Overview of DOT R&D Activities

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Office of the Secretary | U.S. DOT
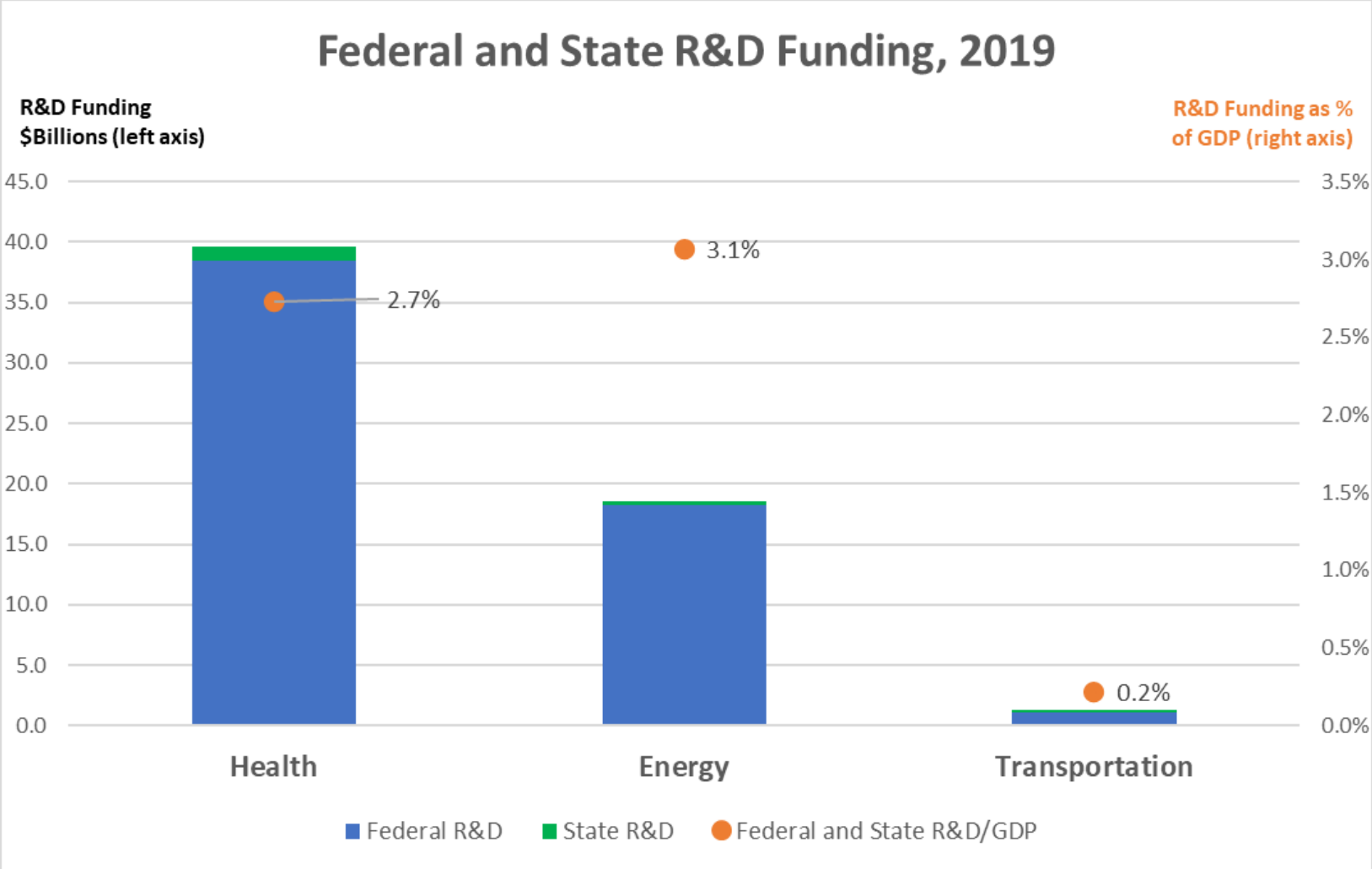
R&D in Transportation

