



Miami-Dade Transportation
Planning Organization

IMPACT OF FUTURE TECHNOLOGY IN THE 2045 LRTP

APPENDIX B *Abstracts*

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #1 Big Carmakers Merge, Cautiously, Into the Self-Driving Lane

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: Neal E. Boudette, *The New York Times*

Date: September 1, 2016

Source: <http://www.nytimes.com/2016/09/02/automobiles/big-carmakers-merge-cautiously-into-the-self-driving-lane.html>

Abstract: Big carmakers, like General Motors, intend to avoid the criticism that has enveloped Tesla's Autopilot — that the driver-assistance technology can lull the person behind the wheel into a mind-wandering sense of false security.

In May, the driver of a Tesla Model S was killed when his car collided with a tractor-trailer crossing a state highway in Florida. Autopilot was operating at the time and failed to recognize the white truck against a bright sky. Neither Autopilot nor the driver, Joshua Brown, hit the brakes. The National Highway Traffic Safety Administration is investigating to see if flaws exist in Autopilot.

While carmakers seek to adopt some of the capabilities of Autopilot, many experts say the concept has a basic flaw — the “handoff” problem. These critics say too many experiments have shown that a person behind the wheel of a car that seems to be driving itself simply cannot respond quickly enough to take over in the instant the unexpected happens and the technology is not equipped to handle it. That is why Ford Motor and Google have each said they would skip driver-assistance systems and focus on future, fully autonomous cars that require no human intervention.

Automakers take a conservative view of new technology and tend to have their own engineers refine and test it until it works as intended. The companies also typically hold clinics where they watch customers try new technologies to make sure it is easy to use and to discover how some might misuse it.

Automakers use radar sensors, cameras and lidar—a kind of radar based on lasers—to read the road and identify vehicles and pedestrians.

Many experts say lidar is better at identifying objects than radar. But it is more costly and does not see as far in front of the car as radar.

The more cautious pace of companies like GM offer systems with radar, cameras and automatic braking that are intended to mitigate or prevent accidents, and a steering capability keeps their cars from drifting out of their lanes. Honda and Toyota stop short of letting their cars drive themselves.

Potential for Pilot Project¹

Near-term²: Wide-scale use of AVs not expected.

Mid-term³: More prevalent use of AVs is expected than in the near-term

Long-term⁴: Wide-scale use of AVs is expected

Cost to Implement

Near-term: Limited government investment is expected to address road infrastructure; more government investment in transit vehicles is more likely.

Mid-term: More investment by government than in the near-term in both road infrastructure and transit facilities.

Long-term: Considerable investment by government in both road infrastructure and transit facilities.

Cost Implications

Near-term: Limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term

Long-term: Greater savings than in the mid-term

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

Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #2 Surveys of Consumers about AV Ownership/Use
Category: A. AV/CAV SUBCATEGORY: A.1 – Cars
Author(s)/Sponsoring Agency: Johanna Zmud, Ipek N. Sener, Jason Wagner/Texas A&M Transportation Institute Erin Stepp/American Automobile Association
Date: April, 2016
Source: 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/
Abstract: The objective of this Texas A&M Transportation Institute study was:1) to gather empirical evidence on consumer acceptance and adoption of factors associated with intention to use autonomous vehicles: 2) how that intention might influence mode choice and vehicle ownership decisions; 3) and, what this could mean for travel demand and congestion in the Austin region. The data were gathered through a two-step process: 1) An initial online survey of 556 residents of the Austin metropolitan area; and, 2) Follow-up, face-to-face interviews with 44 participants. The first question asked of significance was: <i>Is a self-driving car in your future?</i> The response was 50% “YES”, and 50% “NO”. Those who responded “Yes” cited the following reasons: Safer than human drivers; Relieve the stress of driving; Trust the technology; Expect to be more productive while traveling; Can support mobility needs for seniors; Just like public transit. Those who said “NO” cited the following reasons: Don’t trust the technology; Safety concerns; Prefer to drive and control car; Insurance/liability concerns; Don’t know about or see a need for the cars. When asked to speculate on how the advent of AVs would affect the total number of vehicles owned by their household, 61% said no change, 23% said fewer, and 16% said more. On estimating the impact on their amount of travel, 66% expected the same annual VMT, 25% expected an increase, and just 9% expected a decrease. And when it came to the location of their residence, 80% expected no change, with most of the rest expecting to move farther than their present location. Yet, in a survey conducted by AAA, three out of four U.S. drivers report feeling “afraid” to ride in a self-driving car. With today’s heightened focus on autonomous vehicles, this fear poses a potential concern to the automotive industry as consumers may be reluctant to fully embrace the self-driving car. Only one-in-five people surveyed say they would trust an autonomous vehicle to drive itself. On the other hand, the survey revealed that consumer demand for semi-autonomous vehicle technology is high. Nearly two-thirds (61 percent) of drivers reported wanting at least one of the following technologies on their next vehicle: automatic emergency braking, adaptive cruise control, self-parking technology or lane-keeping assist. Among drivers who want these features on their next vehicle, AAA found their primary motivation to be <i>safety</i> (84 percent), followed by <i>convenience</i> (64 percent), <i>reducing stress</i> (46 percent) and <i>wanting the latest technology</i> (30 percent). While six-in-10 drivers want semi-autonomous technology in their next vehicle, there are still 40 percent of Americans that are either undecided or reluctant to purchase these features. Education is the key to addressing this consumer sentiment.
Potential for Pilot Project¹
Near-term²: Use of AVs, High, as a pilot project; less so for a widespread application
Mid-term: More prevalent use of AVs is expected than in the near-term
Long-term: Wide-scale use of AVs is expected
Cost to Implement
Near-term: Limited government investment is expected to address road infrastructure; more government investment in transit vehicles is likely.
Mid-term: More investment by government than in the near-term in both road infrastructure and transit facilities.
Long-term: Considerable investment by government in both road infrastructure and transit facilities.
Cost Implications
Near-term: Limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance.
Mid-term: Greater savings than in the near-term
Long-term: Greater savings than in the mid-term

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #3 “Autonomous Vehicle Implementation Predictions: Implications for Transport Planning”

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: Victoria Policy Institute, Todd Litman
Presented at the 2015 Transportation Research Board Annual Meeting

Date: December 10, 2015

Source: www.vtpi.org/AVIP_TTI_Jan2014.pdf

Abstract: This report explores the impacts that autonomous (also called *self-driving*, *driverless* or *robotic*) vehicles are likely to have on travel demands and transportation planning. It discusses autonomous vehicle benefits and costs, predicts their likely development and implementation based on experience with previous vehicle technologies, and explores how they will affect planning decisions such as optimal road, parking and public transit supply. The analysis indicates that some benefits, such as independent mobility for affluent non-drivers, may begin in the 2020s or 2030s, but most impacts, including reduced traffic and parking congestion (and therefore road and parking facility supply requirements), independent mobility for low-income people (and therefore reduced need to subsidize transit), increased safety, energy conservation and pollution reductions, will only be significant when autonomous vehicles become common and affordable, probably in the 2040s to 2060s, and some benefits may require prohibiting human-driven vehicles on certain roadways, which could take longer.

The report explores the following issues, which may provide a basis for travel demand modeling assumptions:

- Potential benefits
- Potential costs
- Shared vehicles
- Impacts on total vehicle travel
- Likely stages of development and deployment
- Implementation projections
- Planning implications
- Conclusions

This report is less positive than many other papers. Note that Litman is a prolific writer on transportation issues, and is generally a proponent of the use of transit, non-motorized modes, and walkable urban design.

Potential for Pilot Project

Near-term: No

Mid-term: No

Long-term: No

Cost to Implement

Near-term:

Mid-term:

Long-term:

Cost Implications

Near-term: Study

Mid-term: Study

Long-term: Study

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #4 Autonomous Vehicle Technology—A Guide for Policy Makers

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: James M. Anderson; Nidhi Kalra. Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatabi A. Oluwatola all of the RAND Corporation.

Date: 2016

Source: http://www.rand.org/pubs/research_reports/RR443-2.html

Abstract: Autonomous vehicle (AV) technology offers the possibility of fundamentally changing transportation. Equipping cars and light vehicles with this technology will likely reduce crashes, energy consumption, and pollution-and reduce the costs of congestion. This technology is most easily conceptualized using a five-part continuum suggested by the National Highway Traffic Safety Administration (NHTSA), with different benefits of the technology realized at different levels of automation:

- **Level 0:** The human driver is in complete control of all functions of the car.
- **Level 1:** One function is automated.
- **Level 2:** More than one function is automated at the same time (e.g., steering and acceleration), but the driver must remain constantly attentive.
- **Level 3:** The driving functions are sufficiently automated that the driver can safely engage in other activities.
- **Level 4:** The car can drive itself without a human driver.

Effect on Crashes – The Insurance Institute for Highway Safety (IIHS) estimated that if all vehicles had forward collision and lane departure warning systems, side-view (blind spot) assist, and adaptive headlights, nearly a third of crashes and fatalities could be prevented (IIHS, 2010). Level 4 AVs will likely further reduce crashes. **Effect on Mobility** – Level 4 AV technology would enable transportation for the blind, disabled, or those too young to drive providing these groups with independence, reduction in social isolation, and access to essential services. **Effect on Traffic Congestion and Its Costs** – Level 3 or higher is likely to substantially reduce the cost of congestion, because occupants of vehicles could undertake other activities. **Effect on Energy and Emissions** – The overall effect of AV technology on energy use and pollution is uncertain, but seems likely to decrease both. **Effect on Energy**– AV technology can improve fuel economy by 4-10 percent by accelerating and decelerating more smoothly than a human driver. **Costs** – AV technology is likely to decrease the cost of congestion and increase fuel economy, it will also likely decrease the private cost of driving that a particular user incurs. Because of this decline (and because of the increase in mobility that AVs offer to the elderly or disabled), AV technology may increase total VMT, which in turn may lead to increases in the negative externalities of driving, including congestion and an increase in overall fuel consumption.

Potential for Pilot Project¹

Near-term: Wide-scale use of AVs not expected.

Mid-term: More prevalent use of AVs is expected than in the near-term

Long-term: Wide-scale use of AVs is expected

Cost to Implement

Near-term: Limited government investment is expected to address road infrastructure; more government investment in transit vehicles is likely.

Mid-term: More investment by government than in the near-term in both road infrastructure and transit facilities.

Long-term: Considerable investment by government in both road infrastructure and transit facilities.

Cost Implications

Near-term: Limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term

Long-term: Greater savings than in the mid-term

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #5 Smart Mobility: Reducing Congestion and Fostering Faster, Greener, and Cheaper Transportation Options

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: Scott Corwin, Joe Vitale, Eamonn Kelly, Elizabeth Cathles all with Deloitte Consulting, LLP

Date: September, 2015

Source: <http://dupress.com/articles/smart-mobility-trends/#sup-2>

Abstract: This paper speaks to the critically important dialogue going on across the extended global automotive industry about the future evolution of transportation and mobility. The dialogue centers on whether the automotive industry will evolve or whether change will occur at a more radical pace and in a highly disruptive manner. No one knows the full scope and magnitude of the changes that are to come. There are two different visions that center on whether today's system of private ownership of driver-controlled vehicles remains relatively unchanged or whether there is migration to a driverless system of predominantly shared mobility. This paper offers four personal mobility futures: **Future 1: Incremental Change:** Puts heavy weight on the massive assets tied up in the current system. This vision assumes that fully autonomous drive will not become widely available anytime soon. **Future 2: A World of Car Sharing:** Shared mobility serves a greater proportion of local transportation needs. People more heavily value the convenience of point-to-point transportation created through ridesharing and car-sharing. **Future 3: The Driverless Revolution:** Autonomous-drive technology proves to be viable, safe, convenient, and economical. This new segment of the market may offer lighter, more technically advanced vehicles that embrace design principles counter to that of today: four-door, driver-in-front-on-left, gripping-the-steering-wheel reality. But, in this "future", private vehicle ownership continues to prevail. **Future 4: New Age of Accessible Autonomy:** Anticipates a convergence of both the autonomous and vehicle-sharing trends. The earliest adopters will be urban commuters. Over time, as smart infrastructure expands and driver usage nears a tipping point, fleets of autonomous shared vehicles spread from urban centers to densely populated suburbs and beyond.

As the country moves from one future to another, the following benefits will become more in evidence: Vehicles hardly ever crash; traffic jams are rarities; fossil fuel energy demand drops; trip costs plummet; speed of deliveries quickens and costs decrease; and, seamless multimodal transportation becomes the new norm. Much of the technology already exists to turn this vision into reality

Potential for Pilot Project¹

Near-term²: Wide-scale use of AVs not expected.

Mid-term³: More prevalent use of AVs is expected than in the near-term

Long-term⁴: Wide-scale use of AVs is expected

Cost to Implement

Near-term: Limited government investment is expected to address road infrastructure; more government investment in transit vehicles is more likely.

Mid-term: More investment by government than in the near-term in both road infrastructure and transit facilities.

Long-term: Considerable investment by government in both road infrastructure and transit facilities.

Cost Implications

Near-term: Limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term

Long-term: Greater savings than in the mid-term

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #6 Vehicle-to-Infrastructure (V2I) Technologies – a V2I-equipped intersection

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: General Accountability Office: Dave Wise at (202) 512-2834 or wised@gao.gov

Date: September, 2015

Source: <http://www.gao.gov/assets/680/672548.pdf>

Abstract: Vehicle-to-Infrastructure (V2I) equipment may vary depending on the location and the type of application being used. In general, V2I connected components include an array of roadside equipment (RSE) that transmits and receives messages with vehicles. For example, a V2I-equipped intersection would include:

- Roadside units (RSU)—a device that operates from a fixed position and transmits data to vehicles. This typically refers to a Direct Short-Range Communication (DSRC) radio which is used for safety-critical applications that cannot tolerate interruption, although other technologies may be used for non-safety-critical applications.
- A traffic signal controller that generates the Signal Phase and Timing (SPaT) message, which includes the signal phase (green, yellow, and red) and the minimum and maximum allowable time remaining for the phase for each approach lane to an intersection. The controller transfers that information to the RSU, which broadcasts the message to vehicles.
- A traffic management center that collects and processes aggregated data from the roads and vehicles. These centers may use aggregated data that are collected from vehicles (speed, location, and trajectory) and stripped of identifying information to gain insights into congestion and road conditions as well.
- Communications links (such as fiber optic cables or wireless technologies) between roadside equipment and the traffic management center.
- Support functions, such as underlying technologies and processes to ensure that the data being transmitted are secure.

The report states: “ While early pilot-project deployment of V2I technologies is occurring, V2I technologies are not likely to be extensively deployed in the United States for the next few decades. According to DOT, V2I technologies will likely be slowly deployed in the United States over a 20-year period as existing infrastructure systems are replaced or upgraded.”

Potential for Pilot Project¹

Near-term²: Possible on a limited basis

Mid-term³: More likely and more wide-spread than in the near-term

Long-term⁴: Essential

Cost to Implement

Near-term: Up to \$100, 000 per intersection

Mid-term: Less than in the near-term

Long-term: Less than in the mid-term

Cost Implications

Near-term: Savings in healthcare, insurance, delay and congestion that are larger than cost-to-implement

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #7 AUTONOMOUS | SELF-DRIVING VEHICLES LEGISLATION ENABLED IN STATES

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: National Conference of State Legislatures

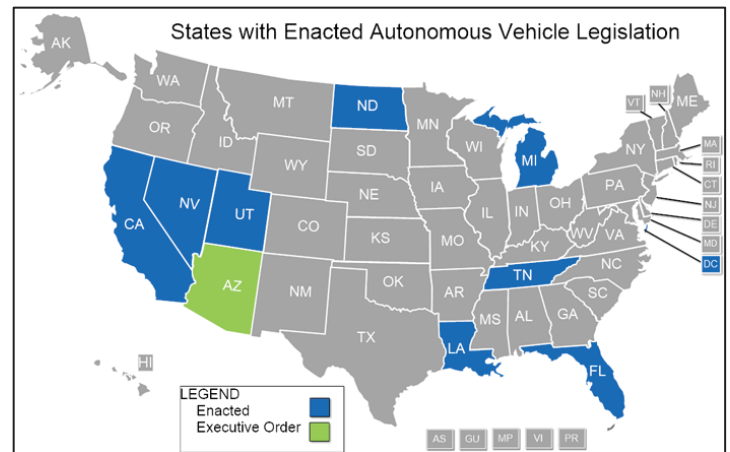
Date: September 13, 2016

Source: <http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx>

Abstract: Nevada was the first state to authorize the operation of autonomous vehicles in 2011. Since then, seven other states—California, Florida, Louisiana, Michigan, North Dakota, Tennessee and Utah—and Washington D.C. have passed legislation related to autonomous vehicles. Arizona's governor issued an executive order to support testing and operating self-driving vehicles on public roads within Arizona."

Florida's legislation, passed in 2012, declared the legislative intent to encourage the developing, testing and operating motor vehicles with autonomous technology on public roads of the state and found that the state does not prohibit nor specifically regulate the testing or operating autonomous technology in motor vehicles on public roads. Florida's 2016 legislation expands the allowed operation of autonomous vehicles on public roads and eliminates requirements related testing of autonomous vehicles and the presence of a driver in the vehicle

Virginia's governor [announced](#) in early June, 2016, a partnership allowing research and development for autonomous vehicles to take place in the state with "Virginia Automated Corridors."



Information on each state can be found at: <http://www.ncsl.org/research/transportation/autonomous-vehicle-legislation.aspx>.

Potential for Pilot Project¹

Near-term²: Likely, as Florida legislation allows such programs

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: While the private sector is developing the vehicles, government investment in infrastructure to allow V2I (Vehicle-to-Infrastructure) communications will be significant and have to compete with other transportation priorities.

Mid-term: Same as above

Long-term: Same as above

Cost Implications:

Near-term: Limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term

Long-term: Greater savings than in the mid-term-term

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #8 Federal Automated Vehicles Policy

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: U.S. Department of Transportation and National Highway Traffic Safety Administration

Date: September 20, 2016

Source: <https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf>

Abstract: 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 for improving safety and mobility for Americans on the road. U.S. Transportation Secretary Anthony Foxx stated: *“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.”* The policy is divided into four sections:

Safety Assessment – Covers the following areas: 1) Data Recording and Sharing; 2) Privacy; 3) System Safety; 4) Vehicle Cybersecurity; 5) Human Machine Interface ; 6) Crashworthiness; 7) Consumer Education and Training; 8) Registration and Certification; 9) Post-Crash Behavior; 10) Federal, State and Local Laws; 11) Ethical Considerations; 12) Operational Design Domain; 13) Object and Event Detection and Response; 14) Fall Back (Minimal Risk Condition); and, 15 Validation Methods

Model State Policy – This section presents a clear distinction between Federal and State responsibilities for regulation of highly automated vehicles, and suggests recommended policy areas for states to consider with a goal of generating a consistent national framework for the testing and deployment of highly automated vehicles.

NHTSA’s Current Regulatory Tools – This discussion outlines NHTSA’s current regulatory tools that can be used to ensure the safe development of new technologies, such as interpreting current rules to allow for greater flexibility in design and providing limited exemptions to allow for more-timely testing of nontraditional vehicle designs.

Modern Regulatory Tools – This discussion identifies new regulatory tools and statutory authorities that policymakers may consider in the future to aid the safe and efficient deployment of new lifesaving technologies.

More details about the policy may be found at www.transportation.gov/AV.

Potential for Pilot Project¹

Near-term²: The policy will have immediate effects on the deployment of AVs. Pilot projects will spread over time.

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: While the private sector is developing the vehicles, government investment in infrastructure to allow V2I (Vehicle-to-Infrastructure) communications will be significant and have to compete with other transportation priorities.

Mid-term: Same as above

Long-term: Same as above

Cost Implications:

Near-term: Limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term

Long-term: Greater savings than in the mid-term-term

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

Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #9 Dual-Mode Vehicle and Infrastructure Alternatives Analysis
Category: A. AV/CAV SUBCATEGORY A.1 – Cars
Author(s)/Sponsoring Agency: Christine Ehlig-Economides and Jim Longbottom / Texas Department of Transportation
Date: April 2008
Source: http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-5827-1.pdf http://faculty.washington.edu/jbs/itrans/dualmode.htm http://www.overlandats.com/
Abstract: The United States has a transportation challenge that requires addressing four issues simultaneously: traffic congestion, environmental pollution, safety, and energy security. A potential solution is the concept of dual-mode system of vehicles that can be driven on conventional streets, and also operate on a high-speed automated, usually electrified, guideway under computer control. Both passenger and freight vehicles are envisioned. In some systems, vehicles are carried on pallets, on others no pallets are required. Five systems were chosen for evaluation because of their technology readiness. While none of the systems was judged ready for commercialization, potential benefits of the technology warranted further development. Stakeholder interviews and a survey of collaboration mechanisms identified organizational and research paths that would enable accelerated development of a system capable of handling personal vehicles, public transit, and driverless freight movement on a common 21st century infrastructure. The Center for Energy, Environment and Transportation Innovation was started at Texas A&M University in July, 2005. A one-year study of various dual-mode concepts was undertaken at CEETI in September, 2006. The final report was published in April, '08 entitled Dual Mode Vehicle and Infrastructure Alternatives Analysis. It is the most extensive study and documentation of the dual-mode concept currently available. One of the recommendations is to <i>“engage the private sector in implementing the new mode with the goal of a 20-year full implementation of a national system, which should be explored to achieve a new level of energy security by 2035”</i>. Interestingly, while the CEETI is inactive, the private sector, in the form of the Space Exploration Technologies Corporation (SpaceX) has, in a way, advanced the basic concept through the Hyperloop.
Potential for Pilot Project¹
Near-term²: Dual-mode is not possible.
Mid-term³: Highly unlikely because the concept has not been adequately advanced.
Long-term⁴: Same as above
Cost to Implement
Near-term: Unknown, but likely very expensive.
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: If ever implemented, potential savings in time, congestion, crash-related costs can be expected.
Mid-term: Same as above
Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: # 10 Cheap Lidar: The Key to Making Self-Driving Cars Affordable

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: Evan Ackerman, IEEE Spectrum

Date: September 22, 2016

Source: <http://spectrum.ieee.org/transportation/advanced-cars/cheap-lidar-the-key-to-making-selfdriving-cars-affordable>

Abstract: That distinctive spinning device on the roof of a driverless vehicle helps the vehicle understand the world around it and keeps autonomous vehicles from being affordable for the average consumer. Currently lidar's (light radar) size, complexity, and cost are significant obstacles to the commercialization of any technology that depends on it. But within the next few years, it is expected to become less expensive.

Lidar, similar to radar, detects objects with pulses of laser light. Lidar has a shorter range than radar which results in a massive increase in resolution. Many experts assert that lidar is a necessity for driverless vehicles because it enables highly precise localization across a wide range of conditions.

Many autonomous cars have relied on the HDL-64E lidar sensor from Silicon Valley-based Velodyne, each of which costs \$80,000. This year, Velodyne announced a new device with a target cost of \$20,000. But, it will be too expensive to be integrated into driverless cars intended for the consumer market.

Another company, Quanergy Systems, projects that its sensor will cost \$250 in volume production, and it should be available to automotive original equipment manufacturers in early 2017. Meanwhile, two startups which are working on \$100 automotive lidar systems indicate they will be released in 2018. Innoviz, in Israel, is promising a "high-definition solid-state lidar" with better resolution and a larger field of view than those in existing sensors. Innoluce, in the Netherlands, is using a microelectromechanical mirror system to scan and steer a laser beam instead of the solid-state approach; its engineers claim it will outperform optical phased arrays in both range and resolution.

The market for a small and cost-effective solid-state lidar system is immense. In August, Quanergy closed a \$90 million funding round on a \$1.59 billion valuation, while Ford and Chinese giant "search" company, Baidu, jointly invested \$150 million in Velodyne. The goal of these investments is to make a \$100 automotive lidar sensor available within the next few years.

Potential for Pilot Project¹

Near-term²: Certain, because of the AV market need

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Lidar sensors dropping from \$80,000 per to as low as \$100 per.

Mid-term: Lidar sensors in the hundreds of dollars making AV affordable to the average consumer.

Long-term: Same as above

Cost Implications

Near-term: Making AVs affordable to the average consumer will affect travel safety, congestion, time, insurance, and more.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #11 Autonomous vehicles could cost America 5 million jobs.

Category: A. AV/CAV SUBCATEGORY A.1 – Cars

Author(s)/Sponsoring Agency: Steven Greenhouse, author of *“The Big Squeeze: Tough Times for the American Worker”* and the *Los Angeles Times*

Date: September 23, 2016

Source: <http://www.latimes.com/opinion/op-ed/la-oe-greenhouse-driverless-job-loss-20160922-snap-story.html>

Abstract: Driverless cars will create some big corporate winners, but they will produce some losers too, notably among the 5 million people nationwide who drive taxis, buses, vans, trucks and for Uber and Lyft. That’s almost 3% of the workforce, according to Lawrence Katz, a labor economist at Harvard. Most of these drivers belong to the same demographic as many factory workers — men without college degrees. It’s not just the driver jobs who will be impacted—loss of business may affect employment at auto dealerships, car washes, gas stations and parking lots.

While this forecast is sobering, some say it can be addressed in a win-win situation, particularly because, unlike many previous technologies that took Americans almost by surprise, it is clear that the autonomous car revolution is coming, providing time to plan for its job impact. But, that was said about the manufacturing and coal industries. Yet, little was/is being done

The solution can be a retraining program so workers are not consigned to a long-term joblessness. Congress could enact a nationwide “green light” for driverless vehicles while, at the same time, establishing a levy on each driverless mile to finance programs for retraining, adjustment assistance, unemployment insurance and, perhaps, government jobs. These programs can also benefit the manufacturing and coal industries.

Potential for Pilot Project¹

Near-term²: Some job-loss impact.

Mid-term³: The job-loss impact will begin to be felt.

Long-term⁴: The job-loss impact will be full-on.

Cost to Implement

Near-term: Significant federal-government investment will need to be in place to address future job losses.

Mid-term: Same as above.

Long-term: Same as above.

Cost Implications

Near-term: Some job losses if retraining programs are not in place.

Mid-term: Greater job losses than in the near-term if retraining programs are not in place.

Long-term: Even greater job losses than in the mid-term if retraining programs are not in place.

