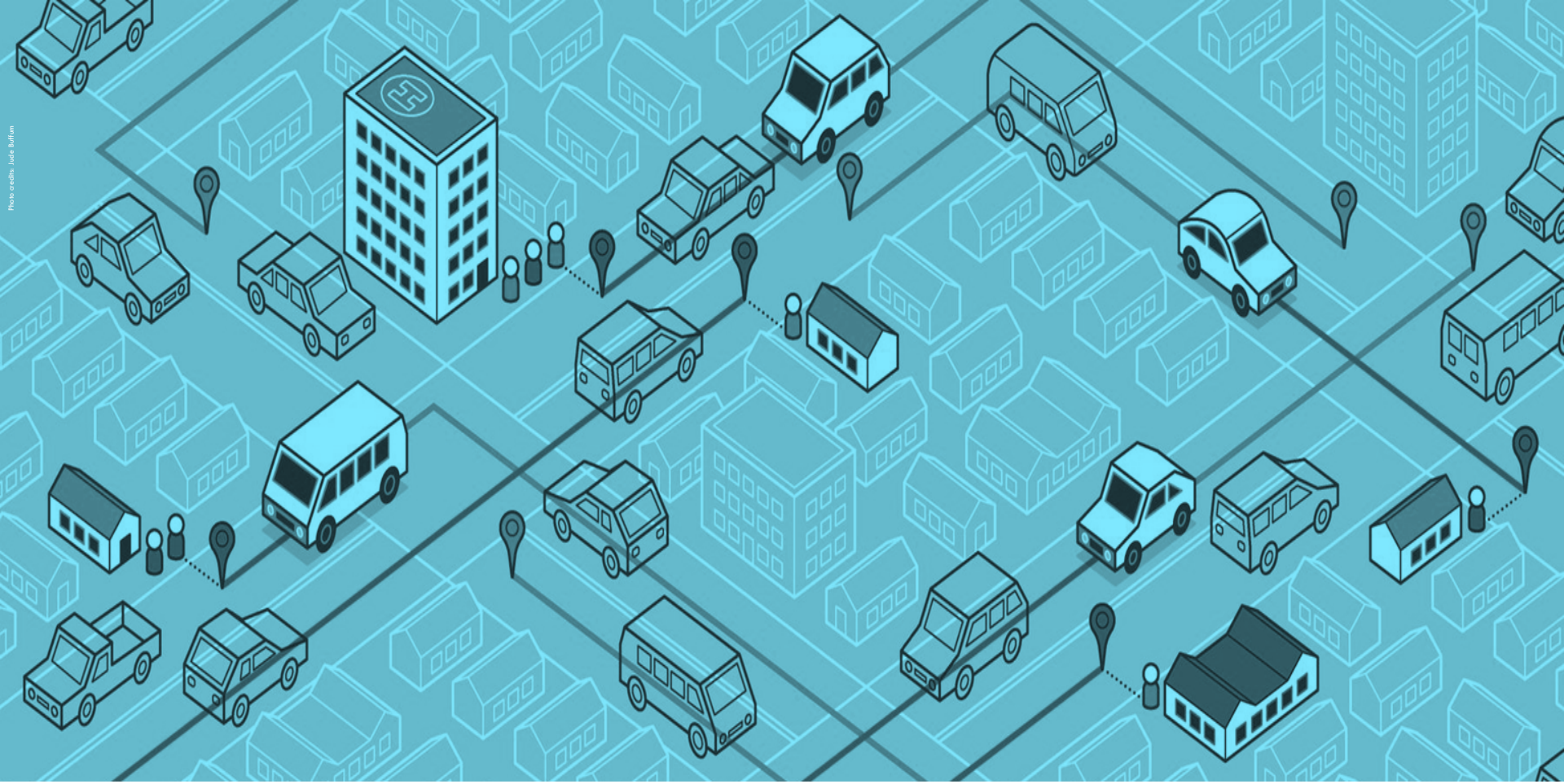


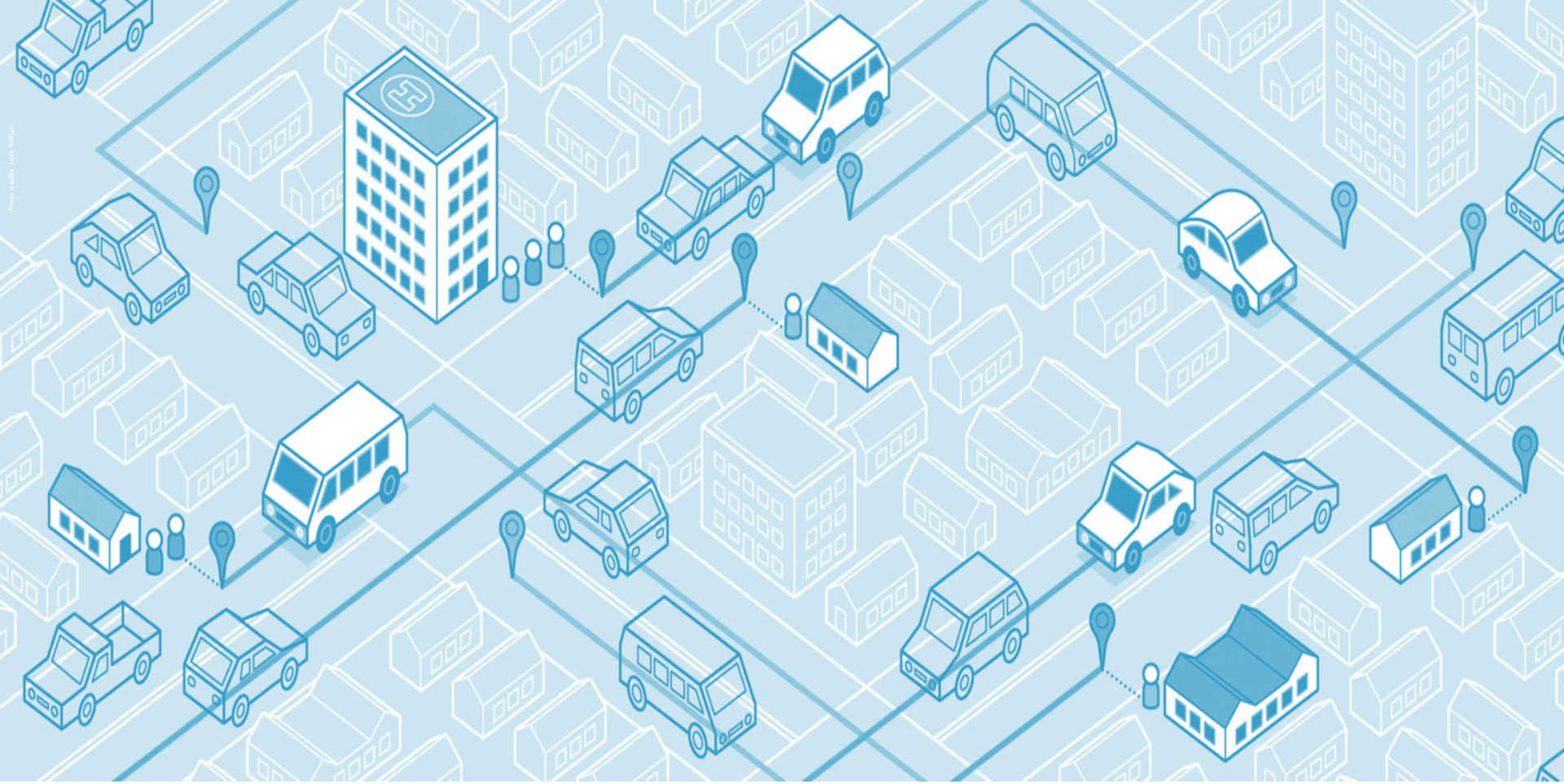
PLANNING FOR CONNECTED AND AUTOMATED VEHICLES

