The Convergence of Automation and Electrification in the Implementation of Automated Mobility Districts

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AMS
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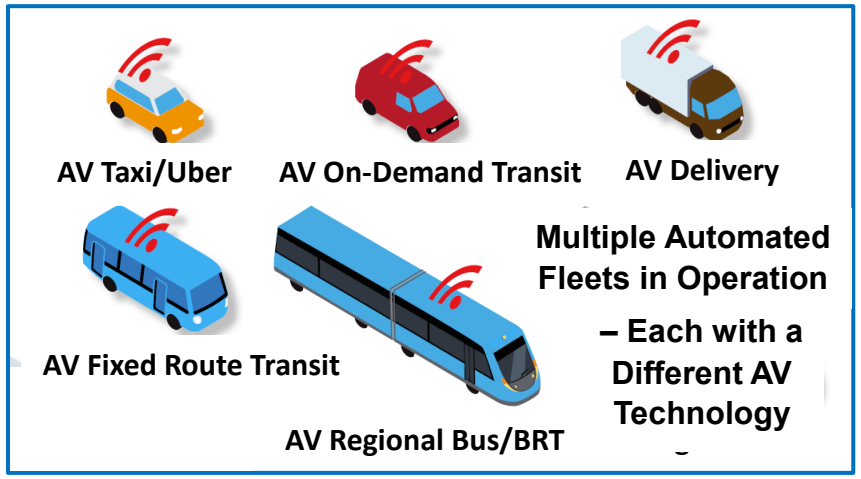
NREL's AMD Implementation Research Focus:

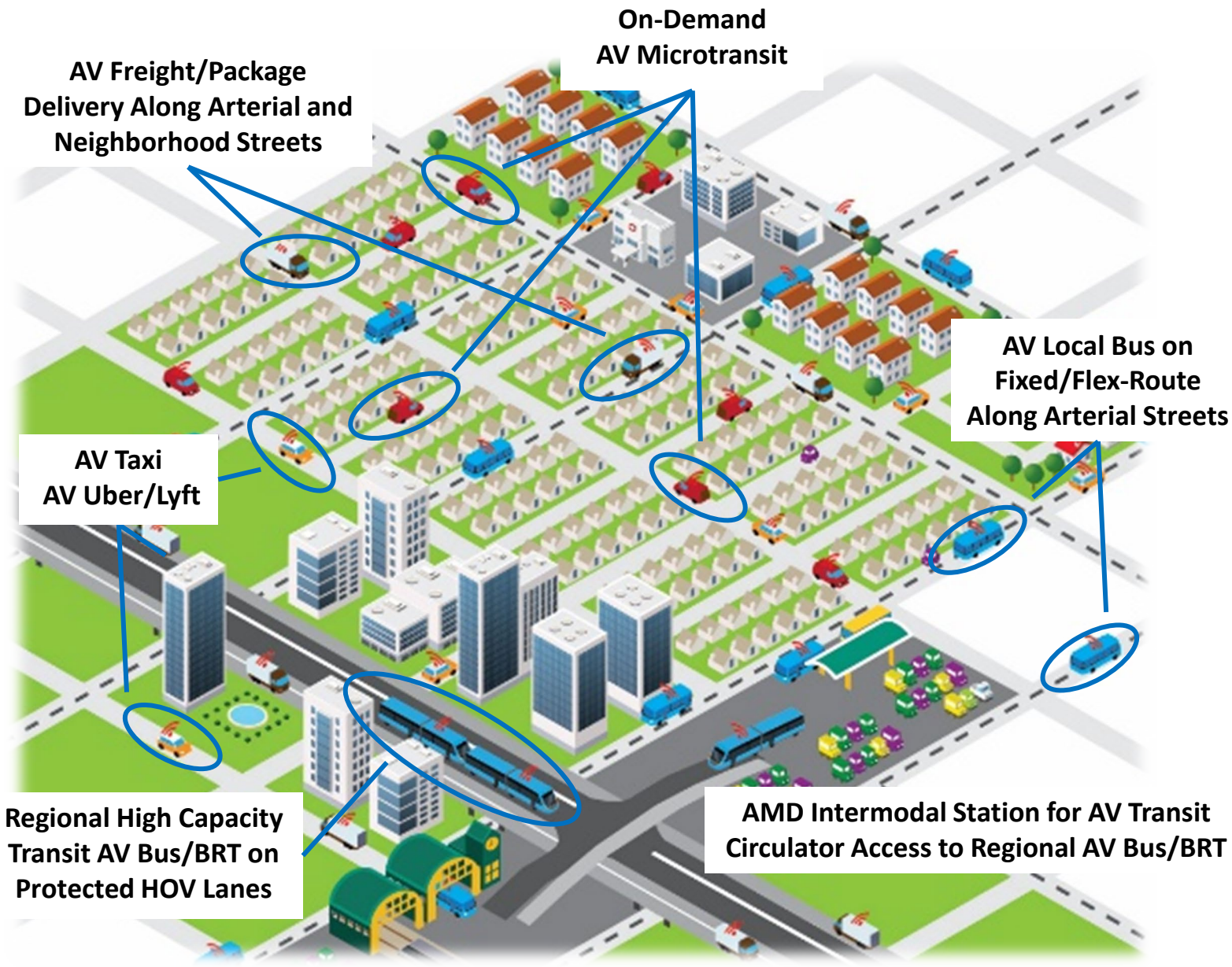
1. Studies to determine how automated/autonomous vehicle (AV) fleets can be effectively deployed on a large scale in dense urban environments such that operational efficiency, energy conservation, and safety is achievable in the near/medium term.
2. Phases 1 and 2 Research has documented and interpreted the trends from early AV deployment sites as prototypical AMDs.
3. Phase 3 Research is now addressing battery-electric vehicle charging and associated transit station/curbfront infrastructure.
4. Phase 3 Overall Objective is to qualify industry readiness and quantify the costs and energy use deploying of AV fleets in AMDs.