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #12 MDC MPO Aerial Cable Transit Feasibility Study
Category: A. AV/CAV SUBCATEGORY A.2 – PoDs
Author(s)/Sponsoring Agency: Jacobs Engineering for the MDC TPO
Date: February, 2016
Source: http://miamidadetpo.org/library/studies/aerial-cable-transit-feasibility-study-final-report-2016-02.pdf
Abstract: The Miami-Dade TPO is interested in understanding the applicability and potential benefits of Aerial Cable Transit (ACT), commonly known as gondolas. ACT offers the potential for reduced right-of-way impacts in that ACT is not a continuous corridor but, instead, is limited to the footprint of the cable support poles and station areas. This type elevated operation allows ACT systems to bypass obstacles, avoid retrofitting streets, reduce the need for high-value right-of-way acquisition and minimize potentially adverse impacts to valuable public and private assets. As such, some heavily-populated densely developed urban areas have implemented ACT over other traditional transit infrastructure. An MDC TPO feasibility study focused on implementing ACT over distances of one to three miles as an extension of the existing rapid transit network to connect to Florida International University (FIU), the Miami Intermodal Center (MIC), Marlins Park/Little Havana, the Health District, Downtown Miami, Port of Miami and South Miami Beach. The study considered existing and planned ACT systems throughout the world, evaluating each for their unique characteristics. It also evaluated each technology for its feasibility within the context of the Miami-Dade Transit System. After studying a number of options, the study chose the 1.2 mile, two-station Marlins Park (Little Havana)-to-Downtown alignment for the ACT because the short length and two-station arrangement would be economically attractive as a demonstration project with relatively low capital and operating costs. Technological risks related to climate control would be mitigated by short trip lengths. This option serves clearly-established markets related to parking demand, entertainment, and cultural activities tapping into several reliable and substantial sources of passenger demand.
Potential for Pilot Project¹
Near-term²: Not likely
Mid-term³: Possible
Long-term⁴: More likely provided it is cost-effective compared to other alternatives.
Cost to Implement
Near-term: \$35 million
Mid-term: \$35 million plus inflation from 2016 to year of implementation
Long-term: \$35 million plus inflation from 2016 to year of implementation
Cost Implications
Near-term: Improved service at a reasonable cost compared to other alternatives.
Mid-term: Improved service at a reasonable cost compared to other alternatives.
Long-term: Improved service at a reasonable cost compared to other alternatives.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: # 13 Maglev Pod Transit-**skyTran**

Category: A. AV/CAV SUBCATEGORY A.2 – PoDs

Author(s)/Sponsoring Agency: Fortune.com

Date: November 24, 2015; January, 2016; May 5, 2016

Source: <http://fortune.com/2015/11/24/skytran-maglev-pod-system-tel-aviv/>, <https://en.wikipedia.org/wiki/SkyTran>,
<http://fortune.com/2015/11/24/skytran-maglev-pod-system-tel-aviv/>, <https://en.wikipedia.org/wiki/SkyTran>

Abstract: **skyTran** is a lightweight two-passenger Pod suspended from elevated passive magnetic levitation tracks. It is expected by its developer to achieve a fuel economy of 200+ miles per US gallon and travel at 155 miles per hour. A 900-foot demonstration track is being built on the campus of Israel Aerospace Industries near Tel Aviv. It was initially projected to be completed by the end of 2015. As of January 2016 work is ongoing. Nonetheless, the developer has plans that by the end of 2016, it will start construction of a 25-mile track in Lagos, Nigeria. An exact route in the city has not yet been planned.

SkyTrans' aluminum rail levitates with help from gravity, a magnet, and a short burst of electricity. Once the Pod reaches 10 mph, it is to glide and accelerate without any additional power. The developer says it will only cost about \$13 million per mile to build, whereas a subway system can cost at least \$160 million for the same distance.

There are still plenty of uncertainties about where **skyTran** could fit into a city's overall transit picture. Depending on variables like follow distance, load times, and network density, a **skyTran** system might or might not be able to move as many people as a conventional light rail or rapid bus system. And, of course, bringing something this complex into the real world always involves uncertainty. As noted above, the current target for the demonstration system in Israel already represents a delay of almost a year from previous goals.

Potential for Pilot Project¹

Near-term²: Unrealistic

Mid-term³: Uncertain

Long-term⁴: Possible

Cost to Implement

Near-term: Developer claims \$13 million per mile. But actual cost is still to be determined.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Speculative, at best

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet	
Topic: # 14 AV Transit	
Category: A. AV/CAV SUBCATEGORY A.3 – Transit	
Author(s)/Sponsoring Agency: Damon Beres, Huffington Post	
Date: June 16, 2016	
Source: http://www.huffingtonpost.com/entry/ibm-local-motors-olli_us_5762975be4b05e4be860f03c	
Abstract: IBM and Local Motors debuted a new self-driving electric vehicle, called the “Olli”, in National Harbor, Maryland, on June 16, 2016. The small bus is capable of transporting 12 people at once. Because it uses IBM’s “Watson” system, pulling vast amounts of data on its surroundings from a variety of sources, the vehicle is smart enough to answer questions from passengers and learn from its environment. For example, if you use the service enough it could eventually determine your general path to work every morning. If you’re running late one day — or Watson uses weather data to assess that it’s about to rain, or that traffic will get worse — Olli might tell you there’s no time for Starbucks. Ask it when you’ll arrive at your destination and it can answer. The vehicle will be available to the public in National Harbor at “select times” in the summer of 2016. Later in 2016, it will be deployed in Florida’s Miami-Dade County and Las Vegas.	
Potential for Pilot Project ¹	
Near-term²: Immediate, as a pilot	
Mid-term³: Same as above	
Long-term⁴: Same as above	
Cost to Implement	
Near-term: Little, if anything, to the public sector	
Mid-term: Same as above	
Long-term: Same as above	
Cost Implications	
Near-term: On a “pilot” basis, limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance. On a wide-scale basis, if AVs are widely available, there will be greater savings in the above-listed areas.	
Mid-term: Greater savings than in the near-term	
Long-term: Greater savings than in the mid-term	

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #15 Self-driving buses take to roads alongside commuter traffic in Helsinki
Category: A. AV/CAV SUBCATEGORY A.3 – Transit
Author(s)/Sponsoring Agency: Samuel Gibbs, <i>The Guardian</i>
Date: August 18, 2016
Source: https://www.theguardian.com/technology/2016/aug/18/self-driving-buses-helsinki
Abstract: Two self-driving buses rolled out in August, 2016, on the public roads of Helsinki, Finland, alongside traffic and commuters, in one of the first trials of its kind. The Easymile EZ-10 electric mini-buses, capable of carrying up to 12 people, will roam the open roads of Helsinki’s in a month-long trial, negotiating traffic for the first time. Finland has become a hotbed of automated technology development and testing because, unlike most of the rest of the world, Finnish law does not require vehicles on public roads to have a driver. This eliminates the red tape encountered in testing autonomous vehicles on public roads in the US and Europe. The city traffic will provide challenging scenarios for the buses to overcome, as they have to keep pace with commuters and other road users, who may not be predictable. The buses have a maximum speed of 40km/h (25 mph) but will travel at an average speed of 10km/h (6mph), making them unusually slow-moving vehicles during non-gridlocked times. The automated buses are being seen as possible an extension of Finland’s public transport system, moving commuters into higher-volume transport systems where costs of alternative transport have proved prohibitive, rather than replacing all human-driven buses. Helsinki is two years into its 10-year plan to make car ownership pointless through point-to-point “mobility on demand” systems, but operating such a system has proven difficult. The smart municipal bus service, Kutsuplus, which integrated a system similar to Uber and other app-based ride hailing service, was shut down after a year due to costs and the low volume of passengers, according to the city.
Potential for Pilot Project¹
Near-term²: High, on a limited basis
Mid-term³: Higher and broader than near-term
Long-term⁴: Very high and on a broad basis
Cost to Implement
Near-term: Unknown at this time, as vehicles are still under development
Mid-term: Unknown at this time, as vehicles are still under development
Long-term: Unknown at this time, as vehicles are still under development
Cost Implications
Near-term: Limited savings in cost associated with congestion
Mid-term: Greater savings than in the near-term
Mid-term: Greater savings than in the mid-term

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #16 Forecast of How The IoT Will Affect **Mass Transit**

Category: A. AV/CAV SUBCATEGORY A.3 – Transit

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider*

Date: November, 2015

Source:



the internet of
things 2015- exan

Abstract: Modes of mass transportation, including planes, trains, and buses, are using internet connectivity to help improve customer satisfaction and reduce maintenance costs. Here's how major players like Delta, Amtrak, and Greyhound are seeing the value in IoT connectivity:

- Internet-connected sensors within planes help maintenance workers ensure safety and that the aircraft are meeting FAA regulations. In addition, offering internet connectivity to passengers enhances their in-flight experience and results in incremental revenue.
- Similar to airlines, bus and train companies now connect their coaches with Wi-Fi to improve the customer experience.

The top four providers of in-flight connectivity — Gogo, Global Eagle, Thales/LiveTV, and Panasonic — have connected 3,340 out of a potential 5,500 commercial aircrafts in North America, or 60% of the total addressable market, according GoGo and Boeing earnings presentations. In addition, these players are planning to expand their offerings to the more than 15,000 global commercial aircraft.

It is forecast that the IoT could potentially add between \$9 billion and \$33 billion in economic impact for train maintenance. This equates to a 10%-40% reduction in service cost, 50% less downtime, and 3%-5% longer equipment life.

Potential for Pilot Project¹

Near-term²: Essential if mass transportation is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Lower operating costs.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #17 Car giants see road to riches in sharing
Category: A. AV/CAV SUBCATEGORY A.4 – Car Sharing
Author(s)/Sponsoring Agency: News Republic
Date: June 12, 2016
Source: https://www.yahoo.com/news/car-giants-see-road-riches-sharing-062326758.html
Abstract: Experts say the status quo of individual car ownership will become untenable, globally, as more people enter the middle class and move to urban centers. As a replacement, shared vehicles that are smart enough to find efficient routes and get passengers close to their destinations could reduce congestion and help the environment. As a result, auto giants are racing to invest in car- and ride-sharing services, lured by the prospect of fat profits yet to be tapped from a billion cars on the world's roads. That is incentive enough for manufacturers from Toyota to Volkswagen to General Motors to join an investment rush, apparently without fear of ushering in a future in which individual car ownership is no longer king. GM invested in 2016 \$500 million in Lyft, one of the chief competitors to Uber in the United States. Last month, Toyota announced a strategic partnership with Uber, with an undisclosed investment. Volkswagen invested \$300 million euros \$336 US) into taxi app Gett on the same day. While automakers see an opportunity, it is too early to accurately assess the potential value of the young car-sharing industry, experts say. And they also don't expect the kind of traditional ownership and sales model to disappear anytime soon. These experts forecast that majority of auto sales, at least until 2035, will remain for private ownership. Even if the future brings self-driving vehicles combined with car-hailing apps to offer a service rivalling private ownership, the market for auto manufacturers could survive. When autonomous vehicles are added to car sharing and ride sharing, those vehicles will be making many more trips and will need replacement much faster than vehicles that are privately owned. Nonetheless, manufacturers, now concerned primarily with building and selling vehicles, will have to decide how to adapt to a market of car-related services.
Potential for Pilot Project ¹
Near-term²: Immediate, as a pilot
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Little, if anything, to the public sector
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: On a “pilot” basis, limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance. On a wide-scale basis, if AVs are widely available, there will be grater savings in the above-listed areas.
Mid-term: Greater savings than in the near-term
Long-term: Greater savings than in the mid-term

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #18 General Motors' Maven is all about car sharing, not ride sharing

Category: A. AV/CAV SUBCATEGORY A.4 – Car Sharing

Author(s)/Sponsoring Agency: Andrew Krok, ROAD|SHOW by cnet

Date: January 20, 2016

Source: <https://www.cnet.com/roadshow/news/general-motors-maven-car-sharing/>

Abstract: Ride-sharing is when a car owner drives you around. Car sharing is when you share a vehicle with others who are nearby. General Motors unveiled in January, 2016, its new car-sharing enterprise known as Maven. Using Maven's app, a potential user searches for a vehicle that fits her/his need – small cars for smaller tasks, like grocery shopping, larger cars for larger tasks like a trip to transport a mattress. Once the vehicle is secured, the phone acts as the key, unlocking and starting the vehicle. Every Maven-branded vehicle comes with Apple CarPlay, Android Auto, satellite radio and a 4G LTE Internet connection. The goal of providing these features is to make a vehicle from Maven feel more personal.

Maven started its operation at the University of Michigan at Ann Arbor. GM expects to expand to residential neighborhoods in Chicago and New York in the future. In Ann Arbor, GM will provide Chevrolet vehicles in parking spots across the city to students and faculty at the University of Michigan. *Wired Magazin* reported that the initial program is free to join, and gas and insurance are included for as little as \$6 an hour.

GM is also working with the CarUnity program in Germany for what it calls a "peer-to-peer" approach to car sharing, which involves individuals renting their personal cars for others to use.

Potential for Pilot Project¹

Near-term²: Ongoing in Ann Arbor, Michigan

Mid-term³: Likely in many areas.

Long-term⁴: Same as above.

Cost to Implement

Near-term: Little, if anything.

Mid-term: Same as above.

Long-term: Same as above.

Cost Implications

Near-term: Savings to the consumer by not having to buy a vehicle and the costs associated with Insurance, maintenance, and the like.

Mid-term: Same as above.

Long-term: Same as above.

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #19 Driverless Technology and the Ambulance of the Future

Category: A. AV/CAV SUBCATEGORY A.5 – Emergency Vehicles

Author(s)/Sponsoring Agency: Rachel Walwood / Fisdap (<http://www.fisdap.net>)

Date: July 23, 2015

Source: <http://www.fisdap.net/blog/driverless-technology-and-ambulance-future>
<https://designmind.frogdesign.com/2015/11/the-future-of-autonomous-emergency-response/>
<http://www.express.co.uk/life-style/science-technology/568243/Driverless-NHS-Ambulances-Red-Light-Green-Newcastle>
<http://www.autoblog.com/2016/09/12/google-autonomous-car-emergency-lights/>
<https://herox.com/news/189-the-evolution-of-uavs-the-ambulance-drone>
<https://www.theguardian.com/technology/2016/jan/13/airmule-first-autonomous-ambulance-drone-takes-flight>

Abstract: The evolution of autonomous vehicles will have far reaching impacts to several industries, and in general, life as we know it today. Emergency response vehicles are not being overlooked. There are numerous benefits – and some downsides as well – to developing an autonomous emergency vehicle, such as an autonomous ambulance. Currently, an ambulance has room for two EMT's on board. The remainder of the space in or on the "rig" is maximized to provide as much room for equipment and storage as possible, in addition to room to work on/around the patient, and the patient herself/himself. One of the two EMT's on-board an ambulance today is responsible for driving the vehicle. However, when an emergency is in progress, having a second EMT available to work on a patient while in commute, vs the need for the second EMT to drive the ambulance to the hospital, can potentially save lives. Autonomous ambulances would also have the ability to position/re-position themselves to other locations, while the EMT crew rests. There will also be potential downside of an autonomous ambulance which may reduce the number of EMT's needed in the workforce.

As drones use continues to evolve, there is potential for ambulance drones (or AirMule's) to transport patients to a hospital. Drone ambulances are designed to take off and land vertically like a helicopter, but can land virtually anywhere, as they occupy about the same space as a small car. An ambulance drone can be deployed with one EMT who can focus solely on the patient, while the drone transports the patient to the hospital autonomously. One ideal candidate to develop ambulance drones is the US military. Ambulance drones could be used in combat to remove injured soldiers from a battle scene without risking further injuries to additional personnel.

Potential for Pilot Project¹

Near-term²: Some, but limited, potential as the AV interest is in larger segments of the automotive market.

Mid-term³: Still limited 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 drives to the hospital autonomously.

Long-term⁴: High likelihood for AV ambulances and Ambulance drones (AirMule's). Current limitations and restrictions on drone flights that must be resolved are weight and capacity.

Cost to Implement

Near-term: Near term cost will depend on how quickly the industry wants this technology to advance. If the industry waits for fully autonomous vehicles (Level 4) to be developed by automakers and others, the cost to implement could be relatively low.

Mid-term: Same as above.

Long-term: The cost to implement ambulance drones could be significant – like autonomous ambulances – if the industry decides to advance without waiting on other industries to develop the technology first.

Cost Implications

Near-term: Autonomous ambulances have the potential to improve safety by communicating with traffic signals to change the signals to green for the ambulance to proceed without interruption.

Mid-term: With the implementation of fully AV ambulances, two EMTs would be dedicated to patient care. Increasing the potential to save more lives, thus reducing the cost of medical care as a whole.

Long-term: Ambulance drones could deploy virtually anywhere, land virtually anywhere, and improve safety and response times, thus greatly decreasing the cost of emergency medical care by potentially saving time, money, and, ultimately, patient's lives.

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #20 Daimler Tests Self-Driving Truck Platoon in Live
Category: A. AV/CAV SUBCATEGORY A.6 – Freight
Author(s)/Sponsoring Agency: Jerry Hirsch, <i>Trucks.com</i>
Date: March 21, 2016
Source: https://www.trucks.com/2016/03/21/daimler-tests-self-driving-truck-platoon-in-live-traffic/
Abstract: Daimler introduced in 2015 its Freightliner Inspiration Truck. Two of the Inspiration trucks were approved for use on Nevada highways in May 2015. In 2014, Daimler released its first autonomous vehicle, called the Mercedes-Benz Future Truck, in Europe. The German automaker believes that adding autonomous features to heavy-duty trucks can transform long-haul trucking, relieving driver stress, improving safety and potentially alleviating a chronic industry driver shortage. Daimler Trucks tested three autonomous driving big-rigs in a tight “platoon” formation on an open stretch of German highway. The test, in live traffic, demonstrated that such formations can reduce fuel consumption by up to 7 percent while also cutting emissions. Connected trucks traveling in a platoon require spacing of about 50 feet instead of the 150 feet required by regular big-rigs. Smaller spacing produces a significant reduction in aerodynamic drag – similar to the slipstream bicycle racers employ in the giant pelotons in the Tour de France. The technology also reduce the trucking industry’s labor expenses Labor typically makes one-third of a firm’s cost of operating each truck. While such technology holds promise, issues must be resolved, such as Insurance and safety, maintenance, management of regulatory requirements, among others.
Potential for Pilot Project¹
Near-term: Wide-scale use of AV trucks not expected.
Mid-term: More prevalent use of AVs is expected than in the near-term
Long-term: Wide-scale use of AVs is expected
Cost to Implement
Near-term: Limited government investment is expected to address road infrastructure.
Mid-term: More investment by government than in the near-term in road infrastructure.
Long-term: Considerable investment by government in road infrastructure.
Cost Implications
Near-term: Limited savings in cost associated with property damage, medical services, legal and court actions, insurance.
Mid-term: Greater savings than in the near-term, including labor/driver costs.
Long-term: Greater savings than in the mid-term

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #21 Autonomous Vehicles: What Fleets Want

Category: A. AV/CAV SUBCATEGORY A.6 – Freight

Author(s)/Sponsoring Agency: Sean Kilcarr | Alert Driving.com and Paul Menig, Fleet Owner

Date: February, 2016

Source: <http://www.alertdriving.com/home/fleet-alert-magazine/north-america/autonomous-vehicles-what-fleets-want>

Abstract: A recent survey conducted by the Technology & Maintenance Council (TMC) and the American Transportation Research Institute (ATRI) of 32 executives representing 31 fleets found that the majority expect AVs to become reality at some future point. However, completely driverless vehicles—ones that are hands off the wheel as well as foot off the accelerator and brake—are not really what they are talking about here. 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.

The real barriers to AV adoption from a fleet perspective are how they deal with bad weather such as ice and heavy rain and the resulting road conditions.

Research that indicates the current incremental cost of AV systems is about \$30,000, for kits that would turn existing trucks into autonomous. That cost covers sensors, telematics upgrades, human-to-machine interface connections, driveline enhancements, and software algorithms. It is predicted early-stage autonomous commercial vehicles will see active use on North American roadways by 2025—largely in platooning operation; the total incremental cost for driverless systems won’t decline by more than 10% to \$27,000 by then. This is due to information technology (IT) needs centered around cybersecurity and safety. As a result, it is not expected that fully autonomous trucks will be deployed on U.S. roadways for at least another two decades. From a global perspective, it is forecast that 8000 autonomous-enabled trucks will be sold worldwide by 2025 for on-road applications, rising to 182,000 units by 2035.

Potential for Pilot Project¹

Near-term: Wide-scale use of AV trucks not expected.

Mid-term: More prevalent use of AVs is expected than in the near-term

Long-term: Wide-scale use of AVs is expected

Cost to Implement

Near-term: Limited government investment is expected to address road infrastructure.

Mid-term: More investment by government than in the near-term in road infrastructure.

Long-term: Considerable investment by government in road infrastructure.

Cost Implications

Near-term: Limited savings in cost associated with property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term, including labor/driver costs.

Long-term: Greater savings than in the mid-term

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

Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #22 Otto Moving with 'Urgency' to Introduce Autonomous Truck Tech <i>and</i> Uber Acquires Otto Self-Driving Truck Startup, Signs Volvo Deal
Category: A. AV/CAV SUBCATEGORY A.6 – Freight
Author(s)/Sponsoring Agency: Tony Dreibus, <i>Trucks.com</i> and Jerry Hirsch, <i>Trucks.com</i>
Date: August 16, 2016 and August 18, 2016
Source: https://www.trucks.com/2016/08/16/otto-autonomous-truck-tech/ https://www.trucks.com/2016/08/18/uber-acquires-otto-self-driving-truck-startup/
Abstract: Otto, a company launched in January, 2016, to develop self-driving truck technology was purchased by Uber in August, 2016, for \$680 million. Otto is engineering kits that would turn existing trucks into autonomous vehicles. Five test vehicles, in the initial test phase, are designed to have a driver on board to monitor progress and be ready to take over in an emergency. Otto is developing how to essentially put a robotic brain into a truck to transform it into an intelligent vehicle. Otto's technology is intended to improve safety and reduce driver fatigue on long trips. Sensors on the truck including radar, lidar, and cameras will help computers paint a digital picture of the vehicle's surroundings. Software then determines speed, braking, acceleration and other functions as the truck moves down the highway. Once the test vehicle phase is complete, Otto plans to install the kit on trucks owned by private fleets or owner-operators so drivers can learn how the technology would affect their driving habits. The goal is for Otto to become a driving assistant for operators who are open to new technologies. The company also is looking to place its autonomous technology with fleet operators who would consider adding autonomous driving technology to their vehicles.
Potential for Pilot Project¹
Near-term: Wide-scale use of AV trucks not expected.
Mid-term: More prevalent use of AVs is expected than in the near-term
Long-term: Wide-scale use of AVs is expected
Cost to Implement
Near-term: Limited government investment is expected to address road infrastructure.
Mid-term: More investment by government than in the near-term in road infrastructure.
Long-term: Considerable investment by government in road infrastructure.
Cost Implications
Near-term: Limited savings in cost associated with property damage, medical services, legal and court actions, insurance.
Mid-term: Greater savings than in the near-term, including labor/driver costs.
Long-term: Greater savings than in the mid-term

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #23 TRUCK DRIVER SHORTAGE ANALYSIS 2015
Category: A. AV/CAV SUBCATEGORY A.6 – Freight
Author(s)/Sponsoring Agency: Bob Costello and Rod Suarez, American Trucking Associations
Date: December, 2015
Source: http://www.trucking.org/ATA%20Docs/News%20and%20Information/Reports%20Trends%20and%20Statistics/10%206%2015%20ATAs%20Driver%20Shortage%20Report%202015.pdf
Abstract: Across the country, the trucking industry faces a 40,000-person shortage, according to the American Trucking Associations. That number is expected to escalate as truckers age out of the workforce, creating supply chain issues across the country. The average trucker is 49 years old compared to the average U.S. worker, who is 42 years old. If the current trend holds, the shortage may balloon to almost 175,000 by 2024. Over the next decade, the trucking industry will need to hire a total 890,000 new drivers, or an average of 89,000 per year. Replacing retiring truck drivers will be by far the largest factor, accounting for nearly half of new driver hires (45%). The second largest factor will be industry growth, accounting for 33% of new driver hires. The industry has historically struggled to attract all segments of the population. Females make up 47% of all U.S. workers, yet only comprise 6% of all truck drivers. This share has been essentially unchanged over time. Conversely, today 39% of drivers are minorities, which has jumped 12 percentage points from 27% in 2001. If the trend continues, there will likely be severe supply chain disruptions resulting in significant shipping delays, higher inventory carrying costs, and perhaps shortages at stores. Because trucks account for 69% of all tonnage moved in the U.S., it is highly unlikely that the driver shortage could be reduced in any significant manner through modal shift (i.e., shifting a large amount of freight from the highway to the rails or another mode).
Potential for Pilot Project ¹
Near-term²: Not applicable (NA)
Mid-term³: NA
Long-term⁴: NA
Cost to Implement
Near-term: NA
Mid-term: NA
Long-term: NA
Cost Implications
Near-term: The shortage of truck drivers will likely lead to supply chain disruptions resulting in shipping delays, higher inventory carrying costs, and perhaps shortages at stores
Mid-term: Same as above
Long-term: Same as above

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



Topic: #24 Forecast of How The IoT Will Affect Logistics

Category: A. AV/CAV SUBCATEGORY A.6 – Freight

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider* and James Macaulay, Lauren Buckalew, Gina Chung, DHL Trend Research | Cisco Consulting Services

Date: November, 2015

Source:  the internet of things 2015- examin and http://www.dhl.com/content/dam/Local/Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf

Abstract: IoT devices will save logistics businesses billions by helping move goods and assets through their supply chains and warehouses faster and more cheaply because:

- Fleets of connected vehicles will cut travel time and costs by taking the most efficient route possible thanks to real-time traffic updates.
- Tracking sensors placed on parcels and shipping containers will help reduce costs associated with lost or damaged goods.

Increased automation will help companies reduce labor costs and increase productivity in warehouses. Improved logistics routing could create more than \$253 billion in economic value in 2025. Global spending on commercial telematics solutions that provide real-time updates to help vehicles take the most efficient route possible will grow from \$20 billion in 2015 to \$47.5 billion in 2020. Investment in IoT devices and systems for tracking and securing goods through logistics and warehouse supply chains will increase from \$5 billion to \$20.5 billion over the same period.

Installations of new industrial robots will reach 416,000 in 2020. Warehouses will be fast adopters of industrial robots. Amazon is already a good example, with nearly 20,000 Kiva robots operating in its warehouses. Each Kiva robot saves more than \$500,000 in annual labor costs.

To successfully implement IoT in logistics will require strong collaboration, along with high levels of participation between different players and competitors within the supply chain, and a common willingness to invest. The shared end goal will be to create a thriving IoT ecosystem. To achieve this, there will be some key success factors required: 1) Clear and standardized approach for the use of unique identifiers for various types of assets among different industries on a global scale; 2). Seamless interoperability for exchanging sensor information in heterogeneous environments; 3) Trust and ownership of data and overcoming privacy issues in the IoT-powered supply chain; 4) Clear focus on reference architecture for the IoT; and, 5) Change in the business mindset to embrace the full potential of the Internet of Things.

Potential for Pilot Project¹

Near-term²: Essential if a logistics business is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased productivity, decreased costs.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #25 Could autonomous trucks be the next weapon for terrorists?

