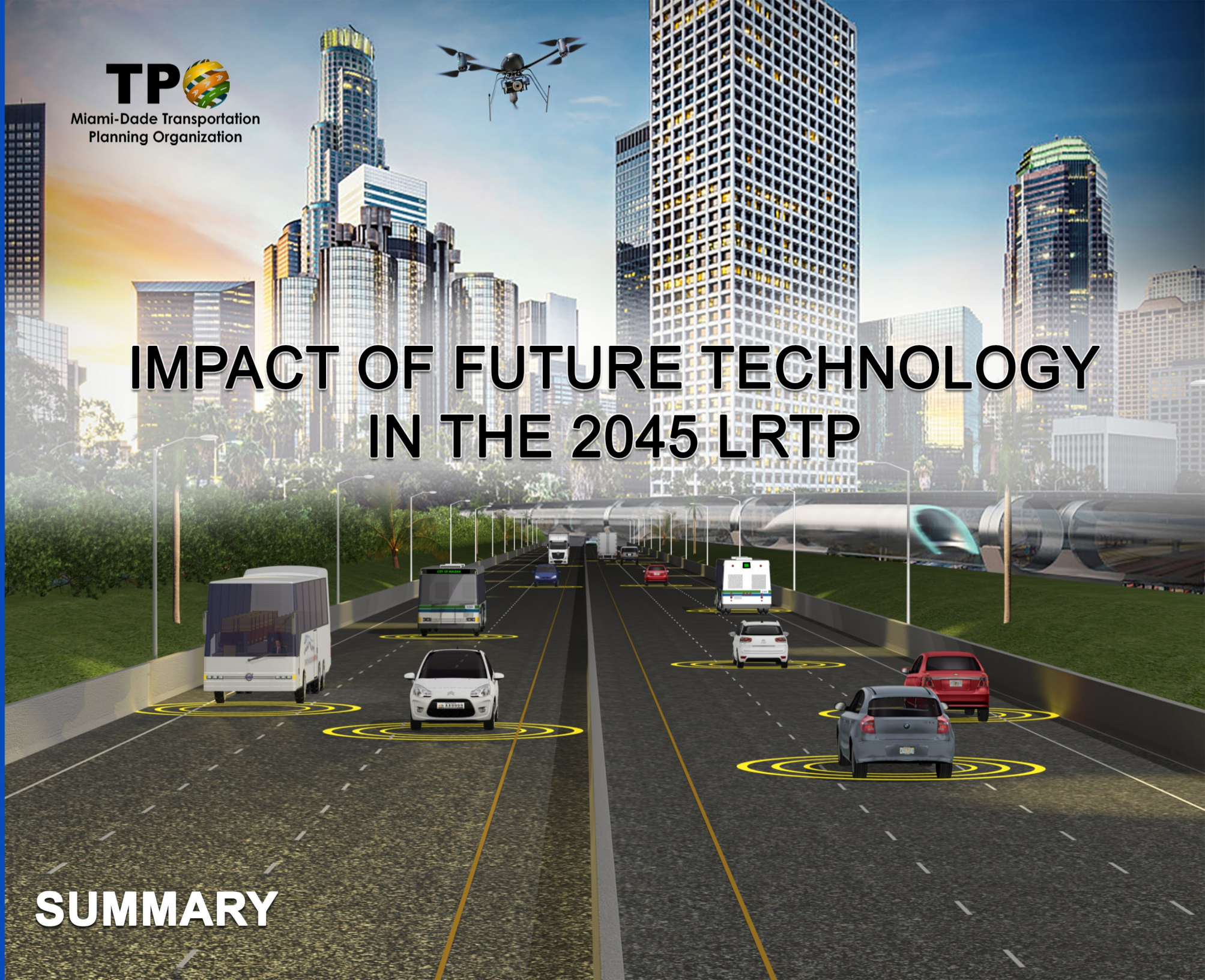


FINAL REPORT – June, 2017
THE CORRADINO GROUP

Summary

S.1 INTRODUCTION

The purpose of this project is to evaluate existing and future technologies that will impact and transform the transportation planning process. It will offer the steps to incorporate technologies in the 2045 Long Range Transportation Plan (LRTP). The project's deliverables address the question: ***"What will our community look like in 20–25 years?"***

Technology advancements are causing a shift in the way automotive vehicles are manufactured, as well as the way we will plan, design, and construct our infrastructure (roads, bridges, and transit systems) to accommodate them in the future. Traditional modes of transportation are being inundated with technology, and, as with everything else technology-driven, the future of transportation is evolving at a rapid pace with auto companies, alone, each spending billions of dollars each year. The limitations are, in fact, not technology, as much as the regulations to be put into place.

