

Project Title:
Autonomous Vehicles and Freight Transportation Analysis

Funding Agency:
The North Central Texas Council of Governments
(NCTCOG)



NCTCOG Project Manager:

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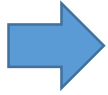


UNIVERSITY OF
TEXAS
ARLINGTON

Department of
Civil Engineering

PROJECT OBJECTIVES

Problems



It is not clear how the advent of emerging automated truck technologies would impact the Dallas-Fort Worth's (DFW) truck industry or the infrastructure needed to support the industry

- Critical trucking issues (e.g. hours-of-service, compliance, safety, driver education, driver retention, truck parking, driver health and wellness, congestion, driver distraction)
- Adequacy of existing facilities
- Need for specialized/separate facilities

Objectives



To conduct a direct and thorough investigation of:

- Impacts of automation on the future of the DFW's truck industry
- Infrastructure needed to support the industry



Photo Source: Daimler AG



TASK 1- Review the Status of Automated Truck Technologies

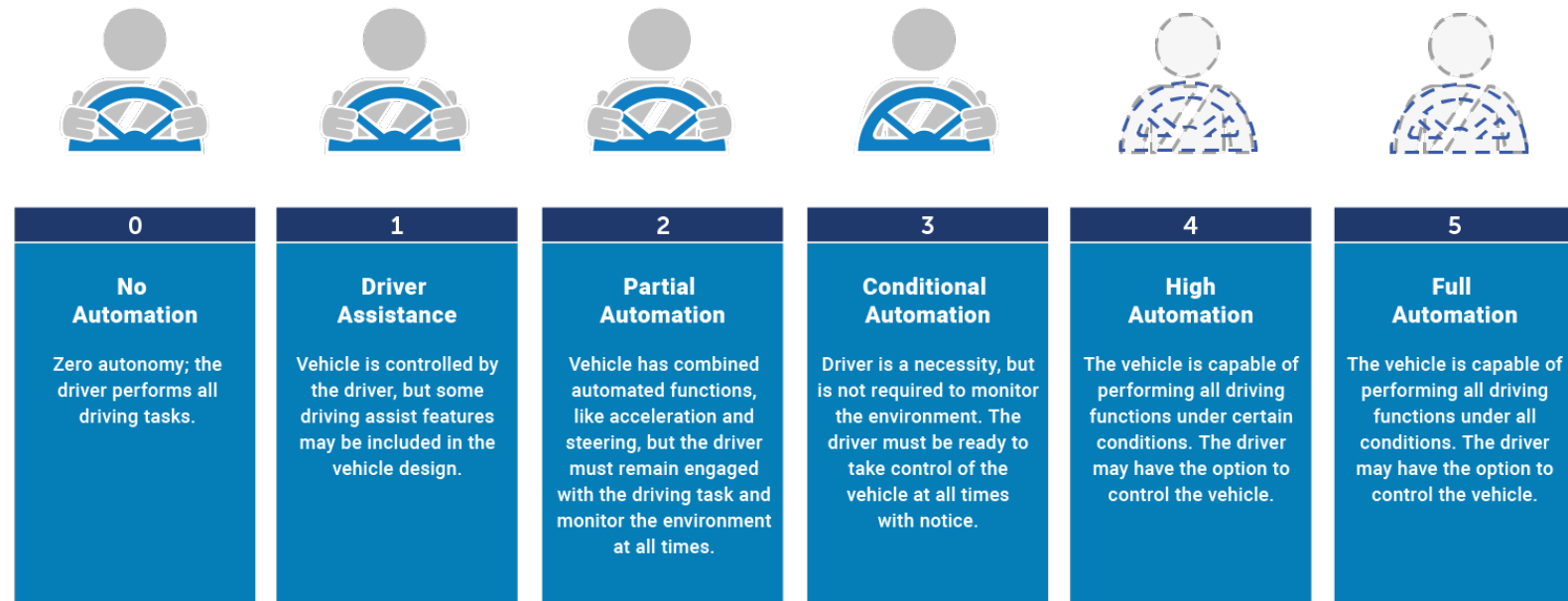
Comprehensive Review of Autonomous Truck Technologies

