Technology Transfer Plan for the National UTC

National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)

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1. Introduction

The National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE) led by Washington State University (WSU) is one of seven National University Transportation Centers (UTCs) sponsored by the U.S. Department of Transportation (DOT). TriDurLE was selected in the recent nationwide competition under the FAST Act. We serve as the only National UTC with a focus on the USDOT strategic priority of "***Improving the Durability and Extending the Life of Transportation Infrastructure***." The TriDurLE consortium includes:

- Alabama A&M University
- Case Western Research University
- Florida Atlantic University
- Missouri University of Science and Technology
- South Dakota State University
- Tennessee State University
- Texas A&M University
- University of Colorado Denver
- University of Mississippi
- University of Utah

Each consortium member of TriDurLE brings certain unique strengths and credentials to this collaborative team and we collectively offer multidisciplinary programs engaged in innovative research, education, and technology transfer.

This technology transfer (T2) plan is designed to facilitate the best practices of T2 and promote the knowledge dissemination, IP (intellectual property) implementation, and brand awareness building of this National University Transportation Center (UTC). As defined by the USDOT's Strategic Plan (FY 2017-2021), T2 are "activities conducted to facilitate the adoption of R&D outputs". The Strategic Plan also "strongly emphasizes USDOT efforts to promote the deployment and adoption of research results [outputs] by integrating technology transfer throughout the Research and Development process". The Memorandum from Kevin C. Womack, dated April 16, 2018, states that "USDOT leadership has determined that a Technology Transfer Plan from each UTC [receiving a grant under the FAST Act] will be a *mandatory requirement*, no longer an option" and that "the 'Grant Deliverables and Reporting Requirements for 2016 University Transportation Centers' will be amended to recognize this requirement." Further, as stated in the Memorandum, "the number of tangible research outputs will now be a required performance measure for each UTC's technology transfer plan." In order to comply with these requirements, TriDurLE has developed this "center-wide" T2 Plan.

During the implementation of this grant, this T2 plan will cover all IP acquired by TriDurLE activities and may be updated as necessary, to accommodate unanticipated IP needs or IP types and related challenges that arise during the duration of this multi-year grant. Individual project Principal Investigators (PIs), in communication with the Center Director or other Site Directors, will ensure adherence to this T2 plan and will suggest changes to it if deemed necessary. This plan will describe the normal practices at WSU (or the appropriate Member University of TriDurLE) and follow the appropriate university policies.

TriDurLE will maintain an on-goingT2 program to ensure research results are made available to potential users in a form that can be implemented, utilized, commercialized, or otherwise applied quickly and to the widest possible audience. The T2 program is a direct extension of TriDurLE's research and education

programs, and such synergy is presented in Table 1. The program is designed to address some of the T2 barriers identified by the CSET Tier 1 UTC Technology Transfer Plan (2018) and by the MPC Region 8 UTC Technology Transfer Plan (2018), including:

1. *Stakeholders don't know the research exists*
2. *Research products are not in an implementable form*
3. *Lack of resources for implementation including funding and training*
4. *Research outcomes are often inconsistent with local culture, policies and procedures*
5. *Practitioners underestimate the payoff or benefits of the technology or overestimate its risks*

Table 1 Synergy of T2 program with other TriDurLE Activities.

Program	***Objective***	***Product***	***Audience***
Research	Enhance multimodal infrastructure durability through cost-effective innovations and holistic solutions	Research projects (reports, publications, etc.)	University peers, USDOT, State DOTs; core researchers, stakeholders; private sector
Education	Increase knowledge; Develop workforce	Seminars, fellowships, Scholarships, K-12	Students, practitioners
Technology Transfer	Accelerate implementation; promote best practices	Patents, technical assistance, training, presentations, etc.	Pooled fund studies, corridor initiatives, USDOT, State DOTs, practitioners

2. Proposed solution to T2 by TriDurLE

This T2 plan will outline T2 goals, identify potential T2 participants and their roles, outline proposed T2 activities, and provide guidance on tracking, reporting, and measuring T2 performance. The goals of T2 activities by TriDurLE will mainly include:

1. ***Knowledge dissemination***, to inform stakeholders in various aspects of transportation infrastructure durability and life-extension, including policy makers, public decision makers, transportation infrastructure professionals, industry partners, researchers and technology developers, and the general public
2. ***IP implementation***, to move the IP from research and development phases towards adoption by practitioners and to spur implementation by industry
3. ***Brand awareness building,*** to increase the visibility of TriDurLE researchers, outputs, and outcomes and to broaden the potential impacts of TriDurLE activities