MAMA/PCLS Summer Conference
Mackinac Island, MI
24 June 2017

CAR
CENTER FOR AUTOMOTIVE RESEARCH

AGENDA

- CAV Technology and Innovative Mobility Services Definitions
- CAV-related Considerations for Municipalities
  - Transportation Systems
  - Infrastructure Investments
  - Land Use
  - Legal and Regulatory Framework



CAV TECHNOLOGY & INNOVATIVE MOBILITY SERVICES DEFINITIONS

ADVANCED TRANSPORTATION TECHNOLOGIES

DEFINITIONS

Intelligent Transportation Systems (ITS)

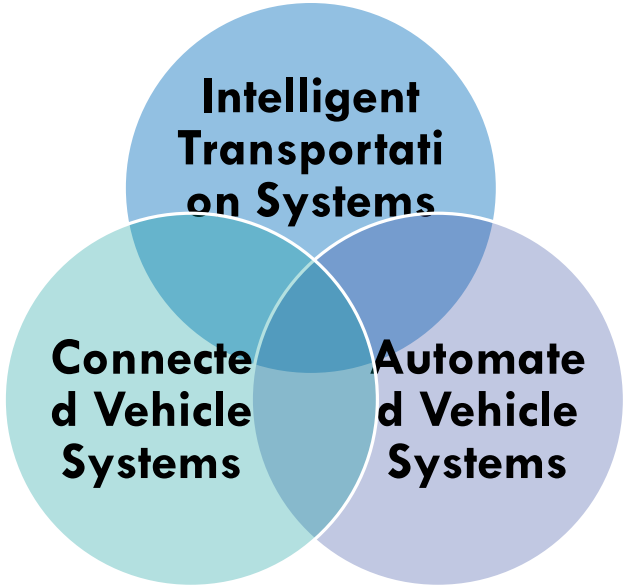
- Electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system (CFR 940.1)

Connected Vehicle Systems

- Any system enabling the exchange of digital information between a vehicle and the world (e.g., another vehicle, infrastructure)

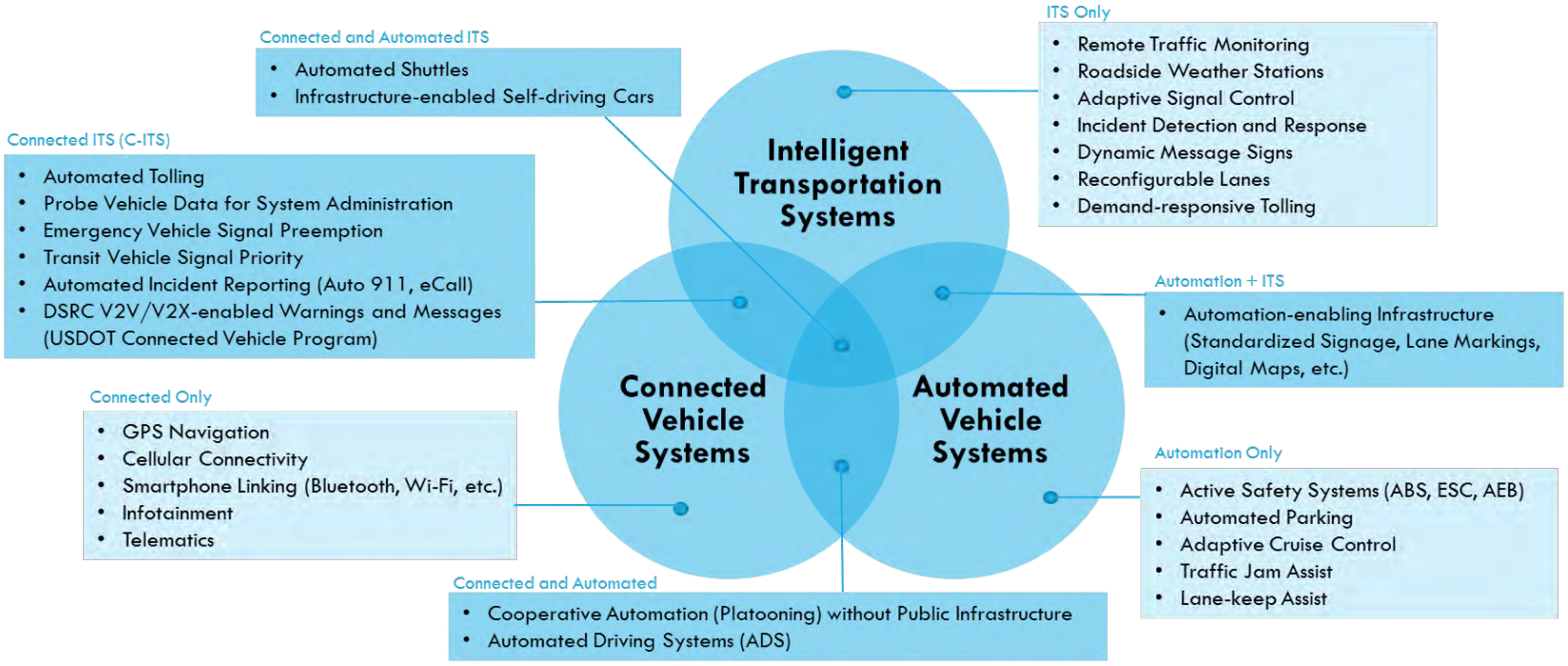
Automated Vehicle Systems

- Any electronic system that influences the lateral or longitudinal operation (or both) of a vehicle



