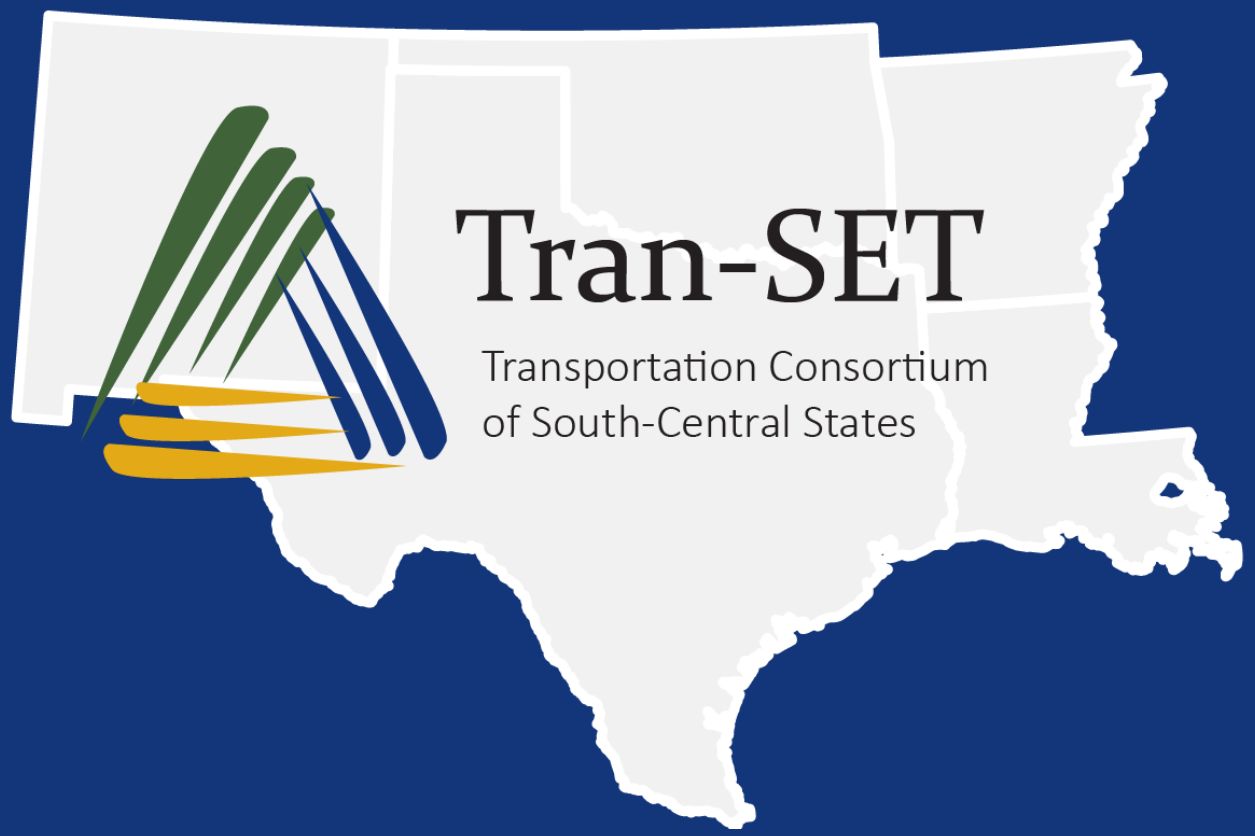


Investigating the Impacts of Truck Platooning on Transportation Infrastructure in the South-Central Region

