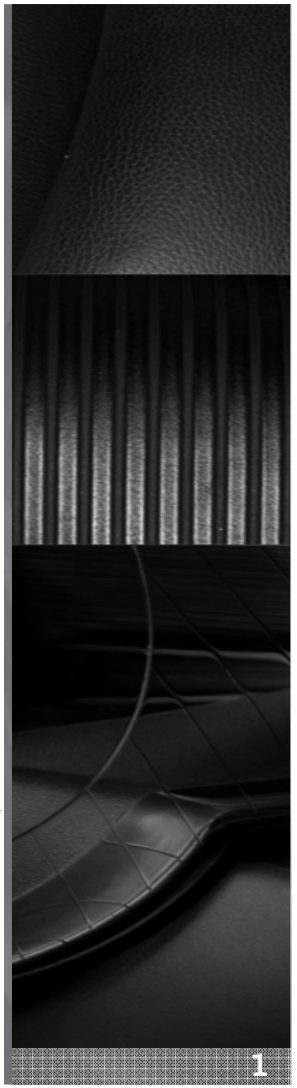
Data


Tylenol Extra Strength Rapid Blast Liquid 8 OZ
Tylenol Extra Strength E-Z Tab 100 Ct.
Choose by Ingredients
I have a headache
Choose by Symptom
Choose by Format
Choose by Age
Tylenol PM Rapid Release 80 Ct.
Choose by Flavor
Choose by Dosage
Choose by Brand
Actavis Ibuprofen Liquid Berry 4 OZ
Advil Children's 4 OZ
Excedrin Extra Strength Caplets 125 Ct.
Advil Liquid Gels 40 Ct.
See reverse for detail.

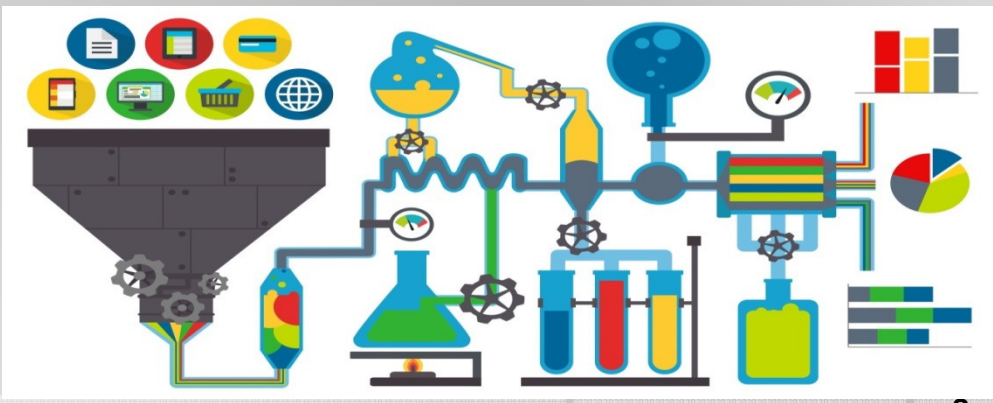


Why Data?

- Asset Management
- Performance Measures
- Situational Awareness
- Historical Knowledge

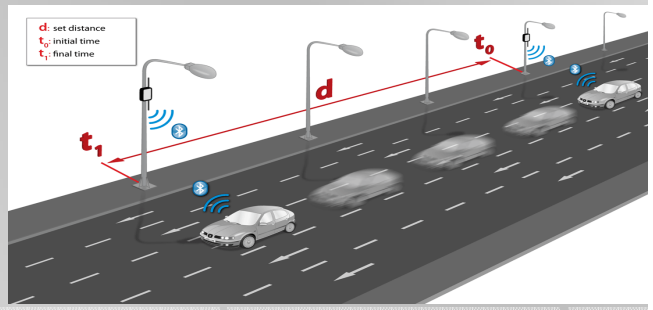
Data Sources

- Roadside
- Vehicle Fleets
- Agency Databases
- Services/Vendors



Roadside Data

- Data Collection Technologies
  - **Spot Data**: Loops, radar, video, microwave, RWIS, LPR
    - Speed, Volume, Occupancy, Classification, Road & Weather Conditions
  - **Section Data**: Video, Bluetooth, Wi–Fi, LPR
    - Speed & Travel Time, Volume, Conditions

