Impact of Future Technology in the 2045 Miami-Dade TPO Long Range Transportation Plan

presented by
Ken Kaltenbach
The Corradino Group

October 18, 2017









Miami-Dade TPO technology evaluation

Acknowledgement: Carlos Roa and Edmondson Tewari, Miami-Dade County TPO

Purpose of the Study

… evaluate existing and future technologies that will inform and transform the transportation planning process. It offers steps to incorporate technologies in the 2045 Long Range Transportation Plan (LRTP). The project addresses the question: ***"What will our infrastructure and community look like in 20-25 years?"***

Transportation is just one piece of the Internet of Things (IoT)

Topics


- Statement of purpose
- Literature review … good luck keeping up!
- Catalog of transportation/technology ideas:

- AV/CAV (automated, connected)
- Smart Cities
- TDM (Travel Demand Modeling)
- Maglev/Hyperloop
- BRT (Bus Rapid Transit)
- Solar
- Energy
- 3D Printing
- Parking
- Bikes
- Drones
- IoT/Data Management
- Banking
- Rain Channels
- Electric Vehicles/Alternative Fuels
- Cost/Financing
- Dashboards
- Traffic Control Systems
- Be in/Be Out
- ADAs (Adv. Driver Assist. Sys.)
- Traveler Information Systems
- Communication Technology

Topics (continued)

Evaluation of technologies (example, there were 101)

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

LRTP - Topics


- ***Alternatives & expected model changes needed for sensitivity testing – required to fully assess the 2045 LRTP***
- Impacts on Funding (federal, state, local)
- Elements of the LRTP by period
  - 2036–2045
  - 2026–2035
  - 2020–2025
- Pilot Project Proposal
- Systems Architecture
- Department of Transportation and Public Works ongoing efforts
- Implementation Steps
- Conclusions

Needed Modeling Changes


- General Approach
  - Construct alternative futures
  - Estimate or assert expected behaviors
  - Modify the model to react to the alternatives
  - Conduct sensitivity tests
- Expected results
  - Identify what issues make a difference and are important
  - Suggest which issues can be modeled, and which might be best handled “off-model”
  - Show which assumptions must be changed, and where local observed data are needed
  - Experience and observations from modeling tests will allow us to make incrementally improve the models (like experience with managed lanes)

Needed Modeling Changes


Some characteristics that must be defined or assumed:

- Policies for driverless vehicles (e.g., is a licensed driver required?)
- Impact of more unaccompanied children and elderly in the tour frequency models and other models
- Degree of market penetration
- Network attributes that identify degree of restriction to AV/CAV
- Revised speed, capacity, volume/delay functions for AV/CAV lanes & transitioning lanes
- Revised lane requirements
- Representations of increased safety & higher reliability
- Out year growth & zonal data changes resulting from AV/CAV.

