



**OREGON DEPARTMENT OF TRANSPORTATION**

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**SPR Quarterly Progress Report**  
6/1/15\* through 9/30/15

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*\*note: This quarterly report includes work in June 2015.*

**1. Project**

Validation of Tsunami Design Guidelines for Coastal Bridges  
SPR TPF 5(307)

**Project Description**

The functionality and survivability of coastal bridges under earthquake and tsunami excitations is a major concern of western US states. A significant number of these bridges are vital to the emergency first response transportation of coastal cities immediately after a Cascadia Subduction Zone earthquake or other major earthquake events that generate tsunami waves in the Pacific Ocean, which will likely be followed by a local tsunami 15 to 60 minutes afterward. At least two numerical studies sponsored by California and Oregon of tsunami loads on a number of coastal bridges have been completed or nearly completed. Several studies have also been conducted on the effects of the “Great Japan Earthquake” of 2011 by Japanese research institutes as well as at UNR. Significant progress in the development of a tsunami design guideline has been made and the results appear promising. However, the reliability of the numerical results is unknown at this point due to a lack of experimental data needed for verification and validation. Thus, it is essential that experiments be conducted to provide data to verify and validate the numerical results to assess the accuracy of the load prediction equations. When validated, the numerical model can then be used to further improve the numerical analysis and development of practice design guidelines.

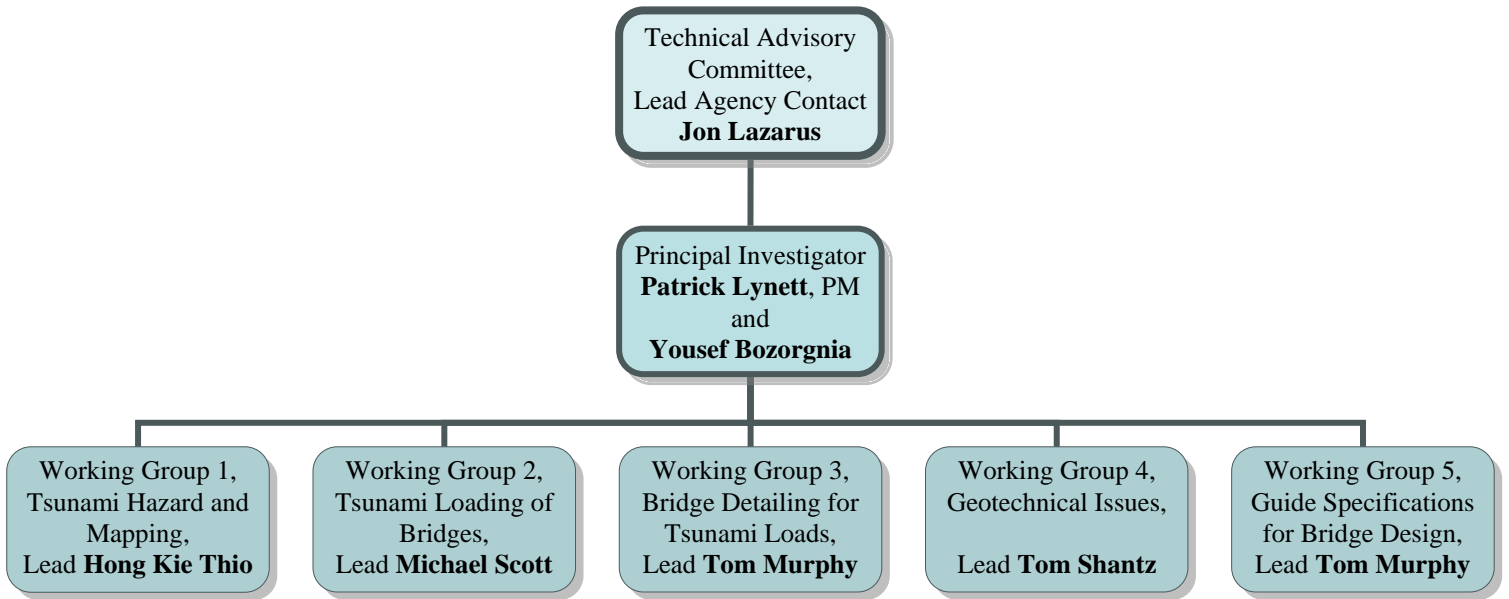
**2. Key Dates**

Start Date for ODOT: April 16, 2015 (contract execution)  
Completion Date for ODOT: June 30, 2018

**3. Principal Investigator and Teams**

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## Relationship/Project Chart



## Planned Project Schedule (red indicates newly added extensions)

Description	Task	Budget %	Personnel (meeting method)	2015		2016				2017				2018	
				Year Quarter	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar
				YR 0.25	YR 0.50	YR 0.75	YR 1.0	YR 1.25	YR 1.50	YR 1.75	YR 2.0	YR 2.25	YR 2.50	YR 2.75	YR 3.00
Discussion of WG1 tasks	WG1.1-3	0%	WG1, (Webex)												
WG1 Workshop @ PEER	WG1.1-3	4%	WG1, WG2 rep (PEER)												
Documentation of Task WG1.1	WG1.1	16%	HKT, PL												
Documentation of Task WG1.2	WG1.2	5%	PL, HKT												
Documentation of Task WG1.3	WG1.3	4%	PL, HKT												
Review of WG1 tasks by WG2	WG2.2	1%	MS (email, Webex)												
Discussion of WG2 tasks	WG2.1-3	0%	WG2, (Webex)												
Literature Review of loading	WG2.1	3%	MS												
WG2 Workshop @ PEER/OSU	WG2.1-2	4%	WG2, WG1 rep (PEER/OSU)												
Documentation of Task WG2.1	WG2.1	1%	MS												
Modeling / Testing (gaps)	WG2.2	9%	MS, PL												
Documentation of Task WG2.2	WG2.2	3%	MS, PL												
WG2 Workshop @ PEER/OSU	WG2.3	4%	WG2, WG1 rep (PEER/OSU)												
Documentation of Task WG2.3	WG2.3	6%	MS, PL, HKT												
Detailing Recommendations	WG3.1	3%	TM												
Identify Geo code issues	WG4.1	4%	TS												
Draft Guide Specifications	WG5.1	14%	TM, WG reps												
Workshop to discuss Draft	WG5.1	4%	WG5												
Final Guide Specifications	WG5.2	15%	TM, WG reps												