TriDurLE will impact multiple modes of surface transportation system and the quality of life of its users. It presents a great opportunity to enable cross-disciplinary research, education and workforce development, and T2 — which is valuable in light of the crosscutting nature of today's challenges (aging infrastructure, more frequent events of extreme weather, etc.). The efforts will be guided and supported by existing stakeholder partnerships and an Advisory Board of diverse stakeholders. The TriDurLE T2 activities will leverage the history of excellence by the Member Universities in transportation research and T2, including the existing stakeholder relationships with the National Research Council (NCHRP, ACRP, etc.), USDOT (FHWA, FAA, IDEA, PHMSA, and UTC programs), state DOTs, National Science Foundation (NSF), Portland Cement Association (PCA), American Concrete Pavement Association (ACPA), USDA, DOE, USGS, DOD, EPA, Deep Foundation Institute, Department of Education, American Concrete Institute (ACI), and private industries, states, municipalities, and multi-state stakeholder groups.

The TriDurLE Outreach Coordinator will be responsible for coordinating the T2 activities at the Member Universities, with the assistance from the Assistant Director for Diversity, when necessary. In light of the multi-institutional nature of this Center, the Site Director of each consortium member university is

responsible for knowledge dissemination and IP implementation commensurate with the relevant procedures of that institution. T2 management and enforcement of T2 expectations among Center members will be guided and coordinated through this general T2 plan, email correspondence, and subordinate Commercialization Plans, if necessary. In addition to the dissemination of relevant technical data and findings via journals, conferences, social media, e-newsletters, webinars, TriDurLE website, etc., PI of each TriDurLE research project is responsible for T2 activities on his or her project.

Each PI (or his/her designee) will manage "all non-R&D activities necessary for the technology to be adopted" (John A. Volpe National Transportation Systems Center, 2016. https://rosap.ntl.bts.gov/view/dot/12262). These include the design, execution, evaluation, and tracking of T2 activities, and may cover the identification of research stakeholders and potential users, additional funding sources, research outputs and outcomes, barriers to deployment or adoption of R&D outputs by the transportation system, and documentation of research impacts. At the completion of each research project, the PI will be required to upload and store all the T2-relevant data electronically, on a server managed by WSU. The information technology (IT) staff at WSU will facilitate the storage and archiving of such data at the discretion and direction of the Center Director and the requirements set forth within the scope of work of TriDurLE.

2.1. Knowledge dissemination

TriDurLE is committed to collecting, publishing, and disseminating the results from our UTC-sponsored research and other activities. TriDurLE will comply with the requirements of the USDOT OST-R for information dissemination. The TriDurLE-produced knowledge will be disseminated in a variety of ways to reach a broader audience. Some planned activities include, but are not limited to:

- The project PIs will prepare the project final reports, and develop project briefs and webinars to showcase research results, while the TriDurLE Outreach Coordinator will provide editorial assistance if deemed necessary
- The project PIs are encouraged to incorporate the research results into online course modules, teaching materials, etc. and disseminate key findings via traditional media outlets (TV, newspapers, etc.) or social media
- The project PIs are encouraged to proactively plan for T2 activities, e.g., identifying the appropriate research needs and engaging T2 stakeholders as early as possible and throughout the project duration and beyond.
- The TriDurLE Advisory Board and other stakeholders may be consulted on the most appropriate delivery method for each specific project in terms of knowledge dissemination.
- The project PIs will be encouraged to submit the results to peer-reviewed journals or other publications (e.g., industry magazines) and academic or professional conferences for possible publication
- The TriDurLE researchers are encouraged to leverage the newly launched journal: ***Journal of Infrastructure Preservation & Resilience*** by Springer Nature for potential publication
- The project PIs will be required to present the results at regional, national, and international transportation forums, workshops, or conferences
- The TriDurLE Outreach Coordinator will submit research reports and project briefs to online libraries such as TRB's TRID, the National Transportation Library, USDOT Research Hub, Volpe National Transportation System CTR, FHWA Library, etc., where suitable
- The TriDurLE Outreach Coordinator will develop and maintain a robust website, publish a quarterly e-newsletter, and periodically post updates to social media
- Much of the non-IP-protected information will be made readily accessible, such as the name of PIs and title of TriDurLE-sponsored projects, research reports, Quarterly e-Newsletters, webinars, Annual Progress Reports, and links to professional events, social media posts and data that can be shared according to the relevant provisions of Data Management Plan.