ADVANCED TRANSPORTATION TECHNOLOGIES

EXAMPLES

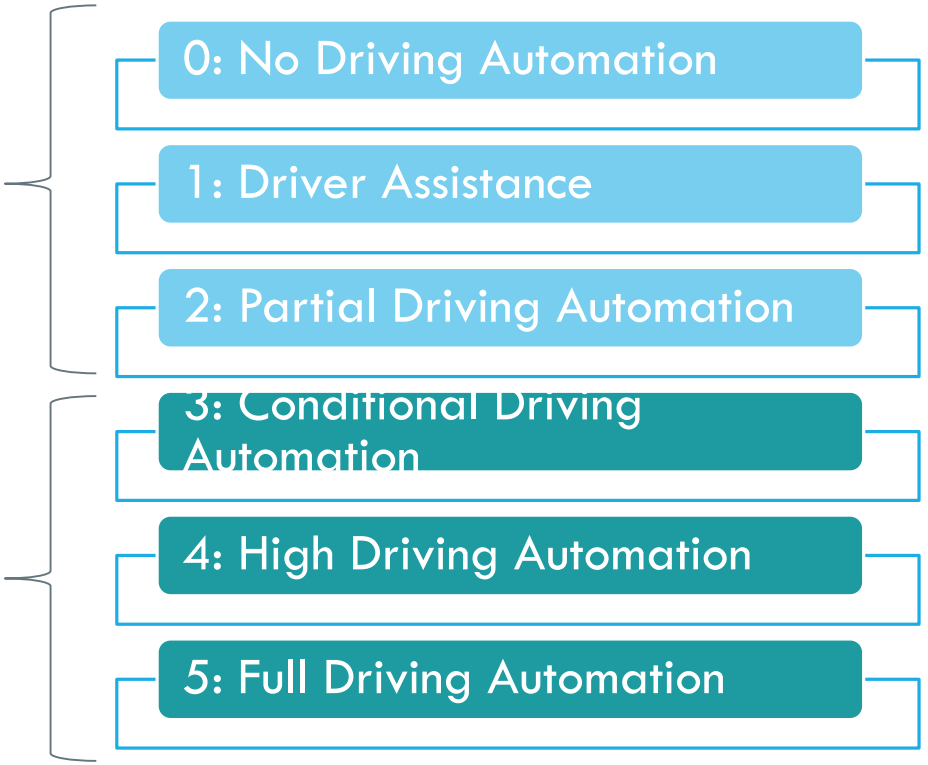


AUTOMATED VEHICLE SYSTEMS

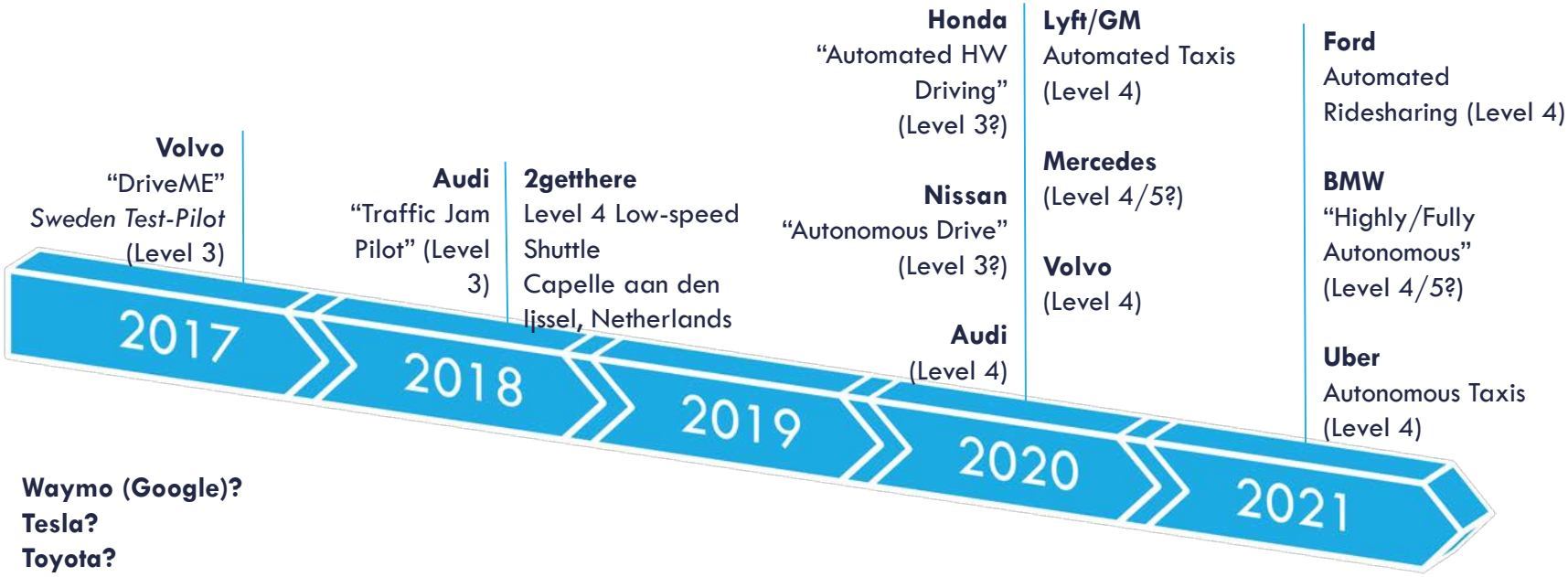
SAE INTERNATIONAL TAXONOMY

Levels 0-2
Available Today

Levels 3-5
Automated Driving Systems
(ADS)
Future

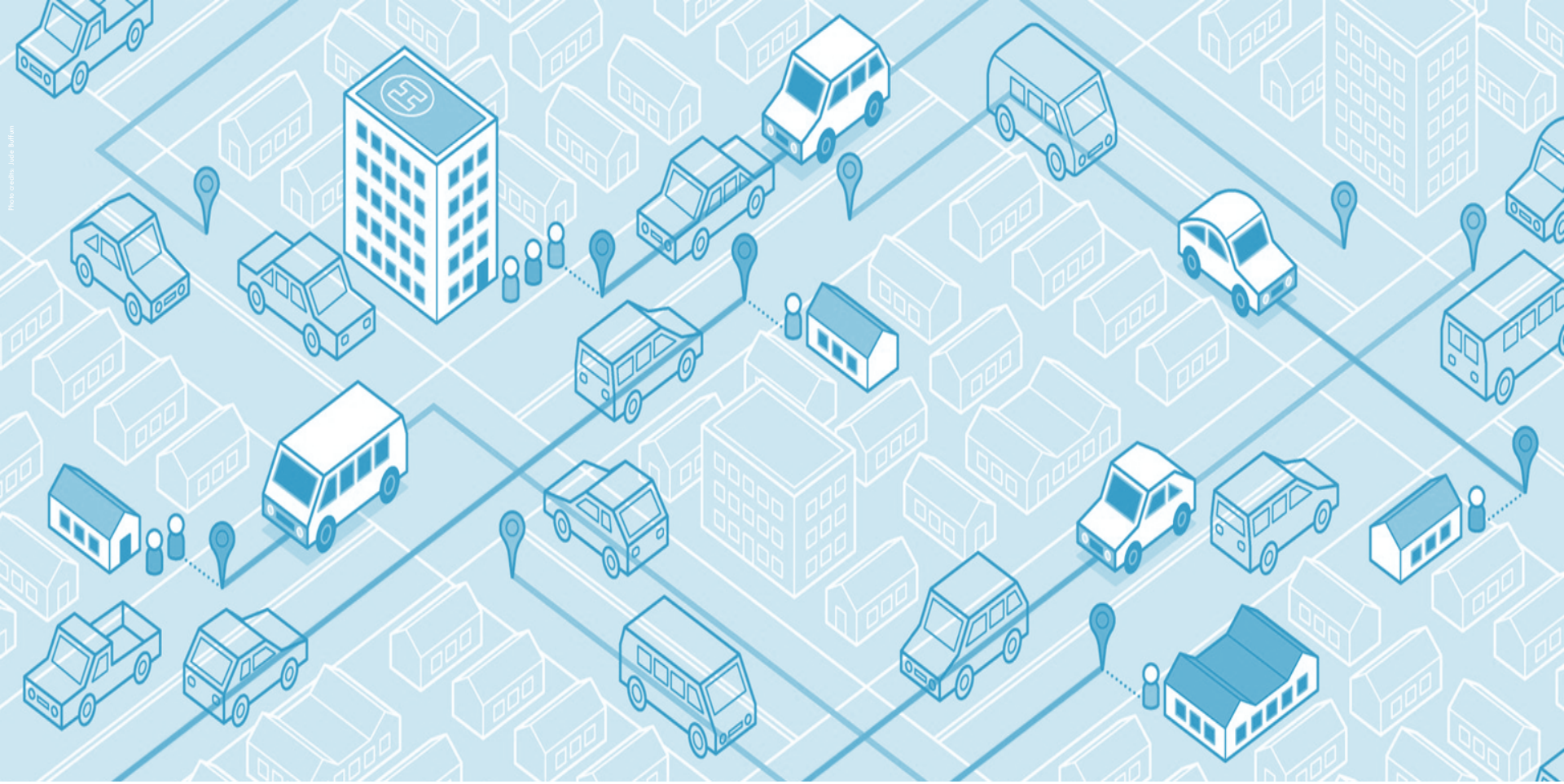


AUTOMATED DRIVING SYSTEMS (ADS)
PROMISES TIMELINE



INNOVATIVE MOBILITY SERVICES
BUSINESS MODELS

Innovative mobility services are transportation solutions enabled by emerging technologies and wireless connectivity that allow for more convenient, efficient, and flexible travel.



TRANSPORTATION SYSTEMS

TRAVEL DEMAND AND VEHICLE MILES TRAVELED (VMT)

- Lower car ownership
- Pay-per-use programs discourage unnecessary travel
- Increased vehicle occupancy
- First-and-last-mile solution with transit
- Overall lower number of vehicles
- Less travel related to searching for parking
- Denser land development (less parking)

- Increased travel demand
- Zero occupancy travel
- Reduced trip chaining
- Mode shift away from mass transit
- Greater urban sprawl
- Significant share of privately owned cars
- Increased mobility of non-drivers
- Increased automated freight and delivery

TRANSFORMATION OF PARKING

CAVs will enable more efficient use of existing parking supply.

Opportunities

- Reduced need for new municipal parking