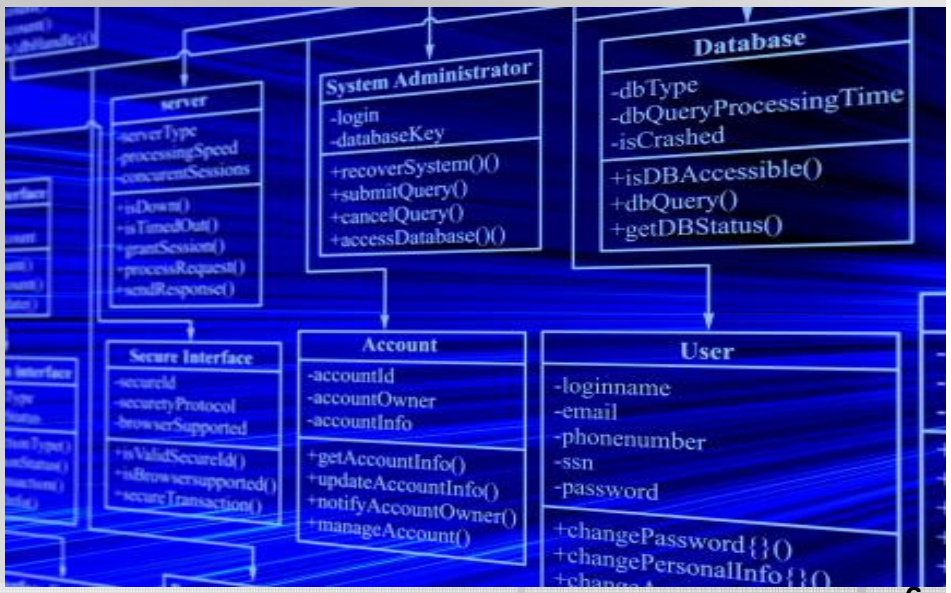


Mobile Data

- Fleet Management Systems
  - Location
  - Action/Status
  - Conditions
  - History
  - Vehicle Characteristics

Internals Sources of Data

- Typically Historical
  - Accidents
  - Incidents
  - Radio Logs
  - Video Logs
  - Work Logs



External Data Services & Sources

- Weather – Universities, Weather Services, Federal (NOAA, etc.), Others
- Data Services – Inrix, HERE, Others

Understanding Data Services

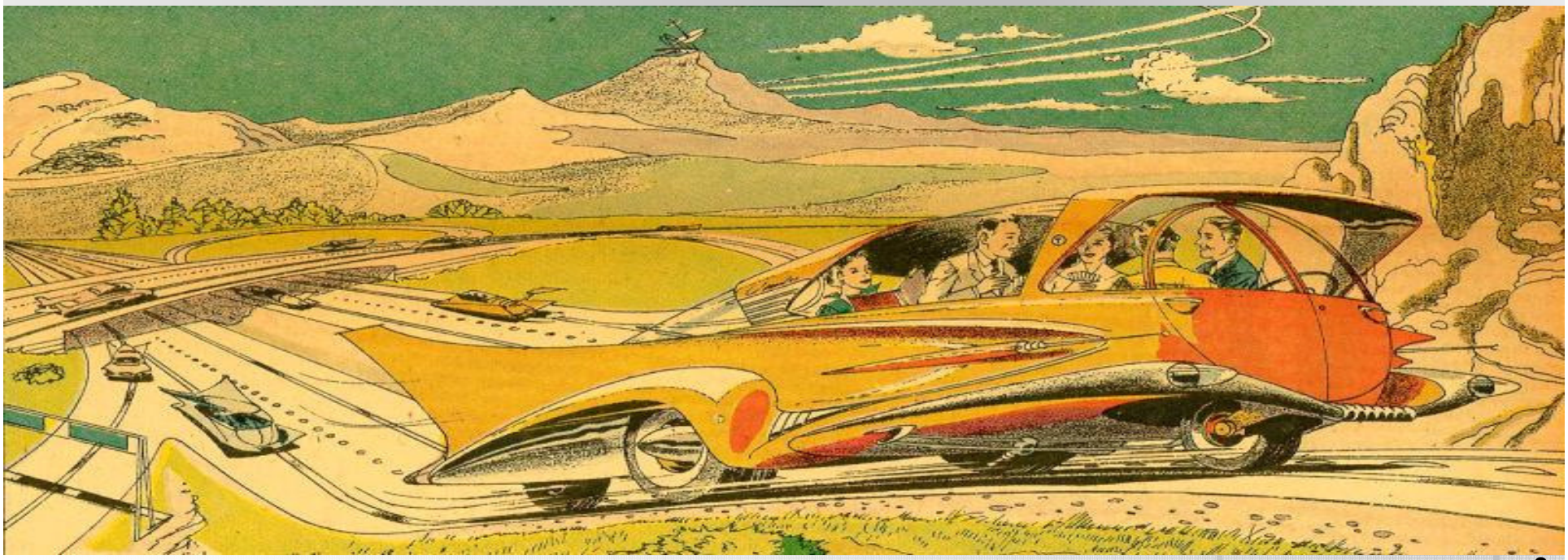
- What Are the Business Models?
  - Data: quality, reporting cycle, science, costs
  - Data sharing and use limitations/restrictions
- What is Actually Being Offered?
  - Raw Data ⇨ Integrated Data ⇨ Processed Data ⇨ Information