Christopher Melson
Principal Investigator

Sept. 24, 2019

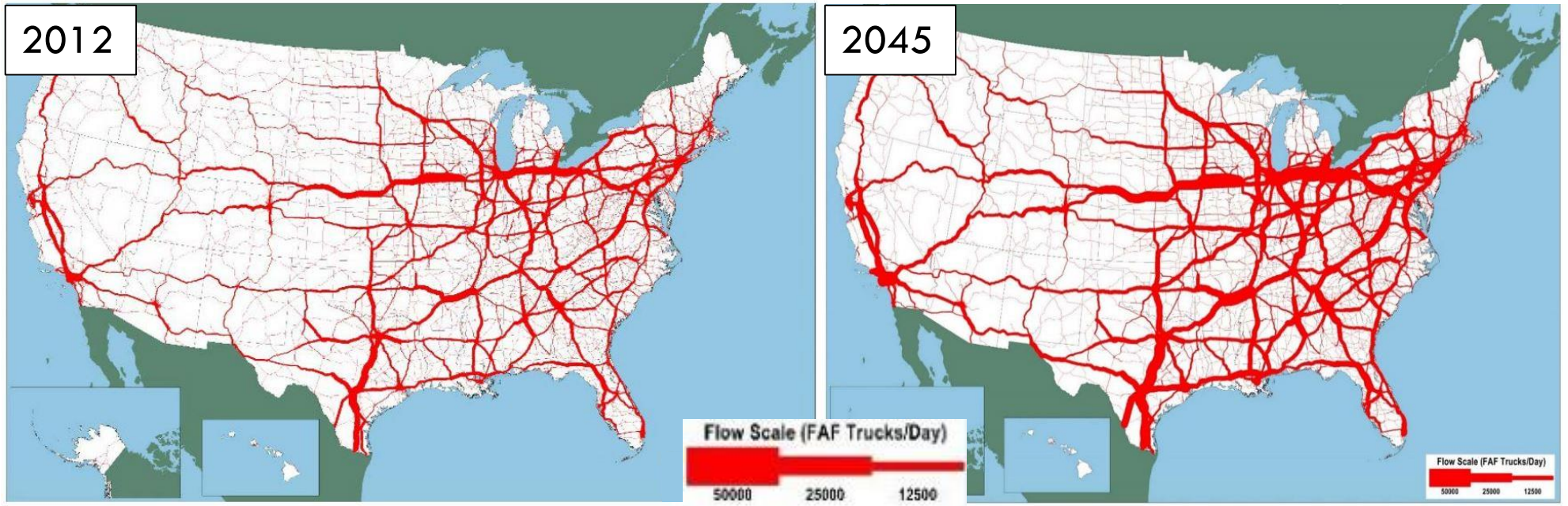
Tran-SET: Project Review Committee (PRC) Meeting #1

Presentation Outline

- Project Overview
- Technology Transfer (T2) Plan
- Technology Readiness Level (TRL)

Background

- Efficient movement of freight critical to region's economy
  - Efficiency muffled by infrastructure system (condition, capacity, congestion)
  - Mitigating negative community impacts



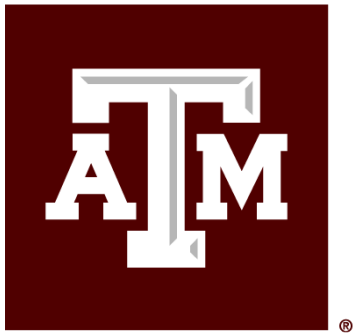
Background (Cont.)

- Truck platooning offers (potential) mobility, safety, environmental benefits
- Self-driving truck technology continually being developed and deployed
- Unclear impacts to infrastructure (pavements)

Project Objectives

- Objectives:
  1. Conduct modeling case studies to estimate operational and environmental impacts of various platooning assumptions
  2. Conduct finite element modeling (FEM) on related case study to estimate impact on pavement
  3. Conduct feasibility study and recommendations

