WILL COUNTY

COMMUNITY FRIENDLY FREIGHT MOBILITY PLAN

WILL COUNTY CENTER FOR ECONOMIC DEVELOPMENT

APPENDIX E

TECHNOLOGY

September 2017

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Advances in technology are rapidly changing the nature of freight movement and are allowing shippers to adapt to economic and political imperatives. Key factors driving technological innovation include increased competition between online retailers, truck driver shortages, hours of service regulations, initiatives to improve highway safety and changing consumer expectations regarding shipping times.

Automation

Autonomous Vehicles

Autonomous, or self-driving, vehicles, are vehicles that can sense their environment and navigate with little or no human involvement. Uber and Google have recently begun testing the use of these vehicles for both passengers and freight. A recent report by the American Transportation Research Institute titled *Identifying Autonomous Vehicle Technology Impacts on the Trucking Industry* discusses the major impacts. Commercial Fuel Buyer magazine summarized the top 10 issues and their implications for truckers as follows:

- Hours of service: Allows for driver rest and productivity to occur simultaneously.
- Compliance, safety, accountability: Will decrease raw Safety Measurement System (SMS)[1] scores, though percentile scoring needs to change.
- Driver shortage: Driving is more attractive with higher productivity, less time away from home and additional logistics tasks. Fewer drivers may be needed.
- Driver retention: Companies with autonomous technology may attract and retain drivers.
- Truck parking: If "productive rest" is taken in the cab during operations, less time will be required away from home at truck parking facilities, and fewer facilities will be needed.
- Electronic logging device (ELD) mandate: Modifications will be necessary depending on level of autonomy.
- Driver health/wellness: The driver could be less sedentary and injuries could be reduced.

[1] The SMS is the Federal Motor Carrier Safety Administration's system for identifying commercial freight and passenger carriers with potential safety problems for enforcement intervention.

- The economy: Carriers that use autonomous trucksAT may see productivity and cost benefits.
- Infrastructure/congestion/funding: Urban congestion could be mitigated through widespread use of AVs (including cars).
- Driver distraction: Drivers will not be distracted from driving if the vehicle is in autonomous mode. [2]

The Society of Automotive Engineers (SAE) and the National Highway Traffic Safety Administration (NHTSA) define 6 levels of autonomous vehicles ranging from total driver control to fully autonomous. (Table 1)

TABLE 1: LEVELS OF AUTONOMOUS VEHICLES

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability *(Driving Modes)*
***Human driver* monitors the driving environment**						
0	**No Automation**	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	**Driver Assistance**	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	**Partial Automation**	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
***Automated driving system* ("system") monitors the driving environment**						
3	**Conditional Automation**	the *driving mode*-specific performance by an *automated driving system* of all aspects of the dynamic driving task with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	**High Automation**	the *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	**Full Automation**	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

Source: SAE International J3016. Available at http://www.sae.org/misc/pdfs/automated_driving.pdf.

[2] Summary of ATRI's Report on Autonomous Vehicle Impacts on Trucking Industry. Synopsis by Kyndall Krist http://www.commercialfuelbuyer.com/summary-atris-report-autonomous-vehicle-impacts-trucking-industry/

Many personal vehicles already incorporate autonomous technology. Vehicles with adaptive cruise control exhibit level 1 autonomy and vehicles with automatic (parallel) parking technology incorporate level 2 autonomy. The key threshold is reached at level 3 where the vehicle controls all driving tasks and the driver can safely turn to other tasks with the expectation that the vehicle will alert the driver of any need to intervene.

While truck manufacturers have begun researching and testing higher levels of autonomy, the most promising applications only reach level 2. These are commercial truck platooning and positive train control (PTC).

TRUCK PLATOONING

Truck platooning involves creating "trains" of two or three semi-autonomous trucks, which are linked together through wireless sensors, and controlled by the lead truck. This allows the trucks to drive in tight formation, reducing wind resistance and increasing fuel efficiency. In one application developed by technology company Peloton, the speed and braking of the pack is controlled by the "captain" in the cab of the front vehicle, with the rest of the drivers following closely and needing only to steer. (Applications where the following trucks also give over steering control to the lead truck have also been tested.) Platooning is currently being tested in the United States and has been tested successfully in Europe.

IMPACT ON WILL COUNTY

Various federal and state agencies have taken steps to prepare for autonomous vehicles. In September of 2016, the Federal Highway Administration released the Federal Automated Vehicles Policy, but has not provided detailed guidance for state or local governments. In the upper Midwest, a coalition of state DOTs and research institutions from Michigan, Ohio and Pennsylvania have formed the Smart Belt Coalition. States such as Arkansas, Iowa, South Carolina, and Tennessee have considered legislation to reduce the minimum following distances for trucks, which would permit platooning. Other states have considered measures permitting testing of autonomous truck technology on highways.