Current and future technologies that can impact autonomous trucks

Available technologies across 5 levels of automations

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

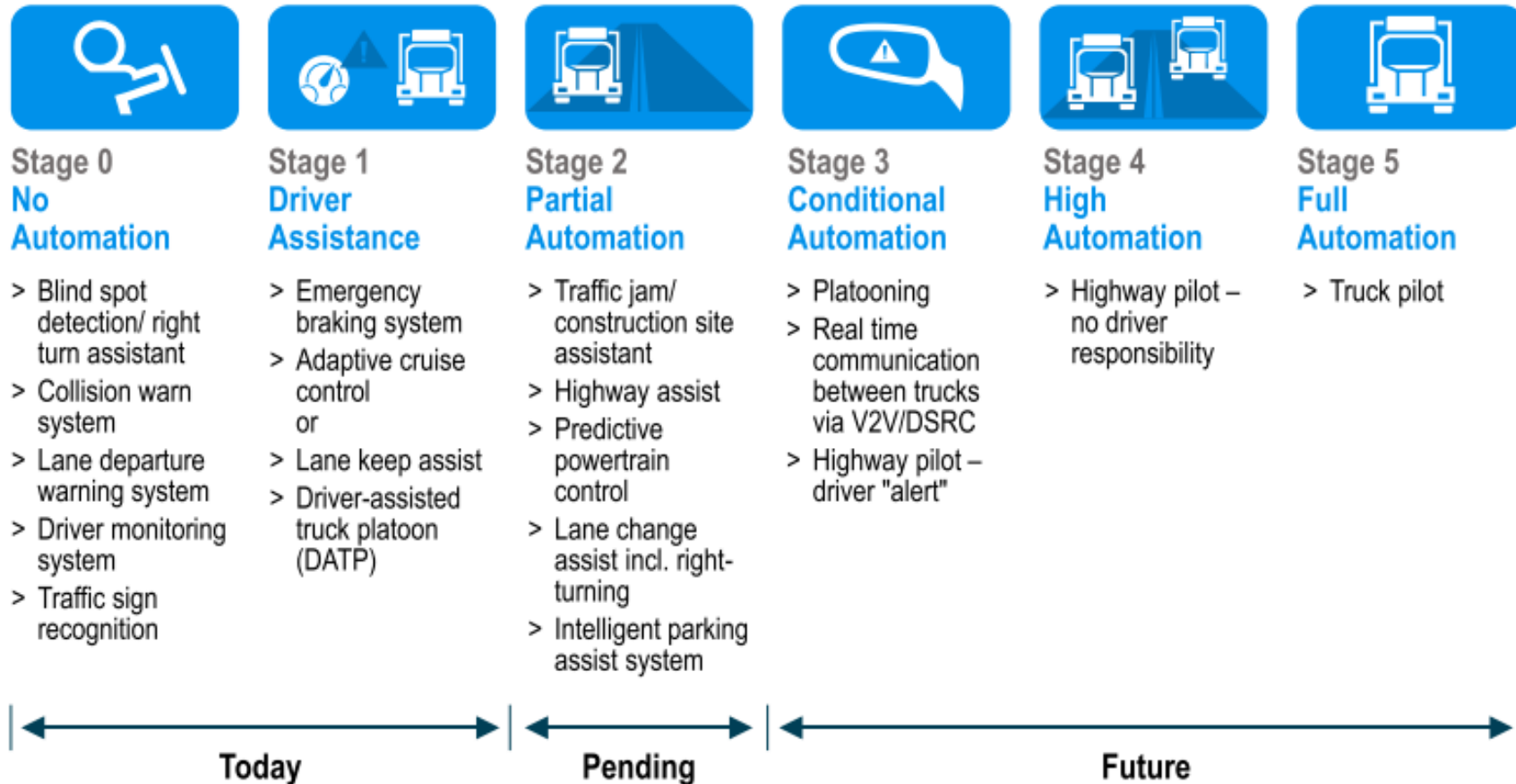
Full Automation



<https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>



TASK 1- Review the Status of Automated Truck Technologies



Source: Berger (2016)

TASK 1- Review the Status of Automated Truck Technologies

STAGE 0 TO STAGE 2 TECHNOLOGY FOR AUTONOMOUS TRUCKING

Currently Available (*Camden et al. 2017, Mohn 2017*)

- Forward Collision Warning
- Adaptive Cruise Control
- Automatic Braking System
- Lane Departure Warning
- Blind Spot Warning
- Electronic Stability Control
- Roll Stability Control
- Speed Limiters
- Onboard Monitoring System
- Electronic Logging Device (ELD)



Stage 0 No Automation

- > Blind spot detection/ right turn assistant
- > Collision warn system
- > Lane departure warning system
- > Driver monitoring system
- > Traffic sign recognition



Stage 1 Driver Assistance

- > Emergency braking system
- > Adaptive cruise control or
- > Lane keep assist
- > Driver-assisted truck platoon (DATP)



Stage 2 Partial Automation

- > Traffic jam/ construction site assistant
- > Highway assist
- > Predictive powertrain control
- > Lane change assist incl. right-turning
- > Intelligent parking assist system

Source: Berger (2016)

TASK 1- Review the Status of Automated Truck Technologies

STAGE 3 AND STAGE 4 TECHNOLOGY FOR AUTONOMOUS TRUCKING

Under Development and Testing

- Many stage 3 and stage 4 automated truck technologies are under development and testing. *(Williams et al 2016, Stephens et al 2014, Clevenger 2019, Daimler 2018, Volvo 2018, Cliff 2017, Embark 2018, Marshall 2018, O’Kane 2019)*
- Even some commercial stage 4 driving has been completed. *(O’Kane 2019)*



Stage 3 Conditional Automation

- > Platooning
- > Real time communication between trucks via V2V/DSRC
- > Highway pilot – driver "alert"



Stage 4 High Automation

- > Highway pilot – no driver responsibility

Source: Berger (2016)

TASK 1- Review the Status of Automated Truck Technologies

STAGE 3 TECHNOLOGY FOR AUTONOMOUS TRUCKING

Under Testing *(Stephens et al 2014)*

- V2X (Vehicle-to-Vehicle, Vehicle-to-Infrastructure) communication based technologies:
 - Intersection Movement Assist
 - Emergency Electronic Brake Lights
 - Bridge Height Inform
 - Curve Speed Warning



Stage 3 Conditional Automation

- > Platooning
- > Real time communication between trucks via V2V/DSRC
- > Highway pilot – driver "alert"

Source: Berger (2016)

TASK 1- Review the Status of Automated Truck Technologies

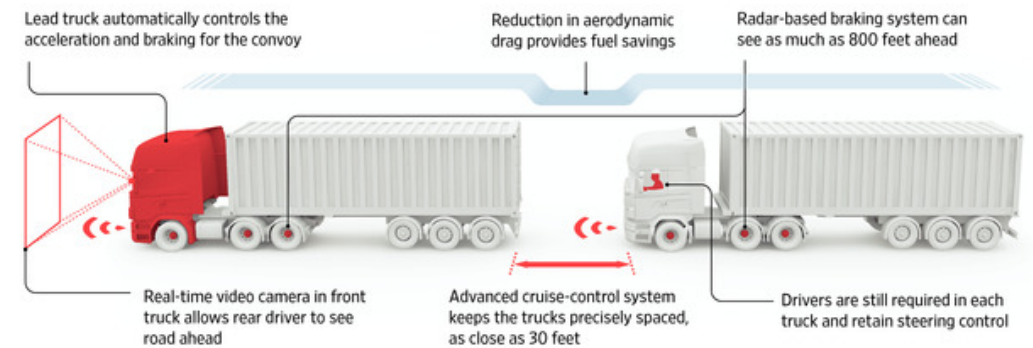
STAGE 3 TECHNOLOGY FOR AUTONOMOUS TRUCKING

Platooning:

- 10% fuel savings for the following truck (*Williams et al 2016*)
- Reduced follow distance helps in improving highway capacity thus leading to reduced congestion
- Driver in following vehicle can rest or engage in other tasks thus increasing productivity
- Requires 5G LTE and legislation change regarding minimum following distance (*Short and Murray 2016*)

How 'Platooning' Lowers Fuel Expenses

New automated-driving technologies allow two or three trucks to closely follow each other. Peloton Technology claims its system allows the rear trucks to use 10% less fuel. Combined savings for the front and rear trucks are 7% at 65 mph.



Source: Peloton Technology

Graphic by Alberto Cervantes/ THE WALL STREET JOURNAL.

Source: Tita and Ramsey (2015)

TASK 1- Review the Status of Automated Truck Technologies

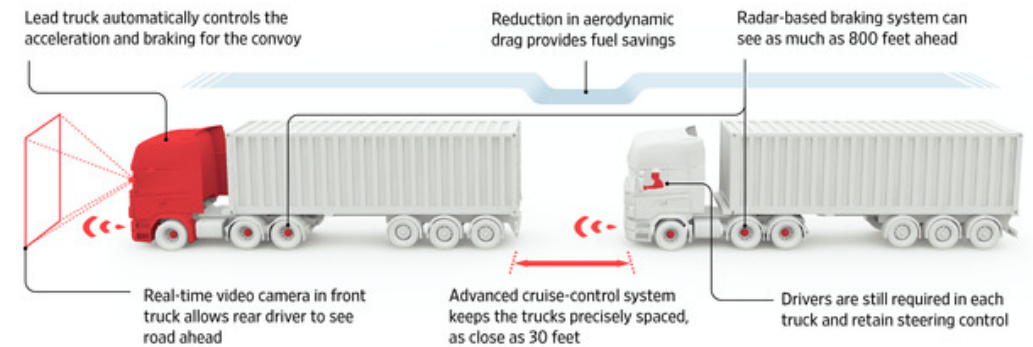
STAGE 3 TECHNOLOGY FOR AUTONOMOUS TRUCKING

