U.S. Department of Transportation
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Cooperative Driving Automation (CDA) and the Use of Artificial Intelligence (AI) to Improve Transportation Operations and Safety

ITS New York,
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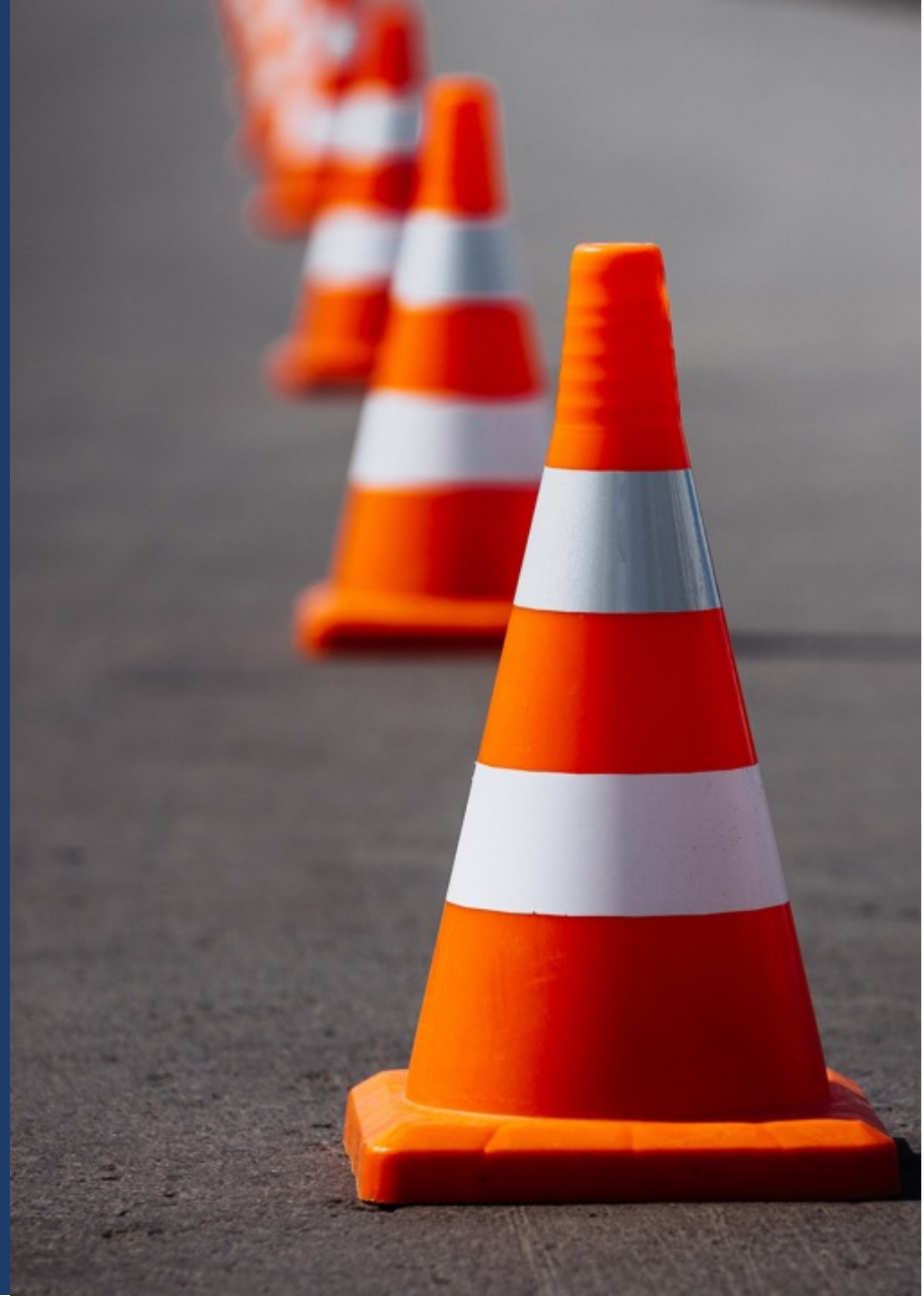

All photos source: FHWA.