Framework of Phase 3 Research for Automated Mobility District Implementation

AMD Concept Has Multiple AV Fleets Operating Within the District

AMDs in Urban Districts and Major Activity Centers with AV Circulation





Source: Houston-Galveston Area Council

The Automated Mobility District Implementation Catalog – Insights from 10 Early Deployment Sites

The 1st Edition was published in 2020.

- Site #1: Columbus, Ohio
- Site #2: Arlington, Texas
- Site #3: Las Vegas, Nevada
- Site #4: Jacksonville, Florida
- Site #5: Houston, Texas

Source: DriveOhio 2019

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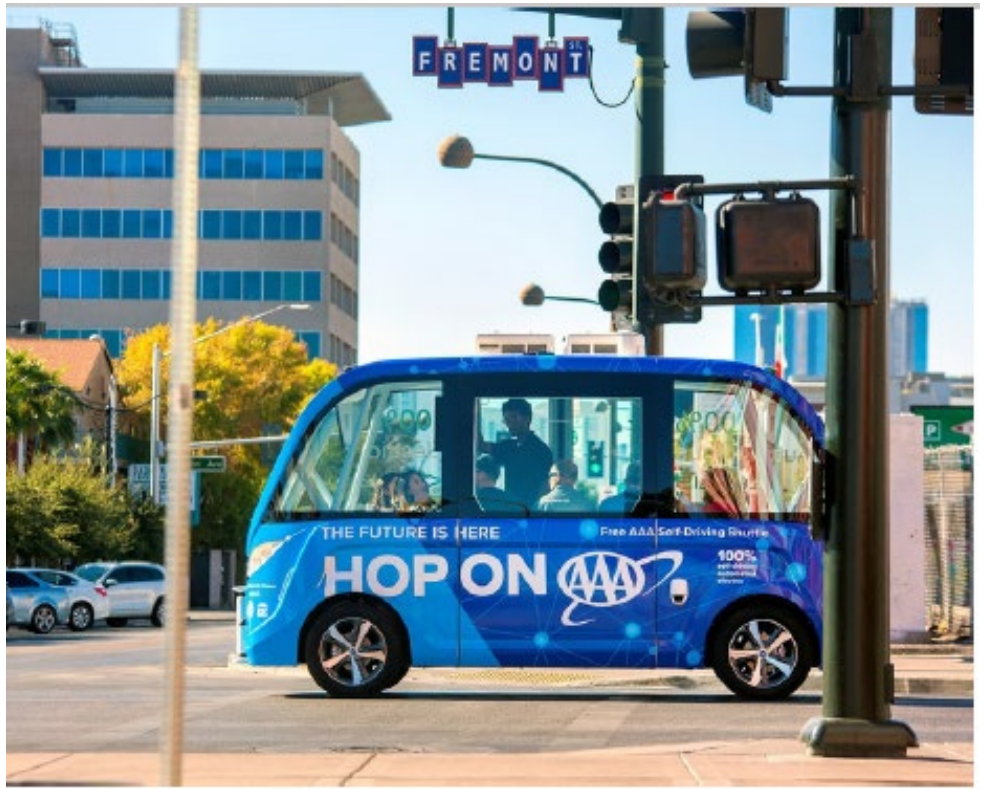
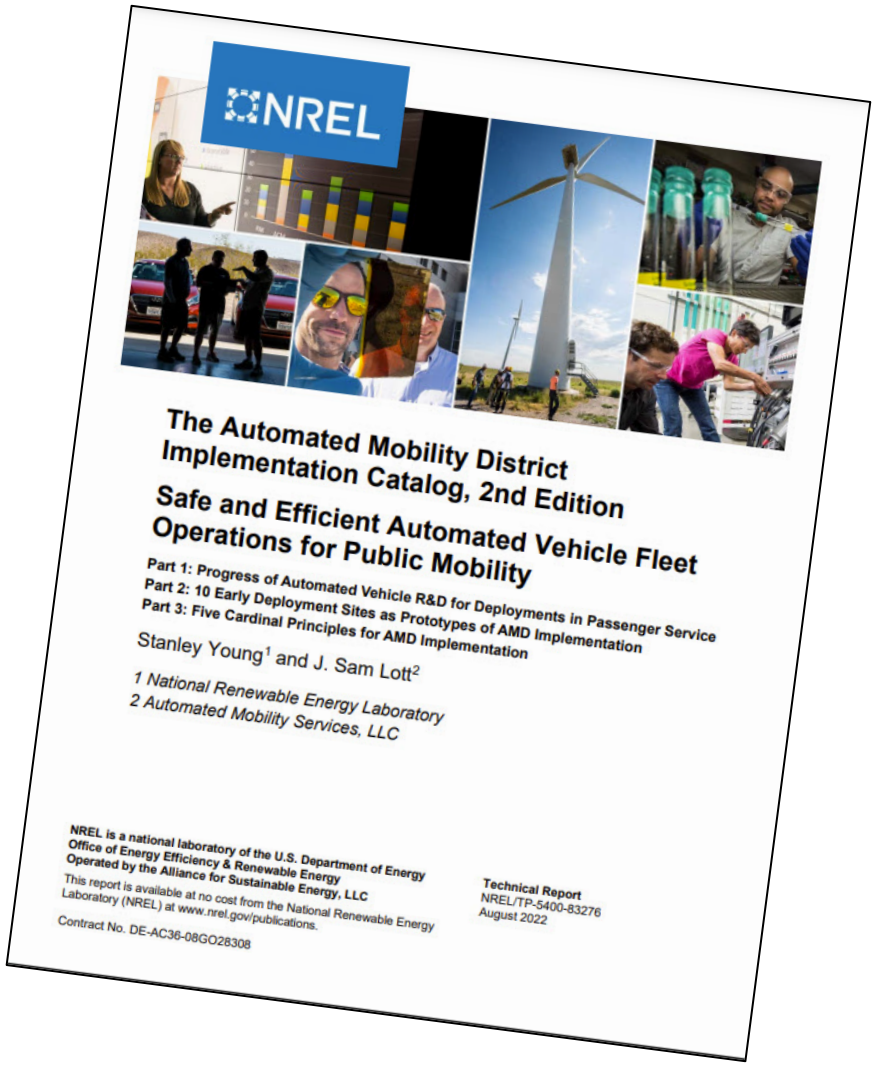


Source: City of Las Vegas and American Automobile Association

- Site #6: M-City, University of Mich.
- Site #7: Rivium, City of Capelle aan den Ijssel, Netherlands
- Site #8: Denver, Colorado
- Site #9: Gainesville, Florida
- Site #10: Babcock Ranch, Florida

Framework of Phase 3 Research for Automated Mobility District Implementation

AMD Implementation Catalog Series is Foundational to Ongoing Research



The Automated Mobility District Implementation Catalog, 2nd Edition

Safe and Efficient Automated Vehicle Fleet Operations for Public Mobility

Young, Stanley and J. Sam Lott. 2022. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-83276. https://www.nrel.gov/docs/fy22osti/83276.pdf.

The 2nd Edition was published in August 2022.

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AMS

Challenges of Automated Operations

1. Fully automated On-Demand Transit Is operationally difficult for direct-dispatch between passenger's origin to destination.
2. On-Demand Transit is finding fixed locations for passenger pickup and drop-off to be highly beneficial for operations – "Corner-to-Corner".
3. Single travel party service becomes more complicated with multi-party shared ride service.
4. Serving a highly "peaked" transit-trip generator such as a regional transit intermodal station may require staging of empty vehicles.
5. Operating fleets become larger as vehicles become smaller and more suited for On-Demand Transit.

Challenges of Electrification

1. Multiple Charging Facility locations within the transit service network.
2. Size of Charging Facilities in terms of the number of vehicle charging positions and corresponding kW capacity.
3. Battery charging rate and charging time vs. service range of vehicle.
4. High cost of charging infrastructure for faster charging speeds and smaller fleet requirements.

AV/EV Operational Complexity is substantially greater when battery-electric vehicles are operating in On-Demand Transit mode