- The TriDurLE Outreach Coordinator can work with the individual PIs to develop marketing materials (e.g., brief videos and brochures) to better present practice-ready research to industry, policy makers and other stakeholders

In addition to research, TriDurLE is committed to technical assistance, continuing education, and leadership activities which can be leveraged for knowledge dissemination. Some planned activities include, but are not limited to:

- Sponsor an implementation assistance forum on TriDurLE research themes
- Develop an APP to share the research activities and findings of TriDurLE weekly with relevant faculty of the Consortium universities, industry practitioners and professionals and students. This APP will also post notices of seminars, workshops and other opportunities.
- Conduct webinars on TriDurLE-relevant topics periodically (at least one free webinar per each of the six thrust areas every year)
- Develop non-degree program to support professional development in transportation
- Leverage partnership with the AASHTO Technology Implementation Group (TIG), Regional Transportation Workforce Centers, Local Technical Assistance Programs (LTAPs), Region 10 UTC PacTrans, local chapters of professional societies (ASCE, ASPE, ITE, ACI, SWE, SBE, etc.), state DOTs, local governments, and others for knowledge dissemination
- Host annual workshops for peer-to-peer information exchange

2.2. IP implementation

As mentioned in the Data Management Plan, the project PIs and their institutions own the research data they generate. Intellectual Property (IP) developed includes, but is not limited to inventions, patent applications, patents, mask works, software, or other legally protectable information, will be owned by the participating party or parties whose employees or agents make or generate the IP. All rights to IP will be maintained by the parties who are responsible for its creation and will be subject to each organization's policies of rights assignation. Therefore, ownership may reside with a single entity or multiple parties. In the event that program IP is jointly held, each contributing organization will have equal rights to the technology, unless otherwise agreed upon and such an agreement is memorialized in writing. Background IP, program IP and other proprietary or confidential information disclosed by any participant to another will be treated as confidential under provisions of the agreements to which each is a party. The T2 Officers of each TriDurLE member university will individually assess patentability and commercial potential and initiate pursuit of patent or other legal protection of their TriDurLE-sponsored research when appropriate.

Upon the creation of joint IP resulted from collaborative research, each participating party or in the case of jointly held IP, parties, will determine whether it is appropriate to file a patent application and will notify the remaining members of the collaborative team of the decision. Each application will be funded at the expense of owner(s) of the IP. Each participant will be free to publish its results; however, the publishing party will provide the other participants thirty-day period in which to review proposed publications, identify proprietary or confidential information, and submit comments. The publishing organization will refrain from publishing or disclosing proprietary or confidential information identified will give full consideration to all comments before publication. Potentially, upon request of a reviewing party, publication may be deferred for preparation and filing of a patent application which would serve to perfect its IP rights.

At the proposal stage, it is mandatory for the project PIs to include an Implementation section in each research proposal submitted to TriDurLE, to present a clear vision for how the research outputs will translate to outcomes and impacts, who are the potential stakeholders, and what are the barriers of implementation. The project PIs are strongly encouraged to move the IP from research and development phases towards adoption by practitioners and to spur implementation by industry. Out of the ten rating criteria (for anonymous peer review), the following five are the ones relevant to IP implementation:

1) Does the proposed project include collaborative subjects?
2) What type of non-federal match will the project offer?
3) Does the proposed project provide implementable outcomes including knowledge that is transferable to relevant agencies and professionals?
4) Does the project provide training opportunities to enrich the transportation community?
5) Does the project take advantage of industry resources and/or engage potential stakeholders?

TriDurLE is interested in facilitating activities and initiatives that accelerate the implementation of our research results and the acquisition of TriDurLE research produced IP rights. We anticipate that TriDurLE efforts in collaboration, workforce development, outreach etc. will help connect the potential stakeholders with researchers (i.e., IP producers) and facilitate IP demonstration, deployment or other types of implementation. The individual PIs are encouraged to work with public or private partners to pursue commercialization and licensing opportunities of their IP. The TriDurLE Center Director, Executive Committee, and Advisory Board will be likely resources to consult with, regarding the potential of IP implementation out of any TriDurLE sponsored project. The Office of Commercialization at WSU and its counterpart offices at TriDurLE Member Universities will ensure that “innovations and discoveries by (university) researchers are evaluated, protected where possible, and licensed by industry partners or start-ups to move technologies forward and generate benefits for researchers, university, and the public”. Serving as a bridge between university and industry, they are responsible for “the evaluation, protection, and commercialization of innovations and discoveries and for the expansion of university’s public impact”. They will provide assistance to TriDurLE researchers in various capacities, such as: invention and patent process, commercialization, Bayh-Dole compliance, confidentiality and non-disclosure agreements, materials transfer agreements, and avoidance of conflict of interest. They will provide guidelines for the commercialization efforts by TriDurLE researchers.