CDA and the CARMA[SM] Program

CARMA

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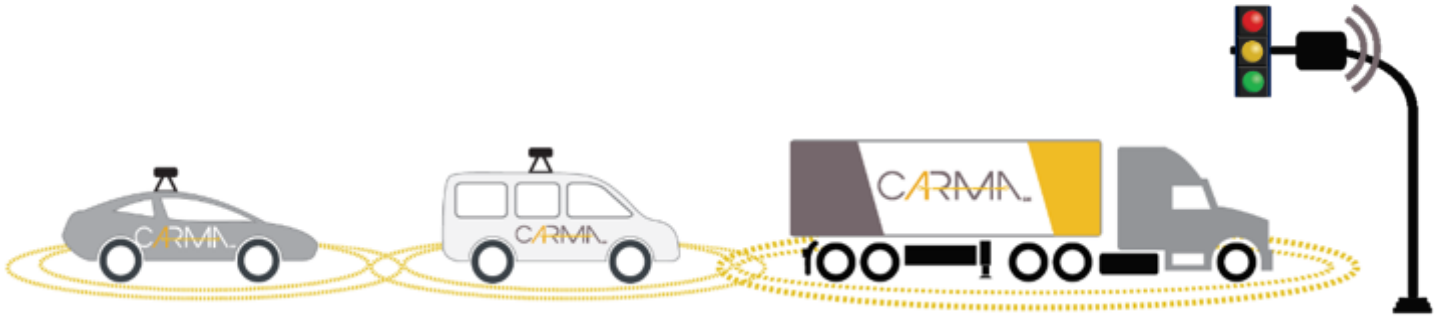
CDA Definition



Source: FHWA.

