Oregon Department of Transportation

Research Stage 1 Problem Statement

Number 26-14 – "Quantification of Construction GHG for NEPA Analysis: Developing ODOT Tailored Infrastructure Carbon Estimator"

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

Materials and fuels related to the construction and maintenance of the highway infrastructure ODOT represent 70% of ODOT's operational carbon footprint.[1] The Oregon Transportation Plan and ODOT's Strategic Plan direct the Agency to reduce GHGs from materials and fuels it uses. ORS 184.879 – adopted by the state legislature in 2022 – also requires the agency to develop strategies to reduce GHG emissions from the materials the Agency procures and to conduct life cycle assessments on projects to help inform reduction strategies. Executive Order 20-04 asks the agency to consider climate impacts into the decisions it makes for the State Transportation Improvement Program (STIP).

To effectively drive down GHGs from the Agency's construction and maintenance operations, ODOT needs to be able to estimate GHGs from various project types and sizes during the planning stage to elevate climate-friendly opportunities and track progress made throughout the project lifecycle. An FHWA tool referred to as Infrastructure Carbon Estimator (ICE) [2]is used in NEPA analysis, but this tool does not include all the project types covered by ODOT and requires construction material quantities not yet available during earlier stages of the STIP planning process. Recently, Minnesota DOT has created a custom version of ICE,[3] reflective of available materials and fuels used for construction in the state of Minnesota. Using Minnesota custom ICE[2] as precedent, this research aims to develop a customized ICE tool applicable for immediate use for the state of Oregon. This research will expand and automate ODOT's life cycle assessment tools to better inform programs and project managers.

The research effort will build on the FY 2016 -19 ODOT GHG Inventory, which estimated embodied carbon emissions and fuel required to complete a project from project bid data and estimated fuel demand for construction equipment by job type. The tool can also incorporate anticipated data and strategies from ODOT's new Environmental Product Declarations (EPD) program (ORS 184.879). The materials to focus on would be asphalt, concrete and steel, and this effort will also include construction equipment fuel as well.

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

An interactive and adaptable computational tool is needed that can estimate construction material GHG for early planning stages. The tool should be populated with ODOT's current material carbon intensities and include options for GHG reductions, even at a generic percent reduction level of specificity.

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[1] https://www.oregon.gov/odot/Programs/TDD%20Documents/ODOT%20Operational%20GHG%20Reductions%20-%20BPs%20and%20Recs%20--%20FINAL%202022.01.05.pdf

[2] https://www.dot.state.mn.us/sustainability/ghg-analysis.html

The research would develop a tool with a predetermined database of materials for various standard project types and sizes, based on ODOT-specific materials, fuels, and known GHG-reduction strategies. This tool would be used for the quantification of construction (embodied) GHG from STIP funding cycle-stage projects. Specifically, the tool would be used to develop typical project lifecycle embodied emissions and potential options to reduce GHGs. This same data and relationships could then also identify the expected GHG from the chosen/funding 100% list of projects, using the options based on the commitments, if any, for each project.

While GHG emission intensities of different materials are now becoming available in Oregon and other states, project quantities of materials are not readily available, especially at early stages where funding decisions are made. The project at this stage can likely identify total project costs and break that into broad work elements. As such, a key research objective would be to classify ODOT's projects into standard types and automatically attribute each with typical quantities of materials at different project sizes/costs, after accounting for non-material costs. A second key workplan element would be to combine the emission rates and project quantities into a computational tool that could estimate the GHG from the full project cycle. That tool would allow alternative emission rates that reflect low-carbon materials and fuels available in Oregon.

The tool and database would be designed to work with the existing project delivery and operations data system, and/or the scoping management system for projects at the STIP scoping stage. The project would build on ODOT's investment in the GHG Inventory and its use in the prior 24-27 STIP analysis, potentially allowing that dataset to be updated overtime with the new EPD reporting data. This work would help the EPD program by providing an approach/data to fulfill the stipulation in the OR EPD law to look at project, not just product, embodied carbon. The tool would complement the FHWA ICE tool, and enable smaller project GHG planning analyses that are difficult to perform with ICE, or help with those projects that do not have enough information to populate the current FHWA ICE tool.

With this research deliverable, ODOT could be more transparent about GHG impacts of project construction dollars. Additionally, this research effort would provide tangible data for the potential GHG from changing construction materials, leading to a better understanding of the return on investment and what types of projects and opportunities exist—with the broader goal of maximizing investment in low carbon materials.

3. (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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Natalie Liljenwall	Air Quality Program Coordinator	Natalie.liljenwall@odot.oregon.gov	
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4. Decision making lenses

Please complete the following three sections. Your answers to these questions will be applied on a programmatic basis to support agency decisions. Answering yes to the questions below is not required.

Resolving a narrowly focused technical research problem may meet agency needs without answering yes to any of the following questions. The ODOT Research Section will seek a balanced portfolio some projects will answer yes to one of the three categories below (e.g. climate, equity, and/ or safety) and other projects in a different category.

We are looking for an overall program balance and no one project is expected to balance all categories. Generally, a research problem statement is expected to be able to answer yes with clear and verifiable information in only one of the three categories below, some projects may be able to answer yes in two or even three categories. Some projects (i.e. needs focused on specific elements of infrastructure design), may have no yes answers but may still be high value research need.