Category: A. AV/CAV SUBCATEGORY A.6 – Freight

Author(s)/Sponsoring Agency: Daniel Bukszpan, special to CNBC.com

Date: July 21, 2016

Source: <https://www.fueloyal.com/self-driving-trucks-tehnology-and-consequences/>
<http://www.cnbc.com/2016/07/21/could-autonomous-trucks-be-the-next-weapon-for-terrorists.html>
<https://www.theguardian.com/technology/2015/sep/07/hackers-trick-self-driving-cars-lidar-sensor>
<https://www.theguardian.com/technology/2016/mar/13/autonomous-cars-self-driving-hack-mikko-hypponen-sxsw>
<http://www.autoinsurancecenter.com/top-20-pros-and-cons-associated-with-self-driving-cars.htm>

Abstract: A serious concern has developed that autonomous trucks can be used as weapons in terrorist attacks. The concern became widely explored when, on July 14, 2016, a 19-ton cargo truck drove into a crowd in Nice, France, killing 84 people. The driver claimed he carried out the attack on behalf of the Islamic State.

Autonomous trucks operate using Wi-Fi-connected artificial intelligence. Anything that uses Wi-Fi can theoretically be hacked, including vehicles, as revealed last year in St. Louis, Missouri, when hackers hijacked a Jeep Cherokee's brakes, dashboard functions, steering and transmission by remotely hacking into its Wi-Fi-connected entertainment system from a laptop 10 miles away.

If a truck communicates its location, speed and fuel level to headquarters, somebody could intercept that message and trick the truck into thinking the person was 'fleet headquarters'. A malicious actor or group could reprogram a truck and use it as a missile as a way to target innocent people.

Potential for Pilot Project¹

Near-term²: NA

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: NA

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: NA

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #26 Shippers setting sail via Internet of (Floating) Things **and** Optimizing Port Ecosystems with IoT Analytics

Category: A. AV/CAV SUBCATEGORY A.6 – Freight

Author(s)/Sponsoring Agency: Donal Power, *readwrite* **and** Optimizing Port Ecosystems with IoT Analytics, AGT International

Date: August 3, 2016

Source: <http://industrialinternetnow.com/shippers-setting-sail-via-internet-of-floating-things/> and https://www.agtinternational.com/wp-content/uploads/2014/10/AGT_AAG_SmartPrt-2.pdf

Abstract: It is said that the marine industry lags behind alternative modes of commercial transport in deploying connected communications and information technology. But shipping companies are increasing connectivity aboard ships to allow the sharing of insights in real time and using the data to optimize shipping systems. One area where IoT is having a significant impact on shipping is tracking vessels to optimize marine maintenance and repairs. It is estimated that having a supply ship offline for repairs can cost between \$58,000 and \$116,000 per day, with a five-week dry docking operation costing nearly \$3 million. IoT at sea allow ships to be tracked, and provide the status and temperature of cargo containers on board. This allows the crew to look into any storage malfunctions that could cause cargo to spoil. Real-time cargo tracking technology allows stakeholders in a supply chain to monitor goods in their journey from production warehouses to the final customers.

An app known as SmartPort processes and applies IoT analytics to produce information that businesses need to make a difference. The **key capabilities** for port authorities are: 1) Real-time asset identifications and tracking; 2) Management of mooring and parking space occupancy and queues; 3) Capacity of goods prediction; 4) Evaluation of port ship and port traffic throughputs, ship turnaround times; 5) Smart routing for operators in real time; 6) Prediction of mooring space costs, number of ships to serve and capacity of goods; 7) Evaluation of ship loading and unloading times, turnaround times; 8) Evaluation of terminal and queues efficiency; and, 9) Prediction of mooring space costs and capacity of goods. **Benefits** are: 1) Adds value across the port systems; 2) Maximizes port asset (mooring spaces) utilization; 3) Decreases ship turnaround times; 4) Increases in-port safety; and, 5) Enables new revenue-generating opportunities.

Potential for Pilot Project¹

Near-term²: Not likely, but possible

Mid-term³: More likely than in near-term

Long-term⁴: Likely

Cost to Implement

Near-term: Significant

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Improvements in port efficiency, safety, ship turnaround times and revenue.

Mid-term: Same as above

Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #27 The Future of Freight Transport and the Implications of Self-Driving Trucks

Category: A. AV/CAV SUBCATEGORY A.6 – Freight

Author(s)/Sponsoring Agency: Admin / Penn Intermodal Leasing, LLC

Date: August 24, 2015

Source: <http://www.pennlease.com/2015/08/the-future-of-freight-transport-and-the-implications-of-self-driving-trucks/>
<https://www.thestreet.com/story/13177664/1/self-driving-trucks-to-revolutionize-industry-juice-us-economy.html>
http://www.dbschenkerusa.com/file/ho-en/2199346/1PYoNJBRO5juVvLV36HUMqPgJnI/7923390/data/Visions_of_the_Future_2030.pdf
<http://truckofthefuture.eu/>
<http://www.ccjdigital.com/future/>
<https://www.bloomberg.com/view/articles/2015-05-27/when-will-self-driving-trucks-destroy-america>
<http://www.orionsystems.com/>
<http://www.orionsystems.com/solutions/fleet-solutions/>

Abstract: Route Optimization and Freight Delivery Route permutations (variations) rely on movement of products between points of origin (manufacturing) to storage/distribution centers, of which products may travel through several, before reaching their final destination. Freight route optimization is measured by hours and minutes of travel. Technological advances in system design and logistics are advancing. In 2013, geospatial technology telematics and algorithms were widely being used for route optimization and planning (See ORION Systems). Automated trucking is high on the list of solutions.

The era of self-driving trucks is approaching, but there are conflicting views as to what degree? and when? Some say that the positive effects of AV trucks on safe transport of hazardous materials, crash reductions, and the economic gains from increased asset utilization and lower transportation costs will hasten its presence in the supply chain. With automated trucking, throughput could be doubled or even tripled and the return on these expensive fixed assets can be dramatically improved. Others acknowledge that long-haul tractor trailers with self-driving trucks face some serious hurdles, including a lack of consistent State regulations. Currently only nine states have regulations in place for autonomous vehicles with few commonalities in their approach. It is also important to note that trucking is competing with rail lines which are shifting to full automation. In fact, rail is likely to see full automation much sooner than freight trucking due to the higher level of automation and infrastructure already in place.

In this debate about when autonomous trucking will penetrate the market, it is noted the industry is particularly suited for robotic transportation. With that in mind, research, such as that produced by, Morgan Stanley predicts “[*complete autonomous capability will be here by 2022*](#), followed by massive market penetration by 2026 and the today’s cars we will be entirely extinct in 20 years thereafter”. Other research estimates significant penetration by 2035, or so. <http://truckofthefuture.eu/>

But, there are more than 5.7 million people licensed professional drivers today, from those who drive delivery vans to those who drive tractor-trailer trucks. Driver costs, including pay, bonuses, healthcare, retirement, insurance, etc., can be almost completely eliminated. However, these millions of drivers/jobs affected is a force with which to be reckoned.

Potential for Pilot Project¹

Near-term: Wide-scale use of AV trucks not expected.

Mid-term: More prevalent use of AVs is expected than in the near-term

Long-term: Wide-scale use of AVs is expected

Cost to Implement

Near-term: Limited government investment is expected to address road infrastructure.

Mid-term: More investment by government than in the near-term in road infrastructure.

Long-term: Considerable investment by government in road infrastructure.

Cost Implications

Near-term: Limited savings in cost associated with property damage, medical services, legal and court actions, insurance.

Mid-term: Greater savings than in the near-term, including labor/driver costs.

Long-term: Greater savings than in the mid-term

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

Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #28 The future of freight: More shipping, less emissions?
Category: A. AV/CAV SUBCATEGORY A.6 – Freight
Author(s)/Sponsoring Agency: Nate Berg, <i>Green Biz</i>
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 Project¹
Near-term²: 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-term³: 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-term⁴: 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



Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #29 Supersize Ships Prompt More Automation at Ports and Massive Robots Keep Docks Shipshape
Category: A. AV/CAV SUBCATEGORY A.7 – Marine
Author(s)/Sponsoring Agency: Each by Erica E. Phillips, <i>The Wall Street Journal</i>
Date: March 27 and 28, 2016
Source: http://www.wsj.com/articles/supersize-ships-prompt-more-automation-at-ports-1459202549 http://www.wsj.com/articles/massive-robots-keep-docks-shipshape-1459104327
Abstract: Proponents of automated cargo handling at U.S. ports have a rule: where megaships call, robots soon follow. That is why ports from Miami to New York are likely to automate. However, experts believe they will lag behind West Coast ports. Some East Coast ports must first dredge deeper harbors, raise bridges and make other improvements just to allow for the biggest classes of ships to stop in the first place. Among global ports, from those in France to Rotterdam to Singapore, the U.S. is behind on automation, which analysts attribute to years of resistance by labor unions. Another reason is that automating a container terminal is expensive, so ports are holding off on buying into the technology until absolutely necessary. Port infrastructure and operations experts say new equipment and technology typically costs hundreds of millions of dollars. Modifications to existing infrastructure can cost hundreds of millions more. In 2015, the Port of Los Angeles welcomed the CMA CGM SA Benjamin Franklin, the largest container ship to ever call a U.S. port, capable of carrying 18,000 of 20-foot shipping containers. Los Angeles is also home to TraPac LLC's container terminal, one of four in the U.S. that has adopted automation technology. But, it is uncertain whether automation was worth the money at the U.S. terminals where it has been tried. The TraPac terminal in Los Angeles faced long delays in environmental permitting, as well as a ballooning budget. TraPac ran into labor-related setbacks in 2014 workers walked off the job for more than a month after several machinery collisions occurred in the automated area of the terminal. Overall, TraPac's automation will cost roughly \$1 billion in public and private funds once the entire terminal is automated, and executives say they aren't sure when the investment will pay off.
Potential for Pilot Project¹
Near-term²: The Port of Miami has already made infrastructure improvements. Equipment is partially automated.
Mid-term³: More equipment automation will occur at Port of Miami.
Long-term⁴: Even more equipment automation will occur at Port of Miami.
Cost to Implement
Near-term: Substantial following the \$1.1 billion infrastructure investment completed I 2015.
Mid-term: Substantial
Long-term: Substantial
Cost Implications
Near-term: Uncertain because of the initial investment required.
Mid-term: Same as above
Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #30 Marine Port Technology and Emissions Reductions

Category: A. AV/CAV SUBCATEGORY A.7 – Marine

Author(s)/Sponsoring Agency: Port Technology and Wikipedia

Date: April 15, 2015 and March 2, 2013

Source: https://en.wikipedia.org/wiki/Rubber_tyred_gantry_crane
https://www.porttechnology.org/news/konecranes_launches_worlds_first_hybrid_reachstacker/Remote_monitoring_Konecranes-style_March_02_2013

Abstract: A rubber-tired gantry crane (RTG crane) is used in intermodal operations to ground or stack containers. RTGs typically straddle multiple lanes, with one lane reserved for container transfer. RTGs are often powered by diesel generator systems. Aside from the intermodal industry, RTGs also are extensively used in erecting large unbalanced structures, assembling large manufacturing components, and positioning pipelines.

The first electrified rubber-tired gantry cranes (ERTG) in the United States were unveiled by the [Georgia Ports Authority](#) (GPA) in December 2012. The new technology reduces fuel consumption by an estimated 95 percent. The new ERTG system was developed with the help of Konecranes, and [Georgia Power](#).

In 2013, Konecranes launched the world's first [hybrid reach stacker](#) for container handling. Its lifting capacity is 45 tons and it cuts fuel consumption.^[14] In June 2013, Konecranes launched a new Automated RTG (ARTG) system. It copes with wide range of surface variations in RTG container yards.^[16] Also in 2013, Konecranes launched a Remote Monitoring and Reporting tool, TRUCONNECT. It allows lift truck operators to track the usage, efficiency and productivity of their lift trucks through a remote connection. Data are transmitted wirelessly to the Konecranes Remote Data Center, where it is analyzed and compiled in online views and reports, accessible 24/7 through a password-protected Customer Portal. In November, 2013, Konecranes developed an auto start-stop feature that turns off the lift truck engine when it idles for a period of time. This function helps reduce fuel consumption by 5-15% along with CO2 emissions.^[17]

Potential for Pilot Project¹

Near-term²: Immediate, as technology/equipment is available, at a price.

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Improved port operations, safety and emissions reductions

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #31 Forecast of How The IoT Will Affect Logistics – Tagging freight

Category: A. AV/CAV SUBCATEGORY A.7 – Marine

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider* and James Macaulay, Lauren Buckalew, Gina Chung, DHL Trend Research | Cisco Consulting Services

Date: November, 2015

Source:  plus.....

[http://www.dhl.com/content/dam/Local/Images/g0/New_aboutus/innovation/DHLTrendReport Internet of things.pdf](http://www.dhl.com/content/dam/Local/Images/g0/New_aboutus/innovation/DHLTrendReport%20Internet%20of%20things.pdf)

Abstract: Today it is possible to track and monitor a container in a freighter in the middle of an ocean, and shipments in a cargo plane midflight. The next generation IoT will provide of tracking and monitoring that is faster, more accurate, predictive, and secure. Freight-Watch International recorded 946 cargo theft incidents across the United States in 2012 and 689 in Europe, with organized crime targeting ports and rest areas. Theft costs shippers and logistics providers billion of dollars each year, from the impact of inventory delays as well as the cost of stolen goods. Through IoT, logistics providers will gain clear and continuous visibility on the movement of goods as well as item-level condition with monitoring to ensure that goods arrive in time, at the right place, and intact. Telematics sensors in trucks and multi-sensor tags on items transmit data on location, condition (whether any thresholds have been crossed), and if a package has been opened (to detect possible theft). Location and condition monitoring through IoT will provide a new level of transport visibility and security.

Potential for Pilot Project¹

Near-term²: The technology to track and monitor freight is already available and will improve in the near future.

Mid-term³: Technology to track and monitor freight will improve over that available in the near-term.

Long-term⁴: Technology to track and monitor freight will significantly improve over that available in the near-term.

Cost to Implement

Near-term: Reasonable

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Savings in terms of prevented theft, condition of goods, lost time will balance costs.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #32 General Motors/Lyft AV Taxis
Category: A. AV/CAV SUBCATEGORY A.8 – Ridesharing
Author(s)/Sponsoring Agency: Mike Ramsey and Gautham Nagesh, The Wall Street Journal
Date: May 5, 2016
Source: http://www.wsj.com/articles/gm-lyft-to-test-self-driving-electric-taxis-1462460094
Abstract: In May, 2016, General Motors Co. and Lyft Inc. announced that within a year they will begin testing a fleet of self-driving Chevrolet Bolt electric taxis on public roads, a move central to the companies’ joint efforts to challenge Silicon Valley giants in the battle to reshape the auto industry. The plan was developed after GM invested \$500 million in Lyft, a ride-hailing company whose services rival Uber Technologies Inc. The program will rely on technology being acquired as part of GM’s separate \$1 billion planned purchase of San Francisco-based Cruise Automation Inc., a developer of autonomous-driving technology. Details of the autonomous-taxi testing program are still being developed, but it will involve a yet-to-be disclosed city. Customers will have the opportunity to opt in or out of the pilot when hailing a Lyft car from the company’s mobile app. Lyft has a <u>prototype</u> smartphone application that would show customers the option of being picked up by an autonomous car. It would have options to contact a GM OnStar assistant for questions or to aid the rider if some problem occurred. The app would also allow the passenger to tell the car when to “go” and when the passenger is finished with the ride and the car can leave. But, the app is only a prototype.
Potential for Pilot Project¹
Near-term²: Car sharing/taxis Immediate, as a pilot
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Little, if anything, to the public sector
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: On a “pilot” basis, limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance. On a wide-scale basis, if AVs are widely available, there will be grater savings in the above-listed areas.
Mid-term: Greater savings than in the near-term
Long-term: Greater savings than in the mid-term

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #33 Uber AV Taxi
Category: A. AV/CAV SUBCATEGORY A.8 – Ridesharing
Author(s)/Sponsoring Agency: <u>Max Chafkin</u> / <i>Bloomberg Business Week</i>
Date: August 18, 2016
Source: http://www.bloomberg.com/news/features/2016-08-18/uber-s-first-self-driving-fleet-arrives-in-pittsburgh-this-month-is06r7on
Abstract: Starting in August, 2016, Uber began in downtown Pittsburgh, PA., self-driving taxi service summoned from a customer’s phone. Uber’s Pittsburgh fleet, which will be supervised by humans in the driver’s seat for the time being, consists of specially-modified Volvo XC90 sport-utility vehicles outfitted with dozens of sensors that use cameras, lasers, radar, and GPS receivers. Starting with a few vehicles, the fleet will grow by the end of the year to a total of 100. The two companies signed a pact earlier this year to spend \$300 million to develop a fully autonomous car that will be ready for the road by 2021. In Pittsburgh, customers will request cars the normal way, via Uber’s app, and will be paired with a driverless car at random. Trips are free, at the writing of this piece, rather than the standard local rate of \$1.05 per mile. In the long run, Uber indicates prices will fall so low that the per-mile cost of travel, even for long trips in rural areas, will be cheaper in a driverless Uber than in a private car.
Potential for Pilot Project¹
Near-term²: Immediate, as a pilot
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Little, if anything, to the public sector
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: On a “pilot” basis, limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance. On a wide-scale basis, if AVs are widely available, there will be grater savings in the above-listed areas.
Mid-term: Greater savings than in the near-term
Long-term: Greater savings than in the mid-term

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

Miami-Dade County TPO Technology Literature Summary Sheet	
Topic: #34 AV Taxi in Singapore	
Category: A. AV/CAV SUBCATEGORY A.8 – Ridesharing	
Author(s)/Sponsoring Agency: Annabelle Liang and Dee-Ann Durbin/ Associated Press	
Date: August 25, 2016	
Source: http://www.bbc.co.uk/news/business-37181956	
Abstract: The world's first self-driving taxis are picking up passengers in August, 2016, in Singapore. It preceded the Uber taxi demonstration in Pittsburgh, PA. Riders must have an invitation from Uber to use the service. They use their smartphones to hail a taxi. The taxis are operated by nuTonomy, an autonomous vehicle software startup. The service began with six cars now, growing to a dozen by the end of the year. The ultimate goal is to have a fully self-driving taxi fleet in Singapore by 2018, which ultimately reduce the number of cars on Singapore's roads from 900,000 to 300,000. At the start, the taxis only run in a 2.5-square-mile business and residential district with pick-ups and drop-offs limited to specified locations. The cars have a driver in front who is prepared to take back the wheel and a researcher in back who watches the car's computers. Each car is fitted with six sets of Lidar — a detection system that uses lasers to operate like radar — including one that constantly spins on the roof. There are also two cameras on the dashboard to scan for obstacles and detect changes in traffic lights.	
Potential for Pilot Project ¹	
Near-term²: Immediate, as a pilot	
Mid-term³: Same as above	
Long-term⁴: Same as above	
Cost to Implement	
Near-term: Little, if anything, to the public sector	
Mid-term: Same as above	
Long-term: Same as above	
Cost Implications	
Near-term: On a “pilot” basis, limited savings in cost associated with workplace losses, congestion costs, property damage, medical services, legal and court actions, insurance. On a wide-scale basis, if AVs are widely available, there will be greater savings in the above-listed areas.	
Mid-term: Greater savings than in the near-term	
Long-term: Greater savings than in the mid-term	

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #35 The Future of Air Cargo: How to Adapt

Category: A. AV/CAV SUBCATEGORY A.9 – Air

Author(s)/Sponsoring Agency: JDA – Supply Chain Nation / Anand Medepalli

Date: December 2012

Source: <http://www.citylab.com/work/2014/10/a-complete-guide-to-the-future-of-us-freight-movement/381012/>
<http://www.inboundlogistics.com/cms/article/air-cargos-future-ready-for-anything/>
<http://aircargoworld.com/airfreight-has-bright-future-despite-technology-lag/>
<http://www.wsj.com/articles/are-drones-the-future-of-air-freight-1436468089>
<http://www.orionsystems.com/>
<http://www.orionsystems.com/solutions/fleet-solutions/>

Abstract:

Freight keeps moving up, in both altitude and value: Air cargo's share of world trade is 2 percent by weight but 40 percent by value, and climbing. The U.S. Department of Transportation predicts a 56 percent increase in the per-ton value of air goods by 2040.

Decades of systems design has led to a breakthrough development in 2013 in the world of logistics: The On-Road Integrated Optimization and Navigation System, or **ORION** (developed by Jack Levis, UPS Senior Director of Process Management) uses geospatial technology, telematics, and algorithmic computation to evaluate more than 200,000 ways to run a single route, then suggests the best one for the day. The system saved UPS 1.5 million gallons of fuel in 2013, and reduced carbon emissions by 14,000 metric tons. "If we can take just one mile a day off each driver's route, it saves us about \$50 million a year," says **ORION**'s creator, Jack Levis.

As of September 14, 2016, Google has begun testing with Drones delivery of fast food (burritos) to college students at Virginia Tech University ("Project Wing". <http://time.com/4493291/google-tests-drone-deliveries-virginia-tech/>). Utilization to deliver goods will increase rapidly in the coming years. of drones

Price is the primary factor when considering the affects of transporting freight by air and which type of transport mode to use. These decisions are dependent on fuel type, and flight materials. Advancement in alternative fuels/energy used to power aircraft, such as biofuel and solar, will be very impactful to the freight transportation industry

- Biofuel: <http://www.cnn.com/2014/01/23/travel/boeing-biofuel/>
- Solar: <https://www.theguardian.com/environment/2016/jul/26/solar-impulse-plane-makes-history-completing-round-the-world-trip>

New technology, in the form of strong, lightweight material could shift the balance of freight transport between air and sea. <https://www.technologyreview.com/s/530611/a-super-strong-and-lightweight-new-material/>

Potential for Pilot Project¹

Near-term²: **ORION** system is operational, but is proprietary to UPS.

Mid-term³: Improve efficiencies in air cargo/freight movement will continue

Long-term⁴: Continued improvement in efficiencies utilizing advancements in technology, as well as integrating with other parts of the industry.

Cost to Implement

Near-term: Already realized with **ORION**

Mid-term: Could be relatively low as technologies advance as a whole.

Long-term: Will result is more savings than costs

Cost Implications

Near-term: Already paying off

Mid-term: Continued cost savings that pay for initial investments and more

Long-term: Cost savings benefit the customers by passing on the savings which impacts the global economy

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #36 Think beyond the rails: Leading in 2025

Category: A. AV/CAV SUBCATEGORY A.10 – Railroads

Author(s)/Sponsoring Agency: Keith Dierkx, IBM

Date: 2016

Source: <http://www-935.ibm.com/industries/traveltransportation/think-beyond-the-rails.html>
<http://www.progressiverailroading.com/>
http://www.progressiverailroading.com/rail_industry_trends/article/Drones-mobility-and-more-Supplier-perspectives-on-next-level-rail-technology--49386

Abstract: The transformation of both freight railways to a more interconnected, transparent and agile form is integral to the future success of the industry. Becoming digitally focused and delivering actionable insights by way of machine-to-machine communications and mobile devices will enable rail operations to run more effectively and efficiently. Mountains of data are generated by customers and partners using digital platforms and mobile devices. Rolling stock, track, sensors, digital video and transaction systems generate even more data. The challenge is to harness and connect these data to improve business results. Because digital is the new normal, this transformation is not optional if a railway wants to remain competitive and thrive. To achieve results that will power the future of the industry, railways need to:

- Collaborate beyond their comfort zones by partnering with adjacent service providers, creating an ecosystem of value; and,
- Use cognitive computing to harness data both inside and outside their enterprises to drive revenue, reduce cost, and win market share.

Freight railways now monitor facilities, assets, systems and shipments in real time. On-time delivery, labor utilization and productivity are all improved. Downtime and delays are minimized. The industry is experiencing an explosion of growth in cognitive computing

Potential for Pilot Project¹

Near-term²: Limited, because an interconnected railroad will not be built overnight.

Mid-term³: More likely than the near-term

Long-term⁴: Very likely

Cost to Implement

Near-term: Unknown, but significant.

Mid-term: Unknown, but significant.

Long-term: Unknown, but significant.

Cost Implications

Near-term: Increased efficiency and reduced costs throughout the industry.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #37 Why Santa Monica Is a Smart City Trailblazer
Category: B. Smart Cities
Author(s)/Sponsoring Agency: Timothy Downs. American City & County
Date: September 01, 2016
Source: http://www.ioti.com/smart-cities/why-santa-monica-smart-city-trailblazer
Abstract: Santa Monica is one of only a handful of municipalities to design, develop and operate a wholly-owned municipal fiber network. In 1998 the city created a telecommunications master plan, part of which was to develop a fiber network that would serve the city, the local college and schools. The initial \$530,000 investment in the fiber infrastructure ultimately yielded an ongoing savings of \$700,000 per year by eliminating the need for leased lines from private providers. The savings allowed the city to not only save money, but to also take the next step with new applications and services that leveraged the network. This enabled other applications. Some of them, like the 17 Wi-Fi hotspot zones in public spaces and 150 public video cameras for security purposes, would have never been possible without the fiber network,” Wolf says. Santa Monica has now leveraged its network to offer additional applications and services it provides to residents and visitors. The network supports parking advisory signs at all parking structures. Drivers are advised via mobile phones about the parking capacity in every structure at any time. For a city that often approaches gridlock, real-time traffic and parking information is critically important. Traffic cameras have been installed throughout the city, and a decision will soon be made on whether to make this available to the public to view over the Internet Wireless parking meters available through Wi-Fi and cellular technologies are also on the agenda. The Institute for Local Self Reliance, a proponent of municipally owned networks, has observed that without spending any new money, Santa Monica has built a great fiber-optic network along major streets ultimately began generating revenue from fiber leases and operating a free Wi-Fi network in popular tourist destinations.
Potential for Pilot Project¹
Near-term²: Good, provided public funds are available to build the fiber optic system in the pilot are. Or, the private sector can be enticed to build it at little or no cost to the public sector.
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Significant for either the public or private sectors.
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Potential savings for the public sector by eliminating the need for leased lines from private providers that may exceed cost to implement.
Mid-term: Same as above
Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #38 Surveying Innovations Across City Systems— “Becoming Smart”

Category: B. Smart Cities

Author(s)/Sponsoring Agency: Laura Adler, DATA-SMART CITY SOLUTIONS

Date: August 31, 2015

Source: <http://datasmart.ash.harvard.edu/news/article/the-urban-internet-of-things-727>

Abstract: Cities are expected to spend \$41 trillion on IoT technologies in the next 20 years in the following areas:

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. Smart grids can be used to identify and address outages and promote conservation through demand-based pricing. In addition to benefiting cities, new devices are also bringing the benefits of energy-related IoT to consumers. Citizens can reduce their energy bills with devices like Nest, which can sense when someone is home and adjust temperatures automatically, and smart-me, which allows users to monitor energy use, turn off unused devices, and manage the temperature in a home or office from a smartphone. **Environmental conditions:** Chicago’s Array of Things and Dublin’s CityWatch are models for the deployment of citywide sensor networks. Sensors on lampposts monitor environmental conditions including temperature, noise, and air quality. The data are used to manage incidents, identify patterns in microclimates, and make predictions about vehicle and pedestrian congestion. These systems feed data into open portals, where the data are available to the public, allowing citizens to take part in tracking and responding to local environmental issues. **Water:** Many cities face severe problems with water -- too much or too little rain. In California, local governments are using IoT to develop innovative ways to plan and manage irrigation, facilitating extensive water conservation, and allocating scarce resources. Other areas struggle to address flooding and wastewater management during storms. In the latter cases, cities are often forced to dump raw sewage into waterways. Using tools developed by Opti, American cities can draw together systems that monitor the weather to monitor and those that control rainwater storage to determine when to hold onto water supplies and when to make room for new rainfall. With appropriate planning, cities can reduce overflow in combined sewers and minimize the pollution of waterways. The citizen-led Oxford Flood Network has developed a system of sensors to gather data on water level from stream and groundwater sources and anticipate flood incidents. The system relies on sensors that use ultrasonic rangefinders, positioned above local waterways, to measure changes in the water level and indicate flood risks. The network makes use of TV whitespace between channels—made available by the local telecom provider—to transmit data, making information publicly available in real time. **Waste:** IoT companies are developing two-way communication tools to reduce labor and increase the efficiency of waste management systems. Companies like Big Belly have sensor-enabled trash receptacles measure waste levels in public bins and share the data with local authorities, allowing them to enhance efficiency by planning collection routes where and when pickup is needed. The same logic is being extended to the home.

