



Estimation of Benefits for Automated Vehicle Systems

Workshop on Connected and Automated Driving Systems

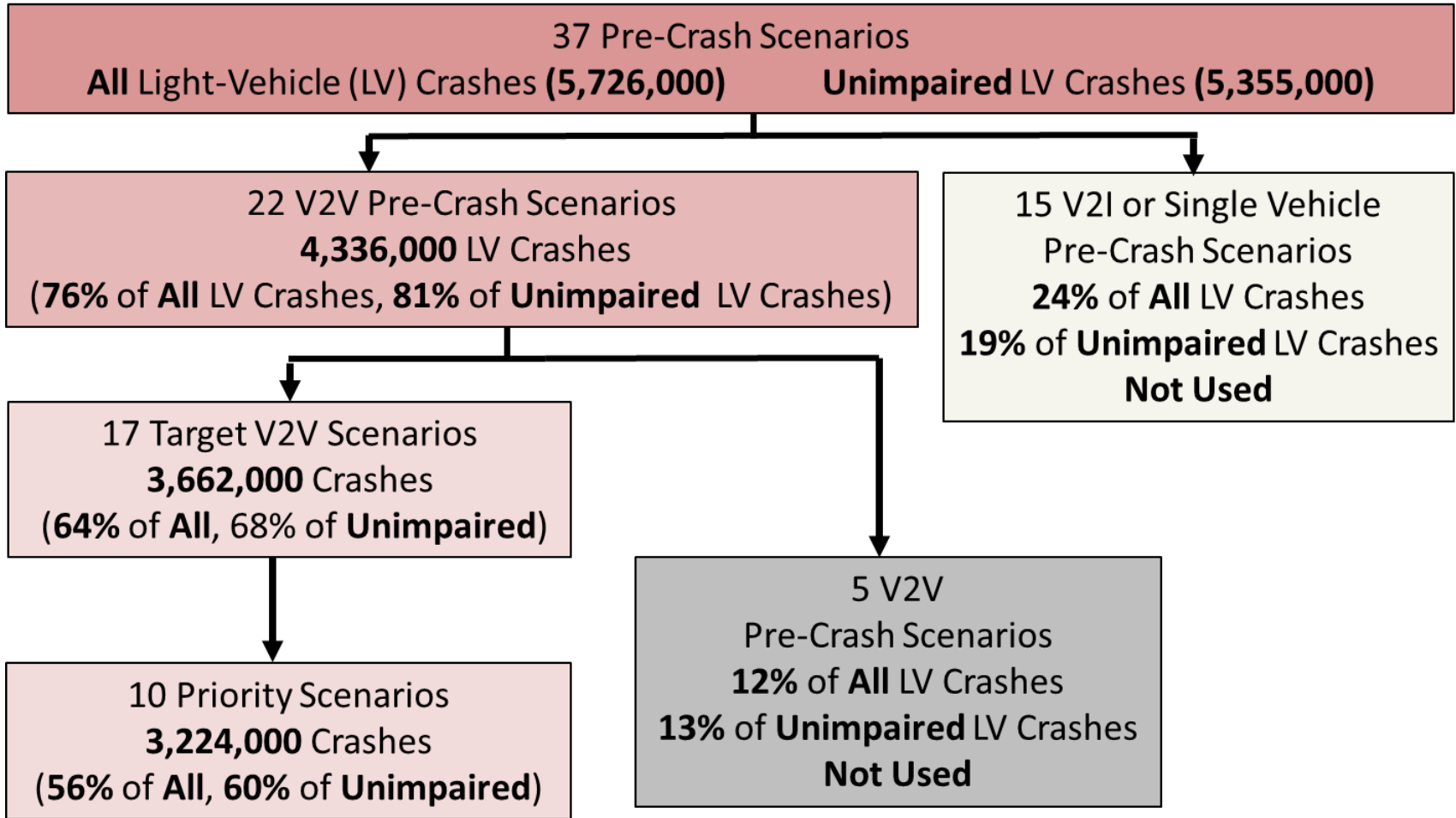
Kevin Dopart, U.S. Department of Transportation

CONNECTED VEHICLE SYSTEMS: BENEFITS & COSTS



“Connected vehicles have the potential to address approximately 80% of vehicle crash scenarios involving unimpaired drivers.”