Climate

Oregon recognizes the climate crisis and makes systemic changes to reduce emissions caused by travel. Every mile driven in Oregon is powered by a clean source of fuel. We seek research that supports construction and maintenance operations are carbon neutral and investments in mobility that support travel by low and no emission modes. While every research project may not result in a reduction in emissions, transportation investments overall support emission reductions to achieve state goals. Oregon envisions a transportation system that is resilient in the face of seismic and climate events and impacts to the degradation of the natural environment are reduced. Our vision includes a transportation infrastructure is built in a way that avoids impacts on key habitat and results in better environmental conditions for wildlife and native vegetation. For definitions and details please review the equity vision, goals, and objectives of the ODOT Strategic Action Plan and Oregon Transportation Plan.

4f. Will addressing the **transportation issue** identified as a need in Question 1 develop, or validate methods for the estimation, measurement, or monitoring of transportation generated greenhouse gasses (GHG)?

☒Yes ☐No ☐Unsure

4g. If climate or GHG is not the focus of this **transportation issue** identified in this problem statement, will the research apply a GHG analysis to transportation infrastructure, planning, operations, maintenance, or materials?

☒Yes ☐No ☐Unsure

4h. Will the addressing the **transportation issue** include development or testing of construction practices, methods, or materials to establish potential reductions in greenhouse gas emissions?

☒Yes ☐No ☐Unsure

4i. Will the solving the **transportation issue** in question 1 study or support the reduction of vehicle miles traveled and single occupancy vehicle travel or support transition to electric vehicles (or other types of zero emission vehicles) or low-carbon alternative fuels?

☒Yes ☐No ☐Unsure

4j. Will the solving the **transportation issue** in question 1 lead to work that will support, measure, monitor, transportation system resilience in response to expected climate events, effects, or natural disasters in general?

☐Yes ☒No ☐Unsure

4k. Will the solving the **transportation issue** in question 1 lead to work that may result in better environmental conditions for wildlife and native vegetation?

☐Yes ☒No ☐Unsure

4l. If you answered yes to any of the climate questions above or can provide alternative details related to climate, please provide additional information:

Climate is the focus of this project, provide information to support projects in the scoping and funding phase to consider construction practices, methods, or materials that provide potential reductions in greenhouse gas emissions (4f). This includes both materials, and potentially construction machinery low carbon fuels (4i). It would provide information for decision making and track decisions over time.

Equity

Equity can have many dimensions and impacts relating to communities, and transportation. It is important that problem statement proposals clearly explain in what capacities are equity dimensions or impacts being examined within problem statements. It is a goal of the OTP to "Improve access to safe and affordable transportation for all, recognizing the unmet mobility needs of people who have been systemically excluded and underserved. Create an equitable and transparent engagement and communications decision-making structure that builds public trust". Proposed research may have the intent of studying elements of this goal or apply analysis to specific transportation topics to ensure the resulting research recommendations is consistent with our equity goals. For definitions and details please review the equity vision, goals, and objectives of the ODOT Strategic Action Plan and Oregon Transportation Plan.

4a Is the **transportation issue** identified as a need in Question 1 specifically focused on transportation equity?

☐Yes ☐No ☐Unsure

4b If the **transportation issue** is not focused on transportation equity, will the primary topic be assessed for equity benefits or impacts within the research project?

☐Yes ☐No ☐Unsure

4c Is the implementation of potential findings from this research likely to directly involve participation from an identified group that would benefit from an equitable process or outcome?

☐Yes ☐No ☐Unsure

4d Is the intended final product or information expected to support ODOT's equity efforts (Including but not limited to supporting one of the equity related objectives of the ODOT's Strategic Action Plan or Oregon Transportation Plan) ?

☐Yes ☐No ☐Unsure

4e If you answered yes to any of the equity questions above or can provide alternative details related to equity, please provide additional information:

Safety

Research outcomes may include interventions and countermeasures to prevent or reduce the frequency of crashes or other causes of transportation-related injury or death; or may include measures to reduce severity of injury (including prevention of death) after a crash or other injurious event. For definitions and details please review the equity vision, goals, and objectives of the ODOT Strategic Action Plan, Oregon Transportation Safety Action Plan and Oregon Transportation Plan.

4m. Will solving the **transportation issue** in question 1 support improving **safety culture** for either transportation workers or the traveling public?

☐Yes ☐No ☐Unsure

4n. Will the solving the **transportation issue** support improving safety through **healthy and livable communities**?

☐Yes ☐No ☐Unsure

4o. Will solving the **transportation issue** support improving safety through using **best available technologies**?

☐Yes ☐No ☐Unsure

4p. Will solving the **transportation issue** support improving safety through **communication and collaboration**?

☐Yes ☐No ☐Unsure

4q. Will the solving the **transportation issue** support improving safety through **investing strategically**?

☐Yes ☐No ☐Unsure

4r. If you answered yes to any of the safety questions above or can provide alternative details related to safety, please provide additional information:

5. Other comments:

A first attempt at quantification of construction project-level GHG occurred with the list of 204 projects in the 24-27 STIP cycle. That effort took project costs, removed non-material costs based on 2016-19 ODOT GHG Inventory, and then applied emission rates per dollar. No attempt was made to identify alternative emission rates considering the materials mix of the projects were so coarse.

6. Corresponding Submitter's Contact Information:

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