Oregon Department of Transportation

Research Stage 1 Problem Statement THIS SCOPE WAS DEVELOPED FOR THE LCTM GRANT but can be considered for ODOT funding

Number 26-50 – "Optimizing Concrete Mixture Proportioning for Structural Concrete to Minimize Global Warming Potential"

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

ODOT has sponsored research to minimize portland cement in concrete pavements. The research resulted in a significant reduction in cement contents for pavement concrete. Because cement is by far the largest contributor to greenhouse gases (GHGs) and global warming potential (GWP), reducing the cement content in concrete is both environmentally beneficial and economical. There are also potential durability benefits. Longer lasting structures can also result in reduced GHGs and GWP. However, concrete for pavements is a relatively small portion of the concrete used in Oregon. A new proportioning methodology, based on the methodology from the pavement research, is needed for structural concrete. This research proposes to develop a revised methodology to minimize paste content and maximize durability in structural concrete. The methodology will assess existing and new cementitious materials (e.g., PLC, SCMs) in structural concrete mixtures to significantly reduce GHGs and GWP, minimize cracking, achieve strength, improve durability, minimize thermal loads for mass concrete, and others. A risk assessment will be performed to ensure compliance with strength and other critical requirements.

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

One final product of the research would be a comprehensive research report with recommendations. The recommendation would likely be a modified mixture proportioning method for structural concrete. Current concrete mix design (02001.15) requires ACI 211.1. This could be modified or replaced. In addition, potential changes to section 02001.30, Concrete Constituents, could occur. It is anticipated that additional changes could be realized from the research but these changes will be better realized nearer the end f the research project.

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.

ODOT Research is looking for individuals that have expert knowledge of the problem, key approval authority, will otherwise help oversee the study, or will implement the results of this work.

Name	Title	Email	Phone
Zechariah Heck	Sustainability Program Manager	Zechariah.HECK@odot.oregon.gov	503-779-4815
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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:

- This research proposes to develop a new mixture proportioning method, based on available aggregate characteristics and required concrete performance, to minimize the cement content in structural concrete. Minimizing the cement content in structural will reduce GHGs (from the cement production process) and GWP, making concrete in Oregon more environmentally friendly.

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:

- The impact of the research results on equity is unknown.

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:

- The impact of the research results on safety is unknown at this time.

5. Other comments:

6. Corresponding Submitter's Contact Information:

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