Matching the Data to Your Need

All Data is Not Created Equal

BAD DATA IS NO BETTER THAN NO DATA.

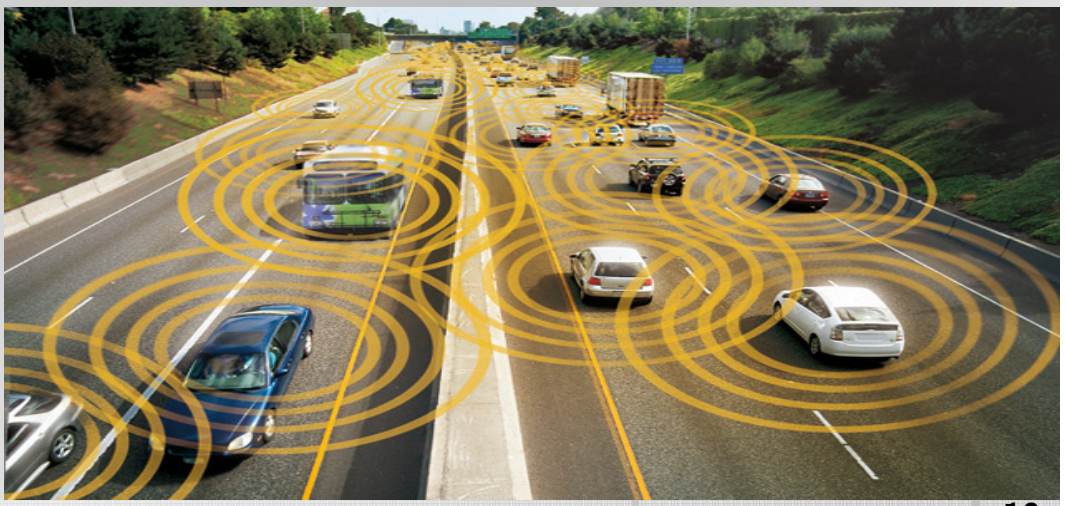
So, before we talk about where we are headed – any questions?



What the Future Holds

The Coming of the Connected & Autonomous Vehicle

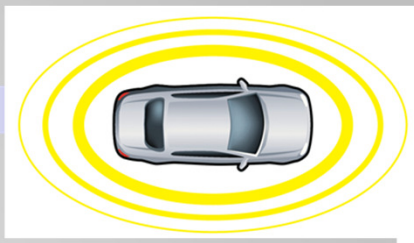
- What is this?
- Timing
- The Data
  - Considerations & Tradeoffs