Platooning: Testing

- Still in development phase and but will most likely be the transition between current trucking technology and autonomous technology (Clevenger 2019).
- Daimler has suggested that savings created from platooning does not justify the investment (Lopez 2019, SupplyChainDigest 2019)
- Peloton on the other hand says that its patented platooning tech does create savings which present a good business case (Lopez 2019 , SupplyChainDigest 2019)

How 'Platooning' Lowers Fuel Expenses

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Source: Peloton Technology

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Source: Tita and Ramsey (2015)

TASK 1- Review the Status of Automated Truck Technologies

STAGE 4 TECHNOLOGY FOR AUTONOMOUS TRUCKING

Highway Pilot (Semi-autonomous)

- Uber (*Newcomer and Webb 2016*) : Successfully delivered cargo for Budweiser by travelling 120 miles
- Daimler (*Daimler 2018*) : In May 2015, the state of Nevada licensed two “Freightliner Inspiration Trucks” for normal operation on public roads.
- Volvo (*Volvo 2018*): Developing Vera, an autonomous truck that is designed to operate in restricted areas, such as ports or warehouse districts to carry big loads along fixed routes.
- Embark (*Cliff 2017, Embark 2018*): Embark’s retrofitted 18-wheelers can already drive themselves while on interstate highways



*Cascadia trucks by Daimler AG with highway pilot enabled in CES 2019
(Source: O’Kane 2019)*

TASK 1- Review the Status of Automated Truck Technologies

STAGE 4 TECHNOLOGY FOR AUTONOMOUS TRUCKING

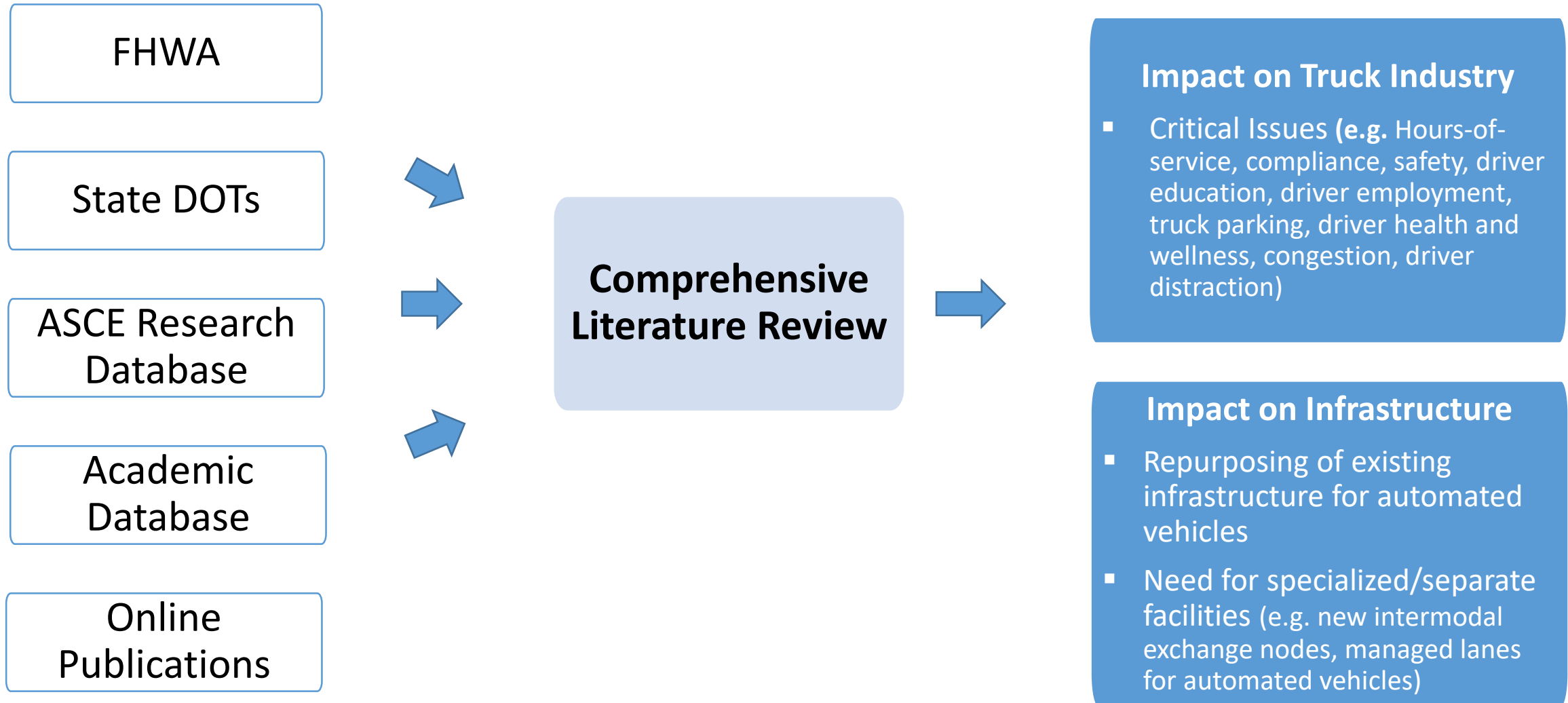
Highway Pilot (Semi-autonomous)

- Startsky Robotics (*Marshall 2018*) : Autonomous highway driving and remotely controlled driving in critical areas.
- TuSimple (*O’Kane 2019*): Stage 4 test runs across different US highways and commercial delivery in partnership with 12 companies.



*Autonomous Truck by TuSimple
(Source: O’Kane 2019)*

TASK 2- Outline the Impacts of Automated Trucks



TASK 2- Outline the Impacts of Automated Trucks

Hours of Service

Justify flexible hours of service regulations if autonomous trucks are viewed as team drivers

Parking

Confine currently ever-increasing parking demand due to expected flexible hours of service

ELD Mandate

Make ELD mandate more acceptable due to expected flexible hours of service regulations

ELD : Electronic Logging Device

CSA : Compliance, Safety, and Accountability

CSA Basics

Reduce crashes and enhance safety in driving



Trucking Issues

Economy

Optimize fuel consumption and increase in hours of service

Driver Shortage

Reduce stress of driving and less monotonous periods that will make trucking jobs more desirable

Driver Health

Allow more rests that will lead to better health of drivers

Driver Distraction

Compensate for driver distraction

TASK 2- Outline the Impacts of Automated Trucks

Road Signs/Markings

Should be at least visible and at best should be able to support V2I connectivity

Launch/Landing Pad

Exit to exit autonomous AT tech requires design of launch and landing pad for transition and platooning

Warehousing

Automation of warehouse needs to be incentivized as successful implementation of AT requires automated warehouses.