Key takeaways

1. *Federal R&D in transportation is low compared to other regulated sectors*

   - *There is significantly more R&D spending in aircraft and vehicles than infrastructure*

2. *USDOT has an approximately $1 billion annual R&D budget, with about half going to the Federal Aviation Administration*

3. *Case Study of an Aspirational Infrastructure R&D Concept*

   - *"AI for Transportation Safety Projects: Mapping, Visualizing, & Building the Future"*

Government Spending on Transportation R&D

Transportation R&D funding is significantly lower than in other sectors of the economy

Federal and State R&D Funding, 2019

R&D Funding $Billions (left axis)

R&D Funding as % of GDP (right axis)

Health: 2.7%
Energy: 3.1%
Transportation: 0.2%

Legend:
- Federal R&D
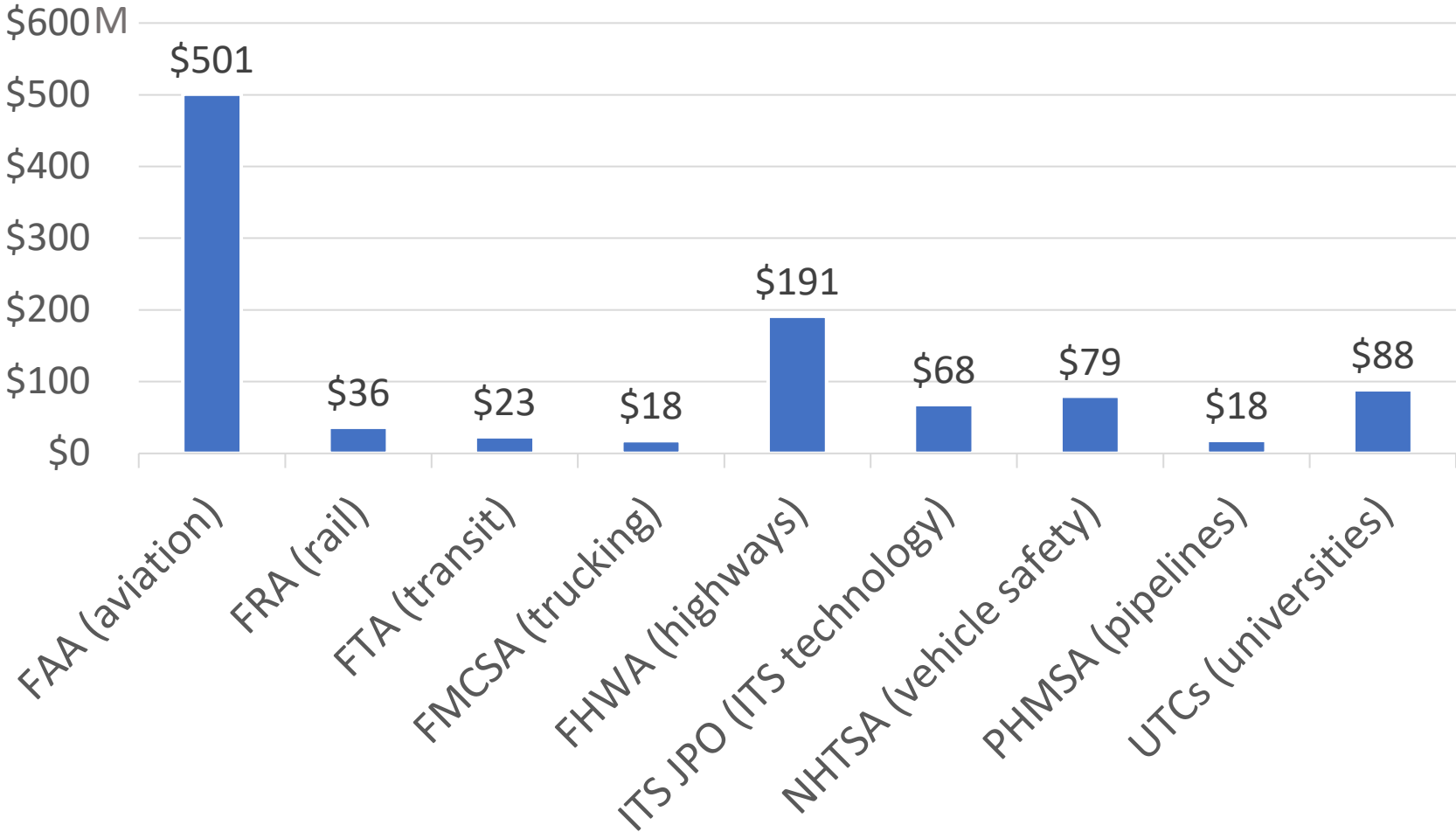- State R&D
- Federal and State R&D/GDP

