

**TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT
Q4/2025**

Lead Agency:
Washington State Department of Transportation (WSDOT)

INSTRUCTIONS:

Lead Agency contacts should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # TPF-5(491)		Transportation Pooled Fund Program - Report Period: <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input checked="" type="checkbox"/> Quarter 4 (October 1 – December 31)	
TPF Title (follow link to TPF webpage): Super-Elastic Copper-Based and Iron-Based Shape Memory Alloys and Engineered Cementitious Composites for Extreme Events Resiliency			
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Lead Agency Project ID: UCB 1874	Other Project ID (i.e., contract #): T-1874	Project Start Date: 2022-12-01	
Original Project Start Date: 2022-12-01	Original Project End Dates: Phase 1 - 2023-11-30 Phase 2 – 2025-11-30 Phase 2 task 6 – 2026-04-30	If Extension has been requested, updated project End Date: 2026-04-30	

Project schedule status:

- On schedule On revised schedule Ahead of schedule Behind schedule

(A) Overall Project Statistics:

Commitments to date \$ (3yrs)	Obligations to date \$	% Obligated	Contracted to date \$	Expended to date \$	Expended to date as % of contracted	Completed this quarter \$
450,000	450,000	100%	449,431	436,565	97%	9,683

(B) Project Description:

The objective of this research project is to:

1. evaluate and test several innovative columns which have self-centering feature to provide minimum residual displacement after earthquake.
2. improve column serviceability after earthquake by decreasing damage and spalling of concrete within column plastic hinge region; and
3. provide cost comparison among columns having different engineered materials; and
4. develop self-centering column design specifications. Particularly, in this proposed research, the low-cycle fatigue characteristics, corrosion resistance, machinability and coupling mechanisms with traditional steel rebar, and cost of CAM, NiTiCo super-elastic alloy (SEA) bars and Fe-SMA shape memory alloy (SMA) bars are being studied.

Direct comparisons are made with Nickel-Titanium (NiTi) SEAs (and traditional steel reinforcing bars as applicable) to illustrate the advantages/disadvantages of each material. If successfully demonstrated for their suitable characteristics, the NiTiCo SEA and Fe-SMA bars could replace their NiTi counterparts at a significantly lower cost and accelerate their applications in bridges. Therefore, the outcomes of this project are directly relevant to state departments of transportation and bridge and structural engineers and designers. This proposed project will build on the success of previously implemented WSDOT's application of shape memory alloy/engineered cementitious composite (SMA/ECC) in the columns of the SR-99 on-ramp bridge in downtown Seattle while making a direct impact on advancing and securing the national transportation network.

(C) Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

In this quarter, 90% the work on electrochemical corrosion testing of the different shape memory alloy compositions has been completed. In the previous quarter, a cyclic polarization testing setup had been prepared. The necessary chemicals such as NaCl, KCl, AgCl, were purchased for these tests. The test samples had been machined to correct geometry and epoxy coated for testing. In this quarter, after system validation, the tests on mild steel and NiTi have been completed. We are specifically measuring the open corrosion potential (OCP) and performing potentiodynamic tests to determine the corrosion rate through Tafel parameters. Currently, the tests on NiTiCo and FeSMA specimens are being run.

Additionally, the work on design examples involving, NiTiCo and FeSMA columns has started. The necessary computer models have been created to run the required simulations. The framework for design guidelines have been completed and the results from the computer simulations will be used to complete this task.

(D) Anticipated work next quarter:

In the next quarter, we will complete the remaining few electrochemical corrosion testing on NiTiCo and FeSMA, process the results and compare these to benchmarks previously obtained including mild steel and stainless steel.

We will continue working on the design examples, and finalize the design guidelines for NiTiCo and FeSMA columns.

(E) Significant Results:

The significant result in this quarter is the completion of the validation of the corrosion testing, and completion of the corrosion tests on mild steel, and NiTi.

(F) Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Most recently a task has been executed by WSDOT for \$30,000 to perform Task 6 on developing design examples and design guidelines for bridge columns with NiTiCo and FeSMA. This final task order has already been executed. The work is progressing on time with an estimated project completion date of April 30, 2026.

(G) Potential Implementation:

We will have a better idea on the implementation trajectory of the findings during Phase 2, within the scope of this pooled fund, if successful and if adequate funding is committed and obligated to conduct Phase 2. The results of Phase 1 look very promising so far.