The goal of the Smart Belt Coalition is to support research, testing, policy, funding pursuits and deployment for autonomous and connected vehicles, and to promote data sharing and provide opportunities for private sector companies to deploy new transportation technologies. The Coalition is developing a strategic plan that will focus on:

- Connected and automated applications in work zones;
- Commercial freight opportunities such as platooning; and
- Incident management applications to provide better information to and infrastructure for emergency responders and other agencies.

Source: Pennsylvania DOT, 'Transportation Agencies in Pennsylvania, Ohio, and Michigan form 'Smart Belt Coalition' to Collaborate on Automated, Connected Vehicles,' press release dated January 17, 2017.

Truck platooning is effective on long-haul truck trips and has been tested by private companies in multiple states including Texas, Nevada, and California. Given the prevalence of drayage and shorter urban truck trips in Will County, platooning may have limited utility for trucks originating and terminating there. However, Transearch data shows that between 60 and 70 percent of all truck trips in Will County are through trips. A coalition approach with neighboring states or counties, similar to the Smart Belt Coalition, focusing on Interstate 80, could potentially free up capacity, reduce congestion, improve safety and provide air quality benefits to Will County.[3]

IMPLEMENTATION PARTNERS

A coalition approach could potentially involve the Illinois, Iowa, Indiana and Ohio Departments of Transportation as well as the public research institutions in those states. The Urban Transportation Center at the University of Illinois at Chicago has conducted research into freight movement in the Chicago metropolitan area and is a potential partner in forming a coalition.

Volvo Trucks has been a partner on several demonstration projects and has been willing to work with state and federal governments. In March of 2017, Volvo conducted a demonstration of truck platoon technology with three linked trucks on California's I-10. The project partners included the California Department of Transportation, local agencies, Volvo Group of North America and U.C. Berkeley.

DRONE DELIVERY

Unmanned aerial vehicle, or drone, delivery has minimal proven capability but has potential as a future freight technology efficiency maximizer. In a vote of confidence, venture capitalists have invested in drone delivery startups and large tech and retail companies have begun testing the technology. Executives at Google Wing claim they will deliver packages in 2017 via drone.

[3] http://landlinemag.com/Story.aspx?StoryID=33040#.WPe3m2nyskI

Two major retailers with a presence in Will County have begun testing drone delivery:

- Amazon, which operates four fulfillment centers in Will County just released an update of its Prime Air program – a delivery system designed to deliver packages within 30 minutes using drones. Amazon has begun a pilot program in a rural area near Cambridge, England from a customized fulfillment center.

- In October of 2016, Walmart asked the Federal Aviation Administration for permission to test drone delivery, with the initial intention of using drones to move goods between distribution centers.[4] Walmart operates a 3.3 million square foot distribution center in the CenterPoint Intermodal Center which could become a hub for drone delivery.

IMPACT ON WILL COUNTY

It is possible that the Amazon and Walmart distribution centers could become hubs for drone delivery. But given Will County's relatively low-density development patterns drones are unlikely to produce an economic advantage for last-mile delivery. The prototypes that companies are testing usually carry just one package, and after the drone makes its delivery, it must fly back to the distribution center to recharge its batteries and pick up the next package. By way of comparison, a UPS delivery truck makes an average of 120 stops a day to deliver hundreds or thousands of packages. Consequently, it is likely that drone delivery will be implemented initially for remote, difficult-to-reach or highly congested urban areas where truck delivery is infeasible or costly or when a product needs to be delivered within minutes[5]. Moreover, there are technological hurdles that still need to be overcome, such as managing the increasingly crowded airspace if widespread drone delivery catches on. Drones would also need to be secured somehow against cargo theft.

IMPLEMENTATION PARTNERS

Given the presence of both Amazon and Walmart in Will County, they may be the strongest potential industry partners.

POSITIVE TRAIN CONTROL

Positive Train Control (PTC) is a system of monitoring, communication and safety equipment that is designed to override human error by automatically stopping a train to prevent train-to-train collisions, derailments caused by excessive train speed, incursions into work sites, and train movements through misaligned track switches.[6] In 2008, Congress passed the Rail Safety Improvement Act of 2008, which mandated that railroads install PTC on all tracks that carry passengers or poison- or toxic- by inhalation materials by the end of 2016. In late 2015, that deadline was extended to 2018.

[4] http://money.cnn.com/2015/10/26/news/companies/walmart-drone-testing/index.html
[5] https://www.trucks.com/2017/01/31/self-driving-trucks-big-data-disruptive-technology/
[6] https://www.aar.org/BackgroundPapers/Positive%20Train%20Control.pdf

Despite the difficulties of implementing a brand-new technology, the American Association of Railroads reports that by the end of 2016, railroads had equipped 62 percent of locomotives and 74 percent of base stations with the necessary equipment for PTC and trained 50 percent of employees to implement PTC.