Managed Lanes

Good alternative when adoption of autonomous trucks is low (Less than 50% for 2 lane highway)



Infrastructure

Parking

To automate parking and improve logistics, real-time parking monitoring infrastructure should be installed

Dedicated Lanes

Should be adopted when autonomous trucking is adopted highly (50% or higher for 2 lane highway)

Charging Stations

Non attainment statutes will push AT tech towards electric vehicles. Hence, electric vehicle charging network should be expanded to reduce range anxiety

Roadside Equipment

V2I tech, which complements onboard equipment of ATs, requires roadside HD cameras, 5G antennae, and link to cloud-based traffic management system

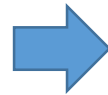
TASK 3: Design Survey Questionnaire

Subjects of interest



What are the risks and opportunities associated with adopting automated trucks with various automation levels in the DFW region?

Survey questions

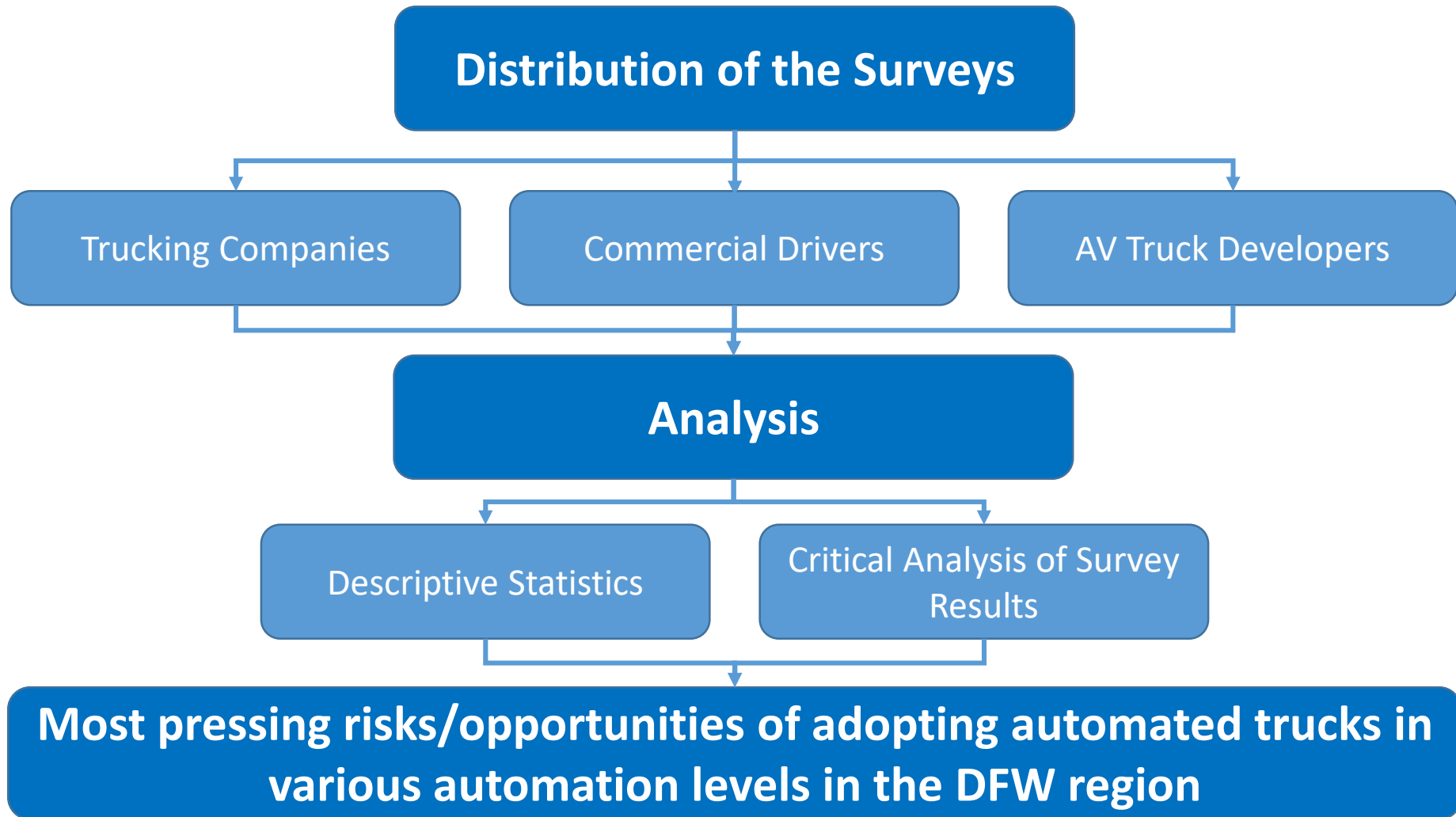


- Short and concise
- Complemented with brief descriptions
- A combination of multiple choice and text questions
- Space for comments and capability to upload documents will be provided to the respondents

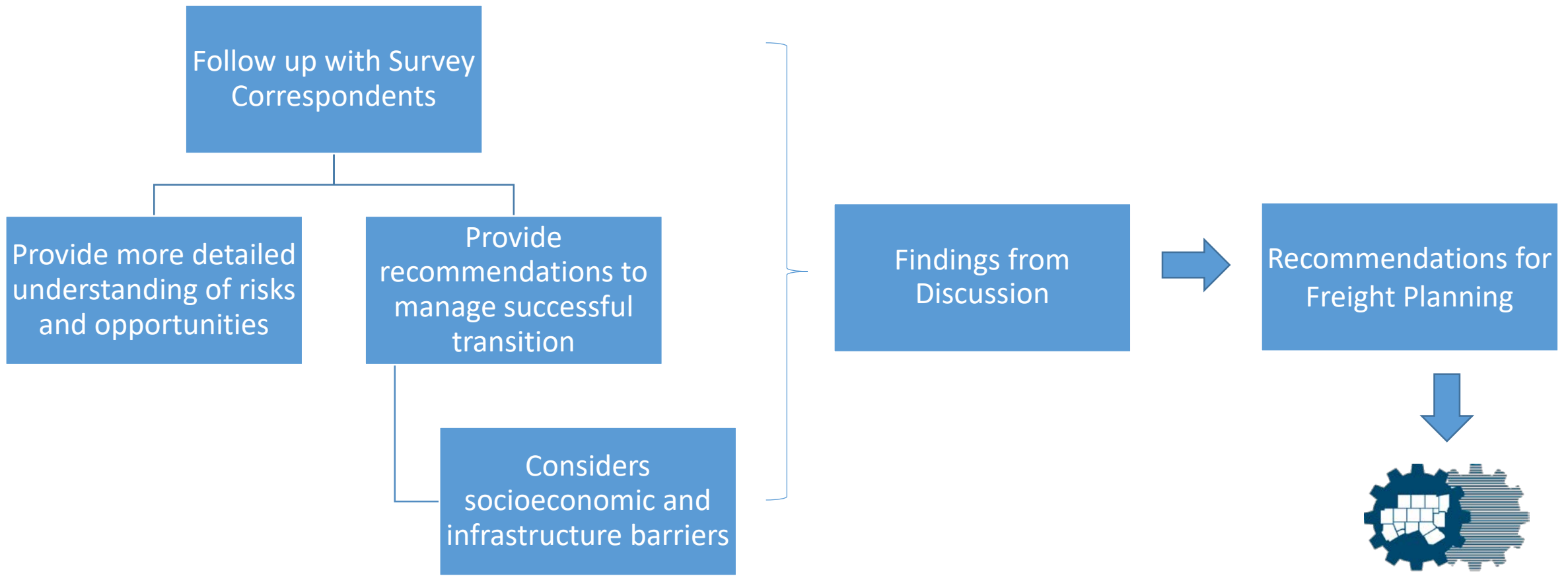
Note: The data collection will take place after acquiring approval of the UT Arlington Institutional Review Board (IRB) and coordinating with relevant parties.