Potential for Pilot Project¹

Near-term²: Likely, as the basic IoT tools have been around for years, like connected street lights to conserve energy. The objective is to interconnect these devices and manage the data they provide.

Mid-term³: More likely as resources become more available

Long-term⁴: Same as above

Cost to Implement

Near-term: Could be significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: While implementing and maintaining a connected system may be significant, the potential cost savings through improved efficiencies plus enhance quality of life will offset them.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #39 Surveying Innovations Across City Systems—Some Challenges

Category: B. Smart Cities

Author(s)/Sponsoring Agency: Laura Adler, DATA-SMART CITY SOLUTIONS

Date: August 31, 2015

Source: <http://datasmart.ash.harvard.edu/news/article/the-urban-internet-of-things-727>

Abstract: By embracing IoT, governments can improve service delivery, increase sustainability, and make their cities safer and more livable places. IoT is allowing cities to transition towards real-time, data-driven management across urban systems, including water, energy, waste management, and transportation. But, while IoT offers opportunities to enhance efficiency, improve public safety, and support development, it also presents several challenges that cities will have to negotiate in order to realize these benefits. Three of the most important are: Design and analysis together: Cities often lack the skills or the technology to use the data they have. In order to make the Internet of Things valuable, cities must ensure that the data-gathering systems are designed together with analytics: the data that is collected should be easily understood and put to use by the governments that collect it. Recruiting tech-savvy leaders: The ability to remain “smart” can only be accomplished by engaging as employees or as consultants, people who can envision and implement cutting-edge systems. Privacy and security: Cities must ensure the privacy and security of citizen data. Defense from hacking/cyberattacks is a prevalent concern, for a government’s constituents, systems and infrastructure. In the latter cases, hacking smart meters can cost millions, but a more malicious intruder could compromise safety for residents. In order to be a “Smart City” cities must make privacy and security a top priority.

Potential for Pilot Project¹

Near-term²: Likely as the basic IoT tools have been around for years, like connected street lights to conserve energy. The objective is to interconnect these devices and manage the data they provide.

Mid-term³: More likely as resources become more available

Long-term⁴: Same as above

Cost to Implement

Near-term: Could be significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: While implementing and maintaining a connected system may be significant, the potential cost savings through improved efficiencies plus enhance quality of life will offset them.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #40 “Using an Activity-Based Model to Explore Possible Impacts of Automated Vehicles”

Category: C. TDM (Travel Demand Modeling)

Author(s)/Sponsoring Agency: Puget Sound Regional Council, Suzanne Childers, et.al.
Submitted for presentation at the Transportation Research Board 2015

Date: August 2014

Source: psrc.github.io/attachments/2014/TRB-2015-Automated-Vehicles-Rev2.pdf

Abstract: Recognizing that automated vehicles (AV) may enter the consumer market with various stages of automation within 10 years while agencies plan for time horizons of 2040 and beyond, PSRC conducted research using the Seattle region’s activity- based travel model to test a range of travel behavior impacts from AV technology. Because the existing model was not designed to model AV’s, some assumptions were changed, including roadway capacity, user values of time, and parking costs. Larger structural model changes were not considered. Four scenario tests show that improvements in roadway capacity and in the quality of the driving trip may lead to large increases in vehicle-miles traveled, while a shift to per-mile usage charges may counteract that trend. Future travel models will require major improvements to model shared-ride and taxi modes, and the effect of multitasking opportunities associated with the new technology.

Four scenarios were examined:

1. Increased capacity from full or partial vehicle automation.
2. Increased capacity and value of time changes assuming that individuals using the AVs will perceive the time in them less negatively than time spent driving in regular vehicles.
3. Increased Capacity, Value of Time Changes, and Reduced Parking Costs, assuming that all travelers, for all trip purposes, enjoy the benefits of robot chauffeurs.
4. Per-mile Auto Costs Increased, assuming AVs have become so common, and effective, that personal AV ownership is no longer necessary: mobility is treated as a public utility, where all trips are provided by a taxi-like system at a set rate.

Tests showed increases in VMT for all alternatives, and decreases in VHT in alternatives except one. The research found that modelers lack data to add AV-related alternatives and variables into travel demand models. Because these vehicles do not yet exist but modelers need to incorporate their possible impacts on travel demand, the most straightforward way to understand behavior would be to conduct a stated preference survey.

Potential for Pilot Project¹

Near-term²: Not applicable in terms of an on-the-ground application. But, applicable from LRTP study

Mid-term³: Yes

Long-term⁴: Yes

Cost to Implement

Near-term: Depends of specific situation on TDM modeling platform. Could range from \$100K-\$500K

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Will likely affect the amount of infrastructure specified in the LRTP.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>	
Topic: #41 “Modeling Autonomous Vehicles”	
Category: C. TDM (Travel Demand Modeling)	
Author(s)/Sponsoring Agency: Dan Macmurphy / Jerry Graham, Traf-O-Data Corp.	
Date: December 9, 2015	
Source: http://www.fsutmsonline.net/images/uploads/mtf-files/Modeling_Autonomous_Vehicles_by_Jerry_Graham_and_Dan_Macmurphy.pdf	
Abstract: This PowerPoint presentation presents an example and test case of how autonomous vehicles (AV) could be modeled in a FSUTMS trip-based model. It doesn’t attempt to estimate how many vehicles would be AV, but attempts to show how assumptions could be made on: • Where AVs could operate in an automated mode. • The system-wide percentage of vehicles that would be AV (called penetration). • Home Based AV Auto Ownership Weighted by Household Income • The required roadway capacity adjustment by Facility Type and penetration. The presentation notes some of the modeling changes that would be required, and shows example of the number of vehicles • How model scripts could be modified to implement this demonstration. • Examples of traffic volumes on various roads that are AV versus non-AV. The presentation shows an initial attempt to use travel demand models as a tool to assess the impacts of AVs.	
Potential for Pilot Project¹	
Near-term ² : Not applicable in terms of an on-the-ground application. But, applicable from LRTP study	
Mid-term ³ : Same as above	
Long-term ⁴ : Same as above	
Cost to Implement	
Near-term: Depends of specific situation on TDM modeling platform. Could range from \$100K-\$500K	
Mid-term: Same as near-term	
Long-term: Same as near-term	
Cost Implications	
Near-term: Will likely affect the amount of infrastructure specified in the LRTP.	
Mid-term: Same as above	
Long-term: Same as above	

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #42 “Effects of Next-Generation Vehicles on Travel Demand and Highway Capacity”

Category: C. TDM (Travel Demand Modeling)

Author(s)/Sponsoring Agency: Fehr and Peers

Date: January, 2014

Source: www.fehrandpeers.com/fpthink/nextgenerationvehicles/

Abstract: This report assesses the likely effects of AVs on traffic generation, highway capacity, and congestion over time, as the percentage of AVs on the road increases. The paper assesses important factors that will need to be understood to plan for and to model AVs:

- Rate of adoption
- Barriers to fleet conversion
- Impact on VMT
- Impact on mode split
- Effect on highway capacity and freeway operation
- Safety and licensing
- Infrastructure
- Legal issues and liability
- Privacy
- Security
- Personal preferences
- Vehicle costs and car sharing
- Impact on non-drivers
- Regional variation

This report presents a reasonable and thorough assessment of how AV’s might be implemented, and explores many of the important issues. It also presents the results of several VISSUM experiments that attempt to quantify the impacts of a range of assumptions.

Potential for Pilot Project¹

Near-term²: Not applicable in terms of an on-the-ground application. But, applicable from LRTP study

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Depends of specific situation on TDM modeling platform.

Mid-term: Same as near-term

Long-term: Same as near-term

Cost Implications

Near-term: Will likely affect the amount of infrastructure specified in the LRTP.

Mid-term: Will likely affect the amount of infrastructure specified in the LRTP.

Long-term: Will likely affect the amount of infrastructure specified in the LRTP.

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #43 "LA to SF in 30 min: **Hyperloop** wars are on" and "**Hyperloop** may be a transportation leap too far"

Category: D. Maglev/Hyperloop

Author(s)/Sponsoring Agency: Both articles written by Marco della Cava for USA TODAY

Date: May 10, 2016 and June 27, 2016

Source: <http://www.usatoday.com/story/tech/news/2016/05/09/la-sf-30-min-hyperloop-wars/84137224/>
<http://www.usatoday.com/story/tech/news/2016/06/25/hyperloop-may-be-transportation-leap-too-far/86284444/>

Abstract: Elon Musk and his aeronautics operation, SpaceX, has launched into high-speed transportation with **Hyperloop**. The concept is for Pods to be propelled in tubes by linear induction motors and air compressors. **Hyperloop** has been open-sourced. The company named **Hyperloop One** is currently the best financed researcher that is trying to make Musk's dream a reality. Design for test tracks and capsules are being developed. A very short (1 mile) track has been built in Nevada and tests of a scale model occurred in May, 2016. Competition among 15 researchers will be held in two phases -- January, 2017 and Summer, 2017.

The **Hyperloop** concept is to take a sleek pod, place it in a vacuum-sealed tube and let it float frictionless above its rails using tested magnetic levitation technology at speeds up to 800 mph. Commute times get slashed and fossil fuel gets saved.

As might be expected, experts have raised issues of cost (a 350-mile run between Los Angeles and San Francisco has been estimated at \$6 billion, or more), technological demands (tubes would have to be straight and vacuum-tight to keep speeds high), practicality (short hops would not make sense) and comfort (humans might not go for travel that feels like a roller coaster ride lodged in tunnels). More specifically, concerns range from whether endless links of welded tubes can retain the vacuum integral to maintaining high speeds given to the physiological impact on passengers at speeds that approach the supersonic.

Potential for Pilot Project¹

Near-term²: Unrealistic

Mid-term³: Uncertain

Long-term⁴: Possible

Cost to Implement

Near-term: \$17 million per mile. But actual cost is still to be determined.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Speculative, at best

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #44 Maglev in Other Countries

Category: D. Maglev/Hyperloop

Author(s)/Sponsoring Agency: Multiple Governments

Date: Ongoing

Source: http://usa.chinadaily.com.cn/epaper/2014-02/19/content_17291903.htm;
http://www.koreatimes.co.kr/www/news/nation/2016/02/116_197061.html ;
<http://www.digitaltrends.com/cool-tech/hyperloop-india/#ixzz4HVgrAtku>.

Abstract: Incheon, South Korea and Beijing are highlighted here. In October 2006, the South Korean government commercialized MagLev train service for citizens living in and around Seoul. Twenty government agencies and private companies took part, including the Korea Institute of Machinery and Materials, Korea Rail Network Authority and Hyundai Rotem. The first magnetic levitation (MagLev) train service was launched on a route linking Incheon International Airport to a nearby station in February, 2016. The unmanned train runs the 3.8-mile line at 50 mph between the airport and Yongyu Station in 15 minutes. It operates free of charge for a pilot period. It may turn it into a commercial service, depending on demand. Two more stages are planned of 6 and 23 miles. Four MagLev trains, each with two carriages, run every 15 minutes, with up to seven trains available for operation. A MagLev train can carry up to 230 passengers and will run at a maximum speed of 80 km per hour (50 mph) although the train was designed to run up to 110 km per hour (68 mph).

Beijing is using maglev in its newer subway system lines in a 65 mph application. China's National Development and Reform Commission considered this fast enough for the city. All the high-end trains will be designed and built at China CNR Corp, Ltd.'s Tangshan plant. Service is on the Daitai line, also known as the S1, which starts at North Beijing's Haidian district, passes through the Shijingshan district and ends in the Mentougou district in Beijing's western outskirts. The six-mile line opened in 2015. South Korea and China have property acquisition processes that make assembling right-of-way easier than in the US.

Hyperloop Transportation Technologies (HTT), an American startup championing the dream of bringing a 760-mph transportation system to market, is planning to negotiate with India.

Potential for Pilot Project¹

Near-term²: Low, needs substantial grade-separated right-of-way

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: \$150-250 million per mile

Mid-term: Same

Long-term: Same

Cost Implications

Near-term: Tax Increment Financing can recoup some costs. Plus, there can be benefits in the cost of productivity.

Mid-term: Same

Long-term: Same

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #45 Dallas to Houston High Speed Rail
Category: D. Maglev/Hyperloop
Author(s)/Sponsoring Agency: Texas Central Partners, LLC
Date: June 2016, Ongoing
Source: http://www.yourhoustonnews.com/pasadena/news/multi-billion-dollar-bullet-train-connecting-houston-to-dallas-expected/article_df2448e8-30a3-11e6-91e3-837610fb3cb6.html
Abstract: Texas Central Partners, LLC (Texas Central), a private company, is developing a new high-speed passenger rail system that will connect Houston and Dallas/Fort Worth. Texas Central held a railroad update Tuesday, June 2016. The fast train will be the first in the U.S. Travel time between Houston and Dallas will be 90 minutes with one intermediate stop in the Brazos Valley area. Nearly 50,000 Texans travel between Houston and Dallas/Fort Worth more than once a week. The train is Japanese technology that Texas Central will purchase. The technology is one of the safest in the world. The train has never had a crash or fatality due to operations for over 50 years in Japan. The train has moved many millions of people every year, and the average annual delay is less than one minute. “The train never crosses a road, so there are no cars on the road waiting on trains. Also there are no trains intersecting the cars, and no whistles or horn on the train,” said Holly Reed, managing director of external affairs at Texas Central. “That’s how you get reliability and safety. There’s one track going north and one track going south, so you never have trains going opposite directions (on the same track).” Out of 97 city pairs studied across the nation, Houston/Dallas came out on top as the most feasible place for the high-speed rail project to be deployed. Texas Central believes the Houston/Dallas city pair is the best option for the train because there is growth in both cities and demand going in both directions. Also, the path is straight and relatively flat for the high-speed rail project. Approximately 10,000 jobs per year will be created during project construction. There will be 1,000 new high-tech jobs once the train is in full operation.
Potential for Pilot Project¹
Near-term²: Low, needs substantial grade-separated right-of-way
Mid-term³: Same
Long-term⁴: Same
Cost to Implement
Near-term: \$150-250 million per mile
Mid-term: Same
Long-term: Same
Cost Implications
Near-term: Tax Increment Financing can recoup some costs. Plus, there can be benefits in the cost of productivity
Mid-term: Same
Long-term: Same

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



Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #46 Maglev in U.S.
Category: D. Maglev/Hyperloop
Author(s)/Sponsoring Agency: Multiple government entities, some in Public-Private-Partnerships
Date: Decades
Source: http://www.californiaprogressreport.com/site/conventional-high-speed-rail-vs-magnetically-levitated-trains-was-maglev-ever-contention ; http://ilikemike.me/report-orlando-maglev-train-dead/ ; http://www.maglev2000.com/assets/FRAsum.pdf ; http://northeastmaglev.com/about-tnem ; http://northeastmaglev.com/about-tnem ; http://www.miamidade.gov/transit/corridor-plans.asp ; http://www.miamidade.gov/transit/library/mpo-douglasroad-transit-corridor.pdf
Abstract: Maglev requires its own controlled right-of-way. In contrast, for example, Tri-rail diesel trains operate up to about 80 mph, in an environment where at-grade crossings are common. Maglev trains require less structural support due to lighter cars, can manage higher grades, and move faster than conventional high-speed passenger rail, with competitive energy efficiency. Maglev has been implemented in other countries, but may lag behind in the U.S. due to less business development here and lack of the ability to aggregate the needed right-of-way (cost). A privately planned MagLev system to connect the Orlando International Airport and Orange County Convention Center (where right-of-way is less an issue) failed to materialize in early 2016 as the Airport was wary of the new technology's ability to generate the revenues from surface transportation that have historically been received. A Florida MagLev 2000 project proposed to connect the Space Coast Regional Airport to Port Canaveral via the Kennedy Space Center Visitors Center was not approved. The Northeast MagLev (TNEM) is a U.S.-owned company based in Washington, D.C., committed to bringing superconducting MagLev technology to the United States' Northeast Corridor. Its future is unknown, primarily due to right-of-way needs and costs, in comparison with existing technologies. A candidate pilot project in Miami-Dade may be to adapt the findings of an already concluded corridor study. These have focused on BRT in recent years. The Douglas Road Transit Corridor Study compared modal cost, system speeds, station spacing, and the like. High speed rail, but at-grade (so not true high-speed rail) was considered. Grade separation means elevating the guideway system, substantially increasing cost - \$150-250 million per mile vs. \$4-60 million (per Douglas Road report).
Potential for Pilot Project
Near-term: Low, needs substantial grade-separated right-of-way
Mid-term: Same as above
Long-term: Same as above
Cost to Implement
Near-term: \$150-250 million per mile
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Tax Increment Financing can recoup some costs. Plus, possible benefits in terms of workplace loss reductions.
Mid-term: Same as above
Long-term: Same as above

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #47 Fast Trains Outside the U.S.
Category: D. Maglev/Hyperloop
Author(s)/Sponsoring Agency: Multiple Governments
Date: Ongoing
Source: http://www.railway-technology.com/projects/arlanda/ ; http://www.fluor.com/projects/high-speed-rail-line-design-build ;
Abstract: High-speed rail continues to develop in a number of European locations for longer distance travel. More recent examples are Stockholm and the Netherlands. In 1993, tenders/bids were solicited a new public-private venture, high-speed line in Stockholm, running to the airport. The winning consortium, Arlanda Link Consortium (ALC), formed a “finance, build and operate” company, A-Train, that started work in 1995. The summer 1999 completion date was delayed to allow stringent reliability and punctuality targets to be met. Then the entire system was transferred to the Swedish state for lease back to the operator. In 2004, Maquarie Group acquired A-Train. A-Train will receive all proceeds from fares for the remainder of its license term, until 2040. The Arlanda link comprises 20km of double-track railway, three stations, all underground, and 7km of tunnels. The airport stations are in 22m-deep rock caverns, and the line has about 20 bridges, tunnels, and portals. Trains are maintained at a purpose-built depot. Each train is fitted with automatic train protection. In 2009, a 62-mile high-speed rail line with four tunnels, an aqueduct, and a 1.9-mile bridge opened from Amsterdam to the Belgium border. Infrastructure construction included the track system, power supply system, noise barriers, signaling system, communication systems, and ancillary equipment such as lighting and control systems. Simultaneous to the construction of the HSL, civil works projects were constructed by other contractors, requiring multi-contractor coordination to maintain the work schedule.
Potential for Pilot Project¹
Near-term²: Low, needs substantial grade-separated right-of-way
Mid-term³: Same
Long-term⁴: Same
Cost to Implement
Near-term: \$150-250 million per mile
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Tax Increment Financing can recoup some costs. Plus, possible benefits in terms of workplace loss reductions.
Mid-term: Same as above
Long-term: Same as above

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #48 US 36 Bus Rapid Transit, CO
Category: E. BRT (Bus Rapid Transit)
Author(s)/Sponsoring Agency: Colorado High Performance Transportation Enterprise (HPTE)
Date: Ongoing
Source: http://www.rtd-fastracks.com/us36_1
Abstract: US 36 is a 16-mile, four-lane divided highway that connects the City of Boulder to Denver at its intersection with I-25. Due to significant congestion, it has been targeted for improvements by the Colorado Department of Transportation (CDOT) since the late 1990s. The US 36 Managed Lane Project/Phase I is an initial 10-miles at \$306 million. It opened in March, 2016, was delivered under a design-build contract and includes the following components: • One express, high occupancy toll (HOT) lane in each direction from Federal Boulevard to 88th Street in Louisville/Superior (approximately 10 miles) and reconstruction of the general purpose lanes. • Replacement of the Wadsworth Parkway, Wadsworth Boulevard, Lowell Boulevard, and Sheridan Boulevard bridges and replacement of the US 36 bridge over the BNSF Railway. • Bus rapid transit (BRT) accommodations at stations located on ramps and adjacent park-n-rides, and bus bypass ramps at several interchanges (new and more frequent bus service will be provided). • Bikeway along much of the corridor. • Intelligent transportation system (ITS) equipment, including for tolling, transit information, and incident management. • Improvement of Regional Transportation District (RTD) stations along the corridor.
Potential for Pilot Project¹
Near-term²: Immediate. Miami-Dade is currently instituting BRT in the SR 836 Corridor.
Mid-term³: BRT is expected to expand to Flagler routes, and later, perhaps, along Kendall Drive and Northwest 27th Avenue.
Long-term⁴: BRT may or may not be converted to light rail transit.
Cost to Implement
Near-term: Buses are \$1 million each. The SR 836 stations are \$12 million each. Highly variable dependent on freeway vs at-grade street deployment and level of signal control and stations.
Mid-term: Incremental costs in the same range as the system expands.
Long-term: Same as above.
Cost Implications
Near-term: Commitment to dedicated local funding source. Long-term support for greater land use density and higher property tax revenue. Potential for significant economic benefits that exceed cost.
Mid-term: Same as above.
Long-term: Same as above.

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #49 Cape Town, South Africa BRT (BRT)
Category: E. BRT (Bus Rapid Transit)
Author(s)/Sponsoring Agency: Cape Town Integrated Rapid Transit
Date: Ongoing
Source: http://ppp.worldbank.org/public-private-partnership/ppp-sector/transportation/urban-passenger-transport/urban-passenger-transport
Abstract: Since 2007, Cape Town has been working on the first phase of an Integrated Rapid Transit (IRT) system to significantly improve public transport. The first leg is work on the MyCiTi IRT system. This first leg is Bus Rapid Transit system, designed to integrate with other modes, especially rail, the backbone of public transport in Cape Town. Like many developing countries, South Africa is in the process of formalizing its public transport services. A law, the National Land Transport Bill, includes a plan for a publicly-controlled, integrated transport system and for cities to take greater control of planning, regulating, implementing and monitoring public transport services. Change meant phasing out contracts between government and bus companies for subsidized services, and the formalization of the minibus taxi industry. This included moving from indefinite permits to fixed-period operating licenses and the implementation of the taxi recapitalization program, which provides a “scrapping” allowance to encourage minibus taxi owners with old vehicles to upgrade them or leave the industry. In May 2011, the first network was launched. The next step was eight new routes. New routes are also being extended to areas north of the central city. The second phase will provide a more extensive service to the southeast parts of the city. The third phase will include the rest of the northern suburbs and Stellenbosch, and the fourth phase the Greater Helderberg area. The full system is expected to take about 15-20 years to implement, with phases being built as funds become available. The aim is to eventually build a reliable, safe and cost-effectives transport network within 500 meters (547 yards) of 75% of the homes in the city.
Potential for Pilot Project¹
Near-term²: Immediate. Miami-Dade is currently instituting BRT in the SR 836 Corridor.
Mid-term³: BRT is expected to expand to Flagler routes, and later perhaps along Kendall Drive and Northwest 27th Avenue.
Long-term⁴: BRT may or may not be converted to light rail transit.
Cost to Implement
Near-term: Highly variable dependent on freeway vs at-grade street deployment and level of signal control and stations. Buses are \$1 million each. The SR 836 stations are \$12 million each.
Mid-term: Incremental costs in the same range as the system expands.
Long-term: Same as above.
Cost Implications
Near-term: Commitment to dedicated local funding source. Long-term support for greater land use density and higher property tax revenue. Potential for significant economic benefits that exceed cost.
Mid-term: Same as above.
Long-term: Same as above.

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #50 Healthline serving the Euclid Corridor
Category: E. BRT (Bus Rapid Transit)
Author(s)/Sponsoring Agency: Regional Transit Authority (RTA)
Date: April 2015
Source: http://www.riderta.com/healthline/about
Abstract: The HealthLine serves the Euclid Corridor. It connects the two largest regional employment areas, Downtown and University Circle, and extends to the Louis Stokes Station at Windermere in East Cleveland. The system cost \$200 million and the HealthLine was named the 'Best' Bus Rapid Transit in North America by the Institute for Transportation & Development Policy, and has been recognized for having the best return on investment for a transit project, regardless of mode, in the country, with more than \$6.3 billion in economic development -- a staggering \$114 gained for every dollar spent on creating and launching the service. The HealthLine: includes 9.2 miles of roadway improvements on and adjacent to Euclid Avenue, with dedicated right-of-way; offers five-minute frequency service during peak travel periods and operates 24-hours-a-day, seven-days-per-week; replaced 108 bus stops with 36 conveniently spaced stations, with precision docking, level platforms, and real-time information displays; reduced travel time from 40 minutes to 28; and, provides low-emission, 63-foot hybrid-electric Rapid Transit Vehicles with five sets of doors, located on both sides of the coach.
Potential for Pilot Project¹
Near-term²: Immediate--Miami-Dade is currently instituting BRT in the SR 836 Corridor.
Mid-term³: BRT is expected to expand to Flagler routes, and later perhaps along Kendall Drive and Northwest 27th Avenue.
Long-term⁴: BRT may or may not be converted to light rail transit.
Cost to Implement
Near-term: Buses are \$1 million each. The SR 836 stations are \$12 million each. Highly dependent on freeway vs at-grade street deployment and level of signal control and stations.
Mid-term: Incremental costs in the same range as the system expands.
Long-term: Same as above.
Cost Implications
Near-term: Commitment to dedicated local funding source. Long-term support for greater land use density and higher property tax revenue. Potential for significant economic benefits that exceed cost.
Mid-term: Same as above.
Long-term: Same as above.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #51 Solar Roadways – Missouri DOT Pilot Project on Route 66

Category: F. Solar

Author(s)/Sponsoring Agency: Ally Hirschlag – UpWorthy.com; Linda Russell, reporter and Tim Leimkuhler, photojournalist – KY3 News

Date: June 27, 2016; June 30, 2016

Source:

<http://www.upworthy.com/one-of-americas-most-famous-highways-is-about-to-become-an-awesome-science-experiment>

<http://www.ky3.com/content/news/Solar-pilot-project-could-pave-way-to-roadways-of-the-future-383470771.html>

<http://www.riverfronttimes.com/newsblog/2016/06/27/route-66-will-get-a-dose-of-solar-power-in-southwest-missouri>

<https://www.youtube.com/watch?v=qlTA3rnpGzU>

<https://www.youtube.com/watch?v=YQba3ENhIKA>

Abstract: The Missouri Department of Transportation (MODOT) is building a pilot project along one of the most famous roadways in America, Route 66 (I-44). A solar roadway project is located at a Welcome Center (rest stop) near Conway Missouri, and is scheduled to be completed before the 2016 winter season. Phase 1 of the pilot project will install solar roadway panels over the existing walkway surface. The solar roadway panels are being installed by Solar Roadways, a start-up company from Idaho. The MODOT hopes to expand upon the pilot project to add Solar Roadway's solar panels on top of the existing parking lot surface and eventually the roadway surfaces along Route 66 (I-44). The solar panels will generate electricity to be used to power the rest stop, and will also generate heat to prevent snow and ice from accumulating on the panel surface during the winter. This MODOT pilot project will be the first test project for Solar Roadways outside of their own research and development testing. If this technology is successful, such that it can be placed onto roadways across the US, it could be the first roadway project that can pay for itself in the long run through generating and re-selling electricity.

