Short Term Future Proofing Strategies for Local Agencies to Prepare for Connected and Automated Vehicles

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Image source: Shutterstock

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Connected and Autonomous Vehicles

- Autonomous vehicles (AV) are able to conduct driving tasks with/without human intervention
- Connected vehicle (CV) have advanced technologies allowing them to communicate to external systems, other vehicles or the roadway infrastructure
- Benefits
  - ✓ Decrease crashes
  - ✓ Improve mobility for road users
  - ✓ Increased capacity

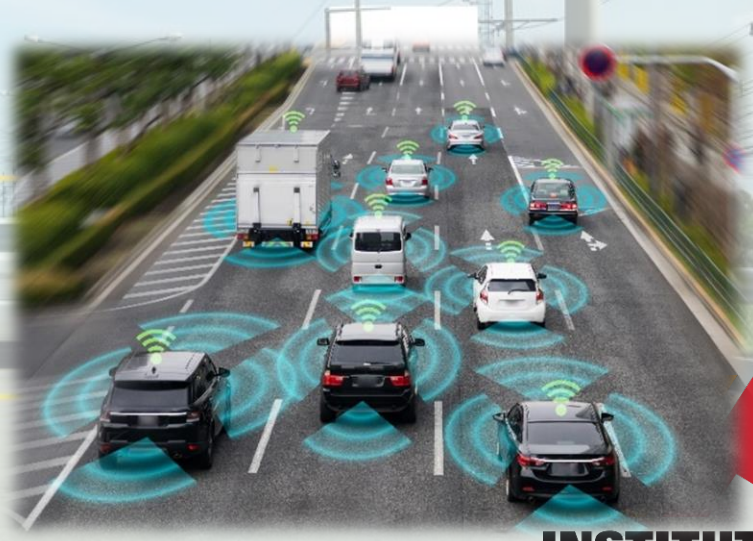

Image source: Shutterstock unless otherwise stated

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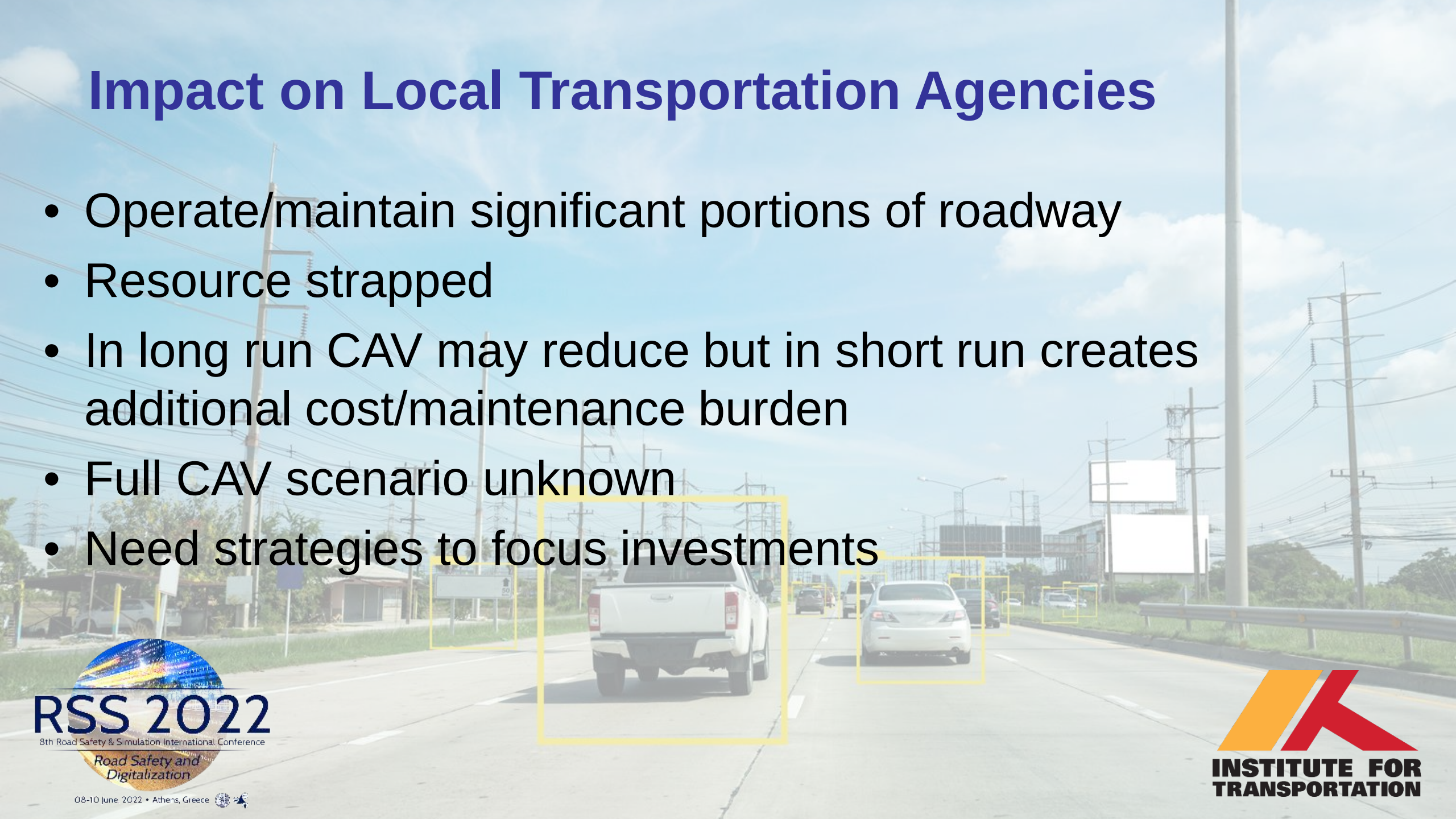
Impact on Local Transportation Agencies

