Oregon Department of Transportation

Stage 1 Research Problem Statement

Number*: 25-41*

Proposed Title: Development, Calibration, and Validation of a Truck Level of Stress Model in Oregon

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs research to investigate.

To-date, ODOT has developed a Multimodal Level of Traffic Stress (LTS) methodology for autos, transit, bicycles and pedestrians (*1*). These methods allow ODOT operations and planning analysts to perform high-level assessments suitable for applications like network screening using limited data extracted from existing databases or aerial imagery. This supports design choices and programming which improves the mobility of pedestrians and bicyclists (*2*). No comparable methodology exists for assessing how transportation system design elements impact medium (delivery) and heavy (freight) trucks; there is a need for a truck-specific LTS methodology to similarly improve truck mobility and access in Oregon. This absence of a Truck LTS is likely related to an absence of existing knowledge related to the needs and perceptions of truck drivers. About 35% of all VMT is commercial traffic, yet transportation analysis consistently focusses on passenger travel and ignores urban commercial and freight movement. This technical gap needs to be resolved; especially as urban areas develop more road reconfigurations have the potential to adversely impact trucks.

2. Illustrate how this **transportation issue** is important to Oregon and ODOT's mission.

The trucking industry is shifting to younger less experienced drivers as driver retirements rise. This trend is confounded by increased restrictions to hours of service and limited access to high quality parking which creates miles of travel seeking parking instead of traveling progressing toward the final destination. We have been spoiled by experienced drivers who are retiring or leaving the occupation because wages are too low to overcome the aforementioned challenges (*3*).

ODOT's mission is to "provide a **safe** and reliable multimodal transportation system that connects people and helps Oregon's communities and **economy thrive**". Improvements to the safety and efficiency of truck operations are integral to both a safe and reliable transportation system and a thriving economy. As trucks share the transportation system with other modes, promoting safety and accessibility for trucks will also benefit other modes (e.g., passenger cars, pedestrians, bicycles). Additionally, METRO and ODOT are currently engaged in a regional mobility policy update which seeks to extend mobility measures beyond vehicles to other modes, including trucks. The updated policy, currently in draft form, will be applied in the next update to the Regional Transportation Plan, due in 2023, and incorporated in the highway mobility policy (Policy 1F) in the Oregon Highway Plan, pending approval by the Joint Policy Advisory Committee on Transportation, the Metro Council and the Oregon Transportation Commission.

3. What **final product or information** needs to be produced to enable this research to be implemented?

This research will result in a validated methodology for assessing Truck LTS using a tiered system. The Truck LTS methodology will be immediately implementable by engineers and planners to assess existing infrastructure and make choices about proposed transportation system modifications that improve truck access and mobility. The research team will ensure the methodology is implementable by engaging CDL operators, engineers, and planners in selecting key design aspects of the transportation system that should inform the tiered system. The system will be validated with a simulator study which assesses CDL operator stress using biometric feedback devices (*4*). This step is critical in the process. Much of the LTS models that have been developed and implemented have never been validated. They are based predominantly on conceptual relationships. Validation of the Truck LTS model is critical to its adoption in practice.

4. (Optional) If able, list the proposed scope of work tasks for this research project. This can include potential research, development, or technical transfer activity(ies) that may develop better understanding of the **transportation issue** and lead to an improvement in the Oregon's transportation infrastructure or services.

Task 1: Brief Literature Review and Survey (2 months)

Conduct a literature review describing existing research on LTS methodologies and design factors anticipated to influence a Truck LTS methodology.

Task 2: Truck Level of Stress Design Charrette *(2 months)*

Conduct a design charrette which brings together CDL operators, engineers, and planners to identify elements of the roadway anticipated to influence a Truck LTS methodology. This discussion will result in drafted descriptions for each of four tiers of Truck LTS.

Task 3: Experimental Design (4 months)

The project team will design and disseminate full-scale Qualtrics survey and separate static roadway environments for the OSU HV Simulator representing each of four tiers of Truck LTS developed in the design charrette.

Task 4a: CDL Operator Survey (3 months)

A minimum of 400 CDL operators will be recruited to respond to a full-scale Qualtrics survey. Data will be used to expand results of the Charrette and to validate the results of the driving simulator investigation.

Task 4b: Subject Testing in Simulator *(5 months)*

A minimum of 30 CDL operators will be recruited to drive the simulated environments representing the Truck LTS tiers in the Heavy Vehicle Simulator. Participants will be outfitted with Shimmer+ Galvanic Skin Response (GSR) devices to record level of stress for each scenario.

Task 5: Data Analysis (4 months)

Analyze the GSR and simulator data to validate truck LTS tiers.

Task 6: Final Report, Research Note & ODOT Recommendations (2 months)

Prepare draft and final versions of the comprehensive study report and research note for review and acceptance of the project technical advisory committee.

Estimated Project Length: 20 months ***Estimated Project Budget:*** $215,000

5. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.

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6. Other comments:

1. ODOT Analysis Procedures Manual Chapter 14: Multimodal Analysis, URL: https://www.oregon.gov/odot/Planning/Documents/APMv2_Ch14.pdf [Accessed Aug, 2021]
2. Regional Mobility Policy Update, URL: https://www.oregonmetro.gov/public-projects/regional-mobility-policy-update/background [Accessed Aug, 2021]
3. 2020 Freight and Economic Analysis Expert Task Group (FEA ETG), URL: https://www.oregon.gov/odot/Programs/ResearchDocuments/FreightandEconomicAnalysisETGPriorites2020.pdf [Accessed Aug, 2021]
4. Cobb, D., Jashami, H., & Hurwitz, D. (2021) "Bicyclists' Behavioral and Physiological Responses to Varying Roadway Conditions and Bicycle Infrastructure," *Transportation Research Part F: Traffic Behavior and Psychology*, Volume 80, Pages 172-188.

7. Corresponding Submitter's Contact Information: [1 individual]

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