Research Approach



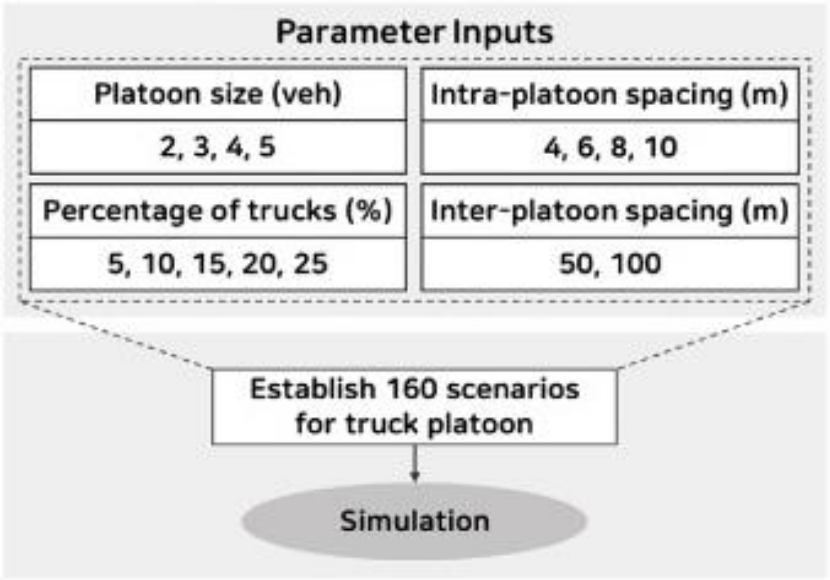
- Task 1: Stakeholder Engagement
- Task 2: Literature Review
- Task 3: Operational and Environmental Analysis (Corridor)
- Task 4: Operational and Environmental Analysis (Network)
- Task 5: Pavement Analysis
- Task 6: Feasibility Study and Recommendations

Task 1: Stakeholder Engagement

- Stakeholders to:
  - Identify truck platooning implementations (and locations)
  - Identify existing traffic models and data
  - Identify pavement data
- Support for T2 activities
- Support for Tran-SET deliverables

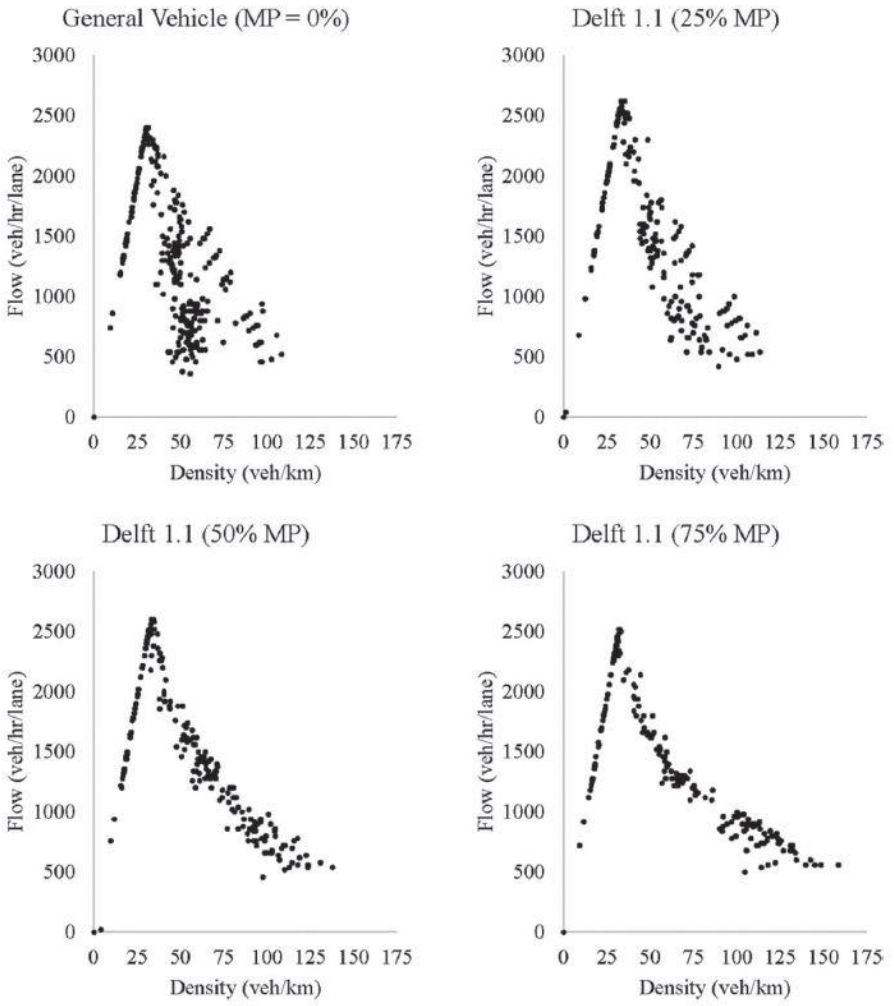
Task 2: Literature Review

- Identify a set of:
  - Truck platooning models
  - Truck platooning configurations/assumptions
    - Platoon strategies, platoon formations, platoon sizes, following distances, market penetrations, etc.
  - Infrastructure impacts



