



## Project-Specific Technology Transfer (T2) Plan

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### Context

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As of July 2018, the [Grant Deliverables and Reporting Requirements for 2016 UTCs](#) mandated a Center-wide Technology Transfer (T2) Plan and an annual T2 Report. Operating within the content requirements of the plan and other provided instructions/guides supplied by OST-R, Tran-SET developed its [T2 Plan](#) on May 2018.

Recognizing that Tran-SET administers research in diverse transportation topical areas with varying technology maturity, the *T2 Plan* requires each funded project to have an individual, project-specific T2 Plan. The project-specific T2 Plans will specify their own unique set of key stakeholders and unique methods to engage these stakeholders. Project-specific T2 Plans are a guide to successfully plan and execute activities during the implementation phase of the project.

### Instructions

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Principal Investigators (PIs) are required to utilize the following template (and provide the requested information) to develop their project-specific T2 Plan. General requirements and a basic timeline is as follows:

- PIs submit an initial, project-specific T2 Plan (utilizing this template) with their proposal.
- The T2 Plan will be reviewed during the proposal review process.
- If awarded, the initial, project-specific T2 Plan will be further reviewed by the respective Project Review Committee (PRC) at the end of the second quarter<sup>1</sup>. Based on comments received, the PIs will revise the T2 Plan within two weeks.
- At the end of the technical (research) phase, the PRC will assess the technology readiness level (TRL) of the developed products/technology. Based on the TRL assessment and further comments from the PRC, the PIs will revise the T2 Plan within two weeks.
- The T2 Plan will act as the PIs' main roadmap during the implementation phase, documenting and guiding its outreach activities.
- The Final Implementation Report template will be based on the T2 Plan template (and its required sections). The Final Implementation Report template will be accessible on Tran-SET's [website](#).
- <sup>1</sup>*Note:* the PIs are encouraged to revisit the T2 Plan on a consistent basis (quarterly basis is recommended), as the products/technology continually develop and mature.

Please review Tran-SET's [T2 Plan](#) for additional information.

### Contact

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Please contact Mr. Christopher Melson (at [cmelson1@lsu.edu](mailto:cmelson1@lsu.edu) or 225-578-3805) if you have any questions or would like additional information.

## Technology Transfer (T2) Plan

### Step 0. Project Information

Element	Information
Project Title	Analysis, Modeling, and Simulation (AMS) Tools for Connected and Automated Vehicle (CAV) Applications
Project Number	DTFH61-16-D-00030; TO 22
Principal Investigator(s)	PI: Dr. Steven Shladover Co-PIs: Dr. Hani Mahmassani, Dr. Dia-Yun Lu, Dr. Alex Skabardonis
Participating University/Institutions	Leidos, California PATH, Northwestern University, UC-Berkeley, Texas A&M University, University of Cincinnati, University of South Florida
Date	June 29 <sup>th</sup> , 2018

### Step 1. Describe the Problem

*Please succinctly describe the problem the proposed products/technology aims to solve. This can be summarized from the RFP and the proposal. However, it must showcase awareness of the problem, awareness of available solutions, and factors needed for decision-makers to decide positively to invest in the proposed solution (Step 2). Please think of this section as defining the appropriate context if having a meeting/discussion with various project stakeholders; placing everyone “on the same page”. Suggested length: no longer than 4 paragraphs.*

Connected and automated vehicle (CAV) technologies offer potentially transformative societal impacts – including significant mobility, safety, and environmental benefits. The Federal Highway Administration (FHWA) has led the development, research, and standards-making of these technologies, and is currently developing deployment approaches and guidance.

Deploying CAV applications require transportation agencies to *effectively* and *fully* quantify the impacts of such implementations, and to identify which application best addresses *their* unique transportation problem. Traffic analysis, modeling, and simulation (AMS) tools provide an efficient means to evaluate transportation improvement projects prior to deployment. In fact, the FAST Act dictates utilizing AMS tools “to the fullest and most economically feasible extent practicable” to analyze highway and public transportation projects.