- Smaller parking spots, less on-site and on-street parking
- Parking relocated on the back of lots or outside prime locations

Considerations

- Possible decline of municipal revenues
- Reconversion in drop-off/pick-up areas
- Relocation of CAV parking impacts both VMT and congestion

TRANSFORMATION OF PARKING

CONNECTED AND AUTOMATED VEHICLES ONLY

INTERACTION WITH NON-MOTORIZED TRAFFIC

Opportunities

- Increased safety for pedestrians and cyclists
- Free up space for pedestrian areas and bike lanes (via road diets)

Considerations

- Need to learn the implicit and explicit cues of pedestrians and cyclists
- Planning and design will need to consider non-motorized modes and CAVs equally

IMPLICATIONS FOR MASS TRANSIT

	Opportunities	Considerations
Private or shared AVs	▪ Offer better first- and last-mile solutions	▪ Reduce public transit demand ▪ Could negate the congestion benefits ▪ Exacerbate equity and digital divide issues
Automated transit	▪ Be more affordable ▪ Improve service in low-density areas ▪ Act as feeder service to rail or BRT ▪ Decrease wait times	▪ Lead to job loss among public transit employees

IMPLICATIONS FOR MASS TRANSIT

AUTOMATED SHUTTLES

Pilot projects for automated transit already exist, mostly in Europe.
Level 4 Automation, available today: low speed, fixed route, limited conflicts