- Operate/maintain significant portions of roadway
- Resource strapped
- In long run CAV may reduce but in short run creates additional cost/maintenance burden
- Full CAV scenario unknown
- Need strategies to focus investments



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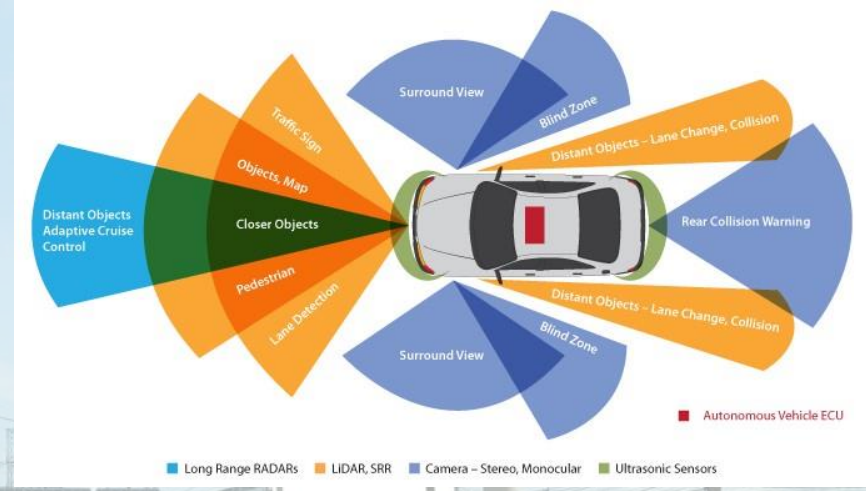
CAV Functions Relevant to Infrastructure

- Cameras
  - ✓ Capture images
  - ✓ Challenges in low light, inclement weather
- LIDAR
  - ✓ Uses light pulses reflected off surfaces to create 3D map
  - ✓ Challenges in low light, inclement weather
- GPS
  - ✓ Provides location
  - ✓ Challenges in urban canyons, lost signal, etc.



https://medium.[illegible]vinaya/perception-in-self-driving-cars-74[illegible]

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CAV Functions Relevant to Infrastructure

- System processing
- Captures data (i.e. images) and translates to actionable information for driver or vehicle control system
- Machine learning algorithms process images to identify and classify objects
- Impacted by inconsistency and complexity

Image source: https://www.v7labs.com/blog/computer-vision-project-ideas

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Pavement Markings

- Indicate road alignment and vehicle position within the lane
- Problematic
  - ✓ Discontinuities
  - ✓ Faded
  - ✓ Wet markings
- Recommendations :
  - ✓ 6-inch markings,
  - ✓ Uniformity
    - Gore areas
    - Contrast marking patterns
    - Delineation of special lanes (i.e., HOV, bike lanes)

Image source: www.sunrisesafetyservices.com/view_item.php2id=34

Signing

- Traffic sign recognition
  - ✓ System notices then interprets lettering, symbols
- Problematic
  - ✓ inconsistency
  - ✓ Damaged/faded
  - ✓ location

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Signing Recommendations

- Pictograms rather than text
- Sign maintenance (retroreflection)
- Vegetation management
- Redundancies
- Uniformity
  - ✓ Sign use and type
  - ✓ Placement

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Traffic Signals

- System notices signal then interprets phase and other information
- Problematic
  - ✓ inconsistency
  - ✓ Lens angle
  - ✓ Glare
  - ✓ Signals may have also have static signs which also need to be interpreted

Image source: https://elkgrovetribune.com/flashing-yellow-left-turn-arrows-at-traffic-signals-utilized-in-elk-grove/

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Traffic Signal Recommendations

- Uniformly placed, horizontal traffic signals are particularly problematic
- Standardization: position, location, color, shape, and refresh rate
- Backplates beneficial for east/west placement particularly in low sun conditions
- Clear, unambiguous association with a specific lane
- 12-inch diameter signal head is preferred over an 8- inch

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