However, current AMS tools are not well suited for evaluating CAV applications because of their inability to incorporate vehicle connectivity and automated features. Guidance on how these AMS tools can be extended to evaluate CAV applications is non-existent. Likewise, deployment concepts, strategies, and guidelines are needed to allow states to understand how and where CAV technologies may effectively be deployed. It is necessary to adapt and re-engineer the existing set of tools available to agencies, validate these models/tools, and provide a mechanism to share these models/tools with public agencies.

## Step 2. Describe the Proposed Solution

Please succinctly describe how the technology solves the problem stated in Step 1, its feasibility of use, and its **value**. Please emphasize and communicate the latter element (its **value**), such as describing its improved accuracy, effectiveness, cost-effectiveness, speed, quality, etc. This can be summarized from the proposal (and later, the final research report). However, please think of this section as defining the **value** of the solution to various project stakeholders in non-technical, easy to understand language. Suggested length: no longer than 4 paragraphs.

The research project will:

1. Develop AMS tools for the two most prominent CAV applications (as determined by a nationally-represented group of stakeholders/users);
2. Incorporate these tools into existing AMS commercial products, improving the state-of-the-practice;
3. Conduct real-world case studies (practical implementation scenarios and real-world transportation networks) for the most prominent CAV applications – to better understand their impacts and deployment strategies/methods; and
4. Develop a AMS toolbox for CAV applications.

To summarize:

1. AMS tools will be developed for the most prominent, applicable, and implementable CAV applications soon-to-be-available to transportation agencies;
2. The AMS tools will be developed and validated from collected data – providing more accurate models, an improvement to the majority of existing models mainly or entirely based on theoretical assumptions;
3. By incorporating the developed tools into existing AMS commercial products, they will be readily available to practitioners – without requiring new software products;
4. The developed AMS toolbox will provide guidance on the application and limitations of the AMS tools; and
5. The documented case studies will provide further guidance on the application of the AMS tools – as well as additional information regarding the potential impacts of CAV applications.

## Step 3. Identify Stakeholder Groups by Name and Role

Please create a list of key stakeholders, describe their roles relative to the adoption of the technology, and assess the level of authority they have. Specifically, please group the stakeholders in the following six fundamental categories:

- Sponsors of research and T2;
- Researchers and developers;
- Deployment team;
- Early potential adopters and problem owners;
- Late potential adopters that follow the technology's development; and
- Others: allies and foes, such as trade organizations, regulators, suppliers, etc.

Please add or delete rows as necessary.

ID	Stakeholder Name	Category(ies)	Project-Specific Category(ies)
A	TRB Task Force on System Simulation (AHB80T)	Researchers and Developers; Ally	Modelers
B	"Traffic Analysis and Simulation" Transportation Pooled Fund Study (TPF-5(176))	Sponsors of Research and T2; Early Potential Adopters; Late Potential Adopters	Modelers
C	Software Vendors: TSS, Caliper, PTV	Deployment Team; Early Potential Adopter; Ally	Modelers

ID	Stakeholder Name	Category(ies)	Project-Specific Category(ies)
D	"Developing HCM Capacity Adjustments for Agency CAV Readiness" Transportation Pooled Fund Study (TPF-5(371))	Sponsors of Research and T2; Early Potential Adopters; Late Potential Adopters	Modelers
E	TRB Joint Simulation Subcommittee (AHB45(1))	Researchers and Developers; Ally	Modelers
F	USDOT AV Proving Grounds (10 sites)	Researchers and Developers; Ally	Applications/Host Sites
G	OEM/CAMP	Ally	Applications
H	"Research Program to Support Vehicle Infrastructure Integration" Transportation Pooled Fund Study (TPF-5(206))	Sponsors of Research and T2; Early Potential Adopters; Late Potential Adopters	Host Sites
I	Virginia DOT	Ally	Host Sites
J	Twinning Partners: Representatives of European Commission Project, CoEXist	Researchers and Developers; Early Potential Adopters; Ally	Twinning
K	Related Research Communities	Researchers and Developers	Modelers
L	Other MPO and State DOTs Interested in Deploying CAV Technology	Sponsors of Research and T2; Early Potential Adopters; Late Potential Adopters	Modelers/Applications