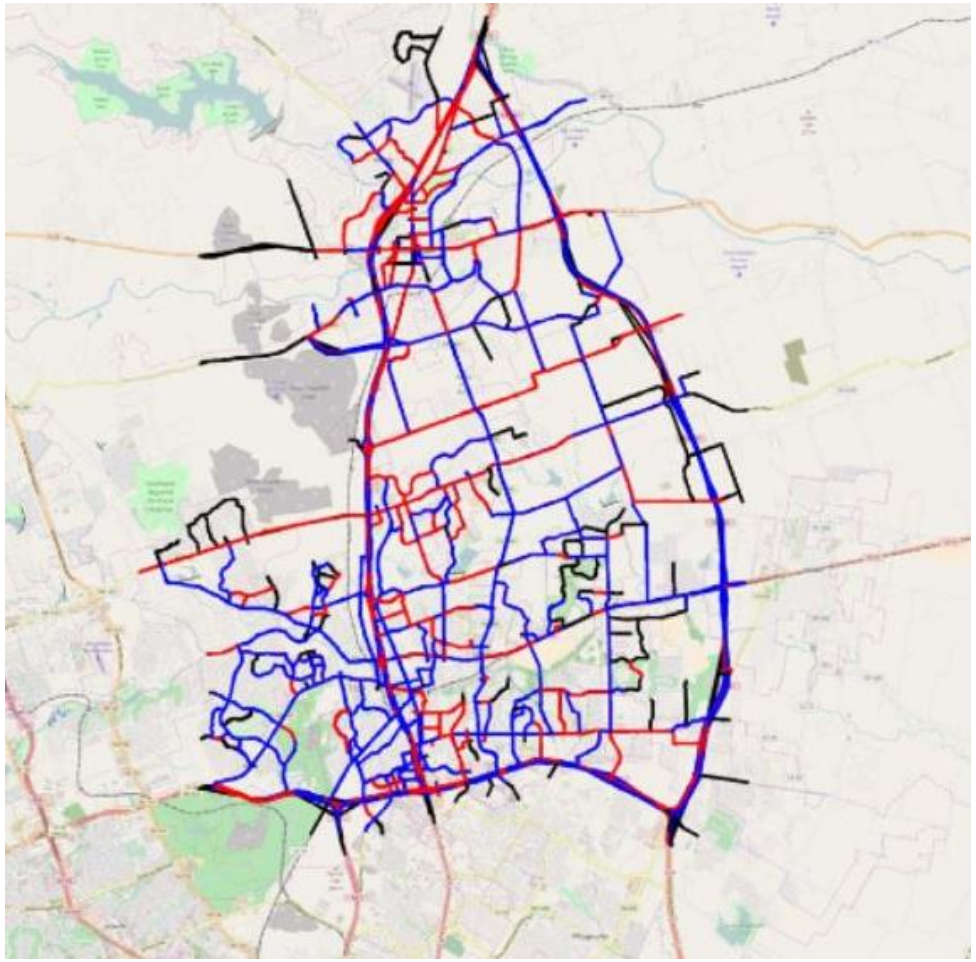
Task 3: Operational and Environmental Analysis (Corridor)

- Model heavily utilized truck corridor:
  - Various truck platooning implementations/configurations (Task 2)
  - Conduct "traditional" microscopic analysis
    - Integrate car-following, lane-changing, platoon formation models/logic
  - Quantify operational and environmental impacts
    - Identify most efficient configurations
- Access to VISSIM (and other softwares)