TASK 4- Conduct the Survey



TASK 5 - Follow up with the survey respondents to provide recommendations



TASK 6 - Prepare Final Report

Final report documents

Task 1 Conduct AV Technology Review

Task 2 Conduct Impact Review

Task 3 Prepare Questionnaire

Task 4 Conduct Survey and Analyze

Task 5 Follow-up and Recommendations

Task 6 Prepare Final Report

Expected Key Findings

1- Impact on truck Industry's critical issues

2- Impact on freight transportation infrastructure

3- Recommendations for freight planning to accommodate use of AV in freight transportation



DELIVERABLES

- Quarterly reports documenting work progress,
- Technology review (Task 1),
- Impact analysis (Task 2),
- Survey questions (Task 3),
- Survey descriptive statistics, critical analysis of survey results, and the most pressing risks and opportunities (Task 4),
- Recommendations for successful transition (Task 5),
- Draft of final report for NCTCOG review and comments, and
- Final project report.

PROJECT SCHEDULE

Task	FY 2018-2019									
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1. Review Technologies										
2. Outline Impacts										
3. Design Survey Questionnaire										
4. Conduct Survey										
5. Provide Recommendations										
6. Final Reports										
Quarterly Reports			Feb 24			May 27			Aug 27	Sep 27
Project Meetings	As needed or upon NCTCOG request									

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Truck Specialized Parking Services



Scott Grenerth

sgrenerth@tsps.io

844.879.877 X 712

419.306.7575

May 23rd 2018

*Largest provider of accurate real-time
truck parking availability information*



- The National Issue
- TSPS Experience and Capabilities
- Shared Solution Opportunities
- Your State/Local Challenges
- Action Now



Regulated by time, the pressure is on

- Must have a 10hr break between driving, also 30 minute break
- April 1st electronic logging mandate = strict compliance
- Excessive loading/unloading times out of driver's control

Regulated by time, but paid
by the ____?

Truckers are Increasingly Frustrated

How long does it take
to park?

Does ELD help?



Not enough inventory; not enough information



The Truck Parking Problem

1. Increases truck emissions 10-20%
2. Reduces mobility on the major highway networks 5-15%
3. Contributes to accidents
4. Illegal, unsafe parking reduces driver safety
5. Illegal, unsafe parking impacts cargo security
6. Negatively impacts the cost of goods to consumers in your state



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Trucker safety



Photo: Fox 2 Detroit
June 27th, 2014



Photo: Scott Grenerth
July 3rd, 2014



ALERIS ROLLED PRODUCTS, LLC
C/O ALERIS ROLLED PRODUCTS, INC.
P.O. BOX 100
LEWISPORT, KENTUCKY 40351

DESCRIPTION:

ALLOY 52 TEMPER Q1 FINISH ME
SIZE 37 X 21 040

THYSSENKRUPP MATERIALS, NA
TWO THYSSEN PA

M18210

SOLD TO
THYSSENKRUPP MATERIALS, NA
CLEVELAND OH44130

JOE NAGLE

NOBR 00402000 30000

PART # R2275

RELEASE 98818

STOP # 04

Photo: Scott Grenerth
July 3rd, 2014

Aleris Rolled Products, Lewisport, KY to Thyssenkrupp, Detroit, MI

Unauthorized/illegal parking



Iowa rest area. Ohio rest area...

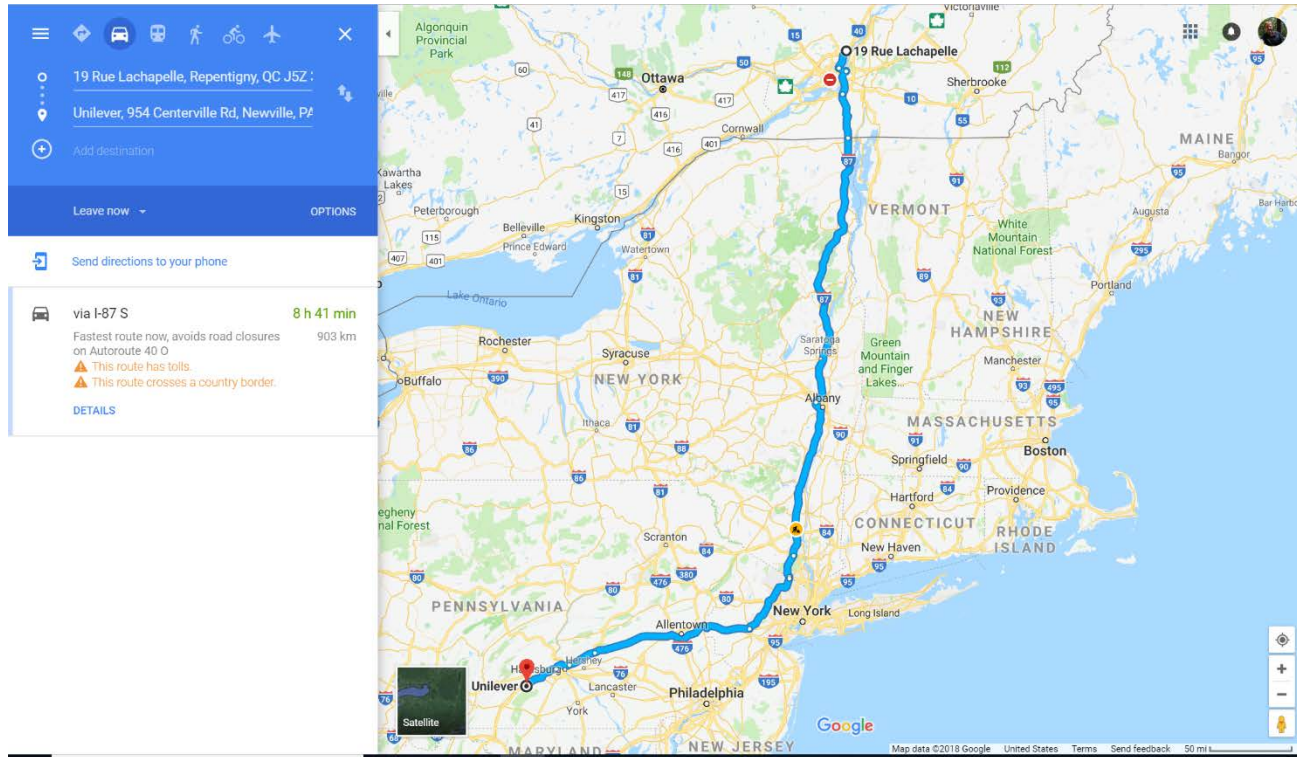
Photo: Rick Fredricksen/Iowa Public Radio