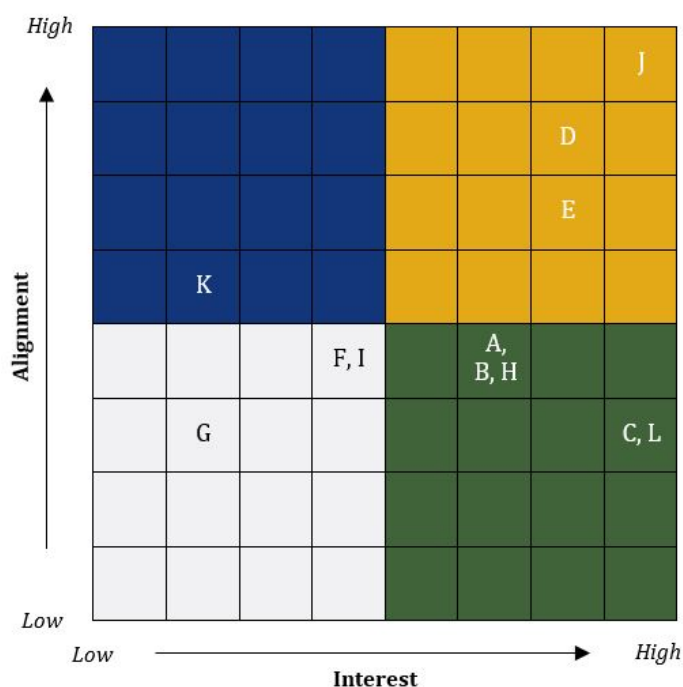
*Please note that Steps 3, 4, and 5/6/7 must describe industry's proposed involvement in the T2 activities. If industry is proposed to be involved, please demarcate the industry stakeholder to distinguish from other stakeholders. For example, utilizing a colored background or superscript (e.g., <sup>a</sup>Barriere Construction, <sup>a</sup>HVJ Associates, etc.). Please do this every time the industry stakeholder is mentioned in the T2 Plan (in Steps 3, 4, 5/6/7, 8, and 9).*

*If industry is not proposed to be involved, please provide a brief reason below (e.g., if the project is solely focused on public sector policy, etc.).*

**Note:** the majority of stakeholders are not related to industry, since the main focus of the project is to provide freely accessible tools and guidance for public transportation agencies. However, industry is involved as it relates to integrating the tools into existing commercial software (C) and providing data to develop and validate the AMS tools/models (G).

#### Step 4. Analyze Stakeholder Alignment

For each stakeholder identified in Step 3, assess their: (1) interest in the technology's adoption and (2) own support and alignment of the technology. Map stakeholders by their alignment and interest in the sections/quadrants below. Please map the stakeholder by inputting their letter ID in the appropriate cell.



#### Steps 5/6/7. Organize Communication Tracking for Stakeholder Groups, Develop Engagement Plans, and Identify Resources to Engage all Stakeholders

Please specify a unique set of engagement activities (that will be conducted during the implementation phase) for each stakeholder identified in Step 3. Determine which stakeholders to engage earlier versus later, whom you will engage, how you will engage them, and what information you'll receive back. Please base the activities on the general recommendations below.

High Alignment	Inform and raise interest	Engage closely and ally
Low Alignment	Minor (minimal effort)	Negotiate, lobby, or neutralize
	Low Interest	High Interest

Please also specify the required resources to support each activity (e.g., this could include presenting at a technical conference (requiring being on the agenda and travel funds), resources for organizing demonstrations, etc.)

This Step should comprise all the activities planned for the implementation phase. Please add or remove rows as necessary.