By adding computers, or on-board units (OBU), with Wi-Fi connections, sensors, cameras, and detectors, vehicles will: communicate, calculate, process data, optimize route planning, avoid crashes, and provide other driver-assist functions. As technology further evolves, vehicles will become fully autonomous. Eventually, the computers will perform all of these tasks simultaneously and as quick as, or quicker than the human brain. This will change the transportation infrastructure of the future.

The U.S. Department of Transportation issued on September 20, 2016, Federal policy for automated vehicles, laying a path for the safe testing and deployment of new auto technologies that have potential to improve safety and mobility on the road. The U.S. Transportation Department indicated: *"This policy is an unprecedented step by the federal government to harness the benefits of transformative technology by providing a framework for how to do it safely."*

S.2 LITERATURE REVIEW

This project goes beyond just driverless cars. The full list of categories for which a literature review was conducted, as part of **Task 2** is:

- **A.** Autonomous Vehicles (AV)/Connected Autonomous Vehicles (CAV)/Mobility
  - **A.1** Cars
  - **A.2** PoDs
  - **A.3** Transit
  - **A.4** Car Sharing
  - **A.5** Emergency vehicles
  - **A.6** Freight
  - **A.7** Marine
  - **A.8** Ridesharing
  - **A.9** Air
  - **A.10** Railroad
- **B.** Smart Cities
- **C.** TDM (Travel Demand Modeling)
- **D.** Maglev/Hyperloop
- **E.** BRT (Bus Rapid Transit)
- **F.** Solar
- **G.** Energy
- **H.** 3D Printing
- **I.** Parking
- **J.** Bikes
- **K.** Drones
- **L.** IoT/Data Management
- **M.** Banking
- **N.** Rain Channels

- **O.** Electric Vehicles/Alternative Fuels
- **P.** Cost/Financing
- **Q.** Dashboards
- **R.** Traffic Control Systems
- **S.** Be in/Be Out
- **T.** ADAs (Adv. Driver Assist. Sys.)
- **U.** Traveler Information Systems
- **V.** Communication Technology

A *Glossary of Terms* is provided in **Appendix A**, included under separate cover.

In total, more than 200 sources were reviewed and 100+ abstracts prepared, a sample of which is provided in **Table S-1**. The abstracts are in **Appendix B**. Both appendices are included under separate cover. Each abstract includes the following information:

- Topic;
- Category (listed above);
- Date;
- Source;
- Abstract of literature;
- Potential for Pilot Project;
- Cost to implement;
- Cost implications.

Figure S-1 provides an example. This body of information was used to determine the technologies that are the most practicable so that Smart City solutions (**Task 3** of the work order), and elements of the 2045 LRTP can be developed (**Tasks 4 and 5**).

