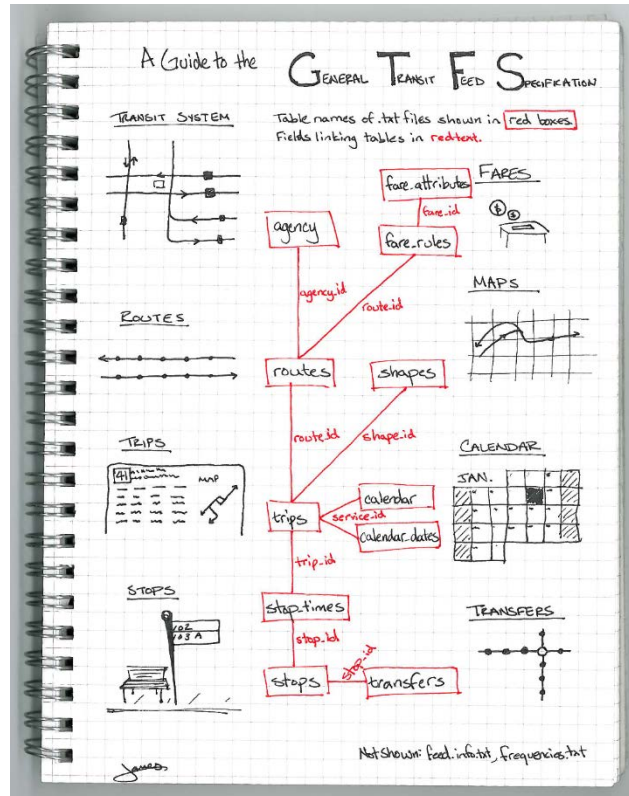
Longer-term Needs Discovery (FHWA Work Zone Data Initiative)



Relationship between Data & Digital Infrastructure for AV Integration

(HINT: DATA = DIGITAL)

A Range of Potential Federal & Non-Federal Roles



Recap: Meaningful Conversations on Data

- Start with the “**why**” – what problem are you trying to solve through data?
- Then talk about “**who**” needs to be involved, and “**what**” data they’re exchanging
- Then dive into “**how**” to make this happen
- Consider using the AV Data Framework and Principles to jump-start your conversations (start small and scale)!

Thank You!

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