

Number: 25-08

Proposed Title: Development of Partial-depth Precast Panels for Rapid, Economical, Durable, and Green Bridge Design and Construction

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

Construction is a major contributor to the world's carbon footprint and has been reported to contribute 23% of the world's greenhouse gas emissions (Sizirrici et al. 2021). It has also been reported that 90% of CO₂ emissions can be reduced by using new materials, new techniques, or new systems. The construction of falsework and formwork, especially for bridges, can cost up to 50% of the overall cost of a construction project (CRSI 2022). These construction practices also significantly contribute to the carbon footprint of construction projects. This research proposes to develop an economical precast stay-in-place *partial-depth* panel system for bridge construction to eliminate the need for a large majority of false-work and formwork. A concrete wearing surface (likely 4 inches thick) will be placed over the partial-depth panels. However, to be cost-effective over the long-term, these systems must ensure that the bridge deck is durable and reliably exhibits long service lives. To achieve economy, reduced carbon footprints, durability, and accelerated construction, decks constructed with these partial-depth precast stay-in-place panels must use materials that reduce the carbon footprint, must be designed to minimize deck cracking to ensure long service lives, must be readily available (from a precast plant), and must possess the properties essential for safe bridge performance. The proposed research directly addresses 4 of ODOT's 6 Strategic Directions: Mobility (reduced construction times), stewardship of public resources (improved economics), safety (significant reduction of workers working at elevated heights), and sustainability (reduced carbon footprint from elimination of falsework and formwork and reduced construction times).

2. Document how this transportation issue is important to Oregon and will meet the [Oregon Research Advisory Committee Priorities](#)

ODOT's Strategic Action Plan includes building, maintaining, and operating a modern, multimodal transportation system to serve all Oregonians, address climate change, and help Oregon communities and economies thrive. Accelerated construction practices will reduce construction durations, thereby reducing community impact, reducing carbon footprint, and improving economy of the built infrastructure in Oregon. Although conventional cast-in-place concrete decks have proven durable, methods, such as precast panel systems, are available to significantly reduce construction times, construction costs, and the carbon footprint associated with conventional construction methods and materials used to construct bridges. Precast, prestressed stay-in-place panels have been used in many States for bridge construction. However, the use of the panels has, in some cases, resulted in deck cracking. Deck cracking can lead to early deterioration of the deck. The objective of this work is to design precast, prestressed panels that result in accelerated and economical construction while ensuring durable and long-lasting bridge performance.

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

The final product of this research will be a comprehensive final report. The report will include all data generated in the research and, using these data, will include clear and simple recommendations for fabricating precast, prestressed panels for rapid and durable bridge construction. The report will quantify the projected reductions in carbon footprint resulting from the use of the precast panel system, will recommend concrete materials and proportions essential for reducing the carbon footprint, will provide recommendations for deck construction, and will identify needed changes to existing ODOT documents. It is anticipated that each chapter

will be an independent section that can be distributed to the organization needing that information. For example, the chapter on the deck panels will be targeted towards the precast, prestressed industry. The final report will be comprehensive with the objective of implementing the research findings.

In addition, the final report will contain an implementation plan. This plan will layout a plan to have precast plants fabricate these panels, will provide a plan to place and construct these partial-depth panels, and will provide a plan for the placement of the top concrete wearing surface. Critical materials and construction practices that can influence economy, carbon footprint, and durability will be identified.

4. (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

5. Other comments:

NA

6. Corresponding Submitter's Contact Information:

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