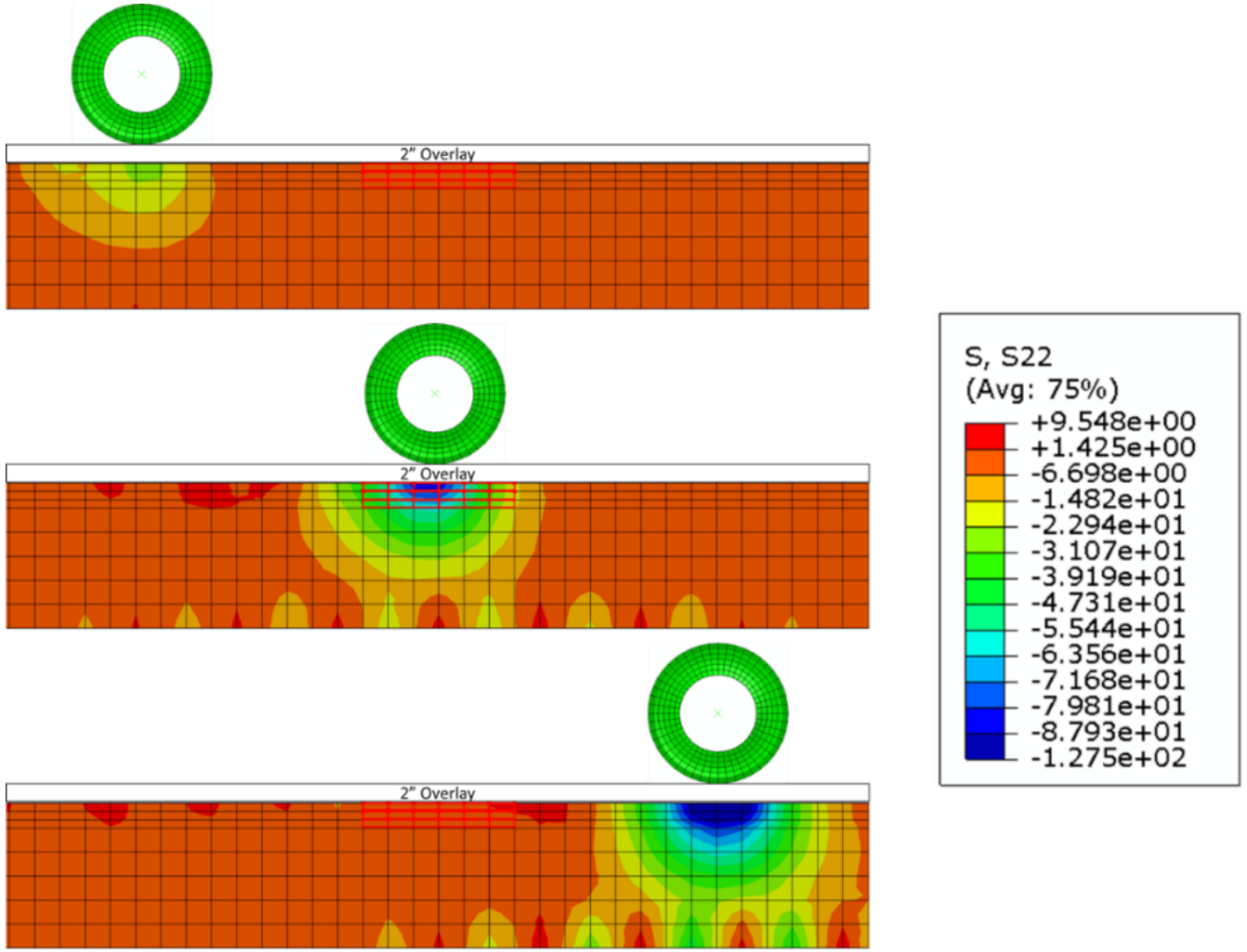
Task 4: Operational and Environmental Analysis (Network)

- Model network w/ heavily utilized truck corridor:
  - Various truck platooning implementations/configurations (Task 2)
  - Conduct mesoscopic analysis
    - Re-routing decisions, congestion at corridor ingress and egress points, etc.
  - Quantify operational and environmental impacts
- Access to Dynameq (and other software programs)



Task 5: Pavement Analysis

- Conduct finite element (FE) modeling:
  - Subset of truck platooning configurations/assumptions (Task 2, Task 3)
  - Conduct pavement analysis:
    - Utilize detailed pavement layer data for heavily utilized truck corridor (Task 3)
    - Utilize traffic (and other data outputted) from Task 3
  - Quantify pavement damage
- Access to ABAQUS



