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 26-51 – “”**

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

There are three general approaches to reducing the carbon footprint on portland cement concrete (PCC) and asphalt concrete (AC). These include 1. replacing conventional binders (e.g., portland cement) with binders that have lower $CO_2$ footprints (e.g., aluminate cements), 2. replacing and maximizing the replacement of the binder with alternate materials (e.g., recycled asphalt, supplementary cementing materials), and 3. minimizing the overall required binder content in the PCC and AC mixtures. The shape, size, texture, and gradation of an aggregate directly influences the amount of voids within these aggregate systems and the amount of voids in the aggregate systems directly influences the amount of binder required for both AC and PCC mixtures. Therefore, optimizing the aggregate shape, size, texture, and gradation can result in mixtures with lower binder contents and therefore lower greenhouse gases (GHGs) and lower global warming potentials (GWP). Optimizing aggregate shape, size, texture, and gradation is dependent on the aggregate crushing procedure. This research will assess aggregate crushing procedures on the performance and GWP of AC and PCC produced with aggregates from different crushing methods. The research will identify aggregate crushing methods that minimize GHGs, GWP, and maximize performance.

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

The final product of this research study will provide recommendations on aggregate crushing and production for AC and PCC systems. The objectives are to: i) determine the impact of using VSI crushers on the performance of AC and PCC mixtures; ii) quantify constructability and durability of mixtures; iii) determine the cost and environmental benefits of using VSI crushed aggregates for PCC and AC mixture production in Oregon;  and iv) to develop a document indicating changes/updates to existing specifications and construction standards to implement requirements for obtaining aggregates that can enhance constructability, performance, while minimizing environmental impact.

**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.

| Name | Title | Email | Phone |
|---|---|---|---|
| Zechariah Heck | Sustainability Program Manager | Zechariah.HECK@odot.oregon.gov | 503-779-4815 |
| Austin Johnson | Concrete Quality Coordinator | Austin.L.JOHNSON@odot.oregon.gov | 503-510-1384 |
| Chris Duman | Pavement Quality & Materials Eng. | Christopher.L.DUMAN@odot.oregon.gov | (503) 559-4994 |
| Kevin Shearmire | Sustain. Engineer | Kevin.J.SHEARMIRE@odot.oregon.gov | (503) 314-7823 |

**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:

ODOT using a significant amount of AC and PCC to construct their infrastructure system. The aggregates used in the AC and PCC have a direct influence on how much portland cement and asphalt are required for these materials. Past ODOT research indicates that optimizing the aggregate shape, size, texture, and gradation can significantly reduce the portland cement and possibly the asphalt. However, how to achieve these characteristics in the field is unknown. This research will assess different crushing methods and will determine which method produces aggregate characteristics that can improve performance while reducing GHGs.

**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 influence of this research on equity is unknown at this time.

**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:

Pavements with improved performance will increase safety for the traveling public. Although unknown, this research could result in improved performance of AC and concrete pavement and structures, thereby improving safety.

**5.** Other comments:

This project is being considered for the LCTM project.

**6.** Corresponding Submitter's Contact Information:

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|---|---|
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