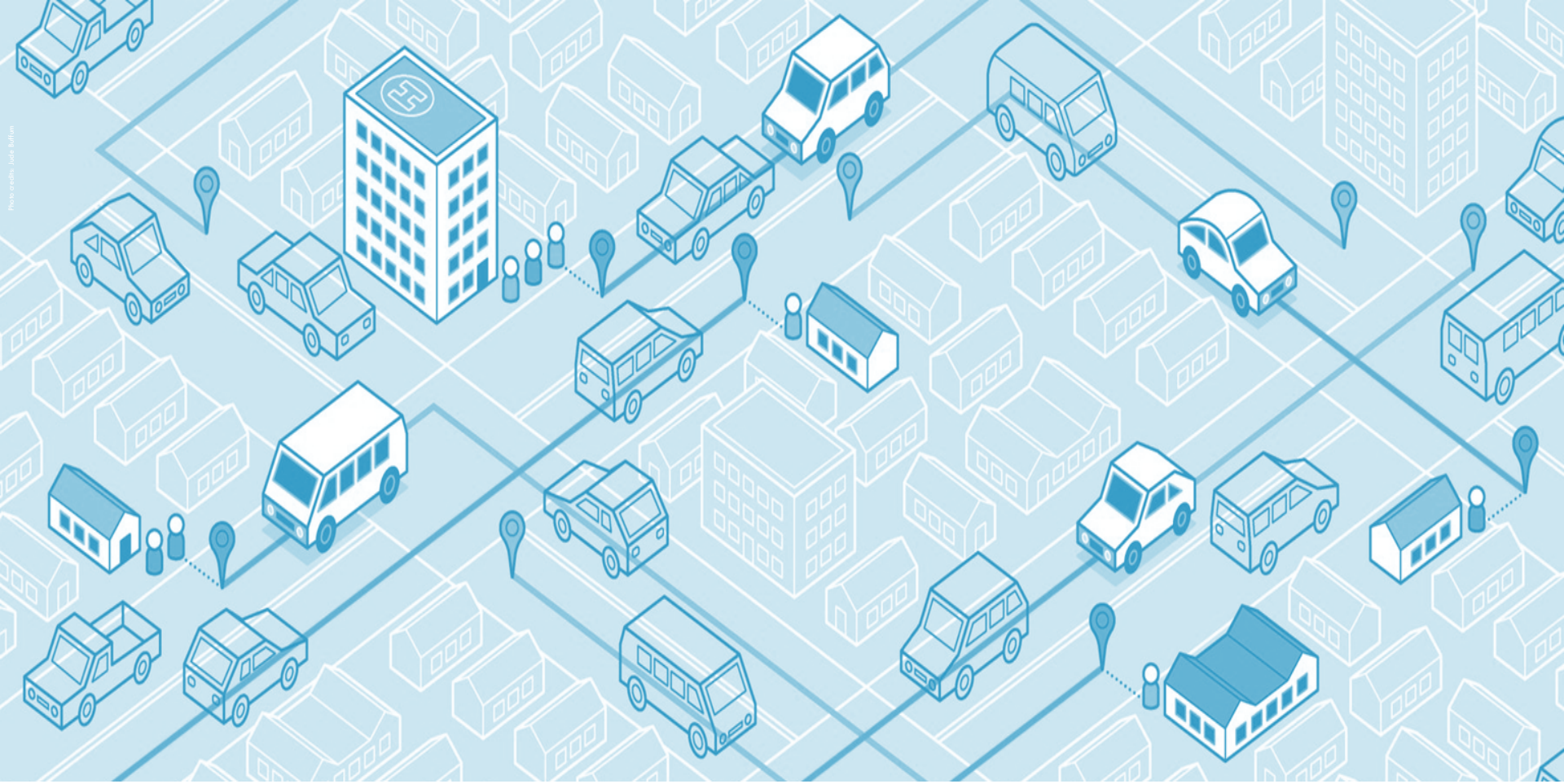
Navya Arma

Easymile EZ10

Local Motors Olli

2getthere

Auro



INFRASTRUCTURE INVESTMENTS

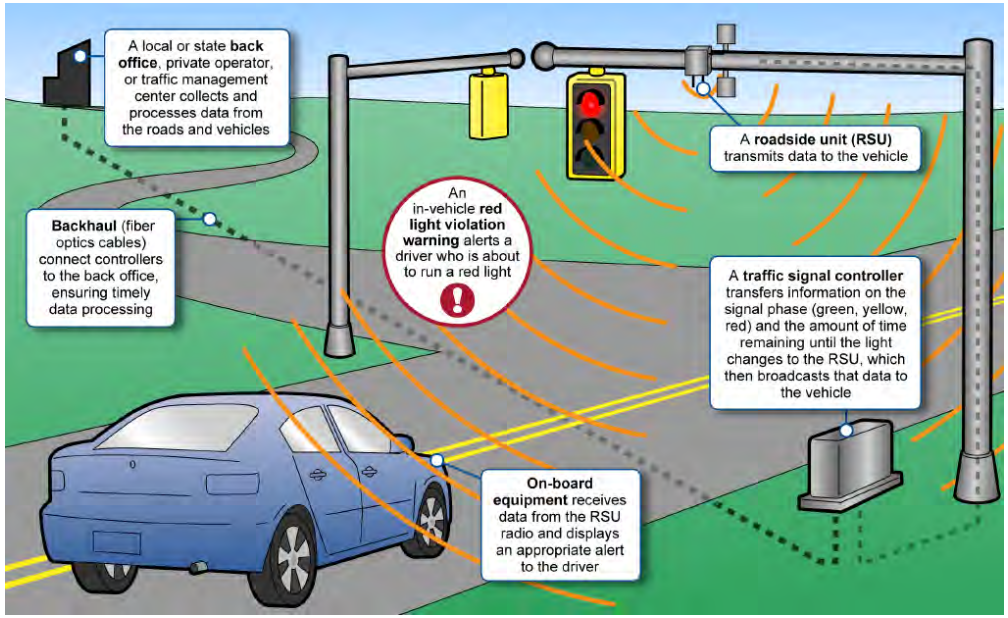
NEW INFRASTRUCTURE FOR V2I

Example of roadside equipment:

- **Roadside units (RSUs)**
- **Traffic signal controller**
- **Traffic Management Center**
- **Communication links**
- **Support functions**

Cost of deploying one RSU: $51,650

- Eligible for federal aid highway funding
- Expected to drop over time

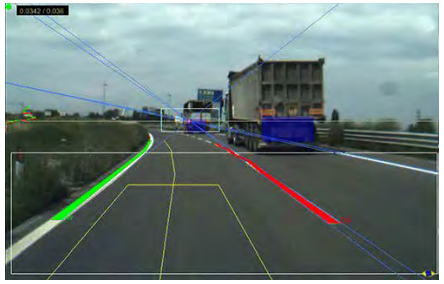


Example of V2I application and roadside equipment (Source: GAO Report 15-775)

MODIFICATIONS TO EXISTING INFRASTRUCTURE

SIGNALS AND ROAD MARKINGS

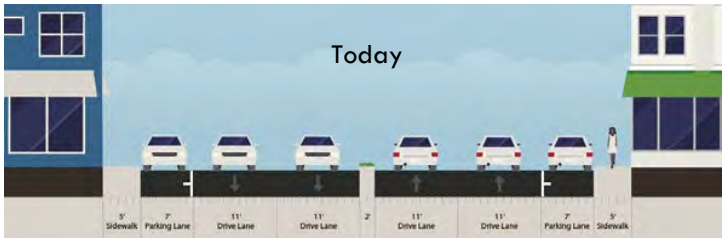
- Traffic signal updates are necessary to enable V2I
- V2I communication may replace some functions of signs and signals
  - Pedestrians, cyclists, or non-connected vehicles still need them
- Clear lane markings are beneficial, but not necessary