Across the entire US, there are thousands of miles of roadway and walkway surfaces where solar roadway panels could potentially be installed. The Solar Roadways start-up has estimated very conservatively that if all of America's roadway and walkway surfaces were covered with Solar Roadway's solar panels, they would collectively generate 3 times more energy than we consume.

Potential for Pilot Project¹

Near-term²: Further expand existing test pilot project(s) and develop new test pilot project locations.

Mid-term³: Expand construction of solar panels to include roadway surfaces and scale up to begin covering several roadways in the US with electricity generating solar panels.

Long-term⁴: Expand construction of solar panels across the entire nation, and construct the solar panels on top of every roadway and walkway surface that is feasible.

Cost to Implement

Near-term: MODOT is using approximately \$100,000 of federal research dollars for the Conway, MO pilot project. The final length of the walkway to be covered with solar panels is currently un-known.

Mid-term: Costs will be reduced as the technology further develops and projects become more widespread.

Long-term: Costs will continue to decrease as competition increases.

Cost Implications

Near-term: Costs are projected to continue to be expensive, and efficiency of solar panels is projected to continue to be low.

Mid-term: Costs are projected to decrease and efficiency of solar panels is expected to increase.

Long-term: If costs can be reduced, and if more efficient solar panels can be developed, in addition to proving that the technology is efficient and sustainable, there is potential that solar roadways could pay for themselves, and generate up to 3 times more energy than we consume. The cost implications could potentially result in the savings of billions of dollars for governments and private sectors who are tasked with building and maintaining roadways, bridges and infrastructure. The reduction of costs associated with eliminating the need to provide fossil fueled electricity to homes and businesses would also save billions of dollars for private sector businesses, the government/public sector, residences and individual citizens.

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #52 Solar Energy Present and Future
Category: F. Solar
Author(s)/Sponsoring Agency: Multiple
Date: Multiple
Source: http://energy.gov/eere/sunshot/photovoltaics-research-and-development ; https://books.askvenkat.com/2013/01/wireless-power-transmission-via-solar.html ; http://www.sciencealert.com/engineers-just-created-the-most-efficient-solar-cells-everver ; http://www.sciencealert.com/india-says-the-cost-of-solar-power-is-now-cheaper-than-coal ; http://www.sciencealert.com/world-s-largest-solar-power-station-planned-for-india ; http://www.sciencealert.com/india-establishes-world-s-first-100-percent-solar-powered-airport
Abstract: The major types of energy currently consumed are not sustainable because there is a limited amount of resources (fossil fuels) to produce it. Power from the sun, in addition to being reliable, is renewable, safe, clean and free. However, efforts to capture and utilize the sun's energy as power are not free. Capturing the sun's energy and converting it to a reliable power source has associated costs and challenges because solar power is intermittent. Therefore, the key to sustainable solar power is an economic storage solution that sustains the power source when the sun is not available (on cloudy days and after sunset). To sustain the use of solar energy, local intelligent power grids need to be developed for solar energy generation, storage, distribution and utilization, at an affordable cost. These grids also need to provide enhanced securities of the energy supply. This can be achieved by establishing flexible transition between grid interconnected and islanded operating modes. With today's technology, solar energy can be captured in space. We have solar powered satellites, and solar power on the international space station. The long-term goal is to capture solar energy in space, and then transmit that solar energy (or power) to earth wirelessly. The power-collecting platforms would most likely operate in geosynchronous orbit where they would be illuminated 24 hours a day (except for short eclipse periods around the equinoxes). Thus, unlike systems for the terrestrial capture of solar, a space-based system would not be limited by the vagaries of the day-night cycle. Furthermore, if the transmission frequency is properly chosen, delivery of power can be carried out essentially independent of weather conditions. Thus Space Solar Power could provide base load electricity.
Potential for Pilot Project¹
Near-term²: High, but limited to smaller undertakings
Mid-term³: Higher and broader than near-term, as advances in storage, distribution and utilization become more prevalent and affordable.
Long-term⁴: Very high if space solar power can be harnessed and transmitted to earth via wireless power.
Cost to Implement
Near-term: Cost will be project specific. An example is found at the Cochin, India, international airport which runs entirely on 46,000 solar panels, spread over 45 acres. This project produces could also provide enough power to run 10,000 homes each year and save 300,000 tons of carbon emissions over the next 25 years. The cost of this system is \$9.3 million, a sum the Cochin Airport expects to save in less than six years by not having to pay electricity bills anymore.
Mid-term: No higher than in the near-term as the solar technology field evolves and competition grows.
Long-term: Uncertain because the cost of capturing energy from the sun, and transmitting it to earth wirelessly is unknown at this time. But, like all new technology though, the costs will decrease as the technology evolves.
Cost Implications
Near-term: Where there is enough land to build the number of solar panels required to sustain an individual operation, such as the 100% solar-powered airport in India, a project has the potential to pay for itself (\$9-10 million) in as few as 5 years, plus eliminate thousands of tons of carbon emissions.
Mid-term: Infrastructure costs will be recovered from savings on electricity in relatively short time periods while eliminating significant amount of pollutants.
Long-term: The potential cost savings with this technology is unfathomable and goes beyond the scope of providing clean, renewable energy that is not only affordable, but most likely would become free in many instances. The even greater potential of this technology, is to provide the ability of transmitting power to anywhere on Earth. When developing nations and 3 rd world countries are able to receive a sustainable and reliable energy source, the global benefits of this are far greater than just free electricity, the impacts would be evolutionary.



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #53 Energy

Category: G. Energy

Author(s)/Sponsoring Agency: Usually cities, often in Public-Private-Partnership (PPP)

Date: Last decade

Source: http://www.eia.gov/Energyexplained/?page=us_energy_transportation ;
<https://www.eia.gov/electricity/state/florida/index.cfm> ; <http://www.miamidade.gov/green/energy.asp> ;
http://www.fsec.ucf.edu/en/consumer/solar_electricity/rebates.htm ; <http://www.caranddriver.com/features/how-tesla-and-elon-musk-are-building-an-ev-infrastructure-feature> ; <http://www.solarroadways.com/> ;
http://www.fhwa.dot.gov/environment/climate_change/mitigation/publications/row/index.cfm ;
http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_TPK/FDOT-BDV24-977-01-rpt.pdf .

Abstract: Energy cost is one factor in one's decision to make a trip. Traditionally, cheap energy (cheap gas) has encouraged trip making. With global warming and environmental concerns that is less true and vehicle miles of travel have been trending down. Gasoline and diesel remain the principle fuels, but hybrids and electric vehicles, are making inroads.

Residential electricity rates in Florida average 11.42¢/kWh, which ranks the state 22nd in the nation. The primary source of electricity is burning natural gas, and Florida is in the top five states in the nation in CO₂ emissions.

Solar energy has a huge potential for expansion. It is widely believed that if citizens are allowed to sell excess electricity back to the grid, solar development would speed up. Property Assessed Clean Energy Programs (PACE) are in place in unincorporated Miami-Dade County for solar panels, hurricane windows and other energy saving upgrades as a financing option to spread installation costs over a number of years. And, as a government, Miami-Dade has an "Electricity Master Plan" to govern its use of electricity. The *2006 Florida Renewable Energy Technologies and Energy Efficiency Act* continues to provide consumers with rebates and tax credits for photovoltaic systems.

Meanwhile, per an article in Car and Driver, Tesla is expanding its network of charging stations. But as of August 2016, in Miami, there is only one charging station at Plantation, FL, 813 S University Drive. Plugshare.com maps dozens of public charging stations. Miami-Dade could have a role in non-residential electric charging stations, especially as it relates to making use of "locally" generated solar power generated, in part by its own policies with respect to property tax incentives for developing solar.

Engineers have developed and are testing panels that act as sidewalk or pavement. More established is FHWA's promotion of solar panels in right-of-way. FDOT installed a ground-mounted solar photovoltaic system at its Turkey Lake Service Plaza in 2012. The conclusion of a project review was that with lowering implementation costs, such installations would be profitable. Miami-Dade could take advantage of solar panels within its rights-of-way, in a predictable cost way.

Potential for Pilot Project

Near-term: High for solar panel installation in right-of-way

Mid-term: Same, plus charging stations could be supported in right-of-way or on County land

Long-term: Same

Cost to Implement

Near-term: \$4 per watt for larger scale systems

Mid-term: Cost will come down

Long-term: Cost will come down

Cost Implications

Near-term: Short-term cost outlay

Mid-term: Individual to project

Long-term: Long-term cost benefit

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #54 The Future Impact of 3D Printing on the Freight Transportation Industry and Retailers

Category: H. 3D Printing

Author(s)/Sponsoring Agency: Cameron Evans /IntergaCore

Date: February 24, 2016

Source: <https://blog.integracore.com/freight/the-future-impact-of-3d-printing-on-the-transportation-industry/>
<http://www.strategy-business.com/article/00219?pg=all>
<https://3dprint.com/119885/wake-forest-3d-printed-tissue/>

Abstract: Presently (2016), the business of moving automotive parts by truck is doing well due to a combination of lower fuel prices, and an improved economy – approximately 7 years removed from the Great Recession of 2008. However, the traditional auto manufacturers face a potential threat in the future: 3D printing. Seen by manufacturers as a way to streamline operations, improve quality, and lower costs, the evolution of 3D printing has substantial implications for trucking firms. As more parts and products are manufactured in finished form and manufacturing sites locate closer to the end destination, the need to procure parts from multiple sources around the globe could be significantly reduced and, in turn, decreasing the need for global transportation. Although 3D printing is mostly used to create prototypes today, it will likely contribute to the re-shoring trend. Remote production in a lower cost market could be replaced by manufacturing facilities located at home closer to the consumer, allowing for a more responsive manufacturing process and greater quality control. As these efforts gain momentum, the need to ship many parts, products, or raw materials to market will be eliminated or greatly reduced. A recent analysis found that as much as 41% of air cargo and 37% of ocean container shipments are threatened by 3D printing. Roughly a quarter of the trucking freight business is also vulnerable, due to the potential decline in goods that start as air cargo or as containers on ships and ultimately need some form of overland transport. Rail companies are the least vulnerable. Footwear, toys, ceramic products, electronics, and plastics industries have the highest potential for disruption, while sectors such as perishables and pharmaceuticals, find 3D printing less threatening.

Potential for Pilot Project¹

Near-term²: 3D printing of footwear, toys (building blocks), ceramic products (flower vase), electronics (protective smartphone case – or the smartphone itself), and countless plastic products (from replacement parts to furniture).

Mid-term³: Adoption of 3D printing technology by a large number of people will be the key to future pilot projects. If 3D printers become a common household item, more than likely a person would choose to print, for example, a new chess piece or plastic fork at home rather than purchasing that item from Walmart.

Long-term⁴: Although they are unlikely in the near term, breakthroughs in nanotechnology or in the ability to inexpensively create the raw materials needed for 3D printing from recycled household waste could completely change the economic trade-offs. There are many other industries that are currently experimenting with 3D printers to produce: houses, commercial buildings, roadway and pedestrian bridges, medical devices such as prosthetic limbs for amputees, and even human organs and tissue for patients who need an organ or tissue transplant.

Cost to Implement

Near-term: 3D printing offers a new manufacturing model. It eliminates the need for expensive, customized tooling, and uses less material. The cost of digital printers continues to decline; startups are now offering hobbyist versions for less than US\$250. But 3D printing isn't poised to take the place of factory production anytime soon.

Mid-term: Costs will increase as this technology is scaled up. The larger the desired object, the costlier it will be to print.

Long-term: As 3D printing becomes more widespread, costs to purchase a 3D printer and costs of manufacturing will decrease.

Cost Implications

Near-term: If transport companies should adjust and redesign networks for more localized moves, or consider introducing completely new logistics services.

Mid-term: As more people adapt to 3D printing, retailers will have to develop new/better ways to draw customers to their business/products. Remaining relevant in a world where anyone can manufacture their own goods without leaving their own home or business will put increasingly downward pressure on many retailers some of which are now struggling with internet competition.

Long-term: If/when 3D printers become household items as common as a television, many retailers will struggle to maintain market share or worse. Why go to a hardware store when you can print the needed item at home.

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #55 How Driverless Cars Spell the End of Parking as We Know It
Category: I. Parking
Author(s)/Sponsoring Agency: Doug Newcomb / PC Magazine
Date: August 12, 2016
Source: http://www.pcmag.com/commentary/346952/how-driverless-cars-spell-the-end-of-parking-as-we-know-it http://auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/self-parking-car.htm http://www.treehugger.com/cars/tesla-showcases-3-self-driving-features-summon-autopilot-and-autopark-video.html
Abstract: Parking issues are prevalent anywhere crowds of people gather. Autonomous vehicles can help address the issue. Once a person arrives at their destination in an autonomous vehicle it can self-park. Auto park and summons functions are required to reach Level 4 of vehicle automation (full self-driving automation). The amount of space required to park a is greatly reduced compared to parking a traditional passenger vehicle. If the vehicle does not have any passengers inside when parking, then the doors do not need to open or close. Side mirrors are not needed for an autonomous vehicle to auto park. This results in the ability to park autonomous vehicles much closer together than traditional passenger cars can be parked today. This saves on needed space. And, in the case of new parking structures, reduces the footprint to accommodate the same number of vehicles while at an existing facility, the space needed is reduced and the revenue, if it is paid-parking, is increased. Tesla Motors has already developed the technology to allow their vehicles to not only auto (self) park, but to also be summoned from its parking space to pick up passengers who are waiting at the door or curbside.
Potential for Pilot Project¹
Near-term²: High, as a pilot project.
Mid-term³: Higher than in the near-term
Long-term⁴: Higher than in the mid-term
Cost to Implement
Near-term: While Tesla has already developed the technology, affordable cost will involve additional research to perfect it.
Mid-term: Costs will involve additional research and development in order to perfect the technology.
Long-term: Costs will involve widespread implementation in all vehicles in order to achieve Level 4 (full self-driving) vehicle automation.
Cost Implications
Near-term: Relatively small on a “pilot project” basis.
Mid-term: Reducing the footprint of a new parking facility thereby allowing other productive land uses in what may be a constrained area will provide benefits is land use that have a greater return than a parking facility economically and in quality of life.
Long-term: Same as above.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #56 Bikes

Category: J. Bikes

Author(s)/Sponsoring Agency: Usually cities, often in Public-Private-Partnership (PPP)

Date: Last decade

Source: https://en.wikipedia.org/wiki/Bicycle-sharing_system ;
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.599.5656&rep=rep1&type=pdf>;
<http://miamidadetpo.org/library/studies/rail-convertibility-study-final-2004-11.pdf>;
<http://miamidadetpo.org/library/studies/csx-corridor-evaluation-study-final-2009-08.pdf> ;

Abstract: Innovations in the way of gadgetry are constant among avid bicyclists. Factors that affect mode shift to bicycles include climate, trip length, and facilities. Miami-Dade has the climate. Trip length is a function of housing location choice and land use patterns. Facilities include bicycle availability, a travel path, and storage at the destination.

Bicycle availability has been enhanced in Miami by Citi, the PPP title sponsor of the Miami Beach bike share program since 2011. That program has expanded to downtown Miami and Coconut Grove with 1,750 bikes at 170 stations. Citi will be title sponsor of the program until 2019, and DECOBIKE will continue as the program operator. This program could be expanded.

Separated bicycle paths play an integral part in the overall bicycle transportation network. Cyclists traveling primarily on separated paths tend to make significantly longer trips. Separated paths minimize conflicts with vehicles and pedestrians, but are costly and require right-of-way. The current LRTP includes a set-aside with planning to include bike/ped facilities, where feasible.

The 2004 TPO "Rail Convertibility Study," assessed the short- and long-term corridor potential for public transportation and bicycle/pedestrian activities of unused or underused rail corridors in the County. The "Miami-Dade County CSX Corridor Evaluation Study," performed for the TPO in 2009 went into greater detail on the CSX rail lines. Planning studies continue with respect to best use of the rail corridors and where and how bicycle facilities can be included.

An important factor in bicycle trip making is secure bicycle storage at destinations. Businesses can play an important role by providing such storage. Miami-Dade could expand bike storage at their facilities.

An opportunity is building pedestrian/bicycle links across canals where there is no road to increase mobility and connectivity. This would provide a modal advantage, not shared by vehicles, to encourage non-motorized trips at no expense to vehicular right-of-way.

Potential for Pilot Project¹

Near-term²: Bike lanes w/road projects; links across canals

Mid-term³: Same, plus paths in RR corridors

Long-term⁴: Same, plus paths in RR corridors

Cost to Implement

Near-term: Bike lane median cost \$89,000 per mile; paved-path median cost \$261,000; links across canals; bridge crossing canal cost \$200,000.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Policy set-aside for bike facilities in budget

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #57 FAA Expects 600,000 Commercial Drones in the Air (by 2017)
Category: K. Drones
Author(s)/Sponsoring Agency: Alina Selyukh, National Public Radio
Date: August 29, 2016
Source: http://www.npr.org/sections/thetwo-way/2016/08/29/491818988/faa-expects-600-000-commercial-drones-in-the-air-within-a-year
Abstract: The Federal Aviation Administration (FAA) expects some 600,000 drones to be used commercially by sometime in 2017. For context, FAA says that 20,000 drones are currently registered for commercial use. What's expected to produce a 30-fold increase in a matter of months are new rules that went into effect on August 29, 2016, which makes it easier than before to become a commercial drone operator. The new rules change the process of becoming a commercial drone pilot: Instead of having to acquire a traditional pilot's license and obtaining special case-by-case permission from federal regulators, drone operators now need to pass a new certification test, abide by various flying restrictions and be older than 16. Huerta says more than 3,000 people preregistered to take the certification test on August 29th, the first day of the new regime. Businesses, however, may get a special waiver to skip some of the restrictions if they can prove they can do so safely. Huerta said Monday that the FAA has approved almost 80 waiver applications; the vast majority sought permission to operate at night. So far, the top uses of commercial drones have included aerial photography, real estate, various inspections, agriculture and filmmaking, according to the Association for Unmanned Vehicle Systems International, the industry trade group. Firefighting, search-and-rescue, conservation and academic research are seen as potential beneficiaries of the new rules. The drone association expects the industry will create more than 100,000 jobs and generate more than \$82 billion for the economy in the first 10 years of being integrated into the national airspace.
Potential for Pilot Project ¹
Near-term²: Immediate
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Little, if anything, to the public sector
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Cost savings in areas of included aerial photography, various inspections, agriculture, firefighting, search-and-rescue, conservation and academic research
Mid-term: Same as above
Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #58 Drone Use for Transportation Purposes

Category: K. Drones

Authors:

C. Brooks, R. Dobson, D. Banach, D. Dean, T. Oommen, R. Wolf, T. Havens, T. Ahlborn, B. Hart Preforming Agency: Michigan Technological University

Sponsoring Agency: Michigan Department of Transportation

Date: April 7, 2015

Source: http://www.michigan.gov/mdot/0,4616,7-151-9622_11045_24249_52176-353767--,00.html

Abstract: Advances in unmanned aerial vehicle (UAV) technology have enabled “drones” to become easier to use and afford. In a budget-limited environment, these flexible remote sensing devices can help address transportation agency needs in operations, maintenance, and asset management while increasing safety and decreasing cost. The project in this report tested and evaluated five main UAV platforms with a combination of optical, thermal, and LiDAR sensors to assess critical transportation infrastructure and issues such as bridges, confined spaces, traffic flow, and roadway assets. A State of the Practice report was developed, and a series of lab tests were accomplished to ensure practicality and safe operations. Field demonstrations were completed at bridges, pump stations, and other venues. The project provided a series of technical demonstrations at the Intelligent Transportation Systems World Congress in Detroit in September, 2014, enabling outreach to a wide domestic and international audience who gained understanding of the advanced research. These demonstrations showed that UAV technologies provide many advantages to help cost-effectively assess, manage, and maintain transportation resources, providing benefit to the traveling public.

Potential for Pilot Project¹

Near-term²: High. One focus is to provide live video streaming and monitoring capabilities in the transportation field. Most drones are flown with a camera attached that can capture high resolution photos and video, but without the ability to live stream that video on the internet. Other near term projects include: rescue missions, security, and improved robo-drones for military use, or for use where helicopter or personnel deployment is dangerous, uneconomical or technically impossible.

Mid-term³: Higher than near term including freight shipping.

Long-term⁴: Higher yet and spreading to personal transportation.

Cost to Implement

Near-term: Cost to implement live stream technology is zero, because this technology already exists. However, there will be research costs (private and public) in adapting this technology to a drone while it is in flight, and broadcast the video footage live.

Mid-term: The cost of package delivery services would include developing the technology, software and hardware costs, operations, and maintenance. At least some of the costs could be recouped by passing them on to the customer.

Long-term: Initially, the major development cost will be public/private research and development. Once the product is ready to be scaled up for consumers, the cost will decrease rapidly at first and become more affordable to the masses.

Cost Implications

Near-term: Savings in labor costs.

Mid-term: Use of drone in freight movement will result in jobs lost, such as: delivery drivers, UPS, FedEx, DHL, and others who could be left without employment in this industry. Savings in a number of areas (crashes, public health, congestion) would also be evident.

Long-term: The cost implications could be positive and negative. Gains could be realized in personal freedoms, to travel in different ways, which would help reduce congestion. This technology could also result in jobs lost – similar to drones used for package delivery and the same companies/sector that will impact.

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #59 What is the Internet of Things (IoT)?

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: Andrew Meola, *Business Insider*

Date: Aug. 24, 2016

Source: <http://www.businessinsider.com/what-is-the-internet-of-things-definition-2016-8?IR=T>

Abstract: The IoT refers to the connection of devices, beyond computers and smartphones, to the Internet. Cars, kitchen appliances, and even heart monitors can all be connected through the IoT. And as the Internet of Things grows in the next few years, more devices will join that list.

Business Insider forecasts that there will be more than 24 billion IoT devices on Earth by 2020. That's approximately four devices for every human being on the planet. And \$6 billion will flow into IoT solutions, including application development, device hardware, system integration, data storage, security, and connectivity. Those investments will generate \$13 trillion by 2025. IoT platforms serve as the bridge between the devices' sensors and the data networks. Three major entities will use IoT ecosystems: consumers, governments, and businesses.

Some of the top IoT platforms on the market today are: Amazon Web Services, Microsoft Azure, ThingWorx IoT Platform, IBM's Watson, Cisco IoT Cloud Connect, Salesforce IoT Cloud, Oracle Integrated Cloud, and GE Predix

As devices become more connected security and privacy have become the primary concern among consumers and businesses. In fact, the protection of sensitive data ranked as the top concern (at 36% of those polled) among enterprises, according to the 2016 Vormetric Data Threat Report.

Cyber attacks are also a growing threat as more connected devices pop up around the globe. Hackers could penetrate connected cars, critical infrastructure, and even people's homes. As a result, several tech companies are focusing on cyber security in order to secure the privacy and safety of all this data.

Potential for Pilot Project¹

Near-term²: Essential if a business and a community are to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Depends of the applications and their extent but both the public and private sectors must recognize and address the need.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term; More efficient and effective delivery of services and products; increased productivity, decreased costs, and improved quality of life.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #60 Internet of Things in Healthcare: Information Technology in Health
Category: L. IoT/Data Management
Author(s)/Sponsoring Agency: Andrew Meola, <i>Business Insider</i>
Date: August 24, 2016
Source: http://www.businessinsider.com/internet-of-things-in-healthcare-2016-8
Abstract: Healthcare applications now let patients schedule their appointments without the need to call a doctor's office and wait for a receptionist. Healthcare information technology lets doctors carry information with them anywhere they go through apps on their smartphones. Arguably the greatest technological leap forward in the last several decades has been the growth of electronic health records, or EHRs. In 2009, a mere 16% of U.S. hospitals were using an EHR, but that figure soared to approximately 80% in 2013, according to Becker's Hospital Review. Previously, hospitals had multiple systems that handled different functions, but EHRs roll all of those into a single system. The Internet of Things is slowly starting to weave into healthcare on both the doctor and patient fronts. Ultrasounds, thermometers, glucose monitors, electrocardiograms, and more are all starting to become connected and letting patients track their health. This is crucial for those situations that require follow-up appointments with doctors. Multiple hospitals have started to utilize smart beds, which can sense the presence of a patient and automatically adjust itself to the correct angle and pressure to provide proper support without the need for a nurse to intervene. The IoT could also help transform patient care at home. Portal technology, lets patients log on to the healthcare providers' websites to access their medical records, download forms, and prepare for appointments. Home monitoring systems allow patients and doctors to keep track of an individual's health when not in the doctor's office to prevent unnecessary and costly trips to sit down with a physician. Smart medication dispensers in the home could automatically upload information to the cloud and alert doctors when patients don't take their medicine. More broadly, this type of technology could let doctors know of any potentially dangerous patient behavior.
Potential for Pilot Project¹
Near-term²: Essential if a business and a community are to be efficient and effective
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Depends of the applications and their extent but both the public and private sectors must recognize and address the need.
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term; More efficient and effective delivery of services and products
Mid-term: Same as above
Long-term: Same as above

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



Topic: #61 IoT Forecast: Examining How The IoT Will Affect The World

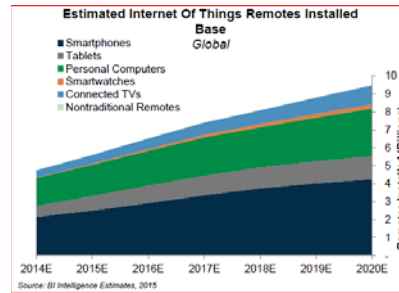
Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: John Greenough,Jonathan Camhi, *Business Insider*

Date: November, 2015

Source:

the internet of things 2015- examir



Abstract: The Internet of Things (IoT) is a vast and growing network of connected objects able to collect and exchange data using embedded sensors.