Table S-1: Sample of Literature Review Results

CATEGORY	SUB-CATEGORY	TOPIC	SOURCE
A. AV/CAV	A.1 Cars	1. Big Carmakers Merge, Cautiously, Into the Self-Driving Lane	http://www.nytimes.com/2016/09/02/automobiles/big-carmakers-merge-cautiously-into-the-self-driving-lane.html
A. AV/CAV	A.1 Cars	2. Surveys of Consumers about AV Ownership/Use	http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/TTI-2016-8.pdf http://newsroom.aaa.com/2016/03/three-quarters-of-americans-afraid-to-ride-in-a-self-driving-vehicle/
A. AV/CAV	A.1 Cars	3. "Autonomous Vehicle Implementation Predictions: Implications for Transport Planning"	www.vtpi.org/AVIP_TTI_Jan2014.pdf
A. AV/CAV	A.1 Cars	4. Autonomous Vehicle Technology—A Guide for Policy Makers	http://www.rand.org/pubs/research_reports/RR443-2.html
A. AV/CAV	A.1 Cars	5. Smart Mobility: Reducing Congestion and Fostering Faster, Greener, and Cheaper Transportation Options	http://dupress.com/articles/smart-mobility-trends/#sup-2
A. AV/CAV	A.1 Cars	6. INTELLIGENT TRANSPORTATION SYSTEMS Vehicle-to-Infrastructure (V2I) Technologies -- a V2I-equipped intersection	http://www.gao.gov/assets/680/672548.pdf
A. AV/CAV	A.1 Cars	7. AUTONOMOUS | SELF-DRIVING VEHICLES LEGISLATION ENABLED IN STATES	http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx
A. AV/CAV	A.1 Cars	8. Federal Automated Vehicles Policy	https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf
A. AV/CAV	A.1 Cars	9. Dual-Mode Vehicle and Infrastructure Alternatives Analysis	http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-5827-1.pdf http://faculty.washington.edu/jbs/itrans/dualmode.htm http://www.overlandats.com/
A. AV/CAV	A.1 Cars	10. Cheap Lidar: The Key to Making Self-Driving Cars Affordable	http://spectrum.ieee.org/transportation/advanced-cars/cheap-lidar-the-key-to-making-selfdriving-cars-affordable
A. AV/CAV	A.1 Cars	11. Autonomous vehicles could cost America 5 million jobs.	http://www.latimes.com/opinion/op-ed/la-oe-greenhouse-driverless-job-loss-20160922-snapstory.html
A. AV/CAV	A.2 PoDs	12. MDC MPO Aerial Cable Transit Feasibility Study	http://miamidadetpo.org/library/studies/aerial-cable-transit-feasbility-study-final-report-2016-02.pdf
A. AV/CAV	A.2 PoDs	13. Maglev Pod Transit-skyTran	http://fortune.com/2015/11/24/skytran-maglev-pod-system-tel-aviv https://en.wikipedia.org/wiki/SkyTrann
A. AV/CAV	A.3 Transit	14. AV Transit in MDC	http://www.huffingtonpost.com/entry/ibm-local-motors-olli_us_5762975be4b05e4be860f03c
A. AV/CAV	A.3 Transit	15. Self-driving buses take to roads alongside commuter traffic in Helsinki	https://www.theguardian.com/technology/2016/aug/18/self-driving-buses-helsinki
A. AV/CAV	A.3 Transit	16. Forecast of How The IoT Will Affect Mass Transit	IoT - Examining How IoT Will Affect
A. AV/CAV	A.4 Car Sharing	17. Car giants see road to riches in sharing	https://www.yahoo.com/news/car-giants-see-road-riches-sharing-062326758.html

Source: The Corradino Group

Figure S-1: Example Abstract

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #28 The future of freight: More shipping, fewer emissions?

Category: Freight – Sea CATEGORY I// #82 on list

Author(s)/Sponsoring Agency: Nate Berg, *Green Biz*

Date: January 16, 2016

Source: https://www.greenbiz.com/article/future-freight-more-shipping-less-emissions
http://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU(2015)569964_EN.pdf
http://www.worldshipping.org/about-the-industry/how-liner-shipping-works
http://www.worldshipping.org/about-the-industry/how-liner-shipping-works/the-step-by-step-process
https://www3.epa.gov/otaq/oceanvessels.htm

Abstract: Much of what we consume embarks on a seaborne journey from another part of the world. Ships handle roughly 90 percent of global trade, nearly 11 billion tons of goods per year. Maritime vessels and ports are only a part of the picture. Airlines, railroads, trucks, warehouses, refrigerators, delivery people — the international system of goods movement -- is integral to the way we live. It also is a huge source of opportunity to reduce humans' environmental footprint. International aviation and maritime transport are constantly growing despite considerable efficiency improvements. In 2012, both sectors together accounted for about 3% to 4% of global emissions (PDF). A recent report (PDF) from the European Parliament estimated that number could rise as high as 17 percent by 2050 due to growth of global transport demand and if the shipping industry does not keep pace with other economic sectors in addressing emissions.

Efficiency gains and developments in automation may have the biggest influence on how the environmental footprint of the global system of goods movement evolves in the coming years. Maritime ports are getting more automated. Ships essentially can plug into the ports where they dock, tapping into local power instead of idling their huge engines and burning hundreds of tons of fuel to sit still. Automated cranes can quickly unload and reload ships to reduce their time in port. And the same systems can quickly move those thousands of containers onto the trucks and trains that carry them to distant locations.