Task 6: Feasibility Study and Recommendations

- Quantify:
  - (Potential) environmental benefits (Tasks 3, 4)
    - E.g.: reduction in carbon and greenhouse gas emissions
  - (Potential) operational benefits (Tasks 3, 4)
    - E.g.: Reduction in congestion and increase in throughput
  - (Potential) pavement damage
    - E.g.: Damage and reduction in service life
- Compare to “base case”
- Possible pavement design recommendations

Project Timeline

Project Tasks	Technical Phase													Implementation Phase							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb		
Task 1 – Stakeholder Engagement		B	1			A			3	A		C	7	B	A	D	9	10	A	11	12	A	E
Task 2 – Literature Review			2																		
Task 3 – Operational and Environmental Analysis at the Corridor-Level									4												
Task 4 – Operational and Environmental Analysis at the Network-Level												5									
Task 5 – Pavement Analysis												6									
Task 6 – Economic Study and Final Recommendations													8								

Milestones

ID	Description	Ant. Date
1	Selected truck platooning implementations	Oct. 15, 2019
2	Literature review (completed)	Oct. 15, 2019
3	2020 Tran-SET Conference	Apr. 2020 (Est.)
4	Corridor-level analysis (completed)	Apr. 15, 2020
5	Network-level analysis (completed)	Jul. 15, 2020
6	Pavement analysis (completed)	Jul. 15, 2020
7	Presentation at AV Symposium	Jul. 2020
8	Economic study (completed)	Aug. 15, 2020
9	Presentation at SimCap Louisiana meeting	Sep. 2020 (Est.)
10	Presentation at Joint Tran-SET Webinar series	Sep. 2020 (Est.)
11	2021 TRB Annual Meeting	Jan. 2021
12	Submission of two journal publications	Feb. 2021

Project Team

Christopher Melson
Principal Investigator
Louisiana State University
(225) 578-3805
cmelson1@lsu.edu

Samer Dessouky
Co Principal Investigator
University of Texas at San Antonio
(210) 458-6475
samer.dessouky@utsa.edu

cmelson1@lsu.edu
Melsatron.com

Alireza Talebpour
Co Principal Investigator
Texas A&M University
(979) 845-0875
atalebpour@tamu.edu

T2 Plan: Objectives

ID	Objective
T1	Truck platooning operational, environmental, and pavement analyses inform local and state transportation agencies' activities in order to better prepare their transportation systems for such implementation
T2	Aid the research community by applying (possibly modifying) their models (and possibly developing new models) to truck platooning case studies important to practitioners, identifying limitations, and communicating "lessons learned"
T3	Educate local transportation modelers on current models/tools available for truck platooning

T2 Plan: Stakeholders

ID	Stakeholder Name	Stakeholder Type	Category(ies)	Project-Specific Category(ies)
A	LaDOTD: CAV Technology Team	State DOT	Late potential adopter; Ally	Policy-Related
B	Local governments: Capital Region Planning Commission (CRPC), City of San Antonio, and Bexar County	Local government	Late potential adopter; Ally	Policy-Related; Modelers
C	Early State Adopters: TxDOT	State DOT	Early potential adopter; Ally	Policy-Related
D	Late State Adopters: ArDOT, NMDOT, ODOT	State DOT	Late potential adopter; Ally	Policy-Related
E	Corridor and Freight Coalitions: I-10 Corridor Coalition, others	Local government	Early potential adopter; Ally	Policy-Related
F	Research Communities: Traffic Simulation Models Joint Subcommittee [AHB45(10)]; Traffic Flow Modeling for Connected and Automated Vehicles Subcommittee [AHB45(3)]; Vehicle-Highway Automation Committee [AHB30]; Pavement Structural Modeling and Evaluation [AFD80]; General and Emerging Pavement Design [AFD30]	Other	Researchers	Research
G	SimCap Louisiana	Non-profit	Ally	Modelers
H	Modeling vendors: PTV Group, Aimsun, Caliper, INRO	Industry	Developers; Ally	Modelers
I	Trucking Associations and Companies: American Trucking Associations, National Association of Independent Truckers, Knight-Swift, JB Hunt Transportation Company, others	Industry	Deployment team; Early potential adopter; Ally	Freight
J	Applicable OEMs: Daimler, Ford, General Motors, Tesla, Volvo, others	Industry	Developers; deployment team; ally	OEMs