An IoT device includes any stand-alone internet-connected device that can be either monitored and/or controlled from a remote location.

IoT devices are connected within the IoT ecosystem. The ecosystem includes all the components that enable businesses, governments, and consumers to connect to and control their IoT devices, including remotes, dashboards, networks, gateways, analytics, data storage, and security.

Businesses will be the top adopter of IoT solutions.

Governments are focused on increasing productivity, decreasing costs, and improving their citizens' quality of life.

Consumers will lag behind businesses and governments in IoT adoption.

There are four market drivers propelling IoT growth. These include expanded internet connectivity, high adoption of mobile devices, low cost of sensors, and large investments from tech companies in IoT sectors.

The four barriers preventing adoption include a lack of security, privacy concerns, large-scale implementation hurdles, and technological fragmentation within the IoT ecosystem.

In total, we project there will be 34 billion devices connected to the internet by 2020, up from 10 billion in 2015. IoT devices will account for 24 billion, while remotes will comprise 10 billion.

Potential for Pilot Project¹

Near-term²: Essential if a business and a community are to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Depends of the applications and their extent but both the public and private sectors must recognize and address the need.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased productivity, decreased costs, and improved quality of life.

Mid-term: Same as above

Long-term: Same as above

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

Topic: #62 Forecast of How The IoT Will Affect **Healthcare****Category:** L. IoT/Data Management**Author(s)/Sponsoring Agency:** John Greenough, Jonathan Camhi, *Business Insider***Date:** November, 2015**Source:**the internet of
things 2015- examin

Abstract: Connected healthcare devices can collect data, automate processes, and more. Given what is at stake in terms of patient health and safety, the security and reliability of many such devices is at a premium. There's a huge opportunity for connected devices in the healthcare sector because:

- Connected devices transmit a vast amount of data that can be used for research and analyzed for patient care. Apple released ResearchKit, which helps developers and researchers build apps to collect and analyze healthcare information.
- Connected healthcare devices provide real-time diagnostic information, which enables doctors to track patients' progress.

Fitness tracker will grow from 41.8 million in 2015 to 100 million will in use in 2020 to play a vital role in data collection and health monitoring.

IoT devices in healthcare will grow from 95 million in 2015 to 646 million in 2020, representing a 46 compound annual growth rate. It's important to note that the devices included in these forecasts do not include fitness trackers and other wearables devices.

Potential for Pilot Project¹**Near-term²:** Essential if the healthcare community/industry is to be efficient and effective**Mid-term³:** Same as above**Long-term⁴:** Same as above**Cost to Implement****Near-term:** Significant.**Mid-term:** Same as above**Long-term:** Same as above**Cost Implications****Near-term:** Increased productivity, improved quality of life, lower operating costs.**Mid-term:** Same as above**Long-term:** Same as above**1:** Considered an on-the ground application; **2:**2020-2025; **3:** 2026-2035; **4:**2036-2045

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #63 Forecast of How The IoT Will Affect **Infrastructure**

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider*

Date: November, 2015

Source:



the internet of
things 2015- examin

Abstract: As municipalities face growing population pressures, they will look to connect their public infrastructure to deploy services more efficiently and improve the quality of life. Examples of how IoT devices and networks are already being used by cities include:

- Connected surveillance cameras are helping police monitor areas with high crime rates.
- Connected traffic lights are helping cities adjust traffic patterns to relieve congestion.
- Connected streetlights are helping cities save energy costs.

Cities' spending on IoT technologies will reach \$133 billion in 2019. Municipalities worldwide will increase their spending on IoT systems at a 30% compound annual growth rate, from \$36 billion in 2014 to \$133 billion in 2019. This investment will generate a massive return for these municipalities, creating \$421 billion in economic value for cities worldwide in 2019.

Installations of connected devices for cities will reach 1.9 billion in 2019. Installations of connected devices for urban municipalities will increase from 454 million in 2014 to 1.9 billion in 2019, when the global installed base of urban connected devices is expected to reach 6.2 billion. This will make public infrastructure one of the biggest markets for connected devices and the software services that support them.

Potential for Pilot Project¹

Near-term²: Essential if a community is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased productivity, improved quality of life, lower operating costs.

Mid-term: Same as above

Long-term: Same as above

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

Topic: #64 Forecast of How The IoT Will Affect **Manufacturing**

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider*

James Macaulay, Lauren Buckalew, Gina Chung, DHL Trend Research | Cisco Consulting Services

Date: November, 2015



Source: the internet of things 2015- examin and

http://www.dhl.com/content/dam/Local/Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf

Abstract: The IoT opens up new possibilities for analyzing and automating manufacturing processes. Manufacturers are expected to increase their investment in IoT devices and analytic systems significantly by 2020 because:

- The price of sensors required for IoT devices has dropped 7% over the past five years and will continue to drop.
- Over the past two years, tech companies have been marketing the IoT to manufacturers to show how the manufacturers can increase their profits.
- 35% of manufacturers already use smart sensors, 10% plan to implement them within a year, 8% plan to implement them within three years, and 24% plan to implement them but don't have a timeframe,

Manufacturers will spend \$276 billion on the IoT by 2020. Manufacturers will invested \$29 billion in 2015; in 2020 they will invest \$70 billion, representing a 19% in compound annual growth rate.

Manufacturing IoT devices will grow from 237 million in 2015 to 923 million in 2020. This will primarily be comprised of sensors retrofitted to pre-existing manufacturing equipment. New manufacturing equipment commonly will come outfitted with IoT technology in the near future.

IoT enables managers to understand what is occurring at a given moment in a manufacturing/factory environment — the performance of machines, ambient conditions, energy consumption, status of inventory, or the flow of materials. Preventative maintenance is a key use case of IoT, and this is particularly critical in a production-floor setting. Sensors can alert managers (or machines) that a physical asset in the factory is exceeding acceptable levels of vibration or temperature, is malfunctioning, or is otherwise prone to fail. This has major implications in terms of overall equipment effectiveness (OEE), a key metric of manufacturing productivity, and has positive ripple effects throughout the supply chain.

Near-term²: Essential if a manufacturing business is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased productivity, decreased costs.

Mid-term: Same as above

Long-term: Same as above



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #65 Forecast of How The IoT Will Affect **Buildings**

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider*

Date: November, 2015

Source:



the internet of
things 2015- examin

Abstract: Building managers throughout the world are looking to implement IoT solutions that save money and improve their buildings' attractiveness. A few ways buildings are being connected include:

- HVAC systems are being connected to monitor and control the temperature throughout the building. This reduces energy consumption, which saves money.
- Connected light bulbs also reduce energy usage.
- Buildings are being equipped with advanced IoT security solutions.

Nearly 60% of US building managers are familiar with the IoT, and 43% believe the IoT will affect how they run their building within the next two to three years, according to a survey from Daintree Networks. Interestingly, the survey found that the majority of lighting fixtures in buildings are not LED. This means they could opt for connected LED bulbs when replacing the current bulbs installed.

An increasing number of commercial and residential elevators are being connected to the internet, making them smarter and more efficient. The need for increased efficiency in the elevator market is staggering. In 2010, New Yorkers' total time spent waiting for elevators equated to 22.5 years, according to IBM. The smart elevator market is expected to grow from \$12 billion in 2015 to \$23 billion in 2020.

Potential for Pilot Project¹

Near-term²: Essential if buildings are to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Lower operating costs.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #66 Forecast of How The IoT Will Affect **Utilities**

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider*

Date: November, 2015

Source:



Abstract: Global energy demand is expected to increase 37% by 2040, according to the International Energy Agency. As a result, energy supplies will likely become strained. Utility companies are increasingly turning to the IoT to make energy use more efficient by using smart meters installed in buildings and connected to smart energy grids, enabling utility companies to manage the flow of energy. Each smart meter is expected to save a utility company approximately \$20 per year in reduced labor and energy savings.

It is forecast that the global installed base of smart meters will increase at a 15% compound annual growth rate, from 450 million in 2015 to 930 million in 2020. Currently, China has the largest installed base of smart meters, with 190 million in 2015. That number is expected to grow to 320 million in 2020, representing an 11% compound annual growth rate.

Based on a European Commission study, the forecast cost of installing smart meters for utility companies around the world will reach \$107 billion by 2020, which will allow utility companies to save \$157 billion by 2035, representing a net gain of \$50 billion.

Potential for Pilot Project¹

Near-term²: Essential if utility organizations are to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Lower operating costs, improved profits.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #67 Forecast of How The IoT Will Affect **Retailing**

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: James Macaulay, Lauren Buckalew, Gina Chung, DHL Trend Research | Cisco Consulting Services and John Greenough, Jonathan Camhi, *Business Insider*

Date: 2015

Source:

http://www.dhl.com/content/dam/Local/Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf

and



the internet of
things 2015- examin

Abstract: Retailing set for dramatic change because of IoT innovations. The “connected retail store” amounts to a diverse collection of IoT-enabled use cases, all promising greater operational efficiency and new forms of customer experience. IoT in the retail industry will drive efficiency through in-shelf availability, inventory and merchandise optimization, loss prevention, mobile payments, and more. This, in turn, will transform the customer experience. For consumers, improved efficiency will flow from several key IoT-reliant applications, including:

- Checkout optimization tools such as Qminder and Waitbot
- In-store guidance for shoppers, such as the OSHbot, introduced by home improvement retailer Lowe’s. This is a robot equipped with sensors, cameras, and speech and video analytics that assists with way-finding and the location of products
- Mobile payments.

Here are a few ways retailers are using IoT devices to target offers, drive sales, and collect data about customers’ in-store shopping habits:

- Beacons, paired with mobile apps, are being used in stores to monitor customer behavior and push advertisements to customers.
- Smart mirrors enable customers to try on clothes virtually, thereby enhancing the shopping experience.
- Digital signage pushes ads and price changes to stores in real time to create targeted sales.
- Smart shelving is used to determine when inventory is low and alerts the store manager to order more.

It is estimated that beacon-triggered messages influenced \$4.1 billion in sales for the top-100 US retailers in 2015. In 2016, nearly \$44.1 billion will be influenced by beacon-triggered messages for the same top-100 US retailers.

Potential for Pilot Project¹

Near-term²: Essential if the Retailing industry is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased revenue, lower operating costs.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet	
Topic: #68 Safeguarding the Internet of Things: Being secure, vigilant, and resilient in the connected age	
Category: L. IoT/Data Management	
Author(s)/Sponsoring Agency: Irfan Saif, Sean Peasley, Arun Perinkolam / Deloitte University Press	
Date: July 27, 2015	
Source: http://dupress.deloitte.com/dup-us-en/deloitte-review/issue-17/internet-of-things-data-security-and-privacy.html	
Abstract: With the IoT, the role of humans diminishes, to the point that in many cases they are removed from the equation: Machines input, communicate, analyze, and act upon the information. A single vulnerable device can leave an entire ecosystem open to being attacked. That is why risk management must be secure, vigilant and resilient. Secure: Effective risk management begins by preventing system breaches or compromises. Lack of interoperability and unwillingness of various organizations to adhere to common standards creates a barrier to standardization of the functionality of IoT devices. Devices that do not adhere to common standards are more vulnerable to attack. Vigilant: Security must be complemented by vigilance to determine whether a system is still secure or has been compromised. As technology evolves, so too will the threats face. When safeguarding an IoT ecosystem, once security is established, remaining vigilant to new or unexpected challenges is crucial in order to maintain that security. Resilient: When a breach occurs, limiting the damage and re-establishing normal operations are much more easily and effectively done when there are processes in place to quickly neutralize threats, prevent further spread, and recover. There is no amount of security and vigilance that can guarantee a breach or compromise will never occur. Next steps (See paper for more details): • Work to define standards for interoperability • Use purpose-built devices or add-ons, rather than pre-IoT solutions • Develop clear responsibilities for the players in your ecosystem • Establish a baseline of data • Institute data governance • Create loosely coupled systems	
Potential for Pilot Project ¹	
Near-term²: Immediate.	
Mid-term³: Same as above.	
Long-term⁴: Same as above.	
Cost to Implement	
Near-term: Data security across all industries will cost billions of dollars collectively. However, data breaches can potentially cost even more, which makes data security and risk management efforts far more than a necessity.	
Mid-term: Cumulative costs will continue to rise along with the expansion of the IoT.	
Long-term: Same as above.	
Cost Implications	
Near-term: Protecting just one large entity or corporation, such as a Fortune 500 company, from a data breach can save billions of dollars.	
Mid-term: Same as above.	
Long-term: Same as above.	

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #69 Securing the Internet of Things (IoT)
Category: L. IoT/Data Management
Author(s)/Sponsoring Agency: Hewlett Packard Enterprise
Date: April 11, 2016
Source: http://hpe-enterpriseforward.com/eiu-securing-iot/ http://www.ctiasupermobility2016.com/events/eventdetails.cfm/2856 http://hpe-enterpriseforward.com/risks-dont-take-secrets-secured-environment/ http://www.computerweekly.com/opinion/How-to-mitigate-security-risks-associated-with-IoT https://erm.ncsu.edu/library/article/risk-management-in-the-internet-of-things
Abstract: The Internet of Things (IoT) is all-encompassing, smart technology that includes every type of individual smart device that can be connected to another device. Consumer products from smartphones, tablets, refrigerators and even light switches to consumer wearables such as smart glasses, smart watches and smart shoes are connected smart devices that are part of the IoT. Smart cars, smart cities, smart roads and infrastructure, smart houses, smart TV's and almost anything electronic is now connected or has the ability to connect to at least one other smart device via wireless technology, Bluetooth, or other means. Data security and privacy protection concerns are always at the forefront when it comes to all of this technology. Everything in the world of technology is vulnerable and there are many who purposely try to preform data breaches (known as hacking) on a routine basis. Not only are they routinely at work, they become better at hacking as they gain experience, and are increasingly difficult to stop. While more and more products are including smart technology, the challenges of mitigating risks to avoid data breaches are ever increasing. Many companies exist in the IT industry that focus on data security, privacy protection, preventing hackers from stealing secure data, protecting against identity theft, among other things. With rapid changes in technology come new and unforeseen risks. The most vulnerable are those who do not realize they are at risk. On the topic of autonomous (driverless) vehicle technology, the majority of people who are not comfortable with concept cite data breaches and security protection as top concerns. Those who don't trust that the data are secure will simply avoid taking the risk.
Potential for Pilot Project ¹
Near-term²: Immediate.
Mid-term³: Same as above.
Long-term⁴: Same as above.
Cost to Implement
Near-term: Data security across all industries will cost billions of dollars collectively. However, data breaches can potentially cost even more, which makes data security and risk management efforts far more than a necessity.
Mid-term: Cumulative costs will continue to rise along with the expansion of the IoT.
Long-term: Same as above.
Cost Implications
Near-term: Protecting just one large entity or corporation, such as a Fortune 500 company, from a data breach can save billions of dollars.
Mid-term: Same as above.
Long-term: Same as above.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #70 Managing Risk for the Internet of Things (IoT)

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: James Andrew Lewis / Center for Strategic & International Studies (CSIS)

Date: February 2016

Source:



160217_Lewis_ManagingRiskIoT_Web_Redat

Abstract: Mitigating risk in order to minimize or even eliminate potential disruption to an enterprise system/environment is paramount to achieving success in the IoT. In order to prevent hacking of Big Data, companies must continuously monitor their systems and infrastructure and be prepared to address an issue as quickly as possible.

The Executive Summary of the attached paper, contains major insights into the vulnerabilities and risks associated with having every smart device connected to another smart device. Increased risk does not always come with increased vulnerability. Benefits of the IoT outweigh the potential for harm. A risk not typically considered is the economic risk of suppressing growth and innovation if premature, overreaching security measures are enacted.

As stated by the paper's authors: **One thing we have learned about the Internet in the last 20 years is that it creates both benefit and risk, and that the benefits outweigh the risks. This same lesson applies to securing the Internet of Things."**

Potential for Pilot Project¹

Near-term²: Immediate.

Mid-term³: Same as above.

Long-term⁴: Same as above.

Cost to Implement

Near-term: Data security across all industries will cost billions of dollars collectively. However, data breaches can potentially cost even more, which makes data security and risk management efforts far more than a necessity.

Mid-term: Cumulative costs will continue to rise along with the expansion of the IoT.

Long-term: Same as above.

Cost Implications

Near-term: Protecting just one large entity or corporation, such as a Fortune 500 company, from a data breach can save billions of dollars.

Mid-term: Same as above.

Long-term: Same as above.

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #71 lot in Wellness/Healthcare

Category: L. IoT/Data Management

Author(s)/Sponsoring Agency: James Macaulay, Lauren Buckalew, Gina Chung, DHL Trend Research | Cisco Consulting Services

Date: 2015

Source:

http://www.dhl.com/content/dam/Local/Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf

Abstract: Using IoT to monitor health of patients extends beyond preventing industrial accidents to improving the wellness of the population in general. The consumer trend of using wearable technologies to enable the "quantified self" has increased dramatically in recent years, exemplified by devices from Apple, Fitbit, Jawbone, Pebble, and Sony. The number of personal health and fitness trackers (including smart watches) in use is expected to grow from over 40 million in 2015 to 100 million by 2020.

Healthcare organizations are moving beyond wearables, which generally track factors such as hours of sleep, steps taken, or calories burned. Some are leveraging IoT for an array of different and more complicated wellness monitoring applications. For example, Novartis and Google are developing smart contact lenses to measure blood glucose levels for diabetes patients. One of the biggest areas of value for IoT, in terms of both health and financial outcomes, is chronic disease management. Monitoring patients - - their blood pressure, their compliance with medication instructions, the care they receive in a hospital or senior living facility - - is perhaps the core application of IoT in healthcare. Products such as so-called "smart pills", which feature tiny sensors embedded in the tablets swallowed by patients, illustrate how IoT-enabled biomedical device miniaturization can give doctors and scientists greater insights into disease. IoT can reduce the potential for medical error among caregivers, provide an opportunity to intervene in emergencies, help medical professionals and patients take a more longitudinal approach to care, and, in the aggregate, shape research.

It is important to note in the area of healthcare IoT, physicians may be affected by the liability of "knowing too much" as litigators may claim upon the death of a patient "...the doctor should have done more to protect my client's life with all the information at her/his disposal".

Potential for Pilot Project¹

Near-term²: Essential if the healthcare community/industry is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased productivity, improved quality of life, lower operating costs.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #72 Clustered regularly interspaced short palindromic repeats (CRISPR) — the potential to fight Zika
Category: L. IoT/Data Management
Author(s)/Sponsoring Agency: Universities and research organizations worldwide. Article by Tina Hesman Seay.
Date: September 3, 2016
Source: https://www.sciencenews.org/article/crispr-inspires-new-tricks-edit-genes
Abstract: This article in <i>Science News</i> is an authoritative summary in layman’s terms of advances in research on clustered regularly interspaced short palindromic repeats (CRISPR, pronounced crisper), and ongoing improvements to the technology. Fundamentally, there are genes and the space between genes along DNA, which is the blueprint for all non-viral life. CRISPR can quickly and efficiently manipulate virtually any gene in any plant or animal, at relatively low-cost, by many scientists. A guide RNA transports an enzyme to a desired spot, cleaves the DNA and allows insertion or deletion per the selected RNA. The potential is to correct genetic disease, sterilize mosquitoes, “cleanse” pig organs for human transplant, add desirous traits to food crops and any number of other changes. One aspect that makes the technology revolutionary is that it is cheap enough and straightforward enough that many laboratories can undertake it. And the Food and Drug Administration may not require changes to crops, for example, as “genetically modified,” which means plants can be brought to the market in a shorter time frame. https://www.geneticliteracyproject.org/2016/06/15/on-usda-decisions-to-allow-crispr-edited-crops-to-forego-additional-regulation/ This technology could take many forms that affect quality of life, with some impacts on transportation. Food crops could be modified to hydroponic culture in cities, for example. Because of the accessibility of the technology its manifestations are hard to predict, but will be many.
Potential for Pilot Project ¹
Near-term²: Research is underway by the public and private sectors in many arenas
Mid-term³: Research will continue to become more focused as research into genetic causes of disease advance. Early onset Alzheimer is an example.
Long-term⁴: Completely unpredictable
Cost to Implement
Near-term: Costs are being borne by the public and private sectors due to the high rate of return in disease control, crop modifications and other aspects of health and welfare.
Mid-term: More of the above
Long-term: More of the above
Cost Implications
Near-term: Little cost to the public except insofar as expenditure of federal research dollars.
Mid-term: Same as above
Long-term: Same as above

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #73 Automation of Banking
Category: M. Banking
Author(s)/Sponsoring Agency: Private Sector
Date: Last decade
Source: http://www.americanbanker.com/issues/179_21/community-banks-opening-up-to-closing-branches-1065326-1.html ; http://www.digitaltrends.com/mobile/square-vs-intuit-gopayment-vs-paypal-here-mobile-credit-card-processors/
Abstract: Automation of banking is continuous with banking done by phone or ATM; on-line banking is becoming the norm. The evolution of bank payment systems is ongoing and rapid. In general, costs are leading many banks to close branches, especially considering on-line options. Even small vendors can buy a credit card processor that can be attached to a phone to avoid use of cash or checks, and use a credit card payment system. “Getting paid with plastic used to mean a host of fees, expensive hardware, and complicated gateway services. Those days are long gone now, thanks to a growing plethora of card readers and other payment processors with simple, straightforward fees, access to inventory management tools, Point-of-Sale (POS) systems, and so much more. Now your smartphone or tablet can handle the bulk of your selling needs, making things a whole lot easier if you’re a small business, freelancer, or just want an easier way to accept credit cards and the new EMV chip they house.” A number of systems link to inventory control, and accounting systems, tracking sales and tax reporting. Meanwhile, third party payment systems such as PayPal are well established. Major retailers continue to promote proprietary credit cards that discount prices when used at that store.
Potential for Pilot Project¹
Near-term²: No public role
Mid-term³: Same
Long-term⁴: Same
Cost to Implement
Near-term: Not applicable
Mid-term: Same
Long-term: Same
Cost Implications
Near-term: Public benefit of fewer trips due to private technological innovations
Mid-term: Same
Long-term: Same

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



Topic: #74 Forecast of How The IoT Will Affect Banking

Category: M. Banking

Author(s)/Sponsoring Agency: John Greenough, Jonathan Camhi, *Business Insider*

Date: November, 2015

Source:



the internet of
things 2015- examin

Abstract: Retail banks have long used a prototypical IoT device — the automated teller machine (ATM). Banking executives are looking to new types of IoT devices, like beacons to more directly target customers with promotions as they enter the branch and sending tellers important information about customers. This helps banks promote their products, grow revenue, and improve customer relationships in the face of new competition from technology companies entering the financial services space.

There are 2.7 million ATMs installed globally today, up from 2 million in 2010. Now, ATMs are getting smarter with added security features, teller-assist functions, and more. These smarter ATMs could help reduce costs by reducing the number of employees needed within the branch.

Potential for Pilot Project¹

Near-term²: Essential if the Banking industry is to be efficient and effective

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Increased revenue, lower operating costs.

Mid-term: Same as above

Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #75 Rain Channels Double as Roadways
Category: N. Rain Channels
Author(s)/Sponsoring Agency: City of Los Angeles, California
Date: November 25, 2015 of Los Angeles example from 1988
Source: http://ask.metafilter.com/225360/Where-do-I-go-to-drive-through-the-LA-River-andOr-Glendale-Narrows ; https://www.kcet.org/confluence/whats-taking-los-angeles-river-revitalization-so-long (a KCET story by Carren Jao, November 25, 2015)
Abstract: From a KCET story by Carren Jao: “There was a time when the Los Angeles River was in danger of becoming a freeway. In 1988, California Assemblyman Richard Katz proposed exactly that. He figured that by turning this concrete drain system of a river into a freeway [sic] would ease traffic congestion on the Ventura and Long Beach freeways by as much as 25 percent. A preliminary report showed, Katz wasn't off the mark. The river could support traffic lanes and congestion would be eased, but it would cost \$30 million per mile. Instead of catalyzing the construction of a freeway, however, Katz instead kick-started advocacy for keeping the river. . . Former Mayor Tom Bradley eventually opposed the plan, advocating instead for a river restoration.” A Los Angeles River Revitalization Master Plan is now in place that calls for river restoration, with bike paths in some sections. The motivation for using drainage rights-of-way as transportation corridors remains. Canals built for freight preceded the railroads in the U.S. Some of these canals have been filled in and used as roads. In South Florida, most water moves through man-made canals purposefully created along defined lines. In the case of Miami-Dade, canals are barriers to travel. Bridging the canals is an opportunity to increase mobility, especially very locally, be it pedestrian/bike, transit, or vehicular.
Potential for Pilot Project¹
Near-term²: Key canal crossing locations could be identified and discussions undertaken with SFWMD
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Bike/pedestrian bridge crossing canal cost \$200,000 per crossing
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: If bike/pedestrian bridge, slight localized mode shift
Mid-term: Same as above
Long-term: Same as above

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #76 87 percent of drivers could switch to electric car with little hassle
Category: O. Electric Vehicles/Alternative Fuels
Author(s)/Sponsoring Agency: Elizabeth Armstrong Moore ; Newser
Date: August 21, 2016
Source: http://www.newser.com/story/229799/87-of-drivers-could-switch-to-electric-car-with-little-hassle.html https://www.washingtonpost.com/news/energy-environment/wp/2016/08/15/range-anxiety-scares-people-away-from-electric-cars-why-the-fear-could-be-overblown/?utm_term=.eac02f460ca2
Abstract: Drivers are generally leery of electric cars because they fear that the battery's charge will run out and strand them. But researchers from MIT and the Santa Fe Institute report in <i>Nature Energy</i> that fear is overblown in the vast majority of the US. They used the Nissan Leaf for the study and concluded that it has a "real-world range" of 73 miles. That's less than the advertised range because it takes into account air conditioning, etc. The study determined that “.. 87% of vehicles on the road could be replaced by a low-cost electric vehicle available today, even if there’s no possibility to recharge during the day,” says MIT's Jessika Trancik, per the <i>Washington Post</i>. The study modeled an enormous amount of very fine-grained data to assess the amount of energy an electric vehicle uses and how quickly it depletes its battery. The data base included hourly temperature data in different U.S. regions, survey data on trip lengths, empirical data on the fuel economy of different cars, and GPS-derived data on the speeds of actual vehicles and how they vary on a second-by-second basis. The study recognizes that, in real life, there are many limitations that prevent suddenly swapping out large percentages of current vehicles for electric ones. Not everybody has access to a charging station at night. Drivers would still need to address alternatives on days when an EV vehicle won't do—long business trips or vacations, for example.
Potential for Pilot Project ¹
Near-term²: Immediate, on a pilot basis. Not immediate on a wider basis.
Mid-term³: Likely beyond a pilot basis.
Long-term⁴: More wide spread than the mid-term.
Cost to Implement
Near-term: Need for power stations will likely require public sector involvement.
Mid-term: Same as above but power stations in greater numbers
Long-term: Same as above but power stations in even greater numbers
Cost Implications
Near-term: Positive but limited effect on the environment with reduction in CO ₂ emissions.
Mid-term: Greater positive environmental effect than the near-term.
Long-term: Even greater positive environmental effect than the mid-term.