Private R&D: there is significant private R&D in vehicle and aircraft manufacturing, totaling $52.6 billion in spending in 2018

Data and Source:
- Similar data for 2020 and 2021
- NSF, CRS, NCES and BEA

USDOT FY2023 ~$1B R&D Spending

Federal Aviation Administration and Federal Highway Administration account for two-thirds of R&D

R&D Case Studies

Sample Projects from Different Transportation Modes

| Agency/Program	Federal Aviation Administration	Federal Highway Administration	National Highway Traffic Safety Administration	University Transportation Centers Program
Lead Research Entity	Intramural	Intramural	Automotive Coalition for Traffic Safety	Clemson University
Funding (Annual)	$18 million	$2 million	$11 million	$4 million
Project	Sustainable Aviation Fuel Testing and Analysis	Complete Streets Initiative	Driver Alcohol Detection System for Safety Research Program	A Multi-Resolution Simulation Platform for Transportation System Security Testing and Evaluation
Summary	Research on fuel composition and its impact on engine operability and translation to standard setting bodies to support qualification of jet fuels from alternative sources.	Complete Streets serve pedestrians, bicyclists, public transportation users, children, older individuals, individuals with disabilities, motorists, and freight vehicles. Research efforts to apply artificial intelligence, vehicle automation, advanced modeling and simulation.	Development of a sensor that can passively and accurately detect driver alcohol impairment. The team is developing 2 separate technologies: breath-based and touch-base.	Built upon on an existing open-source co-simulation environment for cooperative driving automation, project will develop APIs to support various attack scenarios, including sensor attacks, data spoofing attacks, infrastructure attacks, vehicle-level attacks, and network-level attacks, including impacts on V2X infrastructure applications.

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AI for Transportation Safety Projects:
Mapping, Visualizing, & Building the Future

