Research Project Name: A Vision for Transdisciplinary Transportation Engineering
Recipient/Grant (Contract) Number: Florida A&M University; University of Washington Tacoma
Center Name: Rural Safe Efficient Advanced Transportation (R-SEAT) Center
Research Priority: Improving Mobility of People and Goods
Principal Investigator(s): Jeff Walters, Angela Kitali, and Heather Dillon
Project Partners: Washington State Department of Transportation (WSDOT) - Sarah Ott (Olympic Region Traffic Engineer), Pamela Vasudeva (Statewide TSMO Development Engineer), Justin Belk (Olympic Region Traffic Engineer) Cleveland State University (CSU) (REAT Center Research Partner) - Dr. Josiah Owusu-Danquah, Dr. Emmanuel Kidando
Research Project Funding: $101,726.53 (Federal request); $51,000 (Non-Federal cost share)
Project Start and End Date: 9/1/2023 to 12/31/2024
Project Description: Traditionally, transportation engineering has been a specialized field focused on the design and construction of transportation infrastructure, such as roads, bridges, and railways. As society requires transportation systems that are increasingly more complex, there is a growing recognition of the need for a transdisciplinary[1] approach that fosters holistic and multimodal solutions that can promote sustainable and community growth and prosperity. Indeed, transportation issues are multifaceted, involving not only engineering but also social, economic, environmental, and policy dimensions. Moreover, transportation systems are no longer isolated entities but part of a more extensive interconnected infrastructure service network. For example, transportation systems interact with land use planning, urban design, public health, energy systems, and information technology. Therefore, an intentionally transdisciplinary focus would help transportation engineers understand these interactions and design well-integrated transportation systems that support overall societal goals.   Unfortunately, the true need for transdisciplinary transportation engineering remains opaque within the transportation engineering sector. A lack of knowledge on how to operationalize synergies between engineering and non-engineering disciplines leads to potential inefficiencies within transportation engineering organizations and incongruencies between engineering solutions and societal needs. A similar and coupled challenge exists in higher education, where a structured framework for curricular integration across engineering and non-engineering departments needs the transportation industry to serve as a catalyst. Thus, the transportation sector and civil engineering programs would greatly benefit from a rigorous survey and pairing of transportation sector needs with course offerings and cross-departmental collaboration to bolster a more transdisciplinary education workforce connection that equips the next generation of engineers. To meet this need, the proposed research will employ a mixed-method approach to compare and contrast transportation engineering industry needs with existing civil engineering curricula to inform ways to address gaps and incongruencies.
US DOT Priorities: This project aligns with the US DOT's RD&T goal of economic strength and global competitiveness, with a particular emphasis on the research priority of "Creating Pathways to Good Quality Jobs". Its primary objective is to promote a multidisciplinary and collaborative workforce of highly skilled transportation engineers. The project will evaluate the relevance of integrating non-engineering factors (social, economic, environmental, and policy considerations) into transportation engineering solutions. Additionally, it will assess the necessity for recent transportation engineering graduates to possess skills that enable them to address transportation challenges from a more holistic standpoint.

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[1] Transdisciplinarity connotes a strategy that crosses many disciplinary boundaries to create a holistic solution.

Outputs: Identifying, characterizing, and categorizing the human and hard skills required by the transportation engineering sector - both current and future - could help inform civil engineering program curricula that can better meet these needs. Conjointly, identifying the current synergies and gaps in cross-disciplinarity within major civil engineering curricula could inform a path forward toward a transdisciplinary education workforce pipeline. To this end, the complimentary objectives, outputs, and impacts of this project are three-fold:

1. To generate a representative sample and analyze the technical and non-technical workforce needs/skills for transportation engineering within the Department of Transportation (DOT) in Washington, Oregon, and California. Additionally, a comparison of workforce skills and needs for transportation engineering for selected Midwest DOTs will be facilitated by partnering with Dr. Josiah S Owusu-Danquah and Dr. Emmanuel Kidando (our REAT Center Partners), who will be employing the same research design in collaboration with selected students and faculty at CSU.
2. To obtain a nationally representative sample and analysis of synergies and gaps within existing transportation engineering education curricula.
3. To create a practical roadmap for industry and higher education to promote a transdisciplinary transportation engineering workforce of professionals who can develop more effective and sustainable solutions to societal transportation needs across the West Coast and compare these needs with those in the Midwest. (Figure 1). This effectively represents the motivation and theory of change for this research. This work will also be published as a peer-reviewed article in a transportation engineering journal.
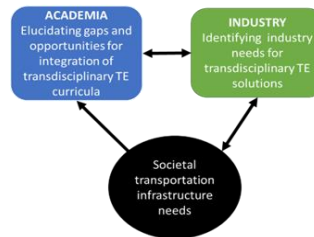

Figure 1: A conceptual framing of the study motivation and theory of change for this research

We presented a part of our work during the 104th Annual Meeting of the Transportation Research Board, Washington, DC.

Walters, J., Balyagati, P. F., Kalambay, P., Owusu-Danquah, J., Kidando, E., Kitali, A., and Dillon, H. (2025). "Bridging Silos: A Vision for a Transdisciplinary Transportation Engineering Workforce," Proceedings of the 104th Annual Meeting of the Transportation Research Board, Washington, DC.

Outcomes/Impacts: This work rigorously identifies and thoroughly characterizes gaps between the skillset needs within the transportation engineering workforce and the typical topics and tools covered within transportation engineering education. Study findings will inform a complimentary suite of actionable recommendations for short- and long-term workforce development strategies that fill these gaps within and across higher education and industry.

Final Research Report: N/A