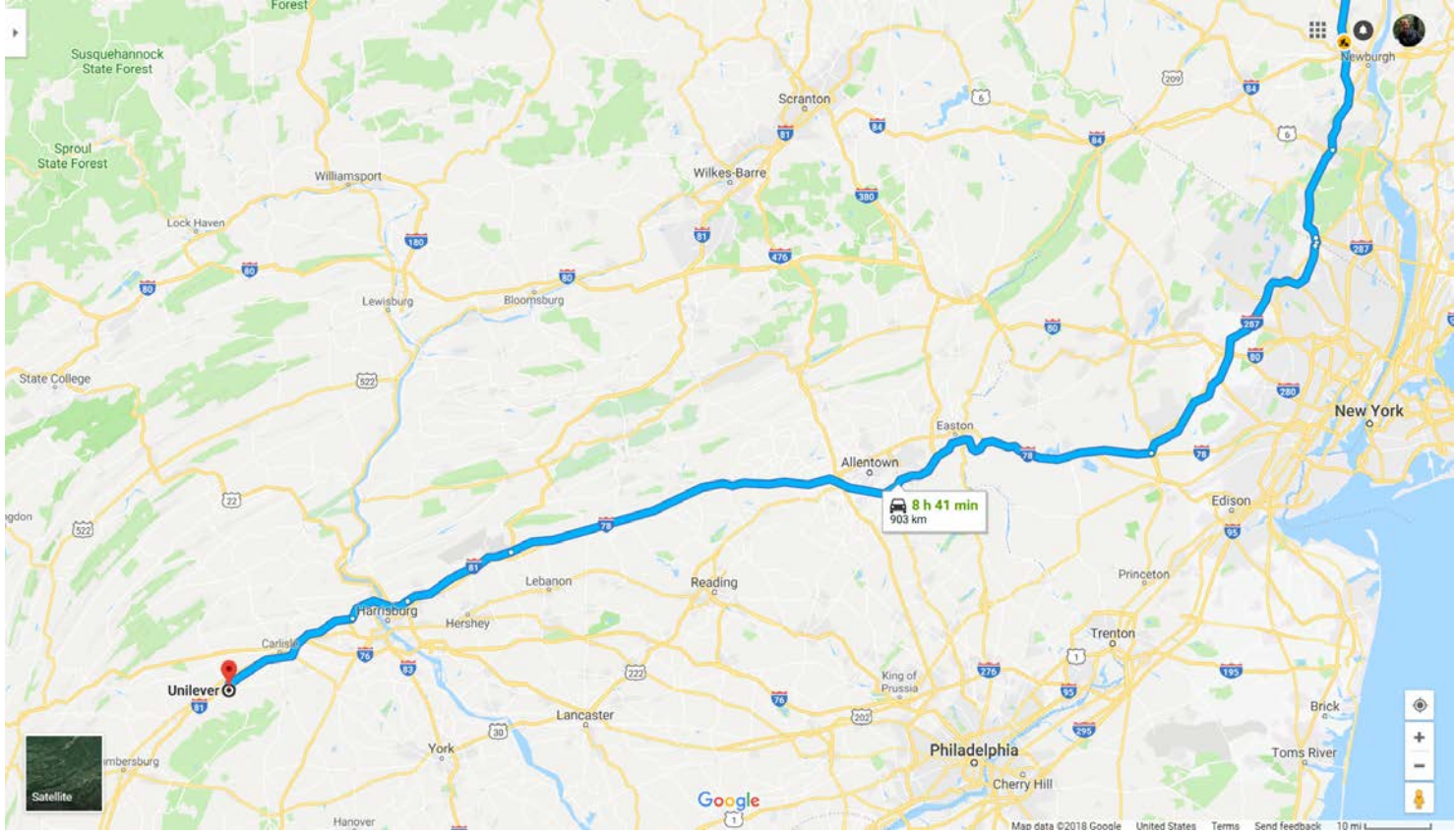
Other locations

- Exit ramp shoulder, secondary street shoulder.
 - Damage \$
- Unauthorized parking, retail store lot.
 - Damage to pavement \$, truck is “booted”
- Far away from where the load is delivering, picking up.
 - Congested traffic, lost productivity for the next day...

Kriska to Unilever



Kriska to Unilever



Regulated by
the hour paid
by the ____

Jason's Law Truck Parking Survey- FHWA

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Jason's Law Truck Parking Survey Results and Comparative Analysis

I. Introduction

This report documents the findings of the Jason's Law Truck Parking Survey. This survey is a requirement of The Moving Ahead for Progress in the 21st Century (MAP-21; P.L. 112-141) legislation that became effective on October 1, 2012. "Jason's Law" was established to provide a "national priority on addressing the shortage of long-term parking for commercial motor vehicles on the National Highway System (NHS) to improve the safety of motorized and non-motorized users and for commercial motor vehicle operators."¹ Specifically, Jason's Law requires the U.S. Department of Transportation (DOT) to conduct a survey and comparative assessment in consultation with relevant State motor carrier representatives to:

1. Evaluate the capability of [each] State to provide adequate parking and rest facilities for commercial motor vehicles engaged in interstate transportation;
2. Assess the volume of commercial motor vehicle traffic in [each] State; and
3. Develop a system of metrics to measure the adequacy of commercial motor vehicle parking facilities in [each] State.²

The DOT is required to make the results of this work publicly available on a website and periodically update the survey. Even without the legislated requirements, the issue of truck parking has long been a priority for the DOT and its operating administrations. Jason's Law helps to advance a more comprehensive set of programs, efforts, and research to improve truck parking and provide States and Metropolitan Planning Organizations with resources to identify parking needs and to encourage improvements and investments.

Jason's Law is named in honor of Jason Rivenburg. On March 4, 2009, Jason stopped for a delivery in Virginia and then headed toward a delivery destination in South Carolina. While only 12 miles from the delivery location, he needed to find parking to rest through the night as his arrival location was not yet open to receive deliveries. Jason did not have a safe place to park. Jason had learned from truckers familiar with the area that a nearby abandoned gas station was a safe location to park and proceeded to park there for the night. Tragically, he was attacked and murdered at this location while he slept with his killer taking both his life and just \$7.00 that he had in his wallet.

Since his death, Jason's wife, Hope Rivenburg, has worked diligently to bring attention to the national truck parking shortage problem. Her efforts, along with those of countless family members, friends, and representatives from the trucking industry, helped to push forth legislation to focus national attention on the issue. After several versions of the Jason's Law legislative language were brought to Congress, the legislative language described above was incorporated into MAP-21.