Imagine if everyone had safer access to the places they want to go…
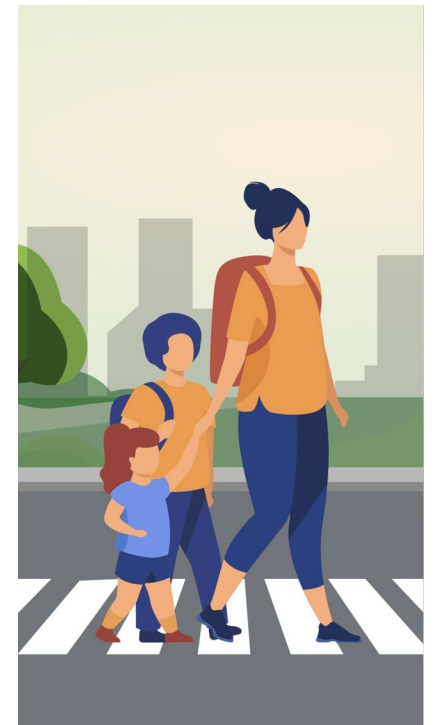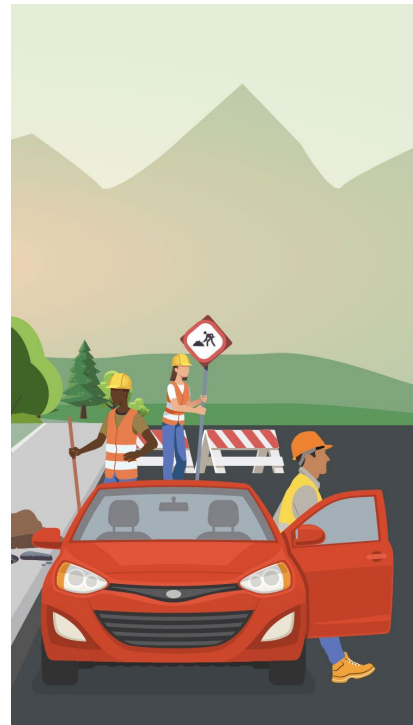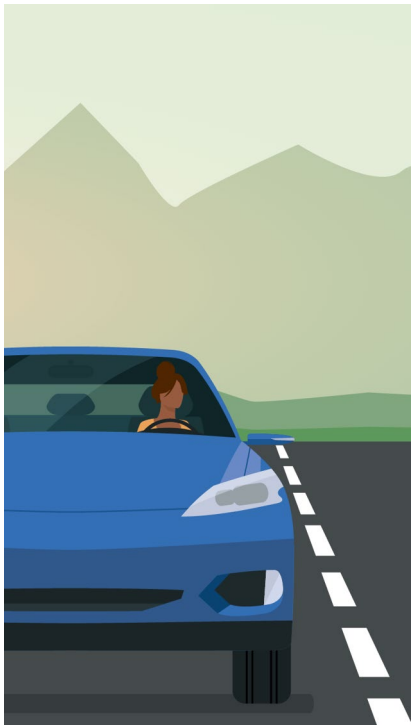
Addressing the Roadway Fatality Crisis