Preliminary Estimates of Benefit & Costs

- Preliminary Cost Estimates of V2V Equipment

- \$341 to \$350 / vehicle in 2020
- \$209 to \$235 / vehicle in 2058



- Annual Benefits of IMA & LTA V2V Applications at full deployment

- Crashes avoided = 400,000 to 600,000
- Injuries avoided = 190,000 to 270,000
- Lives saved = 780 to 1,080



AUTOMATED VEHICLE SYSTEMS – BENEFITS



Steven M. Johnson



AV Target Crash Population Research

■ Goal

- Estimate potential safety benefits that could be gained from automated vehicles at automation levels 2-4

■ Objectives

- Map known automated vehicle functions and operations to crash information
- Query national crash databases (GES and FARS) to estimate the target crash population that could benefit from automated vehicles

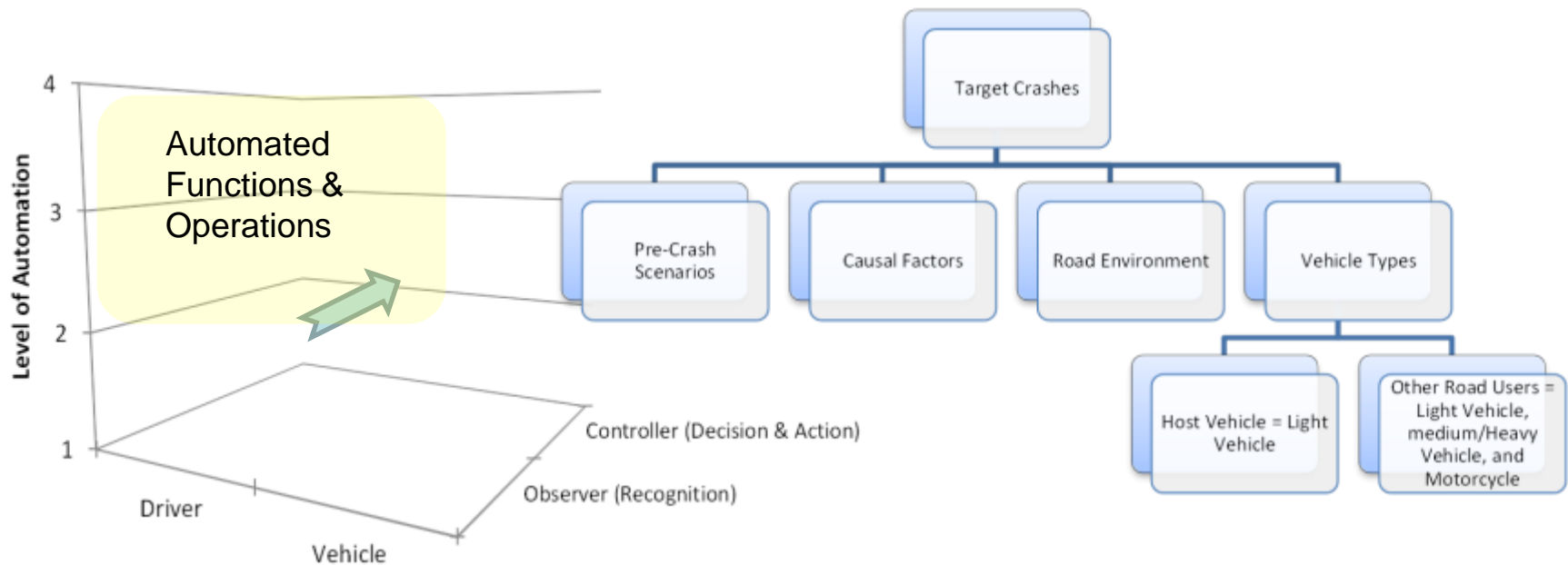
■ Focus

- Automated light vehicles
- Baseline crashes *with* and *without* crash-imminent avoidance applications



Identification of Target Crashes

- Map automated functions & operations to appropriate crash scenarios, causes, & contributing factors
- Identify relevant variables and codes in GES/FARS



AV Multimodal Benefits Framework

- Develop a framework to estimate the potential safety, mobility, energy and environmental benefits of technologies contributing to the automation of the nation's surface transportation system

- Objectives
 - Identify metrics
 - Develop a framework for quantifying impacts
 - Provide a high order assessment of the state of knowledge
 - Incorporate current research by other parties.