Truck Parking – A National Challenge

Truck parking shortages are a national safety concern. An inadequate supply of truck parking spaces can result in two negative consequences: first, tired truck drivers may continue to drive because they have difficulty finding a place to park for rest and, second, truck drivers may choose to park at unsafe locations, such as on the shoulder of the road, exit ramps, or vacant lots, if they are unable to locate official, available parking. Numerous public, private, academic and non-profit studies have been completed on the adequacy of truck parking, and these studies have some common findings, including an expected growth in truck activity, severe shortages of parking for trucks, lack of information on truck parking opportunities, and challenges due to limited delivery windows and specific rest requirements. More detail on these studies is provided below.

Previous Truck Parking Studies and Key Findings

The U.S. Department of Transportation

The DOT has completed several studies addressing the Nation's truck parking needs:

- To evaluate safety issues related to driver rest requirements, the 1996 *Commercial Driver Rest and Parking Requirements: Making Space for Safety* study investigated the need for truck parking facilities acknowledging the difference between publicly supplied truck parking spaces and spaces available at privately operated facilities.
- To evaluate the amount of parking availability in 2002, the FHWA completed the *Study of Adequacy of Truck Parking Facilities*, which addressed an array of issues tied to truck parking and determined that the demand for truck parking spaces was underserved by the supply.



Lessons Learned at TSPS

- Technology increases the value of each asset through better utilization
- Users have indicated a willingness to pay (real-time availability, reservations, mobility, security)
- Underutilized real estate is attracting investment for truck parking and storage



Opportunity

**PROVIDE BETTER UTILIZATION OF TIME-SENSITIVE
PARKING ASSETS THROUGH ACCURATE
REAL-TIME INFORMATION MANAGEMENT AND
EXPANDED PARKING OPTIONS**



Result

**PROVIDE BETTER UTILIZATION OF TIME-SENSITIVE
PARKING ASSETS THROUGH ACCURATE
REAL-TIME INFORMATION MANAGEMENT**





Socially Sourced Information? Yes, but...

- It's better than nothing.
- Information is only useful when it's accurate.
- When was last update?
 - Was the trucker able to see every parking space?
- Policy may have changed
 - No more parking in this shopping center, abandoned lot...

Roadmap: Functional Expansion Using Accurate Data

- Non-traditional truck yard **management services** (SaaS)
- **Border crossing** applications (truck wait time)
- Truck parking **reservations** services (Q3)
- **Chain-Up** services (Q4)
- **Predictive** parking (Q1, 2019)
- Support for platooning, CAV parking requirements, ELD integration
- Urban center commercial delivery parking optimization (Smart Cities)



TSPS Today

- **4 states:**
 - 77 facilities under contract to deliver real-time availability (public and private)
- **2 states:**
 - 3 private facilities under partnership contract for secure intermodal truck operational parking and storage
- **4 states:**
 - In discussion to re-open and operate closed rest areas
- Selected on Smart Cities (Columbus, OH) team
 - Urban CV parking

~25,000 trucks per day have opportunity to take advantage of the service

Client & Industry Recognition

ROADX ACCELERATING TECHNOLOGY

TRANSPORT

SMART TRUCK PARKING

PROJECT OVERVIEW

Highways are the critical economic arteries of our state economy. How efficiently trucks travel on these highways impacts the health of our state economy and our individual pocketbooks. The cost of moving goods by truck is a cost that is included in the price of everything we buy.

Past studies have shown that driver fatigue contributed to 15 percent of all fatal crashes involving trucks. To address this issue, Federal Motor Carrier Safety Regulations mandate specific rest periods for drivers. However, drivers face two main issues when seeking safe and convenient places to rest:

- Not enough safe and convenient parking options where needed – many drivers will spend an hour or longer searching for parking
- No reliable real-time source of information identifying truck parking locations and availability

Truckers expending significant time looking for legal and safe parking at the end of a day will eventually increase the cost of goods paid by the consumer. The annual cost nationally of wasted fuel and nonproductive working hours searching for parking is estimated at \$7 billion dollars.

Truck Specialized Parking Services (TSPS) is currently working in several states to establish a seamless, compatible system that can collect, process and distribute accurate, real-time information about parking availability across the United States. CDOT, through its RoadX program, has partnered with TSPS to provide truck drivers with real-time information about available parking along the I-70, I-76 and I-25 corridors.

REAL-TIME INFORMATION ABOUT PARKING AVAILABILITY

SMARTPHONES

ROADX WEBSITE

DYNAMIC MESSAGE BOARDS ALONG THE HIGHWAY

FLYBY DISPATCHERS FOR LARGE FLEETS

PARTNER

TRUCK SPECIALIZED PARKING SERVICES

TSPS

FROST & SULLIVAN

2016 North American Commercial Vehicle Smart Parking Services Customer Value Leadership Award

2016 BEST PRACTICES AWARDS

2016 NORTH AMERICAN COMMERCIAL VEHICLE SMART PARKING SERVICES CUSTOMER VALUE LEADERSHIP AWARD

JTL CARRIERS LLC,
9218 WYNDHAM HILLS COURT,
FRANKLIN, WI 53132

Truck Smart Parking Services
4195 Central Street
Detroit, Michigan
48210

Attention: Scott McKenna, Director

Dear Scott,

Re: Truck Smart Parking Services, I-94 corridor.

RICK SNYDER
GOVERNOR

KIRK T. STEIGLIE
DIRECTOR

November 30, 2015

primarPetroleum, inc.

1207 Broad Street
St. Joseph, Michigan 49085
(269) 983-7314

To: TSPS Inc.

SUBJECT: TSPS, Inc. and Smart Truck Parking Services



TSPS Business Models

Project financing options:

1. Client pays installation and O&M
2. Grants cover all or some of installation and O&M
3. Client leases the platform including services
4. P3 service model: TSPS pays and gets revenue stream until all costs are recovered, then client may get share of reservation and other user fees.
5. P3 real-estate model: Facility owner contributes the facility. TSPS contributes the technology. Revenue share after costs recovered.