T2 Plan: Engagement Plan

ID	Obj. ID	Engagement Activity [Approx. Date]	Stakeholder(s) Involved	Info Communicated to Stakeholder	Info Gathered from Stakeholder	Resources Required
1	T1	Stakeholder Meeting #1 [Sep. 2019]	A, B, C, D, E	Introduce project (goals, tasks, timeline, stakeholder roles)	Gather general/technical feedback on project; input in truck platooning implementations to analyze	Webinar capabilities; dedicated time to coordinate
2	T2	Presentation at 2020 Tran-SET Conference [Apr. 2020]	A, B, C, D, E, F	Project updates and preliminary results	General and minimal feedback	Travel funds; submitting presentation topic
3	T1, T2	Presentation at AV Symposium [Jul. 2020]	F, H, I, J	Project updates and preliminary results	General and minimal feedback	Travel funds; submitting presentation topic
4	T1, T2, T3	Stakeholder Meeting #2 (TRL Assessment) [Sep. 2021]	A, B, C, D, E, H, I, J	Main results of research project	General and technical feedback of results, TRL assessment, recommendations for further activities	Webinar capabilities; dedicated time to coordinate
5	T3	Presentation at SimCap Louisiana meeting [Sep. 2020]	B, G, H	Main results of research project, modeling of truck platooning	General and minimal feedback	Submitting presentation topic
6	T1, T2, T3	Presentation at Join Tran-SET Webinar Series [Sep. 2020]	A, B, C, D, E, F, H	Main results of research project	Minimal	Submitting presentation topic
7	T2	Presentation at 2021 TRB Annual Meeting [Jan. 2021]	F, H, J	Main results of research project	General and minimal feedback	Travel funds; submitting presentation topic
8	T2	Prepared manuscripts for journal publications [Feb. 2021]	F	Main results of research project	Minimal	Dedicated time to prepare

Technology Readiness Level

Categories	TRL Score	Description	To achieve the given TRL score, you must answer "Yes" to EVERY question at that level.
Basic Research	1	Basic principles & research	• Do basic scientific principles support the concept of the project outcome? • Has the outcome development methodology or approach been developed?
	2	Application formulated	• Are potential framework applications identified? • Are outcome components and the user at least partly described? • Do preliminary analyses or experiments confirm that the application might meet the user need?
	3	Proof of concept	• Are outcome performance metrics established? • Is outcome feasibility fully established? • Do experiments or modeling and simulation validate performance predictions of outcome capability? • Does the outcome address a need or introduce an innovation in the field of transportation?
Applied Research	4	Components validated in laboratory environment	• Are end user requirements documented? • Were individual components (if any) successfully tested in a ***laboratory environment*** (a fully controlled test environment)?
	5	Integrated components demonstrated in a laboratory environment	• Are target and minimum operational/functional requirements developed? • Is component integration demonstrated in a laboratory environment (i.e. fully controlled setting)?
Development	6	Field or full-scale test demonstrated in relevant environment	• Is the operational/functional environment fully known (i.e. user community, physical environment, and input data characteristics as appropriate)? • Was the field or the full-scale experiment tested in a realistic environment outside the laboratory (i.e. ***relevant environment***)? • Does the field or full-scale experiment satisfy all operational/functional requirements when confronted with realistic problems?
	7	Fully integrated outcome demonstrated in operational environment	• Are available components ready to be fully integrated in the final outcome? • Is the fully integrated outcome demonstrated in an ***operational environment*** (i.e. real-world conditions, including the user community)? • If applicable, are all outcome components tested individually under expected conditions?
	8	Outcome proven in operational environment	• Is the outcome proven in an operational environment (i.e. meet target performance measures)? • Was a rigorous test and evaluation process completed successfully? • Does the outcome meet its stated purpose and functionality as developed?
Implementation	9	Outcome refined & adopted	• Is the outcome deployed in its intended operational environment? • Is information about the outcome disseminated to the user community? • Is the outcome adopted by the user community?

Questions?