The goal during this first year is to build a framework. Quantitative analysis of expected benefits will come later.



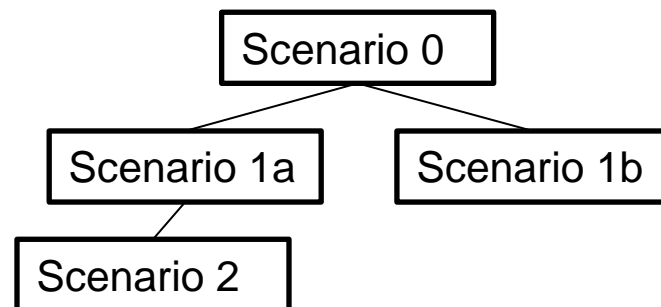
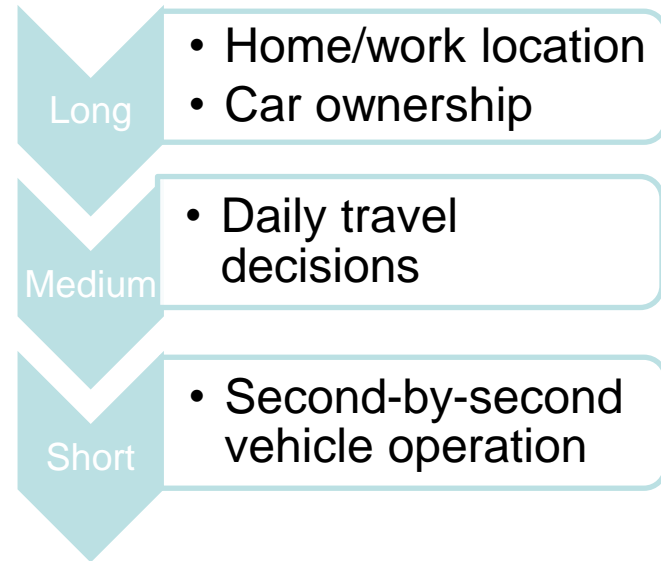
Challenges in Building a Modeling Framework

- Data
 - Performance of the automation application compared to a driver
 - Scaling benefits to a national level
- What is the baseline?
 - **Not** current vehicles
- Risk areas
 - Performance of the automation application in unusual situations
 - Changes in driver / vehicle interaction (more distracted driving behavior?)
- Modeling
 - Need consistent models for driver / vehicle / road performance with and without the automation application
 - Model detail must be sensitive to the impacts of the application
 - Overlapping benefits from multiple applications
- Many possible future scenarios
 - Levels of automation
 - Market penetration
 - Vehicle sharing