Personnel: PL Patrick Lynett  
 HKT Hong Kie Thio  
 MS Michael Scott  
 TM Tom Murphy  
 TS Tom Shantz  
 WG1, 2, ... Working Group 1, 2, ...

Red boxes indicate quarters when deliverables (Task Reports) are to be completed

#### 4. Progress

Working Group 1: Tsunami Hazard and Mapping	30% of total project budget
Progress completed reported in last quarterly report:	0%
Progress completed after this quarter:	5%

##### Key Progress-To-Date

- WG1 has reviewed the current status of tsunami hazard databases, including the up-to-date progress of the ASCE7 inundation maps. Preliminary conclusions of these efforts indicate that uncertainties in any one model can be very large for a local velocity prediction, but that using an ensemble approach (either many trials of the same model or using different models) can yield a more stable and thus higher confidence result.
- WG1 has begun to investigate the available alternatives for site-specific hydrodynamic predictions.

##### Problems

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##### Work Planned for Next Quarter

- Building database of tsunami hazard maps [TASK WG1.1]
  - State inundation maps (Deterministic, source scenario based available for CA, and to a lesser degree OR, HI, WA, AK)
  - ASCE7 maps
  - New maps at the 1000-yr hazard level, developing using a mix of the “scaling” approach and new modeling in selected locations
  - Task completion expected 7/16
- Quantification and inclusion of uncertainties in the onshore propagation and other uncertainties not formally or rigorously included in the ASCE7 probabilistic maps [TASK WG1.2]
  - Will be based on ongoing work by the PEER Tsunami group (PTG)
  - With the results from the PEER project, some discussion in WG1 will be needed in order to determine a method to incorporate this uncertainty on a site-specific basis
  - Task completion expected 10/16
- Method to provide the hydrodynamic information needed (max, mins, time series, etc) for design using the ASCE7 maps as input [TASK WG1.3]
  - Options include using the Energy Method (ASCE7) or some Numerical Model Transect tool in the general vicinity of the structure
  - Easiest path will be to use the ASCE7 Energy method
  - Will require WG1 consensus, and review/discussion with WG2
  - Task completion expected 7/16

Working Group 2: Tsunami Loading of Bridges	30% of total project budget
Progress completed reported in last quarterly report:	0%
Progress completed after this quarter:	5%

Key Progress-To-Date

- WG1 members have begun the literature review of existing methods to estimate loads on bridges / tsunami loads on general structures

Problems

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Work Planned for Next Quarter

- Literature review of existing and ongoing methods to estimate loads on bridges / tsunami loads on general structures [TASK WG2.1]
  - Development of a table of all available and planned model tests with the scale, test configuration, testing protocols and results to aid in the identification of gaps in validation of possible simplified design equations.
  - Determine whether existing methods can be extended tsunami loads on bridges
  - If additional information or testing is needed, develop a plan to obtain
  - Preliminary loading calculation approach, based on expected newly obtained data
  - Task completion expected 1/16

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Working Group 3: Bridge Detailing for Tsunami Loads	3% of total project budget
Progress completed reported in last quarterly report:	0%
Progress completed after this quarter:	0%

Key Progress-To-Date

- N/A

Problems

- N/A

Work Planned for Next Quarter

- Efforts in WG3 are scheduled to initiate in July, 2017

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Working Group 4: Geotechnical Issues (Scour and drawdown induced liquefaction)	4% of total project budget
Progress completed reported in last quarterly report:	0%
Progress completed after this quarter:	0%

Key Progress-To-Date

- N/A

Problems

- N/A

Work Planned for Next Quarter

- Efforts in WG4 are scheduled to initiate in April, 2017

Working Group 5: Guide Specifications for Bridge Design for Tsunami Hazard	33% of total project budget
Progress completed reported in last quarterly report:	0%
Progress completed after this quarter:	0%

Key Progress-To-Date

- N/A

Problems

- N/A

Work Planned for Next Quarter

- Efforts in WG5 are scheduled to initiate in April, 2016

CONTINGENCY PLAN FOR DEVELOPING 1000-YR HAZARD MAPS	%
Progress completed reported in last quarterly report:	0%
Progress completed after this quarter:	0%

Key Progress-To-Date

- N/A

Problems

- N/A

Work Planned for Next Quarter

- There is currently no identified need or authorization to proceed with the development of these hazard maps

7. **Finances**

SPR Project Summary

TBD (Tabular report coming)

8. **Project Summary (Completed by ODOT)**

There was an initial delay after the April 2015 kick-off meeting due to staff changes and contracting. Sub-contracts with team leads are now complete and the research team has begun working together. The schedule was changed to reflect delays. Project work is underway for the starting tasks.