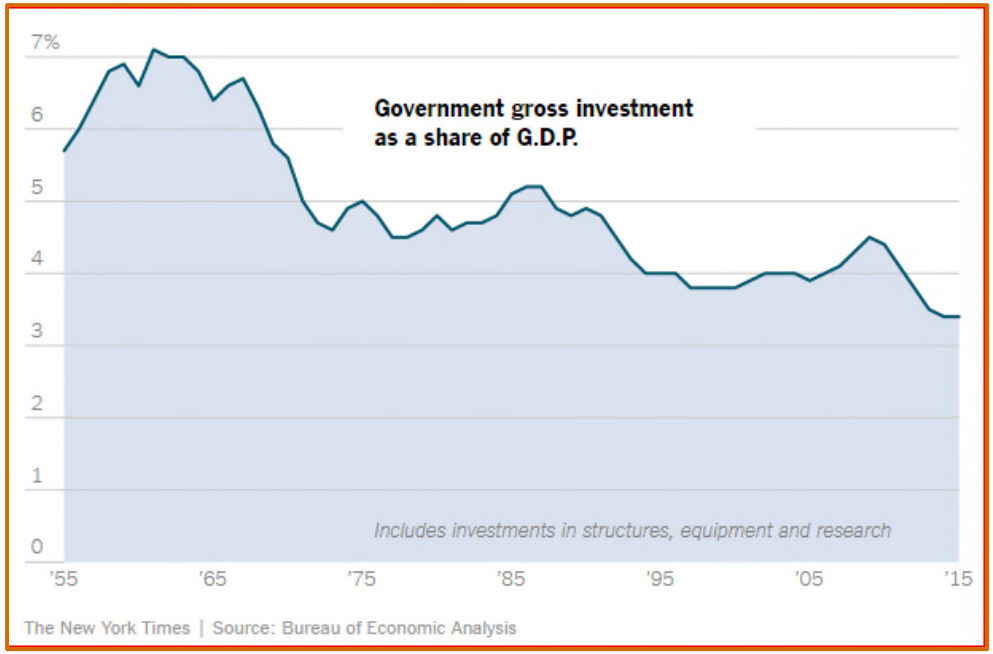
Needed Modeling Changes


Model elements

- Networks
  - Vehicle use restrictions (AV/CAV, mixed, none)
  - Revised speed assumptions and limits
  - Changes in roadway capacities
  - Changes in intersection delays
  - Transit usage, automated transit speeds
- Trip generation (tour & stop frequency)
  - Response to use by unlicensed drivers
  - Revised land uses
- Mode choice
  - Increased vehicle cost
  - Impacts of shared vehicles and rides
  - Increased availability of the auto (shared vehicle) mode
  - Possible new nests for AV/CAV
- Trip distribution (destination choice)
  - Reduced travel times
- Assignment
  - Revised volume/delay functions
  - Other elements not otherwise represented in the network
  - Lane/facility use restrictions
  - Increased VMT likely

LRTP - Funding

- Only about one-quarter of public funds spent on highways and transit comes from the federal government
- Today government spends roughly half as much on public infrastructure as in the 1950's and 1960's
- Funding will depend mostly on state and local funding unless trends change



LRTP Expected Elements 2036-2045

- Autonomous Vehicles
  - Cars
  - Buses
  - Trucks
  - Emergency Equipment
- AV Infrastructure
- 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

Table 4: Predictions of Availability of AV Cars

COMPANY	DRIVERLESS VEHICLE PREDICTION
Baidu	by 2019
BMW	by 2021
Delphi	by 2019
Ford	by 2021
GM	by 2020
NuTonomy	by 2020
Tesla	by 2018
Toyota	in 2020
Uber	Entire fleet by 2030
Volkswagen	by 2019

Source: http://www.driverless-future.com/?page_id=384

Table 5: Period in which AVs Will Reach Certain % of All Vehicles Purchased in U.S.

PERIOD	CONSULTANT	TPO SAC
2020–2025	NA	NA
2026–2035	25%	25%
2036–2045	50%	50%
> 2045	75%	75%

LRTP Expected Elements 2026-2035


- Autonomous vehicle/car penetration: about 25%
- TDM model enhancement becomes critical
- Ridesharing increases
- Some car-sharing
- Limited autonomous trucks
- Experimental emergency vehicles
- Expanded traveler information systems
- Many more electric vehicles
- 3D printing impact on manufacturing & shipping
- Delivery by drones
- Expanded wireless traffic management
- Pedestrian safety technology
- Smart grid to more efficiently allocate energy
- Smart Cities technologies

LRTP Expected Impacts 2020-2025

- Infrastructure: more robust internet & wireless communications
- Transit: BRT, Advanced Driver Assistance
- IoT: impacts on Port of Miami and Logistics
- Smart Cities technologies

The AT&T/Miami-Dade County SMART Cities Operation Center includes a visualization dashboard housed in the Mayor's office.

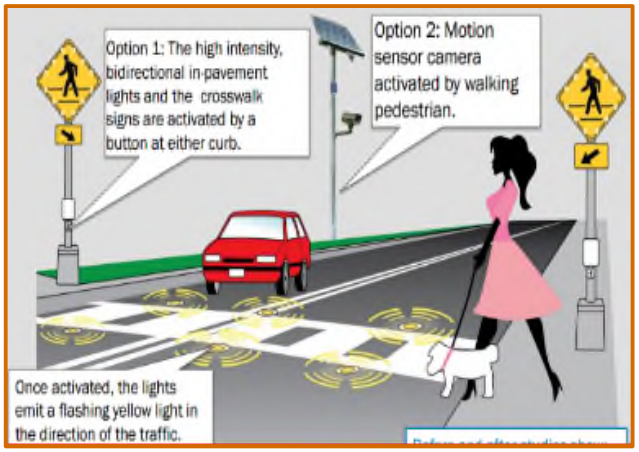
Proposed Pilot Project – 2020-2025


1) **WHERE**: in a compact area, i.e., a smaller incorporated area of Miami-Dade County;
2) **WHEN**: starting by 2020 and continuing for three to five years; and,
3) **HOW**: in cooperation with a local university already engaged in technology research.