Automated Equipment Identification (AEI) has been installed on all of North America's rolling stock since the 1990s. Consisting of passive tags (no power required) mounted on each side of railroad rolling stock and active trackside readers, AEI uses radio frequency technology to identify railroad equipment while en route. Using this installed technology may have other opportunities for comparing AEI information with GPS information for accuracy in determining location. According to "Progressive Railroading" Norfolk Southern began installing in 2010 Global Positioning System (GPS) devices onboard locomotives, and has begun reporting train arrivals and departures by combining GPS time stamps with AEI scanner readings from GPS locomotive-hauled cars.

IMPACT ON WILL COUNTY

By improving safety, PTC will have a positive effect on freight operations in Will County. Four Class I rail lines and Metra passenger rail operate in Will County, in some instances on shared track. Additionally, there may be an opportunity for further exploration on the connectivity between AEI and PTC for coordinating arrival and departure information and coordinate that with trucking and terminal operators. The key to this information is to coordinate with the arrival and pickup times.

IMPLEMENTATION PARTNERS

To develop a logistics information system using AEI and PTC will require individuals with expertise for both technologies as well as the expertise related to terminal operations. This is primarily an issue related to the private sector and does not require the expertise of the public sector.

MANAGED LANES

Managed lanes are defined as "highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions."[7] The operational strategies can include pricing (either traditional tolling or variable tolls based on demand), vehicle eligibility (allowing certain vehicles but restricting others, for example high-occupancy vehicle (HOV) lanes), or access control (e.g., limiting access over long stretches of the facility to minimize turbulence in vehicle flow). These strategies can sometimes be combined, for instance by implementing high-occupancy toll (HOT) lanes, which combine pricing and vehicle eligibility.

With respect to trucks, key managed lane strategies include exclusive truck facilities. Exclusive truck facilities are less common in the U.S. but have been implemented near major seaports to facilitate the flow of trucks to and from the port. An example is at the

[7] https://ops.fhwa.dot.gov/publications/managelanes_primer/

Port of Miami, where an undersea tunnel links the port (which is on an island in Biscayne Bay) to I-95 on the mainland. The tunnel features a dedicated truck lane in each direction as well as dedicated automobile lanes.

IMPACT ON WILL COUNTY

Managed lanes could potentially be used in Will County to help manage the flow of trucks on regional freeways and reduce congestion for other users. For example, assuming sufficient capacity exists, managed lanes could be implemented along I-80, I-55, I-355, or I-57 (or any combination of the four) to promote efficient traffic flows especially during peak commuting hours.

IMPLEMENTATION PARTNERS

The implementation partners for managed lanes would consist of FHWA, IDOT, law enforcement, toll agencies, regional transportation authorities, the public, local municipalities, transit agencies, the trucking and logistics industry, and any other groups that might have an interest in operations of the affected corridor. Given how such a project is likely to cross multiple jurisdictional lines, involving all affected stakeholders early and often would be important for project success.

INTERNET OF THINGS: V2X (VEHICLE-2-X)

V2X is a term for an interconnected communications system of vehicles and infrastructure. It includes V2V (vehicle to vehicle) and V2I (vehicle to infrastructure) applications. V2V allows vehicles to communicate with each other, sending information about speed, location, and braking in order to alert drivers to potentially unsafe conditions. Likewise, V2I allows the vehicle to communicate back and forth with various pieces of infrastructure including traffic lights, road signs, and potentially traffic cameras and other enforcement hardware. Autonomous vehicles do not require V2X, but it is a complimentary technology.

From a freight perspective, truck platooning is one example of V2V. An example of freight V2I is Freight Signal Priority (FSP), where devices on freight trucks can broadcast a message to the signal infrastructure that makes traffic signal controllers aware of an approaching truck. This triggers an alternate phase timing algorithm that can extend the signal green phase to allow the truck to pass through safely. When deployed on a key freight arterial, FSP can improve truck travel times and reduce unnecessary stopping and starting at intersections.

Additionally, a virtual enforcement facility (VEF) is important to monitoring trucks as they move through the urban region. This technology (license plate readers, transponder readers, weigh in motion, safety data readers) allows the enforcement officers to have eyes and ears in remote locations. Sensors, embedded in the highway and on the side of the highway, that measure size and weight along with other safety data can provide enforcement staff with information for immediate enforcement as well as later compliance discussions with the carriers.

IMPACT ON WILL COUNTY

This technology is still in early development, but one application for Will County could involve platooning. A coalition approach with neighboring states or counties, similar to the Smart Belt Coalition, focusing on Interstate 80, could potentially provide direction to Will County for the implementation of V2X.