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #77 Growing momentum for electric cars
Category: O. Electric Vehicles/Alternative Fuels
Author(s)/Sponsoring Agency: Klaus Ulrich, Deutsche Welle
Date: August 4, 2016
Source: http://www.dw.com/en/growing-momentum-for-electric-cars/a-19447582
Abstract: The present-day market share for electric vehicles is tiny but growing says the director of the Center of Automotive Management (CAM) - an independent institute for empirical automotive and mobility research at the University of Applied Sciences. But, the caution is that success will not come overnight. On the global level, it's a picture of growth for electric vehicles. China is fast becoming the leading market. In the first six months, approximately 170,000 electric vehicles were sold there, including buses and light commercial vehicles. The electric vehicle share of the automotive market is only 1.5 percent. The US recorded a slight increase, but a total of only 66,000 electric cars were sold here. The market share is about 2 percent. In Europe, only Norway seems to be accepting of electric vehicles; market share is 3 percent. For Germany, the sales of purely electric vehicles fell 6 percent in the first half of 2016. Three issues affect the sales of electric vehicles: range, infrastructure and price. Customers expect a minimum range of 250-300 miles from a car. But electric cars now only cover distances of 90-110 miles. If the air conditioning is operating, that range drops to only 60 miles, which is completely insufficient to satisfy customer needs. Electric mobility is out of the question for those who don't have a garage with a power connection. Even for those who do, long trips need a dense network of fast-charging stations along the way. Electric cars are still significantly more expensive than comparable vehicles with internal combustion engines. Although Tesla has created demand for high-price electric vehicles and has a long waiting list for a car designed to compete with the Chevrolet Bolt in 2017, other auto makers haven't been as successful, especially as gasoline prices are low. Electric vehicles and hybrid-electric vehicles make up less than 2% of vehicles sold. Nonetheless, electric cars are becoming increasingly important for auto manufacturers because CO2 limits are increasingly difficult to reach. Manufacturers will not succeed in making their fleets meet ever more stringent air pollution limits without electrification. So, it is expected that by 2025, the global market share of electric vehicles will be 10 to 13 percent.
Potential for Pilot Project ¹
Near-term²: Immediate, on a pilot basis. Not immediate on a wider basis.
Mid-term³: Likely beyond a pilot basis.
Long-term⁴: More wide spread than the mid-term.
Cost to Implement
Near-term: Need for power stations will likely require public sector involvement.
Mid-term: Same as above but power stations in greater numbers
Long-term: Same as above but power stations in even greater numbers
Cost Implications
Near-term: Positive but limited effect on the environment with reduction in CO ₂ emissions.
Mid-term: Greater positive environmental effect than the near-term.
Long-term: Even greater positive environmental effect than the mid-term.

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #78 NanoFlowcell thinks you'd rather refuel your battery, instead of recharging
Category: O. Electric Vehicles/Alternative Fuels
Author(s)/Sponsoring Agency: Autoblog Canada
Date: August 2, 2016
Source: http://www.autoblog.com/2016/08/02/nanoflowcell-refuel-battery-charging/
Abstract: NanoFlowcell Holdings believes "virtually no one wants an electric vehicle." It has developed a flow-cell battery technology. The concept is that, instead of a 1,500-pound lithium-ion battery that can take hours to fully recharge, NanoFlowcell's set-up includes two tanks - one with positive liquid electrolytes and one with negative liquid electrolytes - that can carry 40 gallons, as well as a shoebox-sized flow cell. There, the positive and negative electrolytes (similar to salt water) react to create the power that ends up moving the vehicle. Reviewers seemed skeptical of this proposal.
Potential for Pilot Project¹
Near-term²: No potential
Mid-term³: Potential is uncertain
Long-term⁴: Same as above
Cost to Implement
Near-term: Uncertain as technology is more talk than reality
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: None expected
Mid-term: If the technology develops, positive effect on the environment with reduction in CO ₂ emissions.
Long-term: Same as above

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #79 Obama's plan to line the country's roads with electric vehicle chargers
Category: O. Electric Vehicles/Alternative Fuels
Author(s)/Sponsoring Agency: Chris Mooney, <i>Washington Post</i>
Date: July 21, 2016
Source: https://www.washingtonpost.com/news/energy-environment/wp/2016/07/21/this-is-obamas-plan-to-fill-the-countrys-roads-with-electric-vehicle-chargers/?tid=a_inl&utm_term=.fe8b33d5691d
Abstract: The Obama Administration announced on July 21, 2016, an array of new initiatives aimed switching the nation's millions of drivers from gas guzzlers to electric vehicles. This includes installing a national network of electric vehicle charging stations. While there are 16,000 charging stations in 2016 in the U.S. (a 40-fold increase since 2008), many people justifiably fear that they'll run out of charge in an EV and be stranded. Without that assurance to the contrary, EV sales will be held back. To change this, the White House announced a new designation of up to \$4.5 billion in Energy Department loan guarantees to: 1) support new types of EV charging infrastructure; 2) plans to designate and develop key electric vehicle "charging corridors" across the country; 3) plans for the government to procure large numbers of electric vehicles; and, 4) research initiatives at the Department of Energy and its laboratories to improve EV charging technologies. The latter includes technologies that can power an EV with a 200-mile range in the space of 10 minutes — far faster than what's currently available. At the same time, the White House announced that some of the country's largest power companies and automakers — ranging from Duke Energy to the Southern Company, and from Ford to Tesla — had signed on to a joint statement pledging to "drive the market transformation to electric vehicles by making it easy for consumers to charge their vehicles." The partnership signals that even as Tesla and other automakers build more electric cars, companies like Duke, the country's largest electric utility, are taking steps to create more facilities to accommodate them. Duke recently announced a plan to offer cities in North Carolina \$1 million to develop charging facilities, even though there are only about 4,700 EVs in the state
Potential for Pilot Project ¹
Near-term²: Immediate, on a pilot basis. Not immediate on a wider basis.
Mid-term³: Likely beyond a pilot basis.
Long-term⁴: More wide spread than in the mid-term.
Cost to Implement
Near-term: Federal program will invest 44.5 billion to address need for power stations. More public and private funding will likely be required.
Mid-term: Same as above but power stations in greater numbers
Long-term: Same as above but power stations in even greater numbers
Cost Implications
Near-term: Positive but limited effect on the environment with reduction in CO ₂ emissions.
Mid-term: Greater positive environmental effect than in the near-term.
Long-term: Even greater positive environmental effect than in the mid-term.

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



Miami-Dade County TPO Technology Literature Summary Sheet
Topic: #80 Power from the Friction Contact of the Road
Category: O. Electric Vehicles/Alternative Fuels
Authors: Mary Beth Griggs in <i>Popular Science</i> ; Peter Dockrill in <i>Science Alert</i> ; Yanchao Maoa, Dalong Genga, Erjun Liangb, and Xudong Wanga in <i>Nano Energy</i> , Vol. 15.
Date: March 10, 2015; June 30, 2015; July 2015.
Source: http://www.popsci.com/new-goodyear-tires-could-help-power-your-car ; http://www.sciencealert.com/new-car-tyre-nanogenerators-can-convert-road-friction-into-useable-energy
Abstract: First Article: Engineers at Goodyear recently showcased a concept tire called the BH-O3 that has an inner coating that generates energy, which is fed back into the car's electrical system. The material can generate electricity in two ways, from heating, or from the tire contact with the road. The heat can be generated from sitting in a hot parking lot or driving. Second Article: Engineers at the University of Wisconsin-Madison have developed a nanogenerator which harvests energy produced by friction between an automotive vehicle's tire and the road surface. It works through what is called "triboelectric effect" or more-commonly known as static electricity. The tire uses an electrode to create an electrical as the tire strikes the pavement which is stored in the nanogenerator on board the vehicle. Nanogenerator is the term researchers use to describe a small electronic chip that can use mechanical movements to generate electricity. While it is acknowledged that this technology won't replace gas or electric charging stations any time soon, the research team achieved a peak energy conversion efficiency of 10.4 percent - meaning they were able to recapture and use 10.4 percent of their test vehicle's spent energy. The implications for the electric and hybrid motor industry could be significant.
Potential for Pilot Project¹
Near-term²: Not in the near term
Mid-term³: Possible, but unlikely
Long-term⁴: More likely than in the mid-term
Cost to Implement
Near-term: Unknown
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: None as not likely to be available in the near-term
Mid-term: Same as above
Long-term: If available, a positive effect on the environment with reduction in CO ₂ emissions.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #81 Tokyo Hopes to Make Hydrogen Power the Star of the 2020 Olympics

Category: O. Electric Vehicles/Alternative Fuels

Author(s)/Sponsoring Agency:

Date: September 11, 2015

Source: <http://www.wsj.com/articles/tokyo-hopes-to-make-hydrogen-power-the-star-of-the-2020-olympics-1442174267>

Abstract: Hydrogen fuels can provide power for cars, boats and airplanes. Hydrogen gas must be produced, and that production always requires more energy than can be retrieved from the gas as a fuel later on. Therefore most Hydrogen production induces negative environmental impacts. The problems of using hydrogen fuel in cars arise from the fact that hydrogen is difficult to store in either a high pressure tank or a cryogenic tank.

Nonetheless, according to the [Wall Street Journal](#), the Tokyo government plans to spend 40 billion yen (\$330 million) in the next five years to improve hydrogen energy use leading up to the Olympics, making Japan a “Hydrogen Society.” When hydrogen gas mixes with oxygen in a fuel cell, it’s able to produce exhaust-free energy.

The plan is to make the entire Olympic Village hydrogen-powered, complete with at least 100 fuel cell-powered buses, press lounges, and athlete dorms. The government also wants 6,000 of cell-powered cars in the road, with 100,000 on streets by 2025. There’s even going to be a giant pipeline constructed underground that’ll directly funnel the hydrogen into the Olympic Village. It’s part of a bigger plan for Japan as a whole to move to non-nuclear energy sources after the Fukushima disaster.

Fuel cells are becoming more popular worldwide, and the model of using them in Tokyo 2020 could be replicated elsewhere, so long as governments make it a priority: To promote better air quality, the Tokyo municipal government is going so far as to spend \$385 million to subsidize purchases of Toyota’s new fuel-cell vehicles.

Potential for Pilot Project¹

Near-term²: Possible

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Significant, the 2020 Tokyo Olympic Village will cost \$330 million

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: A cleaner environment through cleaner air

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #82 China's Electric Car production
Category: O. Electric Vehicles/Alternative Fuels
Author(s)/Sponsoring Agency: <i>Fortune</i> and Reuters
Date: September 7, 2016
Source: http://fortune.com/2016/09/07/vw-electric-car-venture-jac-motor/
Abstract: China surpassed the United States last year to become the largest maker of pure electric cars thanks to a raft of government incentives to promote the switch from petrol to electricity as the country battles heavy pollution. Sales of so-called new energy vehicles, as battery electric and plug-in hybrid cars are referred to in China, more than quadrupled last year with rapid growth continuing this year. Volkswagen AG has signed a preliminary agreement with China's JAC Motor to explore making electric vehicles in a new joint venture, the two automakers said on Wednesday. JAC is China's ninth largest automaker by group sales. Volkswagen is locked in a dead heat with U.S. automaker General Motors for the title of largest automaker in China, the world's biggest auto market, with GM's primary joint ventures slightly edging out VW's to sell the most cars in the market last year. Global auto brands are only allowed to manufacture cars domestically in China through joint ventures with local partners, with automakers typically limited to two JV partners. Volkswagen already has joint ventures with SAIC Motor and China FAW Group.
Potential for Pilot Project¹
Near-term²: Immediate, on a pilot basis. Not immediate on a wider basis.
Mid-term³: Likely beyond a pilot basis.
Long-term⁴: More wide spread than the mid-term.
Cost to Implement
Near-term: Need for power stations will likely require public sector involvement.
Mid-term: Same as above but power stations in greater numbers
Long-term: Same as above but power stations in even greater numbers
Cost Implications
Near-term: Positive but limited effect on the environment with reduction in CO ₂ emissions.
Mid-term: Greater positive environmental effect than the near-term.
Long-term: Even greater positive environmental effect than the mid-term.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #83 The increased power of electric cars and buses

Category: O. Electric Vehicles/Alternative Fuels

Author(s)/Sponsoring Agency: Mark Phelan, *Detroit Free Press*; [Jay Cole](#), *Inside EVs*

Date: September 13, 2016 and September 12, 2016

Source: <http://www.freep.com/story/money/cars/mark-phelan/2016/09/13/chevrolet-bolt-electric-cars-mainstream-tesla-nissan-leaf-toyota-prius/90108614/>

<http://insideevs.com/proterra-catalyst-e2-bus-debuts-travels-600-miles-charge/>

Abstract: Three issues affect the sales of electric vehicles: range, infrastructure and price. Customers expect a minimum range of 250-300 miles from a tank of gas in a car. But electric cars now on the market only cover distances of 90-110 miles. If the air conditioning is operating, that range drops to only 60 miles, which is completely insufficient to satisfy customer needs.

Now, General Motors is building the 2017 Chevrolet Bolt for sale later in 2016 at a base price under \$30,000, after tax credits. That is more than double the EPA-certified range of the Nissan Leaf, Ford Focus and VW Golf. Tesla is believed to be more than a year from offering a car that can match the Bolt's price and range. According to GM, data indicate a 200-mile range is the point at which there's a big change in the number of people willing to purchase an electric vehicle. Before the Bolt, people had to pay \$60,000 to \$200,000 for an EV that could go 200 miles on a charge. The Bolt is also a keystone of GM's strategy for autonomous vehicle and ride-sharing services like Lyft, in which GM has invested \$500 million.

On a parallel path, the company known as Proterra has electric buses with available battery storage capacities from .440 – 660 kWh – which is up to 6x more than the recently announced Tesla Model S/X P100DL. Proterra claims its electric buses have driven more than 2.6 million miles. It also claims 2016 has been “a breakthrough year in the mass transit sector” for the company as 2016 sales in North America reached 312 e-buses by September which is double the sales in 2015.

Potential for Pilot Project¹

Near-term²: GM's Chevy Bolt and Proterra are available for a pilot project and more

Mid-term³: Likely beyond a pilot basis.

Long-term⁴: More wide spread than the mid-term.

Cost to Implement

Near-term: Need for power stations will likely require public sector involvement.

Mid-term: Same as above but power stations in greater numbers

Long-term: Same as above but power stations in even greater numbers

Cost Implications

Near-term: Positive but limited effect on the environment with reduction in CO₂ emissions.

Mid-term: Greater positive environmental effect than the near-term.

Long-term: Even greater positive environmental effect than the mid-term.

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

Miami-Dade County TPO Technology Literature Summary Sheet	
Topic: #84 "Oregon tries taxing drivers by the mile" and "Road Usage Charge Pilot Program 2013 & Per-Mile Charge Policy in Oregon"	
Category: P. Cost/Financing	
Author(s)/Sponsoring Agency: Keith Laing , <i>The Hill</i> , The Oregon Department of Transportation	
Date: June 1, 2015 and February, 2014	
Source: http://thehill.com/policy/transportation/243610-oregon-to-tax-drivers-by-the-mile-for-roads https://www.oregon.gov/ODOT/HWY/RUFPP/docs/RUCPP%20Final%20Report%20-%20May%202014.pdf	
Abstract: Oregon is testing a new system that would tax drivers by the mile to pay for transportation projects. It is known as MyOreGo and is the first statewide "vehicle miles traveled" program in the nation. The program is voluntary and has promised drivers' personal information will be protected. OReGO volunteers will pay for the miles they drive, creating what is believed will a sustainable way to fund road maintenance, preservation and improvements. Participation in the program is limited to 5,000 cars, which may change as the program advances. Drivers who join the program are charged 1.5 cents per mile. Participants will be given the option of using a GPS to record their miles or using a non-GPS option that will track usage based on the mileage counters of cars. In return for participating, the drivers will be offered a tax credit reimbursing them for the 31-cent-per-gallon Oregon gas tax. The cost of the program is estimated at about 0.5% of revenue. The federal transportation tax has not been increased since 1993 and has struggled to keep pace with construction costs, as cars have become more fuel efficient. So, the idea of switching to a mileage-based tax system to bolster sagging transportation funding has been proposed before at the national level, but was dismissed amid critics' complaints that monitoring the number of miles drivers traveled would violate their privacy.	
Potential for Pilot Project¹	
Near-term²: Possible, if needed state legislation is available	
Mid-term³: Same as above	
Long-term⁴: Same as above	
Cost to Implement	
Near-term: Government can contract with private vendors to provide both equipment and services to increase efficiency and lower costs through the bundling of billings and other administrative enhancements.	
Mid-term: Same as above	
Long-term: Same as above	
Cost Implications	
Near-term: New revenue source that can replace the per-gallon tax and increase the amount of revenue available	
Mid-term: Same as above	
Long-term: Same as above	

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #85 Alternatives to the VMT transportation taxing system
Category: P. Cost/Financing
Author(s)/Sponsoring Agency: The Oregon Department of Transportation
Date: February, 2014
Source: https://www.oregon.gov/ODOT/HWY/RUFPP/docs/RUCPP%20Final%20Report%20-%20May%202014.pdf
Abstract: Commonly suggested alternatives to the per-mile charge include: Raise fuel tax (or index fuel tax), Flat Annual Fee (or Vehicle Registration Fee Increase), General Fund, Tax tire purchases, Tax battery purchases, and a BTU tax. <u>Raise or Index Fuel Tax:</u> It has been unable to meet needs as a long-term financing mechanism, particularly as CAFÉ standards continue to make new vehicles ever-more fuel efficient. <u>Flat Annual Fee:</u> Not considered as fair as VMT tax because drivers who drive modest amounts would subsidize those who drive a lot, contrary to the user-pays principle of road funding policy. <u>General Fund:</u> The volatile nature of general fund revenues will not yield reliable revenue for roads during economic downturns, plus general revenue sources have no connection to road use. <u>Tax Tire Purchases:</u> Considered to have several practical concerns: it is not a precise proxy for road use because tires wear at very different rates; driving habits and weather affect tire wear in ways unrelated to distance traveled; and, it would place a hardship on less affluent purchasers. <u>Tax Vehicle Battery Purchases:</u> Even more than tires, this tax raises concerns stemming from their variable lives depending upon type, geography, electricity use for heat and air conditioning. <u>BTU Tax Some:</u> Would have the same problem as the fuel tax in that increases in vehicle fuel efficiencies will lead to dropping road revenues.
Potential for Pilot Project¹
Near-term²: Dependent of state legislation
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Uncertain
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Revenue source intended to raise more revenue than the current transportation funding system but may have negative impacts if not applied fairly, especially on the less-affluent who cannot afford newer, fuel-efficient vehicles or who would forego the purchase of replacement/new tires because of increased cost associated with new tax.
Mid-term: Same as above
Long-term: Same as above

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #86 "On the Move: State Strategies for 21st Century Transportation Solutions"
Category: P. Cost/Financing
Author(s)/Sponsoring Agency: National Conference of State Legislatures
Date: July, 2012
Source: http://www.ncsl.org/research/transportation/state-solutions-for-21st-century-transportation
Abstract: This paper explores a wide array of innovative surface transportation reform laws, policies and programs that policymakers are considering or pursuing to take the nation's transportation system well into the 21st century. Particular focus is placed on policies that promote fiscal and environmental sustainability; facilitate affordable, safe and accessible transportation choices; and, achieve shared benefits such as improved health and economic development. Efforts were taken to assemble a broad cross-section of approaches to represent exciting transportation reform developments occurring in state legislatures. The report has four sections: • <i>Taking the Long View</i> - Examines policies that are considered forward-thinking to providing transportation infrastructure and services over the long term. This includes provision of sustainable funding and use of life-cycle costing in decision-making. • <i>Using What You Have</i> -Addresses cost-efficient approaches that help make the most of existing infrastructure, such as 'fix-it-first" and asset management, operations management and commute trip reduction. • <i>Giving People Choices</i> - Highlights a variety of viable, accessible and affordable transportation options. Policies reviewed include bicycle and pedestrian safety and travel initiatives. Complete streets policies, car sharing and bike-sharing, transit-oriented development and human service transportation coordination. • <i>Achieving Multiple Benefits</i> - Examines how transportation decisions can successfully achieve diverse public benefits. Discusses comprehensive performance management and examples of how transportation activities have been linked with environmental and public health initiatives.
Potential for Pilot Project ¹
Near-term²: Yes
Mid-term³: Yes
Long-term⁴: Yes
Cost to Implement
Near-term: As this is a policy matter, Implementation costs are considered to be zero.
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Reduced cost in the areas of the environment, public health, and the like.
Mid-term: Reduced cost in the areas of the environment, public health, and the like.
Long-term: Reduced cost in the areas of the environment, public health, and the like.

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #87 State and Local Funding

Category: P. Cost/Financing

Author(s)/Sponsoring Agency: Florida Department of Transportation, Office of Comptroller

Date: January 2016

Source:

<http://www.dot.state.fl.us/officeofcomptroller/pdf/GAO/RevManagement/Tax%20Primer.pdf>
and <http://edr.state.fl.us/Content/local-government/reports/lgfi15.pdf>.

Abstract: State funding is very complex and is explained in Florida's "Transportation Tax Sources, A Primer," Florida Department of Transportation, Office of Comptroller, January 2016. The opportunity for increased local funding for transportation appears to rest on an increase to the *Charter County and Regional Transportation System Surtax* (s. 212.055 (1), F.S. Miami-Dade is collecting 0.5 percent of the allowed 1.0 percent sales tax (page 158, *2016 Local Discretionary Sales Surtax Rates in Florida's Counties*). Likewise, it is collecting 0.5 percent of the allowed 1.0 percent *Local Government Infrastructure Surtax* (s. 212.055(2), F.S.

There is a local fuel tax that is collected by the state. It makes up one percent of the County's operating budget.

Miami-Dade County's principle form of revenue, is the property tax. Global warming will challenge South Florida and its property revenue base as sea levels rise and salt water intrusion progresses.

Potential for Pilot Project¹

Near-term²: Miami-Dade could increase the Regional Transportation System and Local Government Infrastructure Surtaxes.

Mid-term³: Same

Long-term⁴: Same

Cost to Implement

Near-term: Low, Administrative costs

Mid-term: Same

Long-term: Same

Cost Implications

Near-term: Revenue increase immediately upon implementation

Mid-term: Same

Long-term: Same

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #88 Federal Funding

Category: P. Cost/Financing

Author(s)/Sponsoring Agency: Federal Highway Administration (FHWA), Congressional Budget Office (CBO)

Date: June 28, 2016; March 2016

Source: <https://www.fhwa.dot.gov/policy/olsp/financingfederalaid/fund.cfm>
and <https://www.cbo.gov/sites/default/files/51300-2016-03-HighwayTrustFund.pdf>

Abstract: Funding is public, private, or a mix. Public funding is federal, state, and local. Predominant federal transportation funding is provided by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) through formula (population-based) allocations, or grants to state departments of transportation (DOTs) and local agencies (Metropolitan Planning Organizations for larger urban areas, such as Miami-Dade County). Private funding could be for research/development, such as on autonomous vehicle research and drones; or, it can take myriad forms as presented in the MDC TPO P3 (public-private partnerships) Reference Guide. The Highway Trust Fund (HTF), is the principle source of federal highway funding. Revenue is not keeping up with spending as per gallon fuel taxes diminish in real terms due to less driving, more fuel-efficient vehicles and inflation. Since 2008, the HTF has run a deficit, meaning more money is going out than coming in; and, the Congressional Budget Office (CBO) forecasts deficits will continue.

Potential for Pilot Project¹

Near-term²: Federal funding will continue but change from per-gallon to per-mile base. Special grants should be pursued, ala the Smart City Program, and the like.

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Matching funds are needed to leverage federal funding.

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Budgeting revenues for use as matching funds.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #89 Dashboards
Category: Q. Dashboards
Author(s)/Sponsoring Agency: Wikipedia
Date: 2012
Source: https://en.wikipedia.org/wiki/Dashboard
Abstract: A “Dashboard” is, In real-world terms, another name for "progress report". It’s an easy-to-read, often, single page, real-time user interface, showing a graphical presentation of the current status (a snapshot) of performance indicators. Often, the "dashboard" is displayed on a Web page that is linked to a database which allows the report to be constantly updated. It enables instantaneous and informed decisions to be made at a glance. Digital dashboards allow monitoring of key functions of a process in order to gauge how well an organization is performing. Benefits of using digital dashboards include: • Visual presentation of performance measures • Ability to identify and correct negative trends • Measurement of efficiencies/inefficiencies • Ability to generate detailed reports showing new trends • Ability to make more informed decisions • Quick identification of data outliers and correlations Digital dashboards track the flows inherent in the processes that they monitor. Graphically, users may see the high-level processes and then drill down into low-level data for analytical purposes. Three main types of digital dashboard dominate the market today: standalone software applications, web-browser based applications, and desktop applications.
Potential for Pilot Project ¹
Near-term²: Immediate
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Little, relatively speaking
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Improved management with significant potential for improvements in delivery of a service or product.
Mid-term: Same as above
Long-term: Same as above

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

Topic: #90 The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised)

Category: R. Traffic Control Systems

Author(s)/Sponsoring Agency: Lawrence Blincoe, Ted R. Miller, PhD., Eduard Zaloshnja, Ph.D., Bruce A. Lawrence, Ph.D./National Center for Statistics and Analysis, National Traffic Safety Administration

Date: May, 2015

Source: <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013>

Abstract: In 2010, there were 32,999 people killed, 3.9 million injured and 24 million vehicles were damaged in motor vehicle crashes in the United States. The economic cost of these crashes totaled \$242 billion. Included in these losses are lost productivity, medical costs, legal and court costs, Emergency Services costs, EMS Insurance Administration costs, congestion costs, property damage and workplace losses. The \$242 billion cost of Motor Vehicle crashes represents the equivalent of nearly \$784 for each of the 308.7 million people living in the United States in 2010, the year of the analysis, and + 1.6% of the \$14.963 trillion real U.S. Gross Domestic Product in 2010. These figures include both police reported and unreported crashes. When quality-of-life valuations are considered, the total value of societal harm from motor vehicle crashes in 2010 is \$836 billion. Lost Market and household productivity accounted for \$77 billion of the total \$242 billion economic costs, while property damage accounted for \$76 billion. Medical expenses totaled \$23 billion. Congestion caused by crashes, including travel delay, excess fuel consumption, greenhouse gas emissions, and criteria pollutants accounted for \$28 billion. Each fatality resulted in an average discounted lifetime cost of \$1.4 million. Public revenues paid by roughly 7% of all motor vehicle crash costs costing taxpayers \$18 billion in 2010, the equivalent of over \$156 in taxes for every household in the United States. Alcohol-involved crashes accounted for \$52 billion or 22% of all economic costs and 84% of these costs occurred in crashes where a driver or non-occupant had a blood alcohol concentration (BAC) of 0.08 grams per deciliter or greater. Alcohol was the cause of the crash in roughly 82% of these cases causing \$43 billion and costs. Crashes in which alcohol levels, or BAC, of 0.8 or higher are responsible for 90% of the economic costs and societal harm occurs in crashes attributable to alcohol use. Crashes in which police indicate that at least one driver was exceeding the legal speed limit or driving too fast for conditions cost \$52 billion in 2010. Seat belt use prevented 12,500 fatalities and 308,000 serious injuries and \$50 billion dollars in injury-related costs in 2010. But the failure of a substantial portion of the driving population to buckle-up caused 3350 unnecessary fatalities, 54,300 serious injuries and cost society \$10 billion in easily-preventable, injury-related costs. Crashes in which at least one driver was identified as being distracted cost \$40 billion in 2010. The report also includes data on the costs associated with motorcycle crashes, failure to wear motorcycle helmets, pedestrian crashes, bicyclist crashes and numerous different roadway-designation crashes.