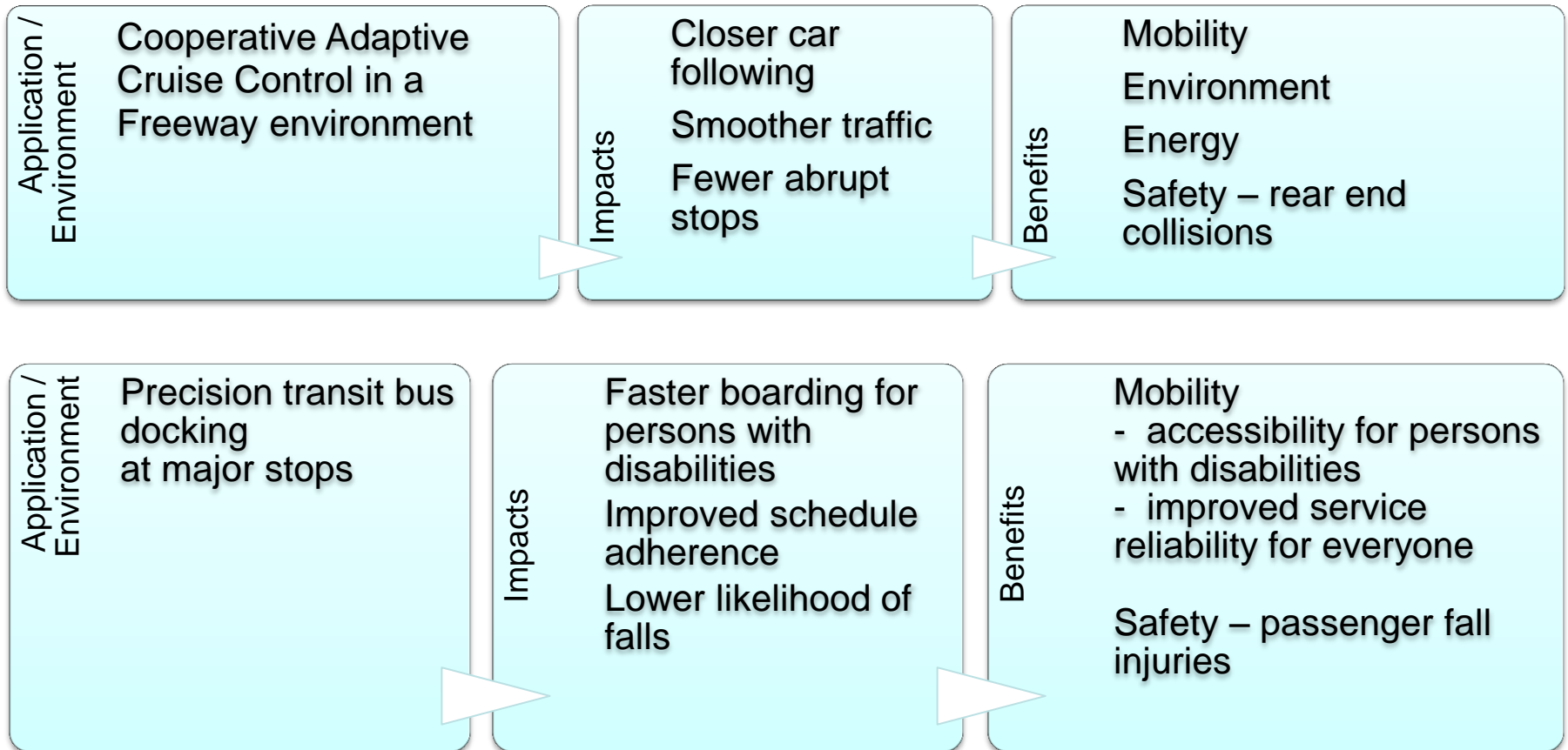


Approach

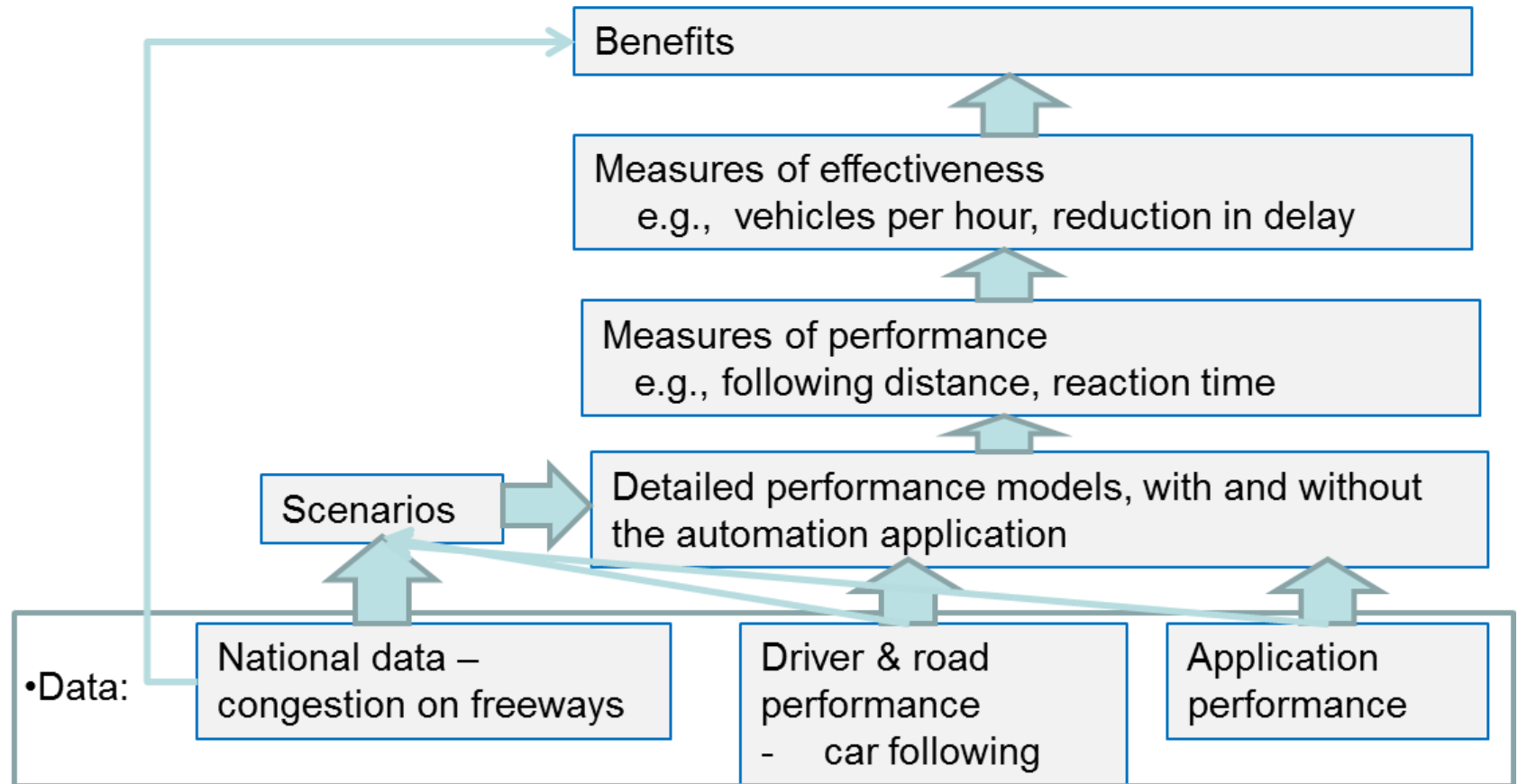
- Divide and conquer
 - Several layers to the framework, with well-defined interfaces
 - Well defined scenarios (e.g., lead vehicle stopped, car following, etc.)
- Consistent methods for modeling “with” and “without” automation
- Use existing tools and methods as appropriate
 - Safety impact methodology
 - Car-following and traffic microsimulation
 - Emissions / energy estimation (MOVES)
- Flexibility to accommodate several visions of the future world (e.g., state of infrastructure, amount of ride sharing)



Applications => Impacts => Benefits



Framework Example: Mobility impacts of CACC on a Freeway (1 of 2)



Measure of performance: the performance of a specific application

Measure of effectiveness: overall impact on the transportation system



Mobility Impacts of CACC on a Freeway (2 of 2)

- Local / short term impacts
 - Greater lane capacity from closer following distances
 - Some safety improvement
- Medium term impacts
 - Traffic shift to the freeway from other congested roads
 - Changes in energy consumption and emissions
 - Improved accessibility to points reached by the freeway
- Long term impacts
 - More development on land that is accessible via the freeway



Next Steps

CY 2014 – 2015

- Develop a modeling framework
 - Conceptual description, including assumptions and boundaries
 - Scenarios to be modeled
 - Existing models and gaps