The issue of getting to/from the port is another dominant conversation in goods-movement. Companies, such as FedEx, are investing in hybrid or all-electric delivery vehicles. Amazon is investigating delivery by battery-powered drones, which could reduce the reliance on traditional vehicles and their emissions. As the economic efficiency of shipping increases on sea and land, there will be more factories in more locations, with the parts and raw materials moving between them at lower cost and with more energy efficiency than today.

Potential for Pilot Project[1]

Near-term[2]: Ports and their "last-mile" infrastructure, like at the Port of Miami, must be modernized in order to match new and improved shipping processes.

Mid-term[3]: Once ports are modernized to handle these new and improved shipping processes, the industry will need to prepare to accommodate continued improvements in shipping technology.

Long-term[4]: Same as above.

Cost to Implement

Near-term: Port upgrades cost millions if not billions of dollars

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: It is expected that reduction in future costs will help make-up for initial spending

Mid-term: Same as above

Long-term: Long-term cost reductions will have far reaching impacts throughout the entire global economy.

1: Considered an on-the ground application; 2:2020-2025; 3: 2026-2035; 4:2036-2045

Source: The Corradino Group

S.3 EVALUATION

Over the next few decades, technology will continue to revolutionize our way of life. The phenomenon of connecting "everything" through technology is termed the "Internet of Things" or "IoT."

The key to planning for this future is to establish a network of technology infrastructure that is capable of supporting human needs. This network must be upgraded quickly and efficiently. With the infrastructure in place, any city, town, rural place, or area along any roadway/corridor can build out the Internet of Things. The impacts, the potential benefits, and the disruptive changes to everyday life as we know it, are just beginning.

By reviewing hundreds of sources of information, the consultant has been able to assess the potential to implement various technologies, from autonomous vehicles to Maglev/fast trains to fossil fuel energy alternatives. Two assessments of implementation potential have been conducted: 1); in various phases of the *LRTP* and, 2) for a *pilot/demonstration project*. **Table S-2** is an example of the evaluation form.

Table S-2: Sample Preliminary Evaluation of Technologies

CATEGORY	SUBCATEGORY	TOPIC	Possible in Pilot Program	Possible in 2045 LRTP		
				2020-2025	2026-2035	2036-2045
A. AV/CAV	A.1 Cars	1. Big Carmakers Merge, Cautiously, Into the Self-Driving Lane				
A. AV/CAV	A.1 Cars	2. Surveys of Consumers about AV Ownership/Use				
A. AV/CAV	A.1 Cars	3. "Autonomous Vehicle Implementation Predictions: Implications for Transport Planning"				
A. AV/CAV	A.1 Cars	4. Autonomous Vehicle Technology—A Guide for Policy Makers				
A. AV/CAV	A.1 Cars	5. Smart Mobility: Reducing Congestion and Fostering Faster, Greener, and Cheaper Transportation Options				
A. AV/CAV	A.1 Cars	6. INTELLIGENT TRANSPORTATION SYSTEMS Vehicle-to-Infrastructure (V2I) Technologies -- a V2I-equipped intersection				
A. AV/CAV	A.1 Cars	7. AUTONOMOUS | SELF-DRIVING VEHICLES LEGISLATION ENABLED IN STATES				
A. AV/CAV	A.1 Cars	8. Federal Automated Vehicles Policy				
A. AV/CAV	A.1 Cars	9. Dual-Mode Vehicle and Infrastructure Alternatives Analysis				
A. AV/CAV	A.1 Cars	10. Cheap Lidar: The Key to Making Self-Driving Cars Affordable				
A. AV/CAV	A.1 Cars	11. Autonomous vehicles could cost America 5 million jobs.				
A. AV/CAV	A.2 PoDs	12. MDC MPO Aerial Cable Transit Feasibility Study				

LEGEND

HIGHLY UNLIKELY	POSSIBLE, BUT UNLIKELY	POSSIBLE	LIKELY	HIGHLY LIKELY
HIGHLY UNLIKELY	POSSIBLE, BUT UNLIKELY	POSSIBLE	LIKELY	HIGHLY LIKELY

Source: The Corradino Group

S.4 ELEMENTS OF THE LRTP

The following are developments expected to occur in each of the following time periods.