ID	Engagement Activity [Approx. Date]	Stakeholder(s) Involved	Info Communicated <u>to</u> Stakeholder	Info Gathered <u>from</u> Stakeholder	Resources Required
1	Stakeholder Webinar #1 [Dec 2017]	ALL; but specifically: B, D, F, H, I, L	Introduce project (goals, tasks, timeline)	Gather input in selecting: [1] CAV applications for model development; and [2] Candidate case studies to pursue	Webinar capabilities; dedicated time to coordinate
2	TRB Annual Meeting [Jan 2018, 2019, 2020]	A, C, E, J, K	Communicating project updates to related research communities	General and minimal feedback	Travel funds; submitting presentation topic; being on agenda of several TRB Committee Meetings (A, E, plus others)
3	Main TFHRC Onsite Event [Feb 2018]	B, D, H, I, L	Current stage of CAV-related research and initiatives by TFHRC, including field demonstrations of several CAV applications	Minimal	Travel funds for bringing public sector stakeholders to TFHRC; funds/dedicated time to coordinate and run field demonstrations
4	Stakeholder Webinar #2 [Jun 2018]	ALL, but specifically: C, D, E, F, G, I, K	Introduce data collection and model development plans	Gather technical input on the draft data collection and model development plans	Webinar capabilities; dedicated time to coordinate and prepare
5	Automated Vehicles Symposium (AVS) [Jul 2018, 2019, 2020]	C, E, F, G, J, K	Communicating project updates to software vendors, industry, and related research communities	General and minimal feedback; establish partnership with OEMs	Travel funds; submitting presentation topic
6	Stakeholder Webinar #3 [Sep 2018]	ALL, but specifically: B, D, F, G, H, L	Update on project, specifically choosing the CAV applications for model development	Finalize the selection of the two CAV applications for model development	Webinar capabilities; dedicated time to coordinate
7	Making Data Publicly Accessible [Mar 2019]	ALL, but specifically: A, B, C, D, E, H, J, L	Data used to develop and validate AMS tools/models (for continued use by researchers and software vendors)	Minimal	Minimal

ID	Engagement Activity [Approx. Date]	Stakeholder(s) Involved	Info Communicated <u>to</u> Stakeholder	Info Gathered <u>from</u> Stakeholder	Resources Required
8	Case Study Report [Aug 2019]	ALL, but specifically: B, D, H, I, L	Conducted real-world case studies; better understanding of impacts and deployment strategies/methods	Minimal	Dedicated time to prepare and revise manuscript
9	Stakeholder Webinar #4 [Feb 2020]	ALL, but specifically: A, C, D, E, K	Update on project, specially model development and validation	Gather technical input on model development and validation	Webinar capabilities; dedicated time to coordinate
10	Journal Publication [Mar 2020]	A, C, E, K	Methodology used to develop and validate AMS tools/models	Minimal	Dedicated time to prepare and revise manuscript
11	Final Report [Aug 2020]	ALL, but specifically: A, C, D, E, J, K	Data collection, methodology used to develop and validate AMS tools/models, the developed AMS tools/models, validation use cases, etc.	Minimal	Dedicated time to prepare and revise manuscript
12	Project Website [On-going]	ALL	Communicating project updates and posting deliverables	Minimal	Website URL; staff experience; maintenance
13	Twinning Activities: Quarterly Webinar Meetings; Annual In-Person Meetings, and Regular Correspondence [On-Going]	J	Project updates, specifically related to Twinning activities	CoExist project updates, specifically related to Twinning activities	Webinar capabilities; dedicated time to coordinate

## Step 8. Identify and Address Barriers to Adoption

**Note:** This section should be completed during (and at the end) of the implementation phase; it will be a required section in the Final Implementation Report.

As engagement activities are executed, please identify stakeholder barriers to adopting the technology. Please communicate these barriers to your respective Associate Director, Tran-SET's Program Manager, and Tran-SET's Research and T2 Program Coordinator, who will assist you in identifying solutions to address the barriers. Please summarize the barriers in the table below.