IMPLEMENTATION PARTNERS

From an enforcement perspective, IDOT and the Illinois State Police are the two lead partners that Will County should coordinate with on implementation of V2I-based enforcement mechanisms. As noted above, a coalition approach would involve multiple state DOT, university, and other partners.

FREIGHT ADVANCED TRAVELER INFORMATION SYSTEM (FRATIS)

The Freight Advanced Traveler Information System (FRATIS) was developed by FHWA to help optimize freight movement between pickup and delivery of goods, attempting to avoid and minimize congestion. It was originally focused on the cross-town movement of containers from one terminal to another to expedite the moves between rail carriers. But the tool evolved to facilitate movement between multiple intermodal facilities that include rail, trucking and marine operations.

In the intermodal system, congestion points exist at the gates where vehicles pickup and drop off goods and are created by traffic incidents outside the terminal. FRATIS bridges the gap between traffic engineers outside the gate and terminal operators inside the gate. FRATIS facilitates two streams of information that can help communication between terminal operations and the carrier, as well as communication between the traffic management center and the carrier. Given this information, the carrier can make efficient connections. Better load management then can reduce bobtails and the number of truck trips.

IMPACT ON WILL COUNTY

Will County provides a natural environment for a tool like FRATIS. With the rapid increase in warehousing and intermodal terminals the orderly movement of freight into and out of those terminals and warehouses could improve system and facility efficiency and also set a foundation for conducting additional business.

IMPLEMENTATION PARTNERS

The partners required for a successful venture into cross communication between the intermodal terminals and warehouses and the traffic management operations of nearby communities include terminal operators, warehouse management, and traffic management center directors along with drayage organizations and the Illinois Trucking Association. Sharing of information will require a memorandum of understanding between these parties.

WAREHOUSE AUTOMATION

Automation in loading, unloading and other repetitive tasks in warehouses is increasing. Amazon purchased Kiva Systems in 2012 for $775 million and now has 45,000 robots at work in its fulfillment centers.[8] As warehouses and distribution centers consistently face labor shortages, especially during the holiday season, deployment of robots and automation has become increasingly attractive.

IMPACT ON WILL COUNTY

Warehouse automation will have little impact outside of the walls of the warehouse. The primary concern is the impact on the number of jobs in the industry. At this point, that impact cannot be foreseen. On the one hand, a higher proportion of work may be performed by robots, but on the other hand, the overall growth in the industry and its profitability has resulted in more warehouse jobs being created. In Will County, the number of warehouse workers is projected to grow by 55 percent between 2016 and 2026 from 5,900 to 9,136.[9] Automation could also change the skill levels required for workers; for instance, higher skilled workers will be needed to manage and maintain the sophisticated automation systems at these facilities.

IMPLEMENTATION PARTNERS

In the case of warehouse automation, Will County will need to react to the impacts of this technology, which are yet unknown. Maintaining communication with private sector partners will help Will County stay apprised of industry needs and opportunities to provide retraining.

FREIGHT YARD AUTOMATION

In a Container Terminal Automation report released in March 2014, the City of Los Angeles Harbor Department identified automated terminals as those with "at least some container handling equipment operating without direct human interaction for 100 percent of the duty cycle of the equipment."[10] Commonly automated equipment includes:

- Automated Stacking Cranes – rail mounted gantry cranes
- Cantilevered Rail Mounted Gantry Cranes
- Rubber Tired Gantry (RTG) cranes
- Automated straddle carrier (Autostrad)

Yard automation may also include container location tracking systems.

Automated gate systems are already deployed at the Chicago area intermodals, which facilitates truck driver access into the yards.

[8] http://www.latimes.com/projects/la-fi-warehouse-robots/
[9] EMSI data, 2016.
[10] Source: "Container Terminal Automation," City of Los Angeles Harbor Department Planning and Economic Development Division.

IMPACT ON WILL COUNTY

Automation of freight yards would be expected to increase efficiency within the yard, similar to the FRATIS system discussed in this report. Increasing efficiency would create additional capacity and room for growth. A portion of the Long Beach Container Terminal that recently implemented automated rail operations was able to reduce average truck visit time from 85 minutes to 38-40 minutes.[11] However, such efficiency improvements inside the terminal gates could lead to higher volumes at intermodal yards, increasing congestion on the transportation system outside the gates.

IMPLEMENTATION PARTNERS

The key partner in a project to automate the intermodal terminals in Will County are the operators of the terminals themselves, the BNSF, UP and CN railroads and CenterPoint Intermodal Center and Ridgeport Logistics Center. The key barrier, though, is cost. As an example, the automated cargo-handling equipment at the Long Beach Container Terminal at the Port of Long Beach was procured at a cost of $65 million.

[11] http://www.joc.com/port-news/us-ports/port-long-beach/automation-halves-truck-turns-times-long-beach-port-terminal_20160531.html