THE PERIOD 2020–2025

- **Infrastructure** that is capable of supporting future technology needs;
- **Freight:** The Port of Miami will move further into the next generation IoT;
- **Transit:** Planning for BRT;
- **Logistics:** IoT devices that will save logistics businesses billions by helping move goods and assets through their supply chains and warehouses faster and more cheaply; and,
- **Smart Cities:** It is expected that progress will be made on all of these elements: Energy, Water, Waste, Transit (BIBO), Retailing, Utilities, Wellness/Healthcare, Banking, Buildings, and Manufacturing.

THE PERIOD 2026–2035

- **Autonomous Vehicles/Cars:** It is expected that the penetration of privately-owned AV cars will be about 25 percent during the period 2026–2035. This will cause some job losses in the transportation sector. Nonetheless, while AVs will have limited personal ownership, their impact cannot be ignored. Therefore, updating the Travel Demand Model suite, discussed in the full report, should begin as soon as possible.
- **Autonomous Vehicles/Buses:** It is possible that AV buses will have a significant place in MDC transit. The job impact here will be complicated by union relations/negotiations. In this area, there will be a need for increased skills, with higher pay, and, likely, increased numbers of maintenance personnel to service the new AV technology.
- **Autonomous Vehicles/Trucks:** The use of self-driving, heavy-duty trucks will be limited but growing during the period 2026–2035. Acceptance of AV trucks by the unions is an issue. So is the willingness of fleet owners to accept completely driverless vehicles—ones that are hands off the wheel as well as foot off the accelerator and brake. Rather, there is more of a focus on "semi-autonomous" truck capability, perhaps for short durations on the highway but more applicable in low-speed environments, such as at truck stops or at warehouse docks.
- **Autonomous Vehicles/Ambulances:** AV ambulances will still be considered experimental in 2026–2035 because fully autonomous ambulances will need to achieve the highest level of automation (Level 4) before allowing the EMT ambulance driver to assist the other EMT with patient care while the ambulance is in motion. On the other hand, there will be increased use of ambulance drones (or AirMules) by hospitals and, to a lesser degree, by government.
- **AV Infrastructure:** Vehicle-to-Infrastructure (V2I) technologies are not likely to be extensively deployed in the United States in the period 2026–2035 as existing infrastructure systems are replaced or upgraded.

- **AV Ridesharing vs. Car-sharing:** It is expected that ridesharing will widely expand in 2026–2035, much of which will be in autonomous vehicles. Uber expects its entire fleet will be fully autonomous by 2030. That, too, will have a job impact, albeit relatively small, both for Uber drivers and those in the taxi business.

- **Car-sharing** will be more limited than ridesharing. Still, it will place a number of AV cars on the road.

- **Electric Vehicles (EVs):** There are many limitations that prevent suddenly swapping out large numbers of current vehicles for electric ones. Not everybody has access to a charging station. Nonetheless, with the sale by General Motors of the Chevy Bolt at a reasonable price, and the federal commitment of $4.5 billion to support development and use of EVs, their presence will grow in the period 2026–2035.

- **Bus Rapid Transit:** The first of three new BRT lines is expected to be in operation during the 2026–2035 period.

- **Gondola:** An MDC TPO study examined a number of options for a gondola and concluded a 1.2-mile, two-station Marlins Park (Little Havana)-to-Downtown alignment was preferred. Nonetheless, it is not expected this will be part of the LRTP in the 2026–2035 timeframe.

- **Rail Freight:** By becoming more digitally focused by way of machine-to-machine communications and mobile devices, rail operations will accelerate the transformation to a more interconnected, transparent, and agile form between 2026 and 2035.

- **Marine Freight:** Automating a container terminal is expensive, so ports are holding off on buying into the technology until absolutely necessary. Even so, it is expected that the Port of Miami will, in the 2026–2035 period, begin to make the substantial investment needed in automated cranes and other robotics in order to continue its position as a leading world port.

- **Logistics:** Creating the optimum logistics system requires strong collaboration and investment by all segments of the supply chain. The MDC TPO should facilitate that participation/cooperation, beginning as soon as possible.

- **3D Printing:** 3D printing will begin to affect manufacturing and shipping in the 2026–2035 timeframe. Remote production overseas in lower-cost locations could be replaced by manufacturing facilities located at home closer to the consumer, allowing for a more responsive manufacturing process and greater quality control.

- **Drones:** Between 2026 and 2035, drone use will grow extending beyond aerial photography, real estate, various inspections, agriculture, and filmmaking, to department stores and food stores plus firefighting, search-and-rescue, and conservation.