 - Proposal for prototype model development

CY 2015 – 2016

- Develop and validate a working proof-of-concept benefits model



For More Information

The screenshot shows the homepage of the United States Department of Transportation. At the top left is the DOT logo and the text "United States Department of Transportation". To the right is a search bar. Below the header are navigation links: "About DOT", "Our Activities", and "Areas of Focus". The main content area features a large carousel of images related to transportation, including a train, a bridge, a carpooling lane, and a cyclist. A prominent headline reads "DOT's GROW AMERICA offers long-term transportation certainty" with a sub-headline: "Legislative proposal sent to Congress would boost public and private investment, create jobs, provide certainty for future growth." Below this is a "Read more about GROW AMERICA" link. At the bottom of the carousel are "Previous" and "Next" navigation buttons. Below the carousel are four resource boxes: "RESOURCES FOR INDIVIDUALS" (with a photo of a woman in a car), "RESOURCES FOR PARTNERS" (with a photo of people in a meeting), "RESOURCES FOR GOVERNMENT" (with a photo of a woman speaking at a podium), and "THE BRIEFING ROOM" (with a photo of a news broadcast and the text "NEWS, VIDEOS, & PHOTOS"). Below the briefing room box are social media icons for Facebook, Twitter, and YouTube, with the text "CONNECT WITH US".

<http://www.dot.gov/>

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