CAV – Connected Autonomous Vehicle

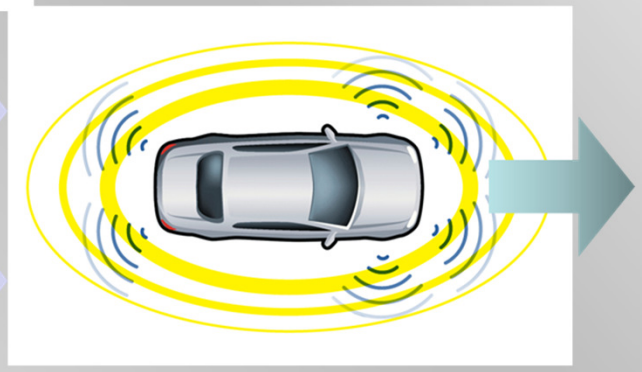
Connected Vehicle

Communicates with nearby vehicles and infrastructure; Not automated



Connected Automated Vehicle

Leverages autonomous automated and connected vehicles



Autonomous Vehicle

Operates in isolation from other vehicles using internal sensors

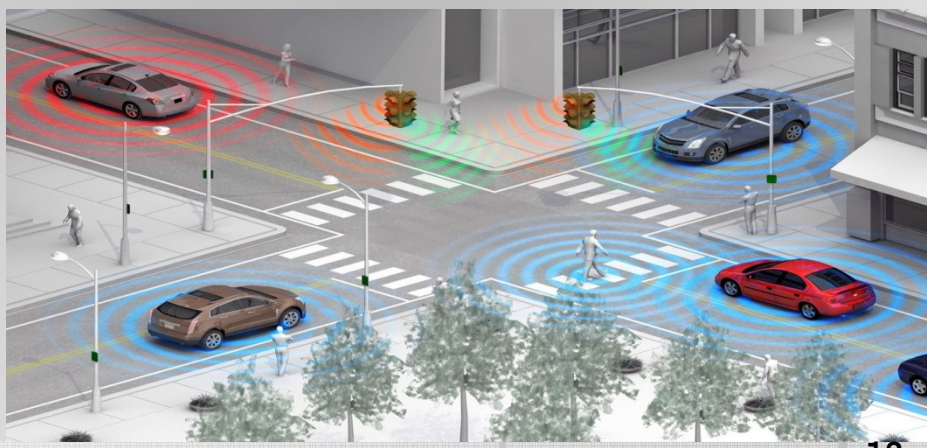
CAV Conductivity

- Vehicles Use Wireless Communications to Provide Connectivity:

  V2V – Between vehicles of all types

  V2I – Between vehicles & roadway infrastructure

  V2X – Between vehicles & others (bikes & peds)



2013: NHTSA
Decision to consider DSRC rulemaking for light vehicles – **V2V**

2015: NHTSA
Passed rule requiring **V2V** in all light vehicles by 2019

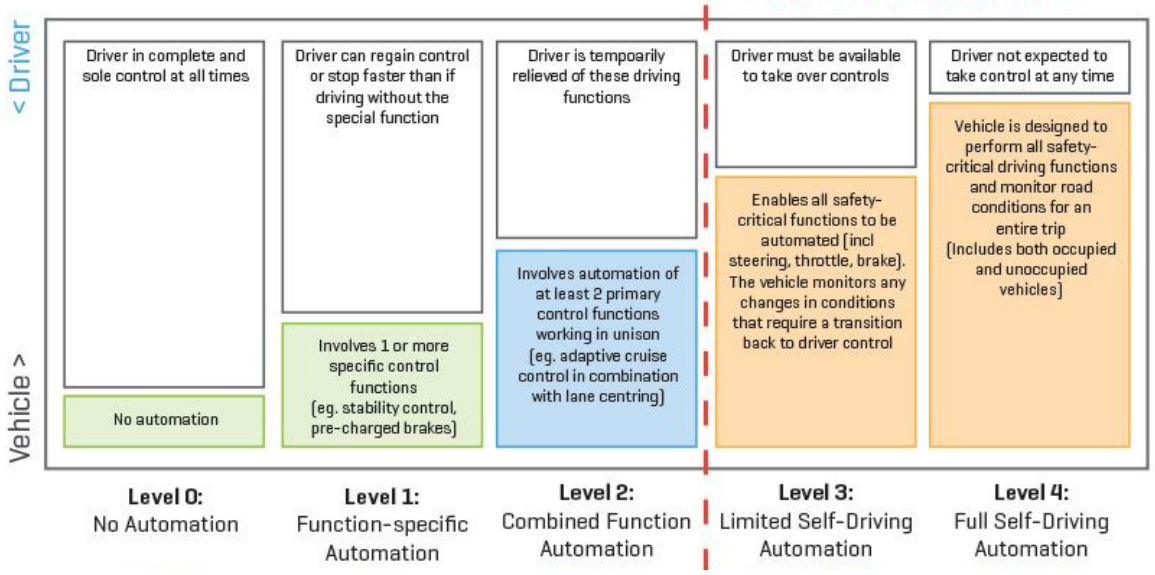
2016: FHWA
Deployment of infrastructure deployment guidance V2I

In 2013 NHTSA determined the future of light vehicle technology. They chose to pursue a Rulemaking requiring vehicles to be equipped with **V2V** communications. Some manufactures have already stated installing the equipment.