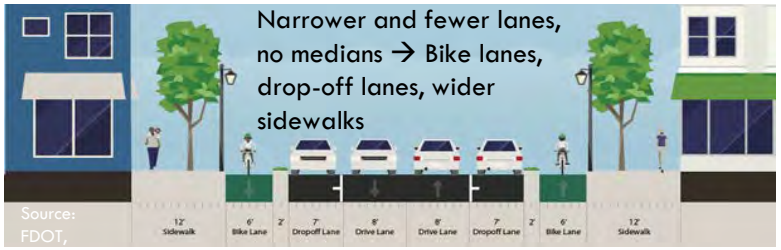


Source: Point Grey

MODIFICATIONS TO EXISTING INFRASTRUCTURE

LANE WIDTH AND ROAD CAPACITY





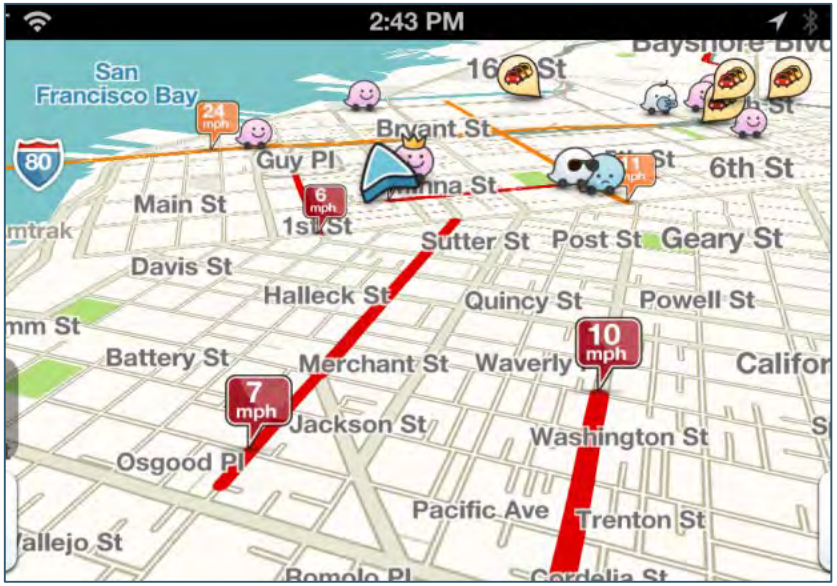
Congestion relief effect could be cancelled out if VMT increases

DIGITAL INFRASTRUCTURE
CROWDSOURCING TRANSPORTATION DATA

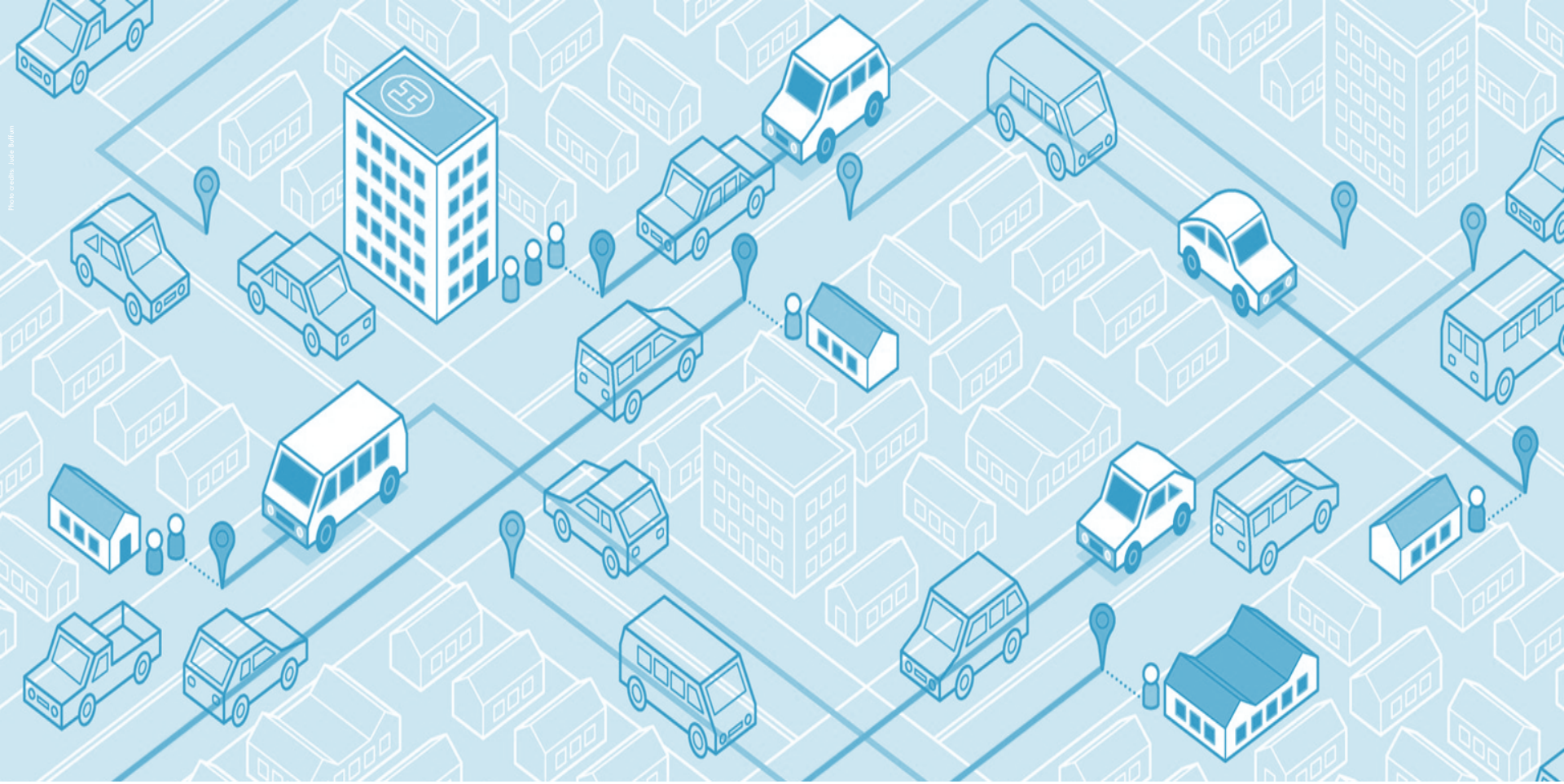
Potential Public Sector Roles

- Creation, maintenance, and distribution of maps for automated driving:
  - Create open-sourced maps
  - Develop open standards
  - Collect and publish pertinent data

- Data exchange partnerships: Waze, HERE, INRIX



Source: Waze



LAND USE

LAND FORM

SPRAWL

Decrease ← Sprawl → **Increase**

- Urban-core space could be freed up for redevelopment, thanks to lower parking demand
- Denser, more walkable developments could be created

Source: Alloybuild

- Willingness to travel longer distances to and from work could increase
- Household and businesses might locate farther from urban cores

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ZONING

Potential changes to zoning ordinances:

- Eliminate or reduce minimum parking requirements
- Develop specifications for parking design for CAVs
- Develop specifications for the design of drop-off/pick-up areas