U.S. Roadway Fatalities 1970 - 2022

Annual Fatalities

50,000
40,000
30,000
20,000
10,000
0

1970   1980   1990   2000   2010   2020
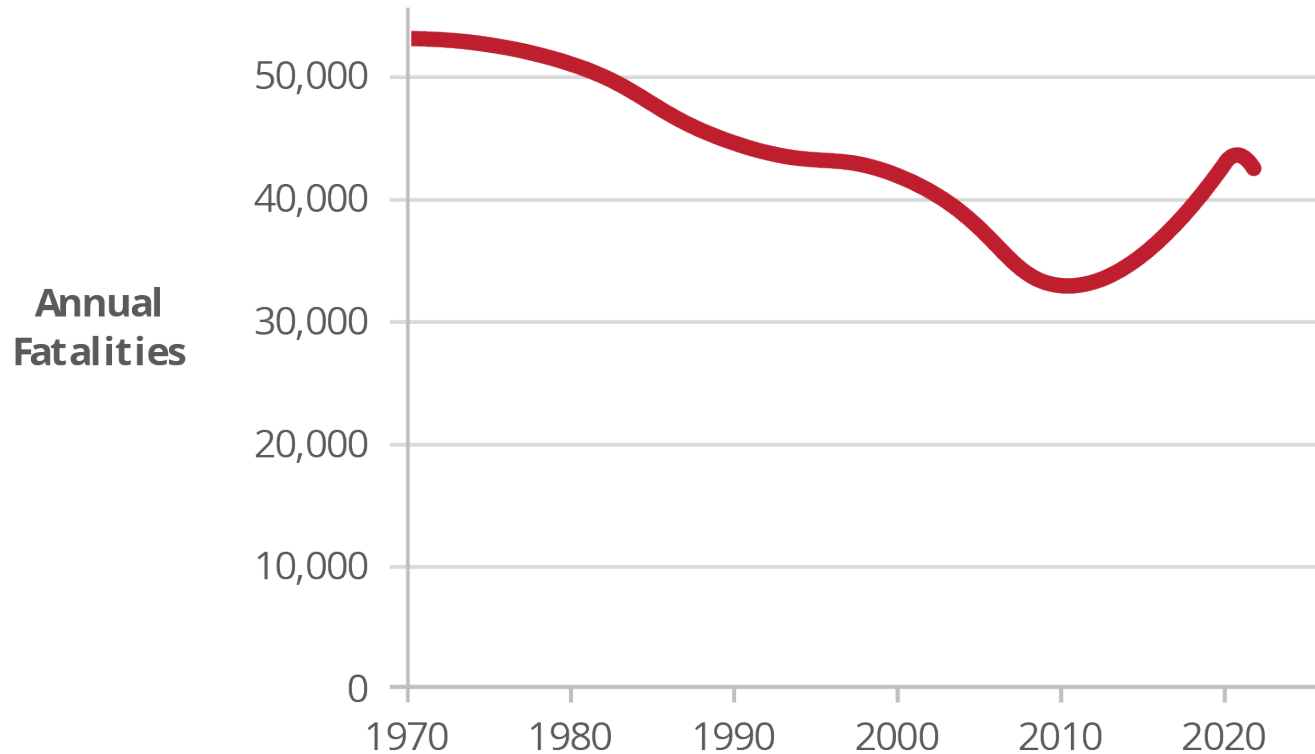