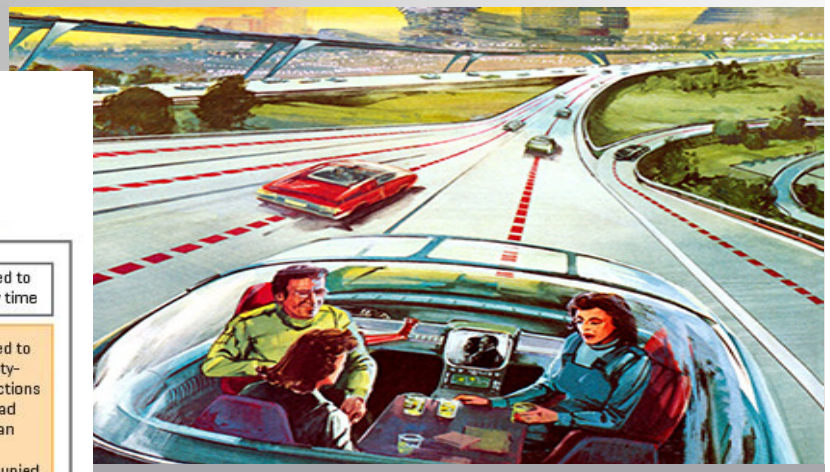
NHTSA's next action is a ruling on heavy vehicles

The CAV Evolution

Levels of driving automation (NHTSA)



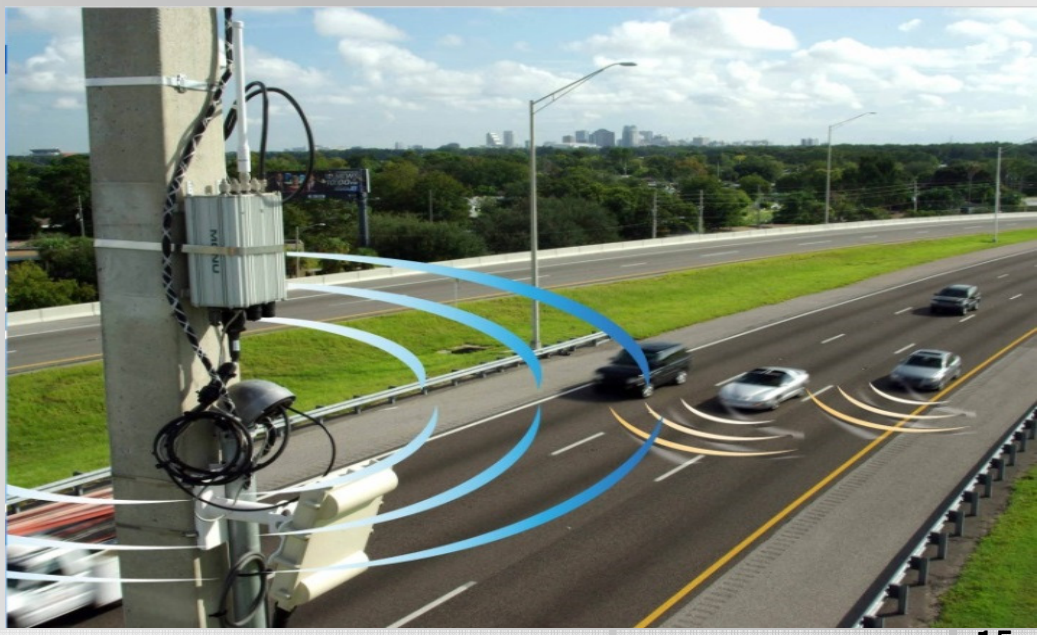
Source: NHTSA (Modified)



DSRC (5.9 GHz Dedicated Short Range Communications)

- Set aside for transportation
- RSU (Roadside Unit) ~ $5K + backhaul
- Short Range – 300 yds
- Path interference
- Requires backhaul
- Data from car:
  - Broadcast 10 times/sec

What about cellular?