- **Roadway Traveler Information Systems:** These systems, already widely in use, will continue to expand.

- **Traffic Management Technology:** By 2026, Miami-Dade County will be increasing the installation of pole-mounted wireless technologies (cameras, sensors of environmental condi-

tions) to manage everything from traffic/pedestrian activities to flooding to ozone/pollution problems. The investment will need to be steady and significant.

- **Pedestrian Safety Technology:** MDC will advance in installing solar-powered in-road light systems which detect the presence of a pedestrian crossing or preparing to cross the street, plus safety reflectors which feature sensors, LED lights, wireless charging, and communications made to blink and alert vehicle drivers to pedestrian movements.

- **Bikes:** MDC has done extensive study and implementation of bicycle facilities and programs. It is expected to continue that work over the next generation to provide a truly multimodal transportation system.

- **Parking:** In the period 2026–2035, vehicle self-parking will be more prevalent. But its effects on parking facilities will have to wait until the number of AVs in the vehicle population reaches more than a majority.

- **Energy:** The smart grid is one of the most well-developed and widely recognized IoT systems. Smart grids rely on smart meters, which relay information about a system's energy usage to a central management system to efficiently allocate resources. In the period 2026–2035, MDC will push forward in this area of energy efficiency.

- **Solar Roadways:** While possible, it is unlikely that solar roadways will play a significant role in MDC by 2036. The technology is years away from being proven.

- **Energy from Road Friction:** This technology is not likely to be widely applicable for some time because it needs to be proven.

- **Smart Cities:** It is expected Smart Cities technologies that are expected to be engaged starting in the 2020–2025 period will be aggressively moving forward in the 2026–2035 period of the LRTP.

THE PERIOD 2036–2045

The key elements in this period will build upon the work of the two previous phases and will include in the LRTP the following. Details are elaborated upon in the full report.

- Autonomous Vehicles
  - ✓ Cars
  - ✓ Buses
  - ✓ Trucks
  - ✓ Emergency Equipment
- AV Infrastructure
  - ✓ Roadway Traveler Information Systems
- Electric Vehicles
- Bus Rapid Transit (BRT)
- Gondola
- Freight
  - ✓ Rail
  - ✓ Marine
- Logistics
- 3D Printing
- Drones
- Traffic Management Technology
- Pedestrian Facility Technology
- Bikes
- Parking
- Energy
- Solar Roadway
- Smart Cities
  - ✓ Environmental Conditions
  - ✓ Water
  - ✓ Waste
  - ✓ Transit
  - ✓ Wellness/Healthcare

  - ✓ Retailing
  - ✓ Utilities
  - ✓ Banking
  - ✓ Buildings
  - ✓ Manufacturing
- Digital Dashboards

A general overview of how these innovations mesh together can be seen by viewing:

https://vimeo.com/209590464
https://vimeo.com/209590865

S.5 PILOT PROJECT PROPOSAL

For purposes of this work, a pilot/demonstration project is proposed on a "Smart City" basis. The pilot is conceived as being conducted: 1) in a compact area, i.e., a smaller incorporated area of Miami-Dade County; 2) starting by 2020 and continuing for three to five years; and, 3) in cooperation with a local university already engaged in technology research.

IMPLEMENTATION

A comprehensive plan for the pilot project needs to be developed by all stakeholders—MDC and TPO, governments of the pilot project area, a local university, FDOT, private partners, and others. Once the plan is developed, private and public funding needs to be gathered. This includes the local government of the pilot project area, the MDC Commission, and FDOT. Eventually, once the pilot project demonstrates success, it should be presented as an attractive addition to the USDOT Smart City program.

Details are provided later in the main report.