REGIONAL AND LOCAL PLANNING

Near term

Develop policies for data collection and sharing

Incorporate CAVs in city goals for safety, GHG emissions, congestion

Start considering policies to manage the VMT and sprawl impact

Medium to long term

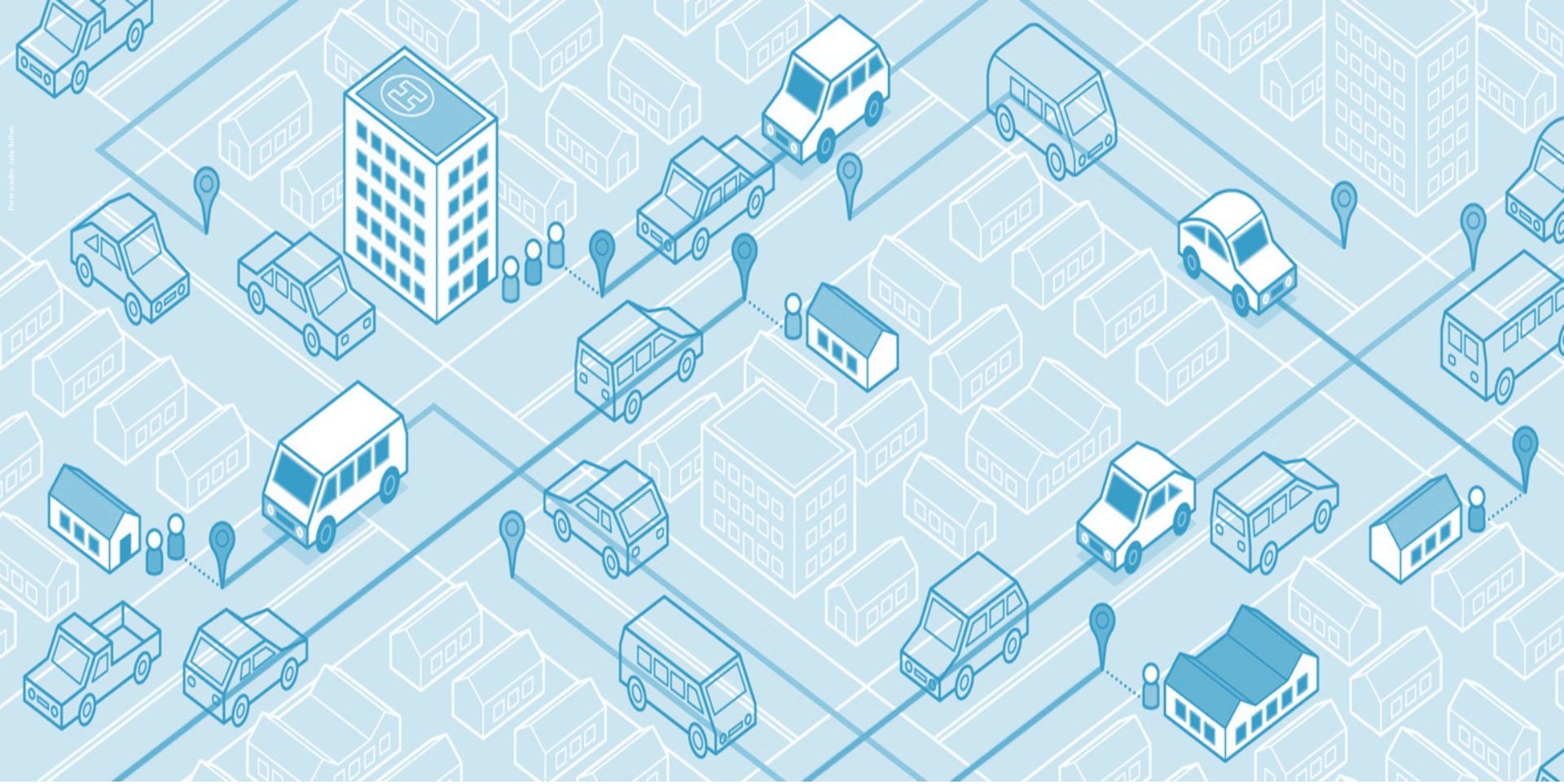
Update travel demand and roadway design manuals