2.3. Brand awareness building

This UTC presents a great opportunity to enable cross-disciplinary research, education and diversity, workforce development, and T2 — which is valuable in light of the crosscutting nature of the existing and emerging challenges in infrastructure durability and life-extension. To grow and sustain the TriDurLE brand during the duration of this National UTC grant and beyond, some planned activities will include, but are not limited to:

- Design the membership of our Advisory Board to be multimodal to engage stakeholders in other modes of transportation and to accelerate innovation delivery
- Conduct outreach and collaboration where suitable, to engage stakeholders such as potential sponsors of research, education and diversity, workforce development, and T2, transportation infrastructure practitioners and problem owners/solution adopters, private industry, researchers, consultants, and professional societies
- Partner across sectors with Universities, industry associations (ASCE, ITE, TRB, AASHTO, LTAPs, ACI, etc.), private enterprise, and state and local governments to share expertise and move research into practice
- Co-sponsor one national or regional conference or workshop annually
- Develop short courses, lend support and participate in lecture series; give presentations and conduct panel discussions at existing conferences
- Ensure that all the technical documents, instructional and marketing materials will include the TriDurLE logo, acknowledge the funding support by the UTC program, and have a link to our website
- Promote completed and ongoing research and other activities/events sponsored or co-sponsored by TriDurLE through social media, conventional media outlets, TriDurLE website, etc.
- Support activities that bridge academic and professional worlds, by sponsoring topical seminars, guest speakers, conference travel and other networking opportunities with transportation infrastructure professionals

- Sponsor outreach activities of TriDurLE to engage primary and secondary school students in the nation, particularly those in proximity of Consortium universities
- Expose young groups to transportation infrastructure-specific activities that demonstrate their significance and personal relevance
- Partner with programs that help develop the next-generation transportation professionals, such as the Summer Transportation Institute, internships and fellowships
- Post link of reports, presentations, abstract of published papers, and information on upcoming events on social media (Facebook, LinkedIn, etc.), and video and audio of seminars, workshops and other webcasted events on YouTube
- Contribute to the national dialog on issues of transportation infrastructure durability and life-extension
- Join the Council of University Transportation Centers (CUTC) and actively participate
- Host tours of laboratory facilities, testbeds, demonstration sites, etc. at TriDurLE Member Universities

3. Measuring and tracking the performance of T2 by TriDurLE

To measure the effectiveness of TriDurLE T2 efforts, the Center Outreach Coordinator will document the following deliverables and activities (Table 2). This information will be collected every six months from individual PIs who has TriDurLE-sponsored research. This information will be compiled by the TriDurLE Outreach Coordinator annually to meet the T2P requirements specified by USDOT OST-R.

Table 2 Performance metrics of T2 to be used by TriDurLE.

Area	***Performance metrics***
Research Outputs	• Number of completed projects; Target: average > 10 per year • Technologies, inventions, patent applications or licenses resulting from research activities; Target: average > 1 per year • Transportation conferences, seminars, symposia, distance learning classes, etc.; Target: average 2 per year • Presentations given at professional and academic meetings; Target: average 15 per year • Peer-reviewed journal or other publications disseminated to showcase research; Target: average 12 per year • Number of transportation professionals participating in the TriDurLE T2 or outreach events Target: average 35 per year • Number and type of stakeholders or end-users potentially interested; their degree of alignment/interest. Note: this includes students that contribute to the UTC research projects
Research Outcomes	• Number of partnerships across sectors that have moved research into practice; Target: average 1 per year • Number of actual (or potential) adoptions of research outputs and type of adoptees; Target: average 1 per year • Number of stakeholders or students that collaborated on producing research outputs; Target: average 20 per year • The degree research outputs changed the transportation system or practice(s)
Research Impacts	• Number and type of benefits to society resulting from research outcomes; consider tracking associated alumni, their employment, influence, and authority to help gauge impact • Degree and range of benefits to society resulting from research outcomes

Overall tracking	• TriDurLE will create a database to track performance indicator data for reporting outcomes to OST-R. The number of conference presentations will be tracked based on trip reports and PIs' project quarterly reports. The number of peer-reviewed publications and circulation data on TriDurLE's e-newsletter will be tracked semi-annually • This UTC will also aim to increase the corporate research support by leveraging and building partnerships with private sector. The dollar amount and Number of such projects will be tracked