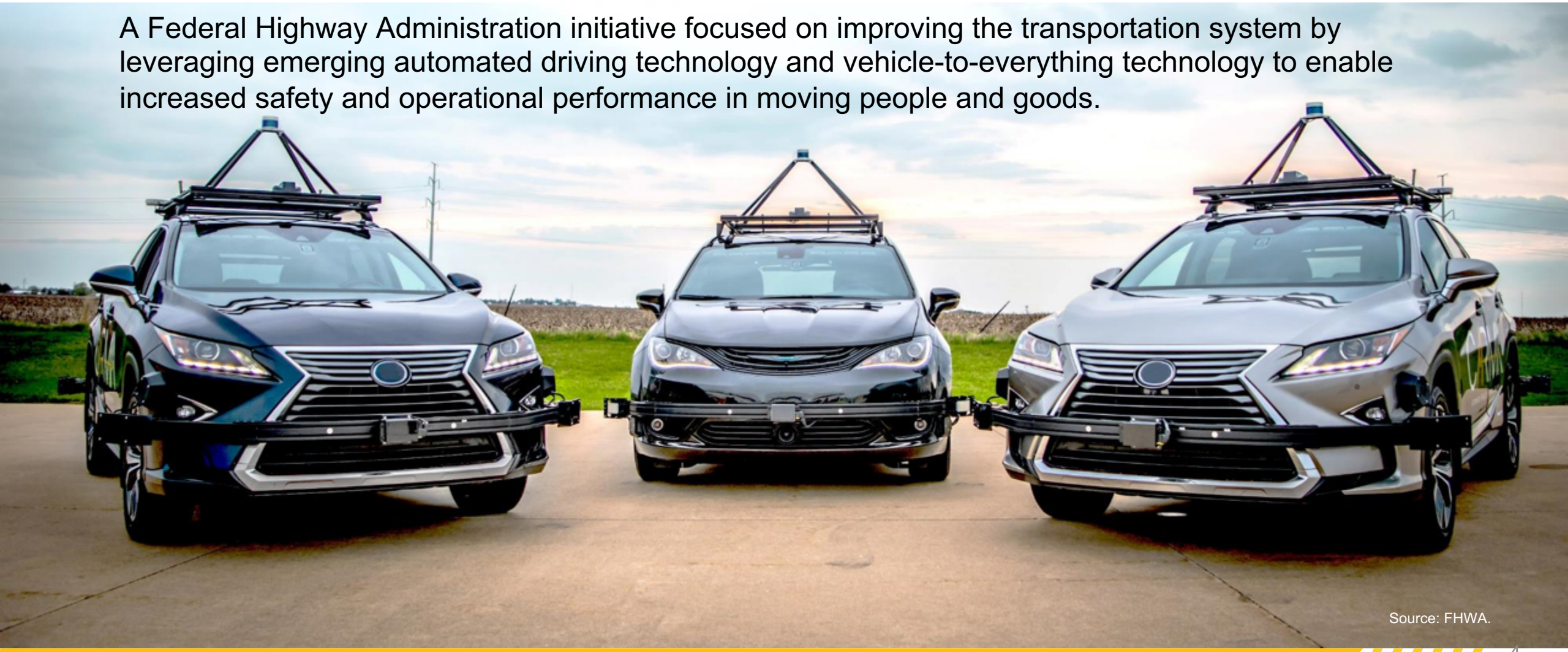
SAE International J3216

CDA: Automation that uses machine-to-machine communication to enable cooperation among two or more entities with capable communications technology and is intended to facilitate the safer, more efficient movement of road users, including enhancing performance of the dynamic driving task for a vehicle with driving automation feature(s) engaged.[1]

[1] SAE International. 2020. *Taxonomy and Definitions for Terms Related to Cooperative Driving Automation for On-Road Motor Vehicles*. SAE J3216_202005. Warrendale, PA: SAE International. https://www.sae.org/standards/content/j3216_202005/, last accessed October 19, 2020.

What Is the CARMA Program?

A Federal Highway Administration initiative focused on improving the transportation system by leveraging emerging automated driving technology and vehicle-to-everything technology to enable increased safety and operational performance in moving people and goods.



Source: FHWA.

Development of CDA Use Cases

Four Transportation System Management and Operations (TSMO) use cases completed.

The CARMA Program developed four initial TSMO use cases for CDA:

- Basic travel.
- Traffic incident management.
- Weather.
- Work zone.

Source: FHWA.

Analysis, Modeling, and Simulation (AMS) Tools to Understand Impact of Automation

Developing AMS Capabilities to Support Traffic Management Systems (TMS)

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AMS and Automation

- Connected vehicles and connected automated vehicles (CV/CAV) may respond very differently than human-driven vehicles.
  - Exchange of basic safety messages will provide CV and CAV with improved situational awareness.
  - Smart infrastructure may also transmit information to CV and CAV to support decisionmaking by drivers.
- The report *Developing Analysis, Modeling, and Simulation Tools for Connected and Automated Vehicle Applications*[1] provides an assessment of how CAV applications may impact traffic to improve the ability to predict the impacts of automation.