S.6 SYSTEMS ARCHITECTURE

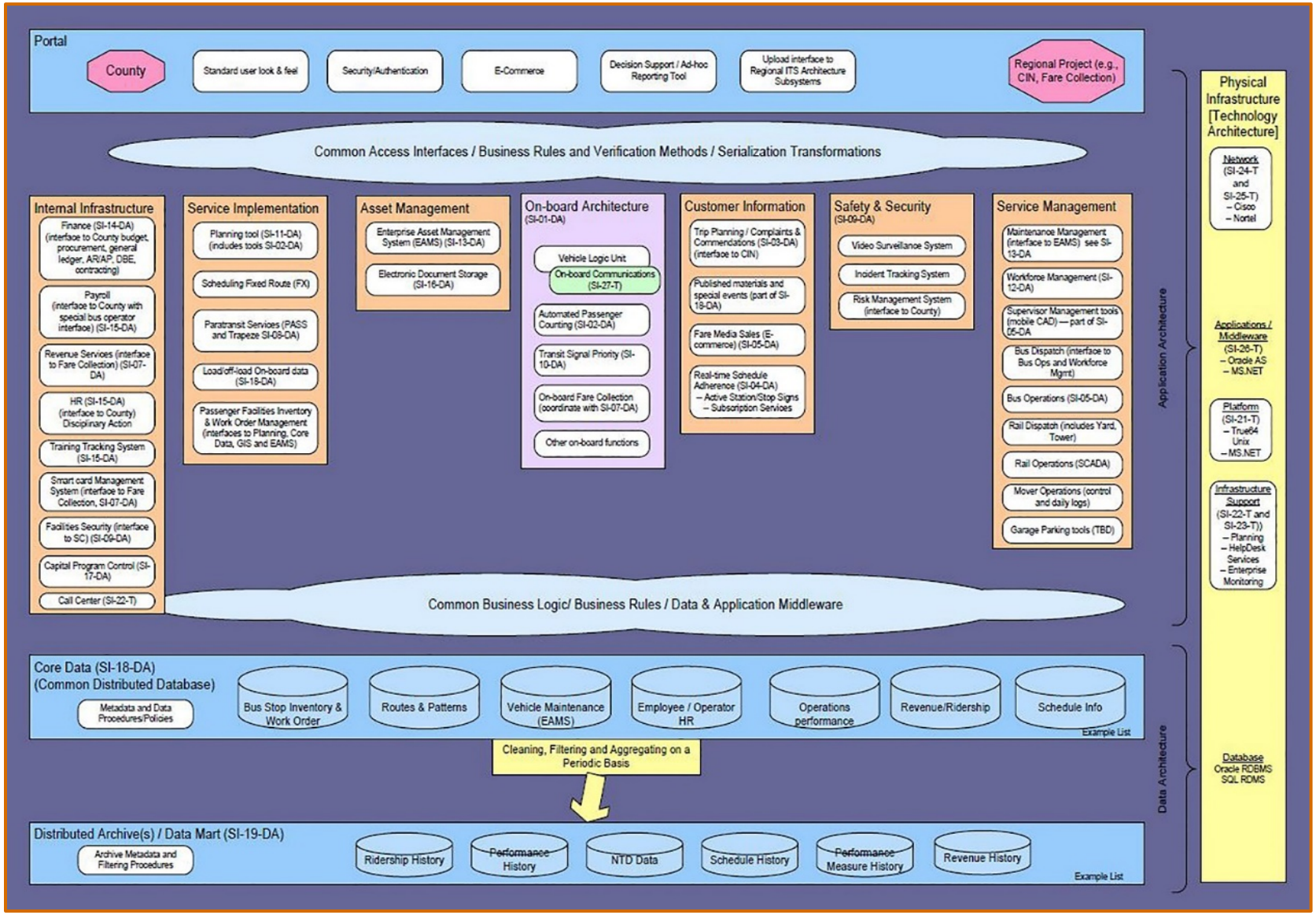
The chart on the next page illustrates the Miami-Dade County systems architecture for just one segment of the county's transportation operation—transit. There are equally intricate designs to manage roadway traffic, data/devices of all kinds, water and sewer information/facilities, and on and on. Therefore, to address the IoT architecture of the future takes a crystal ball, which is not available, at least not to this consultant. As a result, the approach to this task is to "borrow" examples of basic concepts developed by researchers/scientists at IBM, Symantec, The Reason Foundation, and Universities like Carnegie Mellon, Florida, and Michigan, to illustrate current thinking, which will quickly evolve as more technological developments become available.

It is noteworthy that Miami-Dade County's progress toward becoming an IoT SMART Community is aided by being the first municipality to launch an AT&T Smart Cities Operation Center. The program aims to give governments visibility into their communities' conditions using an integrated visualization dashboard placed in the County Mayor's office.

In Miami-Dade, AT&T is now working to apply solutions that address intelligent lighting and smart transportation as part of its Smart Cities initiative. In collaboration with its alliance member Hitachi, AT&T will soon be deploying public safety solutions, including:

- Remote monitoring and more efficient operations solutions for police and public safety officials;
- Upgrades to the county's existing infrastructure with smart LED lighting;
- Reliable data to help inform decision making around urban transportation planning; and,
- A traffic intersection network solution to help improve traffic flow.