Source data: National Highway Transportation Safety Administration
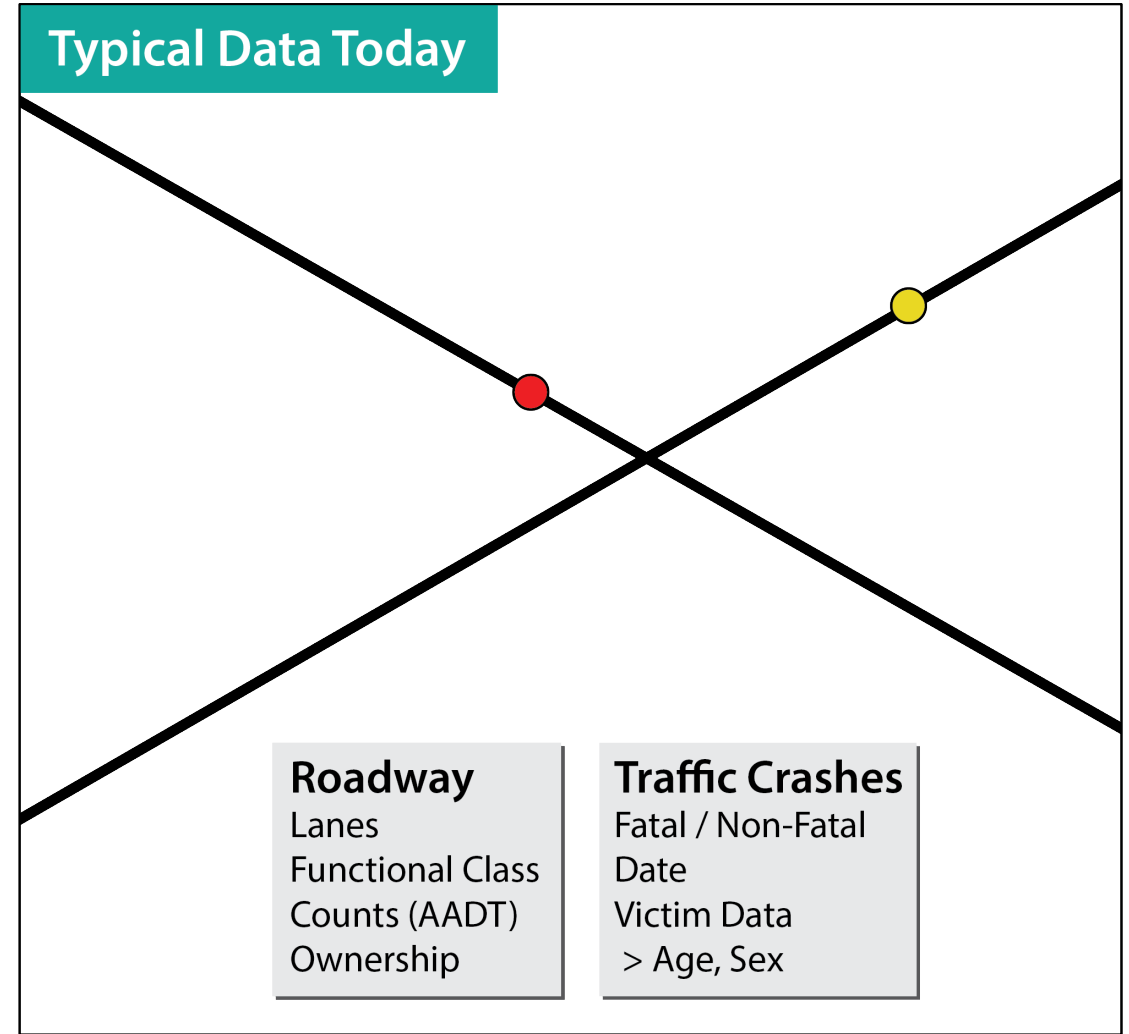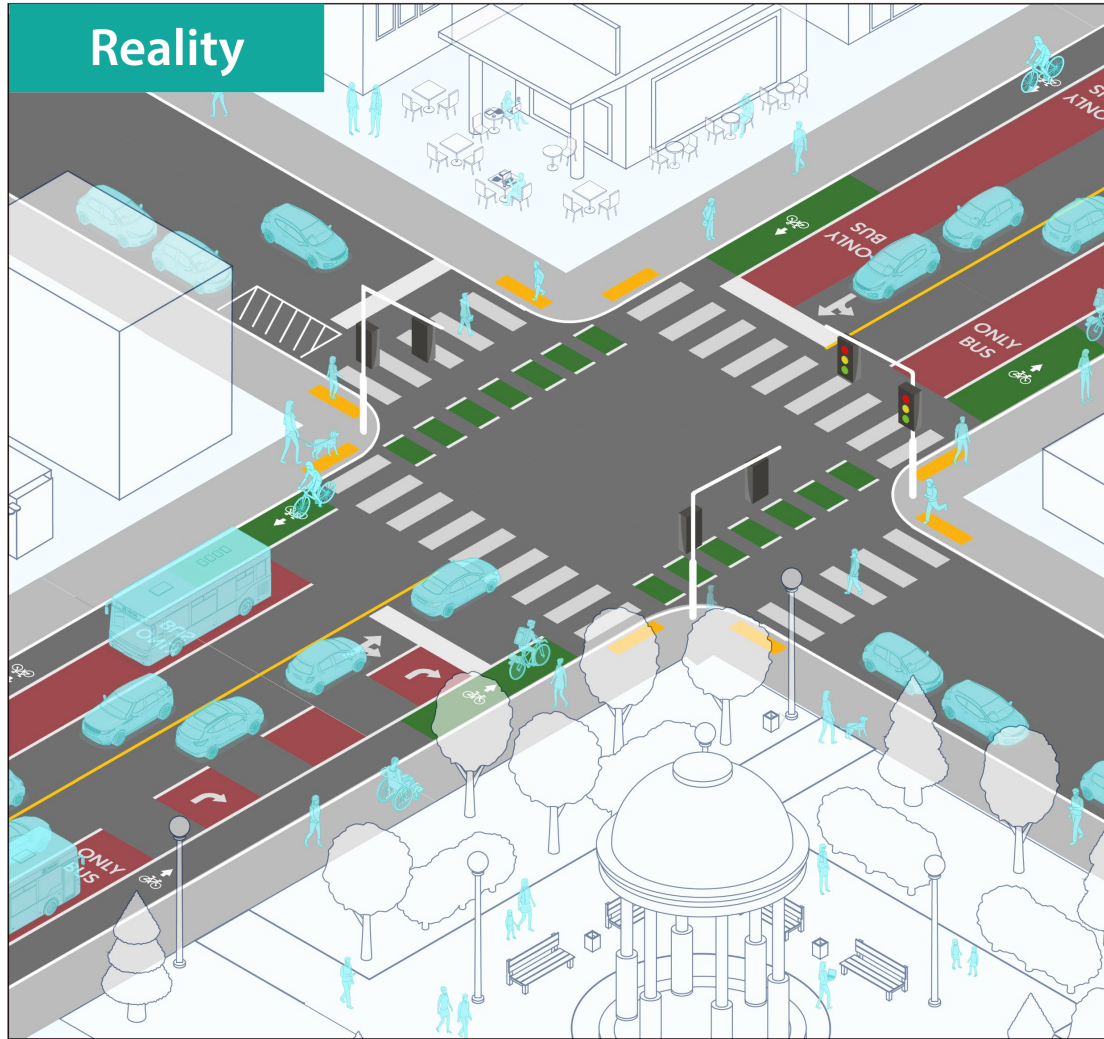
> **Safety is Proactive**
>
> Proactive tools should be used to identify and address safety issues in the transportation system, rather than waiting for crashes to occur and reacting afterwards.
>
> *National Roadway Safety Strategy*
> U.S. DOT