Reevaluate road capacity needs and road expansion projects

Reevaluate transit fleet management plans and service delivery plans

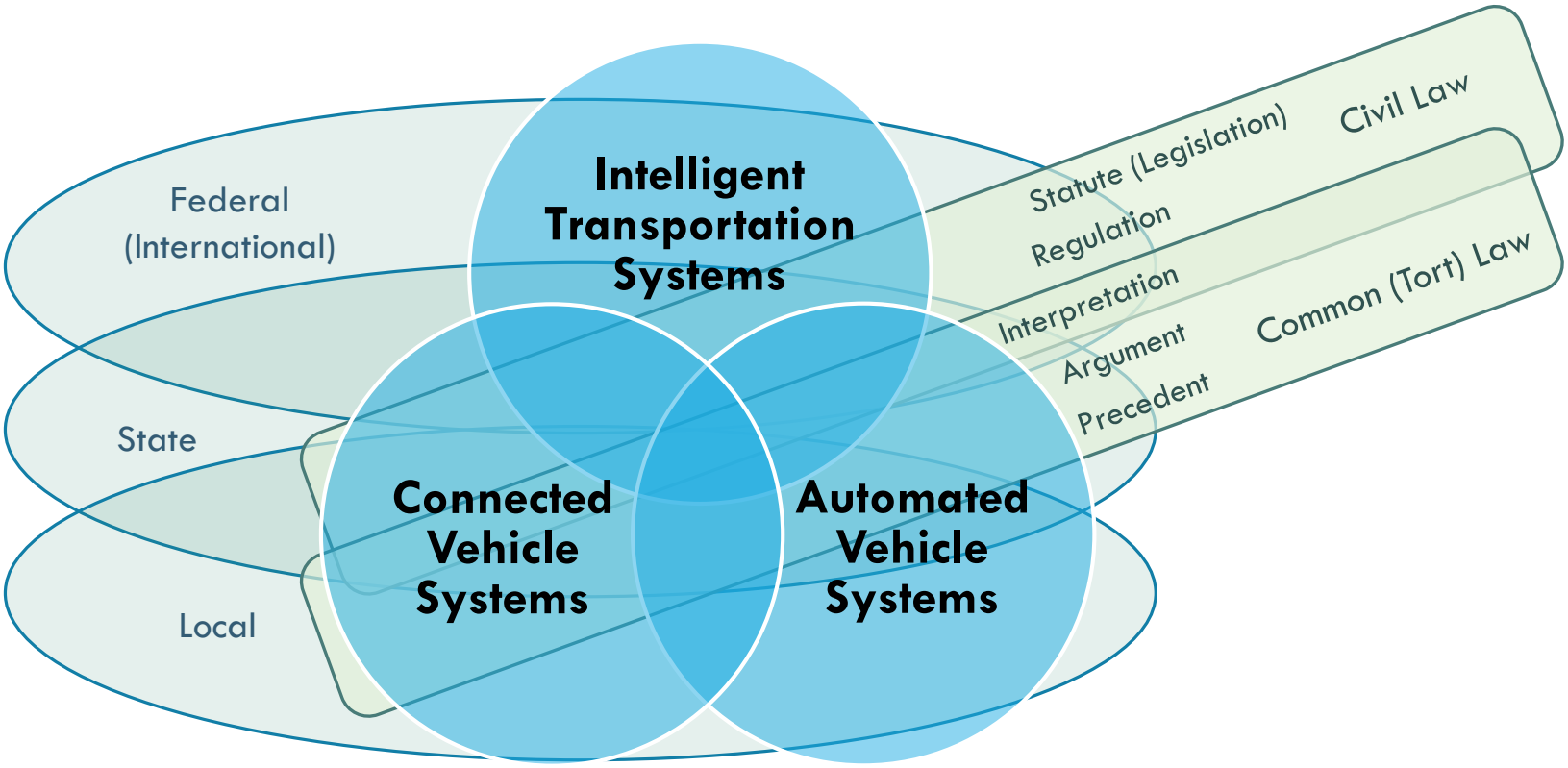
Plan infrastructure investments

Take impact of CAVs into account in long range transportation plans



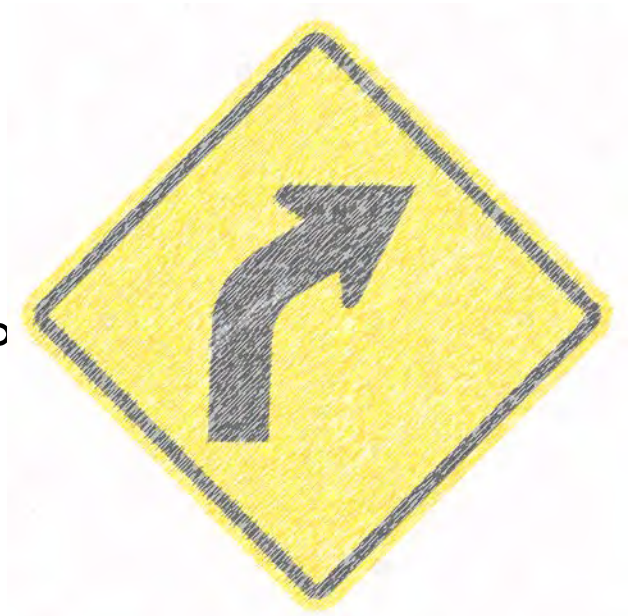
LEGAL AND REGULATORY CONSIDERATIONS

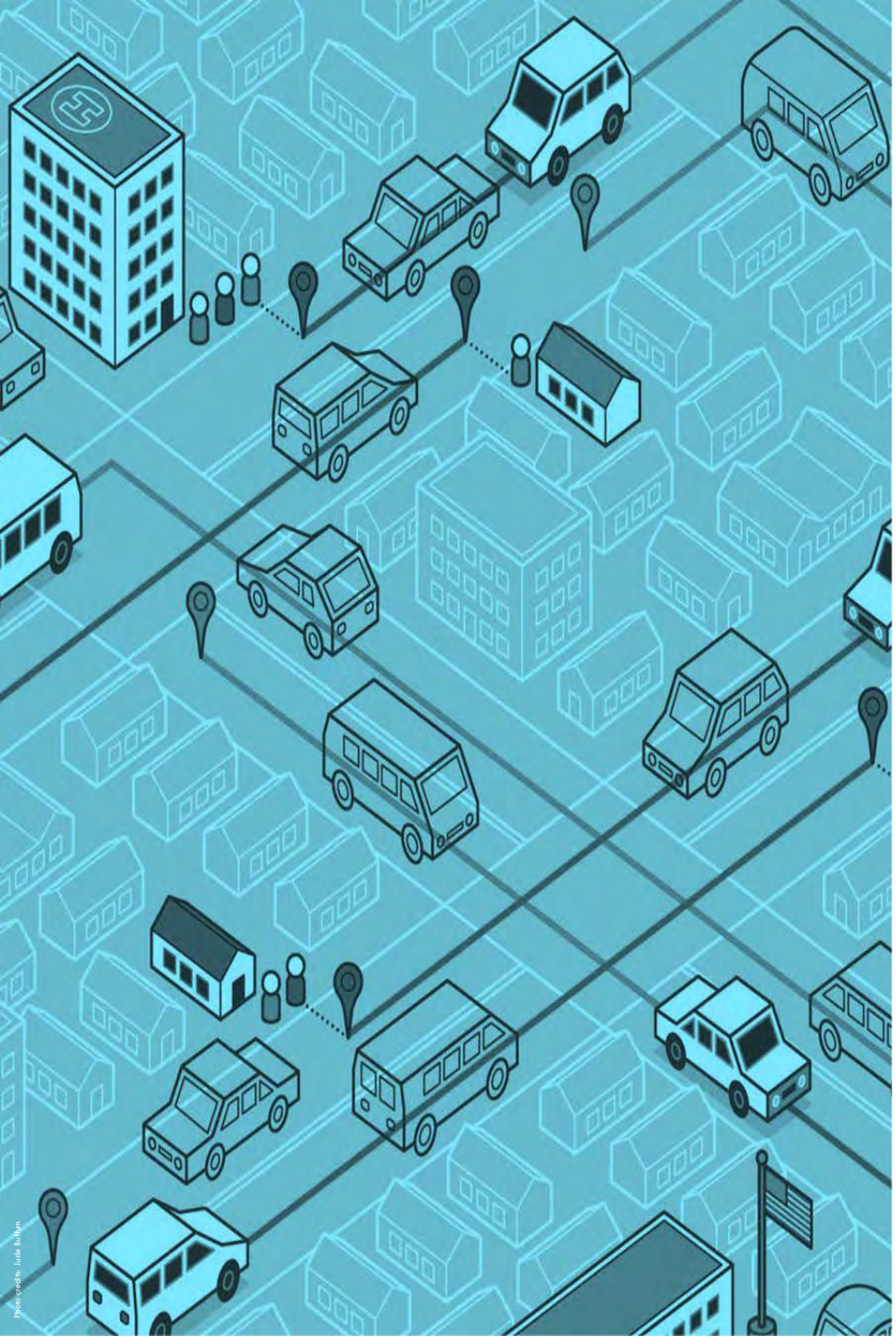
LEGAL FRAMEWORKS



THINGS THAT COULD CHANGE LEGAL LANDSCAPE

- Automated vehicle deployment
- Connected vehicle mandate
- Federal legislation, regulation, and
- State legislation, regulation, and po
- Local statute and policy





THANK YOU! QUESTIONS?

Valerie Sathe Brugeman, Senior Project Manager, Research

vbrugeman@cargroup.org

Center for Automotive Research

3005 Boardwalk Drive, Suite 200

Ann Arbor, MI 48108

www.cargroup.org