



Caltrans Division of Research,  
Innovation and System Information

Research

Notes

Seismic /  
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Project Title:  
Development of Validated Methods for  
Soil-Structure Interaction Analysis of  
Buried Structures  
  
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## Development of Validated Methods for Soil-Structure Interaction Analysis of Buried Structures

Investigate soil-structure interactions of buried structures with Caltrans standard installations to test the applicability of the proposed methods for buried structures by the National Cooperative Highway Research Program (NCHRP) Report 611.

### WHAT IS THE NEED?

Caltrans needs guidance material for the design and placement of underground structures subject to seismic loading. Recent guidelines, such as those given in National Cooperative Highway Research Program (NCHRP) Report 611, offer specific analysis procedures for buried structures. Confidence in this report is uncertain because there is a lack of experimental validation for these procedures. The validity of NCHRP's recommendations are unclear for culvert configurations in Caltrans Standard Plans, which are embedded in compacted fills.

### WHAT ARE WE DOING?

Conduct centrifuge tests on two representative Caltrans specimens: a rectangular reinforced concrete box and a circular corrugated metal pipe. The specimens and the surrounding soil will be instrumented to determine incremental pressures due to seismic loading. Finite element simulations will be carried out to help interpret the test measurements. Findings from the tests will be compared against predictions made with the method described in the NCHRP Report 611.

### WHAT IS OUR GOAL?

Determine the validity (or lack thereof) of the displacement-based analysis procedure provided in the NCHRP Report 611, which yields the incremental seismic demands on buried structures. Come up with guidance for the design of culverts. Identify future research and testing needs, as needed.



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### WHAT IS THE BENEFIT?

Accurate analysis methods will lead to costs savings in the design and construction of culverts and will improve seismic resiliency of Caltrans installations.

### WHAT IS THE PROGRESS TO DATE?

Three proposals (UCLA, UCSD, UCI) were evaluated by a Caltrans technical team consisting of Geotechnical and Bridge Design Engineers on December 11, 2014. UCLA's was selected as the best proposal with which to move forward.

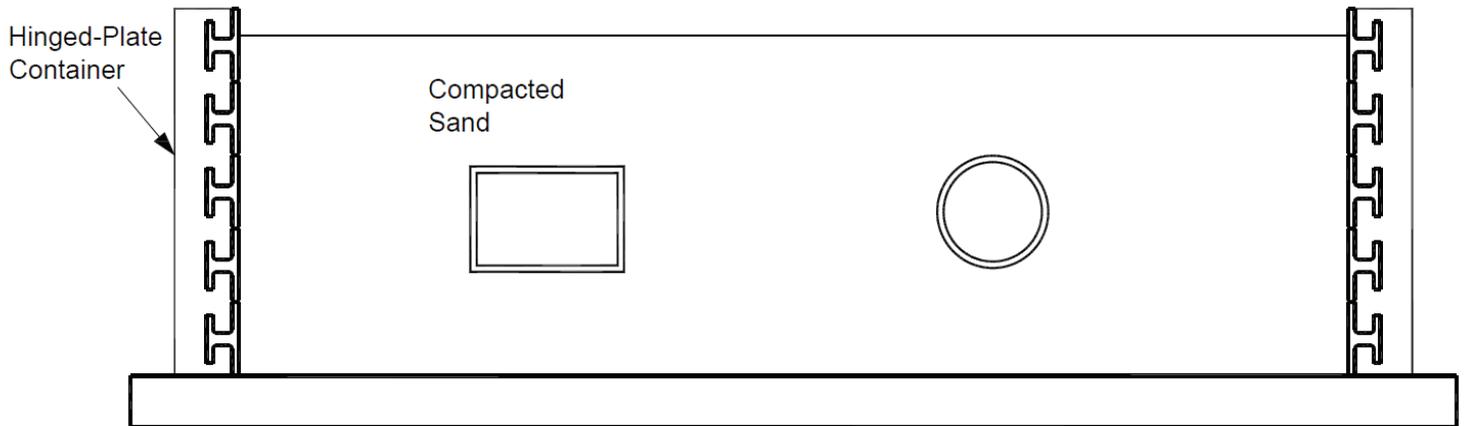


Figure 1. Centrifuge model layout

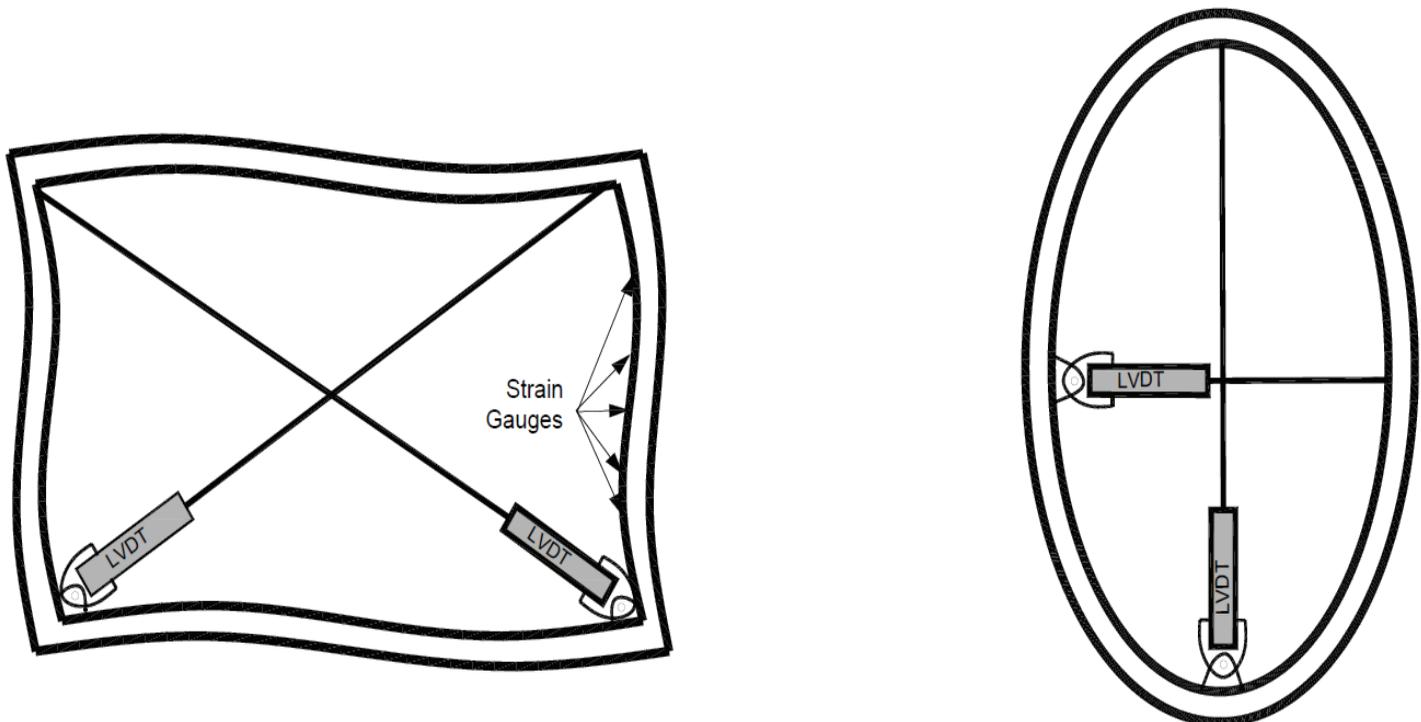


Figure 2. Structural instrumentation detail: Strain gauges will be distributed throughout inside of structure, but only a few sample positions are shown for clarity.

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