Discussion

- Our platform exists;
- Install base ~100 by end of year;
- Data feed integration (TMC, 511, etc.);
- Option to install and maintain signs;
- Demand is there for a reservations service to subsidize the costs;
- We are prepared to assist with grant requests





Truck Parking Models

Options:

1. Shipper/receiver provides parking on-site
2. Shipper/receiver partners with provider to operate parking
 - Adjacent land, cooperatively within industrial park...
3. State/municipality partnership
 - Mutually beneficial terms



Truck Parking Models

Your role to ensure safe and efficient transportation

1. Work with shippers/receivers to provide parking options
2. Let shippers/receivers/municipalities know there are partners to provide parking solutions
3. Work with a partner to provide accurate real-time parking information and capacity



Truck Specialized Parking Services



Scott Grenerth

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844.879.877 X 712

419.306.7575

May 23rd 2018

*Largest provider of accurate real-time
truck parking availability information*



STATEWIDE TRUCK PARKING STUDY

Texas Freight Mobility Plan Implementation



Lack of available parking causes “Informal Parking”





PROJECT OVERVIEW



Truck Parking Study Overview

PURPOSE

Assess and address truck parking needs with practical, innovative and cost-effective strategies

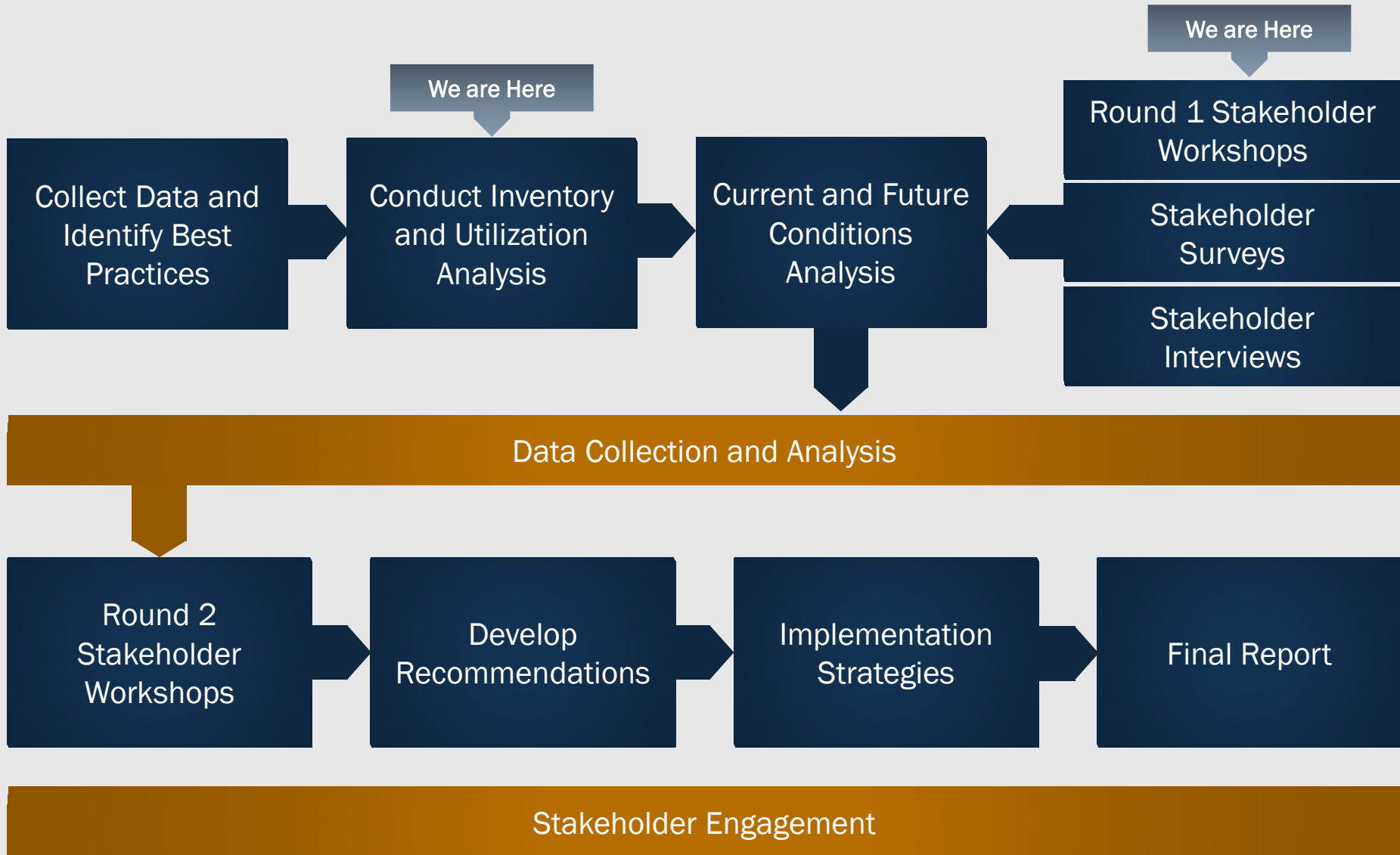
GOALS

- Enhance the safety, mobility and efficiency on the Texas Multimodal Freight Network
- Develop actionable strategies to meet truck parking needs across the state
- Use technology to optimize existing truck parking assets

OBJECTIVES

- Improve safety on the roadways
- Identify specific needs for truck parking in Texas
- Assess the ability of current public and private facilities to address truck parking needs
- Identify technologies and other strategies to address truck parking needs
- Assess the ability of current and future technologies to help drivers
- Recommend strategies to improve truck parking across the state of Texas
- Develop an action plan for technology implementation

Truck Parking Study Tasks



Challenges





WE NEED YOUR INPUT



Topics for Discussion

- Is truck parking an issue in the region? If so, what are issues?
- Where is informal truck parking occurring?
- Where is more truck parking needed?
- What are some strategies to address the issues?
- What role can TxDOT play?





<http://Camsys.participoll.com/>

URL and QR Code are also shown at the bottom of your agenda

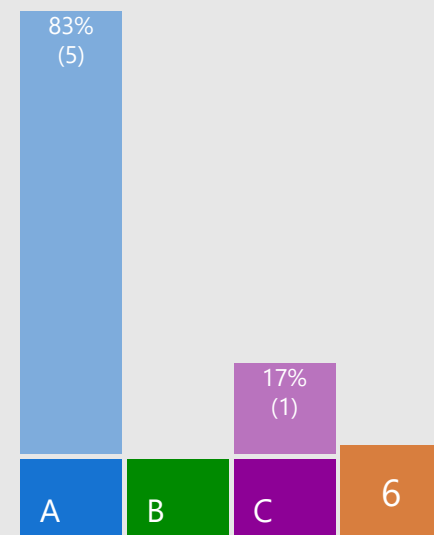
Interactive Discussion Questions

Please select a choice to test the polling:

- a) Yes
- b) No
- c) Maybe

During any question, you can enter additional comments in the text box below the answer choices.

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Interactive Discussion Questions

1. What is the greatest truck parking challenge in this region?

- a) Truck parking does not exist in highly developed areas
- b) Existing parking is occupied or reserved near pickup/delivery
- c) Congestion and Hours of Service limitations
- d) Ordinances or regulations preventing overnight truck parking
- e) Other (please comment)

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Interactive Discussion Questions

2. What is the most critical effect of informal truck parking?

- a) Congestion
- b) Productivity
- c) Safety
- d) Air Quality
- e) Economic Development
- f) Other (please comment)

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Interactive Discussion Questions

3. What technologies do you prefer for getting information about truck parking?

- a) Smartphone/In-Cab apps
- b) Web-based systems which dispatchers can use
- c) Variable message signs on the highway
- d) Dedicated radio station messaging
- e) Other (please comment)

<http://Camsys.participoll.com/>



Questions?

Take our quick freight survey any time:
<https://texasfreightstudies.metroquest.com/>



Round 2 of Workshops in Summer 2019
Preliminary results of projects to be presented