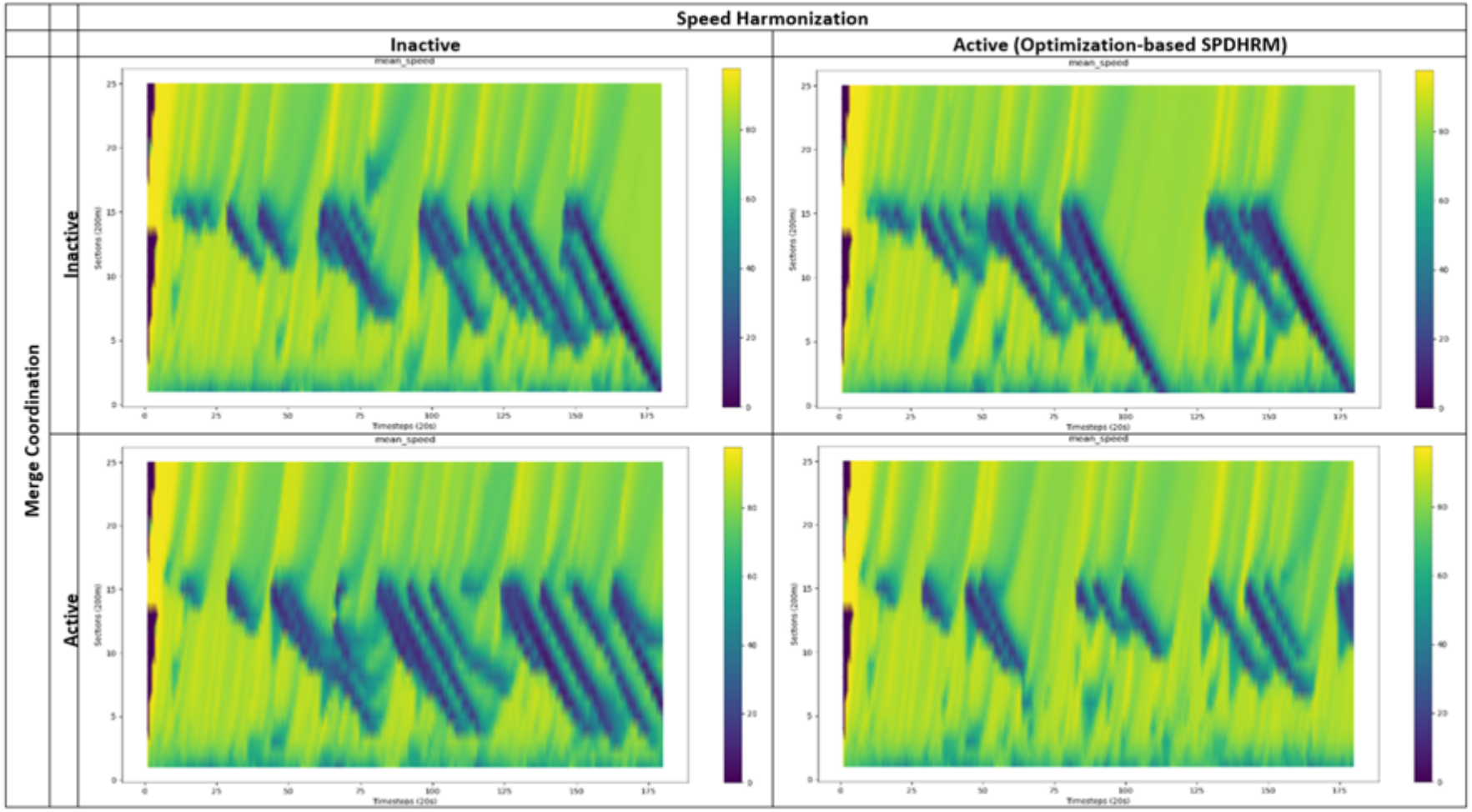
[1] Federal Highway Administration. 2021. *Developing Analysis, Modeling, and Simulation Tools for Connected and Automated Vehicle Applications*. Report No. FHWA-HRT-21-077. Washington, DC: Federal Highway Administration. https://www.fhwa.dot.gov/publications/research/operations/21077/index.cfm, last accessed September 27, 2021.

Joint Application of Simulation Results

Speed Distribution Across Time and Space

Vehicle Types:
CV – 90 percent.
CAV – 10 percent.

Assessment of speed distribution and congestion comparing current situation with two CAV applications



SPDHRM = speed harmonization.

Source: FHWA.

AI to Improve Traffic Operations and Safety

Use of AI in AMS and in TMS

AI and TMS

- CV/CAV will increase amount and velocity of data.
  - Basic safety messages will provide instantaneous position and speed.
  - Sensor data could provide a variety of data on road and traffic conditions, potentially including video streams.
- AI systems can sort through sensor data and develop actionable information for TMS operators.
  - An example is early detection of queue development or a traffic incident.
  - This information should include expert systems that provide recommended actions using existing TSMO use cases.

Questions?

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