Potential for Pilot Project¹

Near-term²: Not applicable in terms of an on-the-ground application. But, applicable from LRTP study

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Not applicable because these are data, not products

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Multiple savings in the cost of productivity, medical expenses, legal and court costs, Emergency Services costs, EMS Insurance Administration costs, congestion costs, property damage and workplace losses if AV is implemented

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #91 Safety reflector for pedestrians gets connected to IoT

Category: R. Traffic Control Systems

Author(s)/Sponsoring Agency: Paul Buckley, *Smart2.Zero.com*

Date: January 29, 2016

Source: <http://www.smart2zero.com/news/safety-reflector-pedestrians-gets-connected-iot>

Abstract: VTT Technical Research Centre (Espoo, Finland) and safety reflector company Coreplast Laitila (Laitila, Finland) have collaborated to create a smart reflector that can be wirelessly controlled via a mobile phone application. When a pedestrian is approaching a dangerous crossing the reflector - which features sensors, LED lights, wireless charging, and communications - can be made to blink and alert car drivers. In the future, the reflector could communicate directly with smart traffic lights or cars to warn, for example, a turning truck driver that a pedestrian is in the area of a crossing.

It is also possible to connect the reflector to other on-line activities such as mobile gaming, which could make it more attractive for teenagers to use. Reflectors could be set to shine in a common tribal color or to react in real-time to gaming actions and to the track to which the user is listening.

The smart reflector is an example of enhancing everyday objects with new functionalities by connecting them to the Internet of Things (IoT). The smart reflector prototype will be publicly presented for the first time at Coreplast Laitila's stand (Hall 4.2, stand B15) at the [Paperworld 2016](#) Trade Show in Frankfurt, Germany.

Potential for Pilot Project¹

Near-term²: Likely

Mid-term³: Very likely

Long-term⁴: Same as above

Cost to Implement

Near-term: Unknown, but likely to be reasonable

Mid-term: Unknown, but likely to be reasonable

Long-term: Unknown, but likely to be reasonable

Cost Implications

Near-term: Improved safety and reduced liability of pedestrians and motorists.

Mid-term: Same as above

Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #92 Solar Pedestrian Crossings

Category: R. Traffic Control Systems

Author(s)/Sponsoring Agency: Various

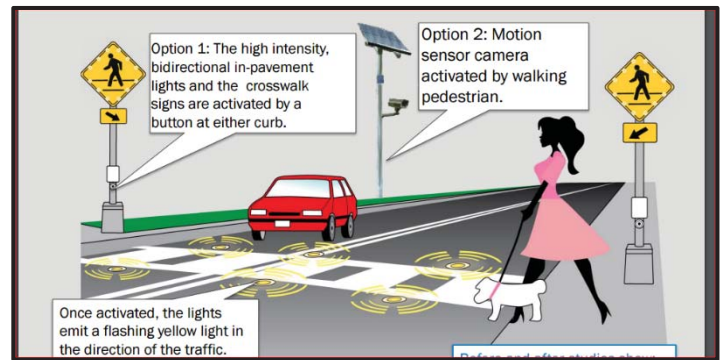
Date: Various

Source: <https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=solar%20pedestrian%20crossing%20pavement>

Abstract: An a field study of 100 lighted crosswalks with 427 million vehicle crossings demonstrated that the accident rate was 80% less than predicted for uncontrolled, unlit crosswalks.

The newest technology to achieve this performance is a solar-powered in-road light system that alerts motorists to the presence of a pedestrian crossing or preparing to cross the street. Amber lights embedded in the pavement on both sides of the crosswalk and oriented to face oncoming traffic. In-road warning lights produce a daytime-visible light focused directly in the driver's line of sight clearly indicating the curve, hazard, crosswalk, variable lane, or lane edge. This requires no interpretation by the driver resulting in increased visibility.

When the pedestrian activates the system, either by using a push-button or through detection from an automated device, the lights begin to flash in unison, warning the motorist that a pedestrian is in the vicinity of the crosswalk ahead. The flashing LEDs shut off after a set period of time, i.e., the time required for a pedestrian to safely cross the street.



Potential for Pilot Project¹

Near-term²: Ready to apply

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Reasonable

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Improved safety and reduced liability of pedestrians and motorists.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #93 Smart IP Cameras Can Read Traffic, Identify Pedestrians

Category: R. Traffic Control Systems

Author(s)/Sponsoring Agency: Intel's Internet of Things Group

Date: November 24, 2014

Source: <http://www.intelfreepress.com/news/smart-ip-traffic-cameras/8915/>

Abstract: Want to know what a car and pedestrian were doing prior to a collision of the two? With older systems, law enforcement had to follow each object or person individually, but new security cameras launched in China, by Intel's Internet of Things Group, with smarter chips are assisting law enforcement agencies in the analysis of vehicle and pedestrian traffic with real-time results. Using an Intel Atom E3845 processor embedded within a security camera for onboard analysis – a task previously reserved for high-end, back-end servers – unnecessary background footage is automatically ignored or removed while pedestrians, vehicles and bicycles are extracted and categorized in real time.

Kedacom, a video conference and network surveillance system manufacturer in China, is the first corporation to adopt Intel's reference design in its smart IP camera solution, which provides car, people and object differentiation. An Internet protocol (IP) camera is a digital video camera attached to a computer network or the Internet allowing it to send and receive data, often used for surveillance.

With the hardware and software combination, hour-long videos can be "compressed" into a much shorter length of time, sometimes merely a few minutes, as well as into a smaller file. This is accomplished with the camera itself actually analyzing the video, identifying and isolating various objects in the scene, and then overlaying these identified objects in a much shorter video. The resulting video, which is delivered to the back-end servers, shows a static background with the objects overlaid in motion.

Intel China's Internet of Things group, envisions the smart IP camera technology will be used within shopping malls for crowd monitoring, traffic counting and business intelligence with the back-end servers being freed up to perform data collection and data mining. The technology could eventually become incorporated into consumer video monitoring products, moving beyond the traditional "hot spot" and "zone watching" they currently do.

Potential for Pilot Project¹

Near-term²: Immediate

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Unknown

Mid-term: Same as above

Long-term: Same as above

Cost Implications

Near-term: Improved safety and reduced liability of pedestrians and motorists.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #94 Chicago deploys computers with eyes, ears and noses

Category: R. Traffic Control Systems

Author(s)/Sponsoring Agency: Patrick Thibodeau, Computerworld

Date: September 2, 2016

Source: <http://www.computerworld.com/article/3115224/internet-of-things/chicago-deploys-computers-with-eyes-ears-and-noses.html>

Abstract: Chicago is deploying sensors on light poles to monitor, photograph and listen to the city. The effort is costing as much as \$7 million, and may be the largest urban data collection of its kind once all 500 nodes are in place. The nodes have an array of sensors with enough computing capability to conduct data processing on the device and minimize the amount of bandwidth needed to transmit data. Cameras will track the movement of pedestrians, vehicles and whether water is pooling on the street. Another camera will be pointed to the sky. A microphone will monitor noise levels. There will also be temperature, pressure, light and vibration sensors. Particle sensors will detect pollen. Gas sensors will check air quality, recording carbon monoxide, nitrogen dioxide, sulfur dioxide, and ozone. Even the magnetic field will be monitored. Once the unit is placed 20 feet up on a pole, the city wants to do as much as remotely as possible. The data will be publicly available through the OpenGrid.io portal once enough sensors are deployed. The entire installation will be completed in 2018.

The city has an analytical team of 17 people of data scientists, business intelligence experts and database administrators, so the data can be used for predictive analytics. For instance, Chicago has relied on spot surveys to measure traffic and pedestrian flows. But the camera data, which may snap up to two photos per second, will enable the city to continuously track movement at intersections and analyze how to improve safety. Data from the photos can be gathered and transmitted and the photo itself deleted. The system protects privacy.

The device will shut down in extreme weather, although the heat generated by a four-core Arm processor and a Samsung processor used in cell phones will provide some protection in extreme cold.

Although cities are deploying sensors in urban environments, it appears there is anything as extensive as what's going on in Chicago.

Potential for Pilot Project¹

Near-term²: Immediate

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: 500 locations in Chicago cost \$7 million

Mid-term: Probably less than the near-term experience.

Long-term: Probably less than the mid-term experience.

Cost Implications

Near-term: Improved safety and reduced liability of pedestrians and motorists.

Mid-term: Same as above

Long-term: Same as above

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

Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #95 Integrated Transit Mobility Application

Category: S. BIBO/One Inclusive App

Author(s)/Sponsoring Agency: Various

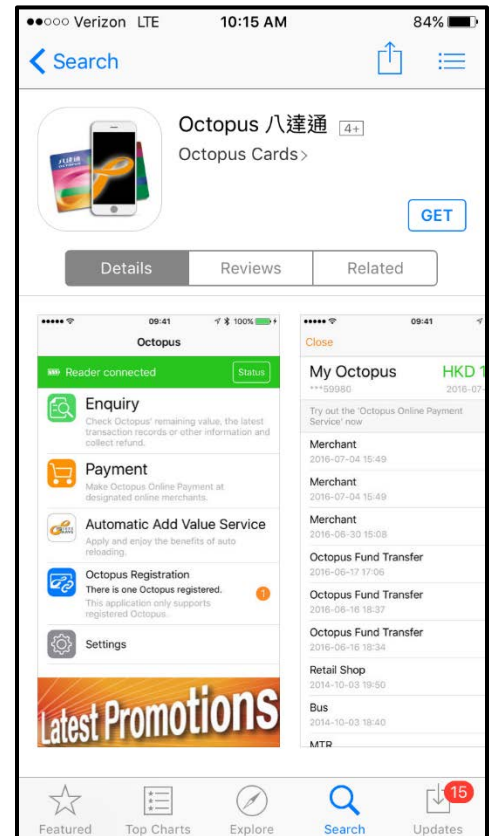
Date: September 19, 2015

Source: <https://charliecard.mbtta.com>

<https://www.taptogo.net>; <https://transitstore.miamidade.gov>; <https://smartrip.wmata.com/storefront>;
<http://www.miamidade.gov/transit/easy-card.asp>

Abstract: Mobility apps currently allow for traveler information for smart phone users, providing information on possible trip options, transfer points, and real-time information for transit services. Miami-Dade allows online loading of the EASY card. Other cities have integrated these Transit Access Pass (TAP) cards into their online presence or on apps, both accessible by phone. Logging onto the Los Angeles, Washington, DC, and Boston websites allows for prepaid amount to be added to the smartcards without having to approach a kiosk. These transactions vary in time for funds to be available, generally within 48 hours, though it can be within 45 minutes for buses with mobile validators.

In London and Hong Kong, various transit apps exist with the cards. —————→ These apps allow the transit user to know how much is left on their card, and also add new funds plus track their previous activity. On the Octopus Card app, the mobile device can utilize the Bluetooth function to link to Octopus Card, which is configured to allow the transit pass to double as a debit card for local vendors, incorporating a function to pay online vendors. In London, an app is not provided but rather an open source of the data, allowing for private developers to create their own app.



Potential for Pilot Project¹

Near-term²: Readily implementable.

Mid-term³: Implementable in a form updated for latest BIBO technology.

Long-term⁴: Implementable in a form updated for latest BIBO technology and other technologies that emerge.

Cost to Implement

Near-term: Much of the development costs have already been realized for the app, which can be further developed in Miami-Dade. Infrastructure and installation of bus tracking technology, accounting systems for new forms of payment will vary but may already be absorbed by the costs of other programs.

Mid-term: Same as above.

Long-term: Same as above.

Cost Implications

Near-term: Low-to-moderate returns in terms of convenience afforded customer.

Mid-term: Same as above.

Long-term: Same as above.

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #96 Ticketless Transit
Category: S. BIBO/One Inclusive App
Author(s)/Sponsoring Agency: Various
Date: September 19, 2015
Source: https://www.virgin.com/travel/ticketless-transit-getting-around-the-city-with-just-your-phone ; http://www.passengertransport.co.uk/2016/02/cubics-multi-modal-check-in-be-out-trial/
Abstract: Mobility apps currently allow for transit travelers to purchase tickets using a mobile app. The app works by allowing the individual to purchase either tickets or passes before boarding to be stored on the app, awaiting activation. Once activated, it can be shown as paid fair to any ticket collector. In some instances, the app may be configured to allow the phone to utilize Bluetooth for a Tap-in/Tap-out system. Apps for US systems generally include single flat-fare tickets, or day/multi-day passes with the potential for variable fare based on distance. One application is being tested in 2016 in Duisburg, North Rhine-Westphalia, Germany, for a 'Check in Be Out' ticketing system, involves a pilot program on six buses and three trains, with future plans affecting 173 buses, 18 underground trains and 45 trams. After checking in, which creates a timestamp, Bluetooth beacons on the vehicle track the signal until it can no longer be received, after which it will assess the correct fare based on distance and charge it to the owner's account. Existing apps are generally integrated with trip planning tools, and may link to both internet and static system maps. This technology is not restricted to just one specific mode of transit; its application has been utilized for rail, bus, light rail, and ferry services. The technology only requires that an individual have an active smart phone and for the transit vehicle to be equipped with a reader for check-in purposes. Internet service is generally required for the purchase of the tickets to function correctly.
Potential for Pilot Project¹
Near-term²: Readily implementable.
Mid-term³: Implementable in a form updated for latest BIBO technology.
Long-term⁴: Implementable in a form updated for latest BIBO technology and other technologies that emerge.
Cost to Implement
Near-term: Much of the development costs have already been realized for the app, which can be further developed in Miami-Dade. Infrastructure and installation of bus tracking technology, accounting systems for new forms of payment will vary but may already be absorbed by the costs of other programs.
Mid-term: Same as above.
Long-term: Same as above.
Cost Implications
Near-term: Low-to-moderate returns in terms of convenience afforded customer.
Mid-term: Same as above.
Long-term: Same as above.

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #97 Be-In/Be-Out Systems (BIBO)
Category: S. BIBO/One Inclusive App
Author(s)/Sponsoring Agency: Various
Date: September 19, 2015
Source: http://www.thelocal.ch/20160229/sbb-caves-in-over-rail-pass-customer-data ; http://www.thelocal.ch/20160307/swiss-trains-pilot-ticketless-fare-system ; http://webarchive.nationalarchives.gov.uk/20091203214536/ ; http://www.dft.gov.uk/pgr/scienceresearch/orresearch/paymentsystems.pdf ; http://www.mobility.siemens.com/mobility/global/en/integrated-mobility/eticketing/pages/eticketing.aspx#BiBo_System_20_Be_in_Be_out ;
Abstract: Be-In Be-Out (BIBO) systems refer to technology that is implementable on transit systems and which allow for passengers to enter and exit a transit system without checking in or out via fare cards or smart cards requiring contact or close proximity to readers, including those in gated (i.e. Metrorail) and non-gated (i.e. Tri-Rail) systems. The lack of an additional fare step presumably allows for better flow in and out of transit by removing queues found at kiosks, gates, or via fare collection boxes. BIBO systems, through usage of reception devices, can detect the presence of smartcards, requiring no action from the rider except they must have their smartcard and they must have had it set up before the transit trip. Cards are linked to a payment account, and fares are assessed at the end of the trip. Since BIBO systems can indicate where a person boards and where they exit, it can calculate the most appropriate fare for the consumer, allowing for applications in both fixed and variable fare systems. Due to the nature of the payment setup, it is imperative that a BIBO system acknowledge that the burden of information (fare knowledge) is on the consumer. BIBO can currently be found in Switzerland, where SwissPass is utilized on the railways. In other areas, BIBO is undergoing evaluation. There are several challenges to implementing a BIBO system. Like with other fare systems, fare enforcement can be an issue; with BIBO, one means of preventing fare evasion is to have passengers flash their smartcard to the operator as they are boarding, or via random checks similar to how honor systems work. What remains to be seen is how much proximity is the setting for the devices to work, and if it is on a sleep mode until activated. Battery life will affect the device, and thus fare payment. Security of the devices is important as well. Fraud is an issue that needs to be addressed, as some of the technology may be mimicked in its current form. There is also the concern that signals can be intercepted and otherwise copied for re-use. As discounted fares are part of transit passes, the issue of identity applies. These devices are linked to accounts for fare payment, so bank and credit card security is a concern. Lastly, there is the issue of data privacy. With data storage, personal information regarding travel patterns could be tracked.
Potential for Pilot Project¹
Near-term²: Will occur, but only with the addressing of major concerns.
Mid-term³: High; system expected functional by 2025
Long-term⁴: High
Cost to Implement
Near-term: High. Will require new devices and the development of security systems.
Mid-term: Moderate to High. Will require constant defense of data.
Long-term: Moderate.
Cost Implications
Near-term: Improved attractiveness/use of transit.
Mid-term: Same as above
Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #98 Advanced Driver Assistance System (ADAS) for Buses
Category: T. ADAS
Author(s)/Sponsoring Agency: Many, including the Federal Transit Administration
Date: Web sites accessed August 30, 2016
Source: https://en.wikipedia.org/wiki/Advanced_driver_assistance_systems . Corradino experience with bus systems.
Abstract: Bus operators are confronted with many distractions: watching for patrons running to the bus, collecting fares, seating elderly and handicapped persons, dealing with patrons, <u>and</u> the rigors of driving a large vehicle. <u>Advanced_driver_assistance_systems</u> (ADAS) automate/adapt/enhance vehicle systems for safety and better driving. Safety features are designed to avoid collisions and accidents by offering technologies that alert the driver to potential problems, or to avoid collisions by implementing safeguards, such as automatic braking, land drift, and showing what is in blind spots. Camera systems can be especially important to bus operators to see the many pedestrians near the bus, including those placing bikes on bike carriers, those passing behind the bus, and those running to catch the bus. ADAS for buses can be part of an integrated system of communication with the dispatcher, traffic conditions, rider information, the garage, and police. Commercial systems such as WAZE already have the capability of identifying rea- time congestion and offering alternative routes that avoid that congestion. For fixed-route buses, reroute options are limited, as buses cannot operate over some city streets (narrow, sharp turns), and any bus that deviates from its route must return to the route as quickly as possible to avoid skipping bus stops (unless the bus has closed doors and is operating in express mode). In very congested conditions, the driver may be able to make better decisions than a dispatcher or congestion software due to local conditions. Many systems, like Miami-Dade Transit, know the locations of their buses at all times. Real time apps and displays in transit stations/shelters help riders, and in-cab notifications keep buses on schedule, within the established on-time window set for the system. GPS systems already on buses can track vehicle miles and interact with software to indicate when buses need scheduled maintenance. This can involve instructing a driver where to park the bus at the end of the day. Notification to police in emergency situations can improve driver and passenger safety if there is an unruly passenger(s) or boarder, and notify police of ongoing incidents. On board cameras can record events inside and outside the bus to aid law enforcement.
Potential for Pilot Project ¹
Near-term²: Yes, some measures are in use today
Mid-term³: Yes
Long-term⁴: Yes
Cost to Implement
Near-term: WAZE-type systems are inexpensive
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Incidental to normal bus operations
Mid-term: Same as above
Long-term: Same as above

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



Miami-Dade County TPO Technology Literature Summary Sheet

Topic: #99 What Are Highway Traveler Information Systems

Category: U. Traveler Information Systems

Author(s)/Sponsoring Agency: Texas A&M Transportation Institute

Date: Current, and updated often

Source: <https://mobility.tamu.edu/mip/strategies-pdfs/traffic-management/executive-summary/traveler-information-systems-1-pg.pdf>

Abstract: Traveler information systems for highways (for transit-specific, see BIBO abstract) update drivers on current roadway conditions— including delays, incidents, weather-related messages, travel times, emergency alerts, and alternate routes. Providing this information to drivers before and during trips allows them to make more effective travel decisions about changing routes, modes, departure times, or even destinations. More informed drivers result in more efficiently utilized roadway capacity. This means less gridlock and better traffic flow. Travel information is generated by sensors reporting to a traffic management center or through private entities using data from in-vehicle location devices, or from smart phones communicating location and speed. This information is then disseminated via traditional broadcast media, internet, mobile devices, or roadside messaging. Personalized travel messages and alerts enable individuals to access trip-specific information on demand, or sent to them via email or text message subscription services. Once familiar with these services, nearly 80% of drivers use traveler information to make daily decisions about route or departure time.

Though relatively inexpensive, these critical systems sometimes face budgeting/funding challenges. However, the same infrastructure that provides traveler information also enables more effective incident management and performance measurement—which can mean a greater return on the investment. Maintaining and upgrading these systems to reflect the most up-to-date technology requires implementation and maintenance funding. The good news is that technology and communication advances are driving costs down each year.

Houston TranStar’s sensor network collects data and disseminates traveler information to the public, the media, and third-party providers. Each year, nearly 2 million incident and travel time messages are sent to more than 200 roadside message signs in the region. Benefit-to-cost ratio is estimated to be more than 11 to 1.

Potential for Pilot Project¹

Near-term²: Immediate

Mid-term³: Same as above

Long-term⁴: Same as above

Cost to Implement

Near-term: Reasonable

Mid-term: More reasonable than in the near-term.

Long-term: More reasonable than in the mid-term.

Cost Implications

Near-term: Maximizes roadway efficiency and capacity; reduces the impacts of congestion; and, increases safety by alerting drivers of upcoming hazards.

Mid-term: Same as above

Long-term: Same as above

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

<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #100 What Traveler Information Systems Do
Category: U. Traveler Information Systems
Author(s)/Sponsoring Agency: State and municipal governments, transit providers, and the private sector
Date: Ongoing
Source: https://en.wikipedia.org/wiki/Advanced_traveller_information_system ; https://www.waze.com/ ; http://www.tomtom.com/en_us/
Abstract: An Advanced Traveler Information System (ATIS) acquires, analyzes, and presents information to assist travelers in moving from a starting location (origin) to their desired destination. An ATIS may operate through information supplied entirely within one's vehicle (autonomous system), use data supplied by a traffic management center, or increasingly use information provided on one's cell phone. Relevant information may include locations of incidents, weather and road conditions, optimal routes, recommended speeds, and lane restrictions. Modes of mass transportation, including planes, trains, and buses, are using internet connectivity to help improve customer satisfaction and reduce maintenance costs. Third party applications are becoming available for cell phones that are multimodal, and integration is expected to advance rapidly. For vehicular travel systems, such as Waze (iPhone app), share real-time traffic and road information and alerts users before one approaches police, accidents, road hazards or traffic jams, based on information from other drivers. The app, known as Tomtom, promotes its ability to track one's habits and provide information accordingly. There are still limits – gated roads in private communities, short-term changes, limits of the turning radii of large vehicles that cannot go where passenger vehicles can go, and the like. But with little effort, one could drive to an unfamiliar city, park, and then use the local transit system almost seamlessly. Similar transitions are now enabled among airlines and local transit systems. Beyond this, there other now customary conveniences of querying or looking at a map on a phone to determine the next place to eat, get gas, shop, find a point of interest, and so forth, complete with travel time and route.
Potential for Pilot Project¹
Near-term²: Immediate
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: Reasonable
Mid-term: More reasonable than in the near-term.
Long-term: More reasonable than in the mid-term.
Cost Implications
Near-term: Maximizes roadway efficiency and capacity; reduces the impacts of congestion; and, increases safety by alerting drivers of upcoming hazards.
Mid-term: Same as above
Long-term: Same as above

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



<i>Miami-Dade County TPO Technology Literature Summary Sheet</i>
Topic: #101 “ <u>Nextdoor</u> ”, the social network designed specifically for neighborhoods
Category: V. Communication Technology
Author(s)/Sponsoring Agency: Mashable Website to New York Times
Date: 2011-2016
Source: http://mashable.com/2013/08/21/nextdoor-android-app/#o27zXQHwvmqp http://well.blogs.nytimes.com/2015/10/13/meet-the-neighbors-theres-an-app-for-that/? r=1
Abstract: “Nextdoor” has built social networks to serve individual neighborhoods since 2011. Users must show proof of residency within a certain neighborhood to be admitted, and the objective is to create an environment where "it feels as safe to share online what you would share offline. It's not uncommon for users to post phone numbers, addresses or even names of their children on the site, knowing that they are amongst a close, local community. The utility of the iPhone app has made it popular among these tight collections of neighbors. Nextdoor often functions as a digital “Neighborhood Watch” program. It also partners with many local authorities, which means users can receive neighborhood-specific emergency alerts in the case of any danger. Other day-to-day examples where the app's mobile presence comes in handy range from users helping neighbors find lost pets. Because of its “neighborhood” function, and security focus, seniors can be readily taught the ease of its use by a neighbor.
Potential for Pilot Project ¹
Near-term²: Immediate
Mid-term³: Same as above
Long-term⁴: Same as above
Cost to Implement
Near-term: The cost of a mobile device (iPhone)
Mid-term: Same as above
Long-term: Same as above
Cost Implications
Near-term: Improved security with the potential to lessen impacts of vandalism, fire, contagious illnesses.
Mid-term: Improved security with the potential to lessen impacts of vandalism, fire, contagious illnesses.
Long-term: Improved security with the potential to lessen impacts of vandalism, fire, contagious illnesses.

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





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