Miami-Dade County Transit System IoT Architecture



Source: Miami-Dade County

S.7 DTPW AND ITS PARTNERS' EFFORTS RELATED TO SMART CITIES AND CAV TECHNOLOGIES

ONGOING EFFORTS

Following is a summary of the ongoing efforts at the Miami-Dade County Department of Transportation and Public Works (DTPW).

- Adaptive Signal Control Technology (ASCT) Deployment;
- Advanced Transit Management System and AV Technology;
- Smart Streetlighting;
- Mobile Apps:
  - ✓ MDT Tracker;
  - ✓ MDT Transit Watch;
  - ✓ Upgrade of DTPW's Fare Collection System and Infrastructure;
  - ✓ All-inclusive Trip Planner and Payment App;
  - ✓ On-Demand, Flexible Transit Program; and,
  - ✓ CIVIQ Mobility Experience (CME).
- Other ongoing projects/efforts include implementing:
  - ✓ PayByPhone, mobile parking payment applications for Metrorail parking garages and parking-and-ride facilities;
  - ✓ WAZE partnership for data exchange;
  - ✓ Bikesharing program for Metrorail stations and other transit facilities, dynamic carpooling application (RideFlag);
  - ✓ Sidewalk Labs' Smart Parking App to help drivers find available parking in real time through Google maps;
  - ✓ RideFlag/SFCS Partnership for dynamic carpooling app;
  - ✓ Reversible traffic flow lanes;
  - ✓ Transit Signal Priority for buses; and,
  - ✓ EV Infrastructure network plan to increase availability of charging stations across the county, particularly at transit facilities to increase access to transit.

FDOT AND MDX CAV-RELATED EFFORTS

- FDOT's Freight Signal Priority (FSP) pilot; and,
- MDX's SMART 836:
  - ✓ SMART 836 CV Technology Deployment;
  - ✓ V2I Mobility Applications Deployment;
  - ✓ DSRC-Based Application for Pavement Surface Analysis; and,
  - ✓ Bluetooth and Wi-Fi Readers Technology Deployment.

WHAT CAN BE SEEN/EXPECTED IN 2020 AND BEYOND

- Autonomous shared vehicle transportation services;
- Implementation of Mobility as a Service (MaaS); and,
- Mobility Platform.

S.8 IMPLEMENTATION

Beginning immediately, the TPO should update its Travel Demand Model, consistent with the proposal presented in this report. Likewise, research on funding mechanisms is key to developing a cost-affordable plan. New funding concepts should be explored, such as: Vehicle Mile Charge in place of fuel tax; Rental Car Passenger Facility Charge; Value Capture/Tax Increment Financing with tax districts around stations or along segments of the route. The TPO should engage a Study Advisory Committee with members from the public and private sectors to test/brainstorm the schedule/viability of items in the time periods for implementation. Then—with the LRTP consultant engaged—the full analysis will begin, including public involvement. Coordination with SMART Plan developments will be essential. New technology, and high-type transit, in combination with possible and significant land use changes will affect the future of the TPO region more than at any time in the past.

S.9 CONCLUSION

The "IoT Revolution" is changing the world faster than ever with impacts greater than past "economic" revolutions. Over the next few decades, technology will continue to revolutionize our way of life.

The transformations are, in many ways, unfathomable. Residential neighborhoods, public utilities, education, healthcare, manufacturing, and public safety will transform in ways that will change the entire world. Over the next 50 years, vehicles will no longer have a driver's seat, steering wheel, or pedals. The shipping industry will become further automated and autonomous, where the need for drivers of semi-trucks, cargo ships, and trains could disappear.

The key to participating in the *Internet of Things* revolution is to establish a network of technology infrastructure that is capable of supporting human needs. This network must provide for the technology infrastructure to be upgraded quickly and efficiently. With the infrastructure in place, any city, town, rural place, or area along any roadway/corridor can build out the Internet of Things. The impacts, the potential benefits, and the disruptive changes to everyday life as we know it, are just beginning.

Miami-Dade County will be at the forefront of this technology revolution as will other world-class cities.


TPO
Miami-Dade Transportation
Planning Organization