The Digital Footprint of Real-World Infrastructure

Reality

Typical Data Today

Roadway
Lanes
Functional Class
Counts (AADT)
Ownership

Traffic Crashes
Fatal / Non-Fatal
Date
Victim Data
 > Age, Sex

Data Future

Roadway / Intersection
Lanes / Dimensions
Materials / Condition
Speed Limit / Observed Speed
Counts (AADT)
 > Turning Movements
Curb Use / Behavior
Transit Facilities
 > Transit Service

Bike / Micromobility
Bike Lanes / Mulituse Paths
Dimension / Separation
Counts / Mode
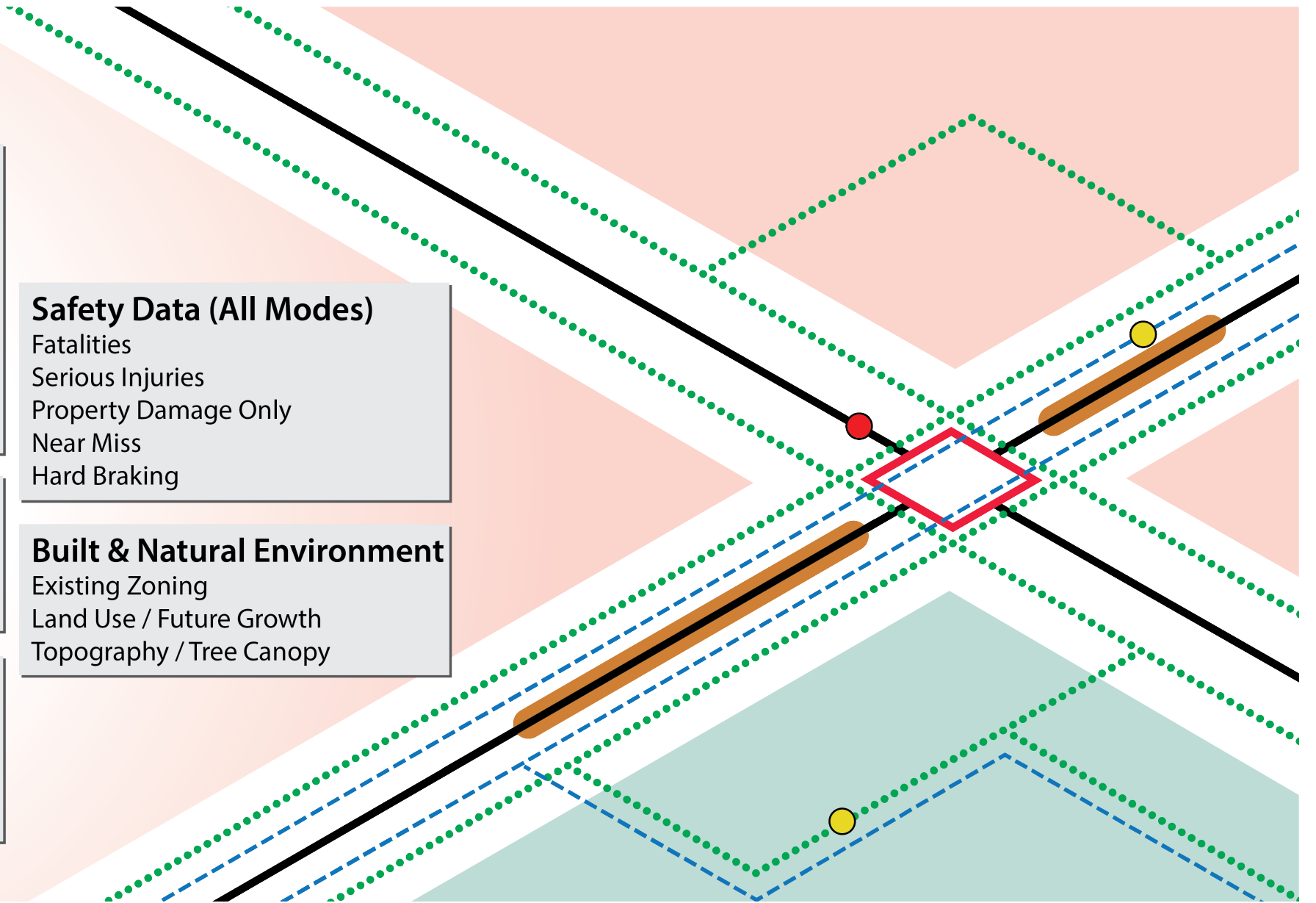
Sidewalks / Footpaths
Accessibility (ADA)
Crosswalks / Curb Cuts
Materials / Condition
Counts

Safety Data (All Modes)
Fatalities
Serious Injuries
Property Damage Only
Near Miss
Hard Braking

Built & Natural Environment
Existing Zoning
Land Use / Future Growth
Topography / Tree Canopy

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A National Transportation Infrastructure Observatory

Built Environment

Usage

Infrastructure

Natural Environment

Roadway Features
Aerial Image Pattern Recognition

Anonymized Aggregated Ped/Bike Counts
Machine Learning and Sensor Fusion

Sign Inventory
Large Language Models

Aggregated Traffic Flow and Risk Behavior
Vehicle Telemetry and Sensor Fusion

Infrastructure Accessibility
Street-level Sensing

STOP

Overcoming Data Challenges & Addressing Privacy Risks

Data Aggregation Hurdles

- Federal coordination harnessing expertise across sectors to drive:

  - Facilitating national data standards

  - Refining raw data

  - Validating refined data

  - Serving refined data to end users

Safeguarding Privacy

- Anonymized and aggregated user movement, count, and speed data

- Security to prevent personal reidentification

- Edge-computing to avoid personally identifiable information in recordings and storage

- Open and transparent processes for data validation and verification

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Translating Data to Impact: Application Ecosystem

National Datasets Enable Scalable Applications and Analysis

- Planning / Design
- Community Engagement
- Project Prioritization