ID	Stakeholder Name	Barriers to Technology Adoption	Potential (or Actual) Actions to Address the Barriers
C	Software Vendors: TSS, Caliper, PTV	Hesitant to adopt externally developed AMS tools/models into their commercial software	[1] Continually communicate the users' desire for the developed AMS tools/models; [2] Involve vendors in model development and validation; [1] and [2] can be done in activities #4 and #5; also, involve in technical review of deliverables.
G	OEM/CAMP	Unwilling to provide data to better develop and validate the AMS tools/models; Keeping logic secret/proprietary	[1] Continually ensure that AMS tools/models will be developed as to keep logic secret/proprietary; [2] Limited benefit to OEMs; limited alignment with adoption of the technology; Uncertain (at this point) potential actions to address barrier; Will monitor OEMs involvement and continually invite them to participate in project
L	Other MPO and State DOTs Interested in Deploying CAV Technology	Late potential adopters need consistent, "success stories" before taking steps/investments towards adoption	[1] Continually highlight more involved MPOs and state DOTs (stakeholders B, D, H, and I) and their plans to utilize the developed AMS tools; [2] Develop mechanisms to share their "success stories" after the project ends

## Step 9. Establish an MOU between Early Adopter and Research Sponsor

**Note:** This section should be completed during (and at the end) of the implementation phase; it will be a required section in the Final Implementation Report.

After the implementation phase is completed, Tran-SET's Research and T2 Program Coordinator with assistance from Tran-SET's Program Manager and Associate Directors will informally and formally assess the effectiveness of engagement activities that occurred during the respective project cycle. This assessment will include identifying products/technology suitable for further studies via MOUs with established stakeholders.

In regards to T2, MOUs are typically entered into with early adopters to collect data on the technology's performance in the working environment when it is implemented. Please provide any information that may inform and be useful for Tran-SET in deciding to pursue MOUs related to the developed products/technology. For example:

- *Would the products/technology benefit from an MOU with an established stakeholder? Are the products/technology at the state where stakeholders can provide insightful feedback or provide supplemental performance data?*
- *What would the MOU look like? Who would be the stakeholder and what would their role and contributions be?*

*It is OK if the products/technology are not in an appropriate state or form to pursue MOUs; but if so, please state so with a brief reason why.*

Entering into MOUs may be the next logical step to further T2. Specifically, having the most promising early potential adopters (the state DOTs involved in B and D) utilize the developed AMS tools (and guidance in the AMS toolbox) to conduct additional case studies. It would be critical for the state DOTs to document their experiences (user feedback, modifications, how results informed decision making, etc.). This feedback, in turn, can lead to future problem statements – and potentially to future projects (fully or partially funded by the state DOTs involved in B, D, and H).

Another potential venue to further T2 is to encourage the adaptation of portions of the AMS toolbox and final report into the *Transportation System Simulation Manual* – currently being developed by stakeholder A and funded by stakeholder B.

## Step 10. Performance Metrics

*Note: This Step will be conducted at the programmatic level through existing methods (quarterly progress tracker and reports). No input is required. If you would like additional information, please see Tran-SET's [T2 Plan](#).*

## Emphasis Areas

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*OST-R has identified the “commercialization and licensing of research outputs” as an emphasis area that the T2 Plan needs to fully address.*

*Please describe the commerciality of the developed products/technology and if there are any plans to pursue commercialization, a patent, or a license. This may (but isn’t required to) include:*

- Market need/value proposition, highlighting the unique value proposition and market research evidence;*
- Market size and societal need presenting the size of the market and the societal need it addresses; and*
- Competition and competitive advantage presenting the existing competitors and market leaders.*

*Tran-SET realizes that a minority of products/technology will pursue commercialization. If this section is not applicable, please state so with a brief reason why.*

This section is not applicable; the main focus of the project is to provide freely accessible tools and guidance for public transportation agencies. Commercialization and licensing of research outputs will not be pursued.