When Does This Start to Matter?

- A limited number of cars being sold today that are already connected.
- NHTSA Ruling means that by the 2020 model year all new cars sold will be connected
- The average age of a car on the road today in the US is 11.4 years. (254M cars)
- By approximately 2032 the vast majority of cars on the road will be connected.

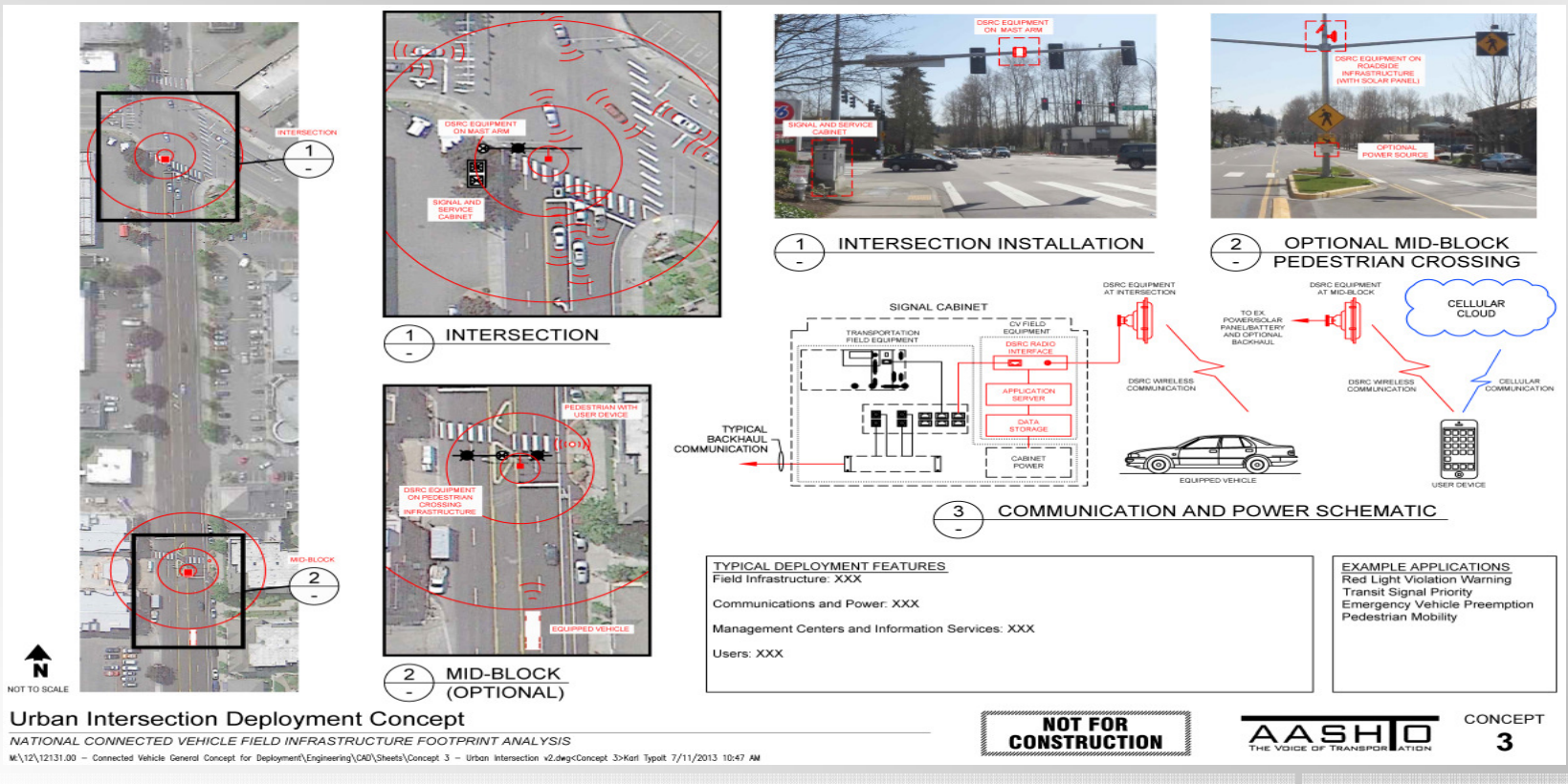
What percent of cars need to be connected before it matters?