- Probably will not include significant private ownership of AV/CAV's

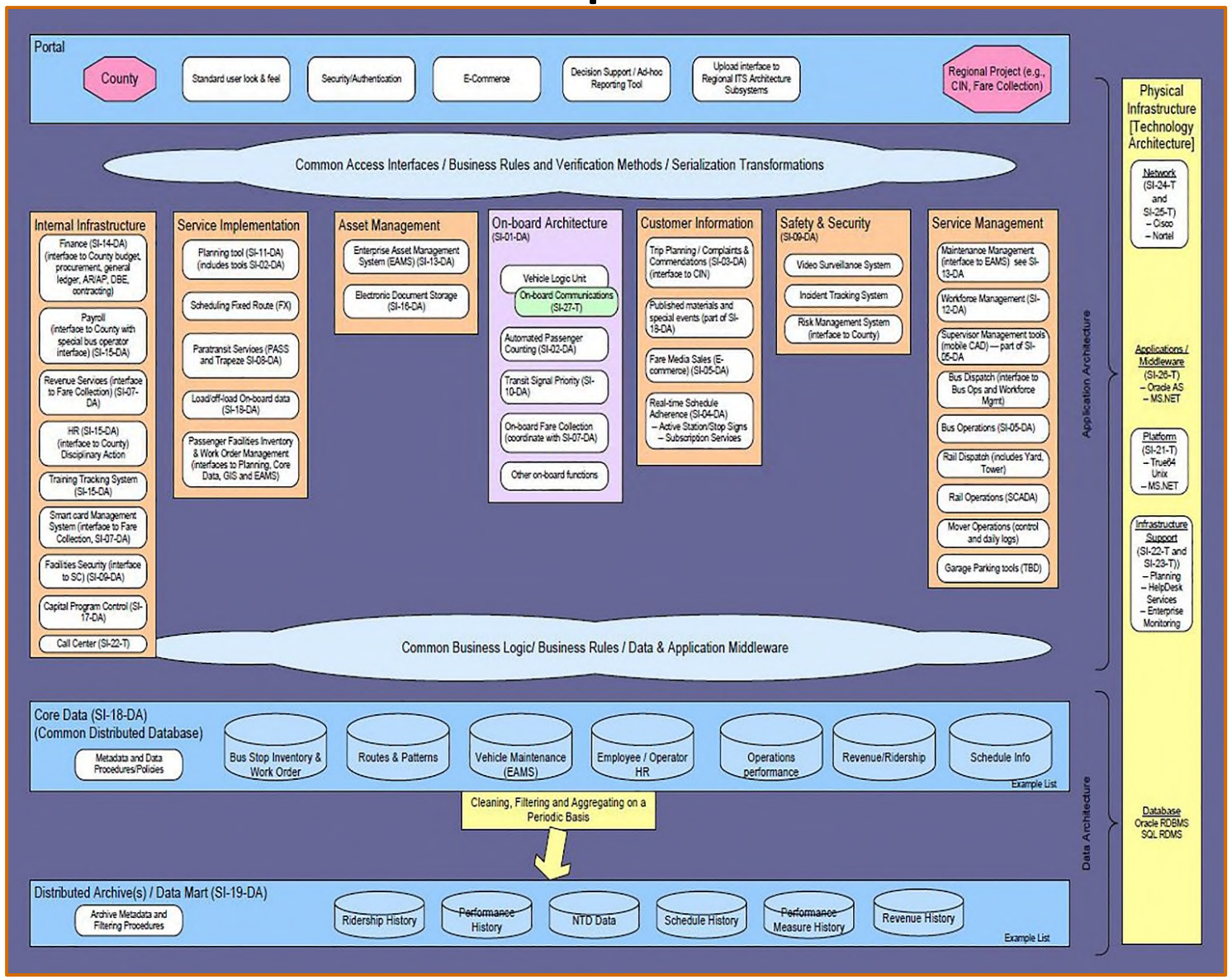
Technology Pilot Project – 2020-2025

- Car sharing
- Lyft & Uber AV ridesharing
- Small AV transit vehicles
- Transit mobility apps
- Emphasis on electric vehicles
- Solar-powered, in-road light systems that alert motorists to the presence of a pedestrian
- Smart Cities elements



IoT System Architecture

Miami-Dade Transit Example



DTPW's ongoing efforts


- 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
  - All-inclusive Trip Planner & Payment App
  - On-Demand, Flexible Transit Program
  - CIVIQ Mobility Experience (CME) – advanced Wifi
- FDOT & MDX
  - FDOT's Freight Signal Priority (FSP) pilot CV technologies
  - MDX's SMART 836

Implementation Steps


- Travel demand model enhancements
- Research on funding mechanisms
- Coordination with the SMART Plan
- Establishment of a technology team to monitor and pursue technology issues

Conclusion

"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."