CAV Data – The Basic Safety Message

BSM Part 1 - Required Transmitted - 10 times/sec How - DSRC	BSM Part 2 - Optional Transmitted - Vendor Specific How - DSRC/Cell ?
Location Speed Heading Acceleration Brake applied status Traction control system status Antilock brake system status Stability control system status Vehicle size/weight	Exterior lights Hazard lights Wiper status ABS activated Traction control loss Stability control activated Is raining/rain rate Other precipitation Roadway friction Solar radiation Ambient air temperature Ambient pressure

The BSM is not the same thing as OEM telematics

CAV Data – Requires Equipment!



The Two Conflicting Sides of the CV Equation

- For V2I to work:
  - We need agencies to be able to receive and transmit data and information via roadside units.
  - We need OEMs to write and install applications within their vehicle software systems to send, receive, process, and use that data.
- But….
  - Agencies don't want to invest in V2I until significant connected vehicles are on the road that can leverage the investment.
  - OEMs don't want to invest in applications until significant roadside infrastructure is installed to make them useful to their customers.

What is in the Works?

- AASHTO/ITSA/ITE have convened a V2I Deployment Coalition composed of owner/operators and OEM
  - Focused on helping move V2I forward – is looking at a national deployment challenge.
- AASHTO also has a Connected/Autonomous Working Group of owner/operators
  - Focused on providing guidance to USDOT

What is in the Works?

- USDOT is working on a:
  - A ***Vehicle to Infrastructure Deployment Guidance*** Document

    Will cover many aspects of helping to understand and plan for deployment – Due out this summer
  - A ***Guidance for Weather Responsive Traffic Management Strategies Using Connected Vehicle Data*** Document

    Will cover fleet and public applications – Due out next spring
- WYDOT has a project underway along I–80 to demonstrate CV technology for winter road operations and travel information.

Considerations

- More data availability – Real or perceived
- More expectation of data driven processes
- More demand for sophisticated data management

- More reliance on external services: Data processing, security, backhaul, etc.
- More equipment/contracts to support: Roadside, mobile, back office, etc.
- More software
- More need for supporting skill sets – technical and analytical

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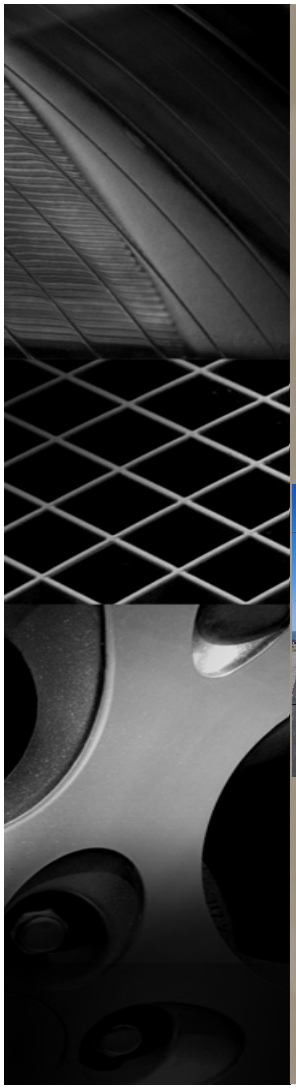
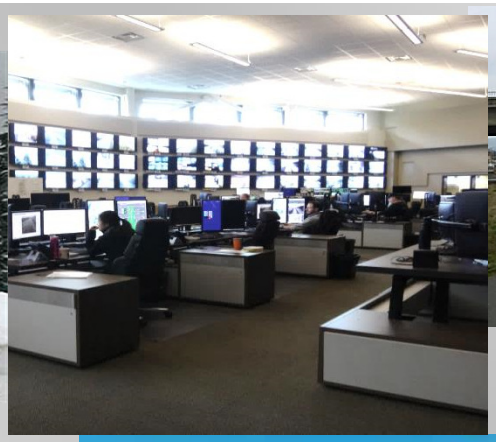
Difficult Decisions Ahead: Investment strategies, trade–offs, compromises, & managing expectations





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The Autonomous Promise