



# CAIT

Center for Advanced Infrastructure & Transportation  
Rutgers, The State University of New Jersey

NJDOT Bureau of Research  
QUARTERLY PROGRESS REPORT

Project Title:	Seismic Analysis of Retaining Walls, Buried Structures, Embankments, and Integral Abutments		
RFP NUMBER:	2000-25	NJDOT RESEARCH PROJECT MANAGER: Mr. Anthony Chmiel	
TASK ORDER NUMBER:	127 / 4-26995	PRINCIPAL INVESTIGATOR: Dr. Husam Najm	
Project Starting Date:	01/01/2003	Period Covered: 4 <sup>th</sup> Quarter 2004	
Original Project Ending Date: :	12/31/2003		
Modified Completion Date: :	12/31/2004		

Task	% of Total	% of Task this quarter	% of Task to date	% of Total Complete
1. Literature Review on Seismic Design of Abutments, Retaining Structures, Buried Structures, and Embankments	10	0.5	95	9.5
2. Provide Analysis, Design, and Detailing of Free Standing Abut and Retaining Walls	20	1	90	18
3. Provide Analysis, Design, and Detailing of Integral (Diaphragm) Abutments	20	1	90	18
4. Provide Guide Specifications Manual to assist Designers in Designing Free-Standing and Integral Abutments, Embankments, Buried Structures and Retaining Walls	30	1	90	27
5. Prepare Progress reports	10	0.5	90	9
6. Final Report and Technical Memos	10	0.5	90	9
<b>TOTAL</b>	<b>100%</b>	<b>4.5</b>	<b>90.5</b>	<b>90.5</b>

Project Objectives: 1) Perform comprehensive review of new seismic design guidelines proposed in NCHRP 12-49; 2) Provide guidelines for seismic design of seat types abutments, integral abutments, retaining walls, and buried structures; 3) Provide analysis, design, procedures of these structures with examples based on new provisions; and 4) provide specifications for the seismic design of these structures in NJ consistent with new LRFD general seismic design criteria

Project Abstract: Current LRFD provisions are based on seismic design criteria and detailing provisions that are at least 10 to 20 years old. These provisions are mostly based on the Division I-A Seismic Design of the AASHTO Standard Specifications (1996) and NEHRP (1997). NCHRP Project 12-49 was initiated to address the inadequate performance of highway bridges in recent earthquakes and the deficiencies in the current seismic code. NCHRP Project 12-49 is intended to develop comprehensive specifications for seismic design of bridges considering all aspects of the design process including: (1) design philosophy and performance criteria, (2) seismic loads and site effects, (3) analysis and modeling, (4) design requirements, and (5) detailing. These new specifications will be nationally applicable with provisions for all seismic zones. In the area of foundation design, the NCHRP 12-49 provisions are essentially an update of the existing AASHTO LRFD provisions, incorporating both current practice and recent research results including additional specific guidance on spring constants for spread footings, deep foundations, and integral abutments. Because of the several significant changes in the design criteria and approach provided in the new provisions, there are questions on how these new provisions will affect the design and performance of bridge in states nationwide as well as the retrofit of existing bridges. There are also questions on the impact of new provisions on the design of abutments and retaining walls. Hence, there was a need to evaluate the impact of the new seismic design provisions proposed in NCHRP Report 12-49 on the seismic design and detailing of bridges in New Jersey. Two examples will be designed based on the new NCHRP provisions. Soil factors will be



# CAIT

Center for Advanced Infrastructure & Transportation  
Rutgers, The State University of New Jersey

evaluated and compared to current data base of site-specific spectra, and guide specifications for seismic design of bridges and buried structures in NJ will be developed consistent with the new guidelines.

1. Progress this quarter by task: *Journal of Bridge Structures* titled " Impact of NCHRP 12-49 on Seismic Design of Bridges on Soft Soils in New Jersey", by H. Najm, H. Nassif, and H. Capers was published in October 2004. A presentation was made on October 4, 2004 in a seminar sponsored by the Bridge Engineering Association on seismic design in New York City. Work focused mainly on seismic design of retaining walls using soil continuum and response spectra. Results were compared to the Monobe-Okabe dynamic earth pressure. Also various earth embankment profiles were modeled and evaluated. Also we are working on a curved bridge design example based on both specifications to be added to the two design examples in the Appendix.

2. Proposed activities for next quarter by task: Summarize NJDOT design guidelines based on evaluation of NCHRP 12-49 and design examples. Incorporate NJDOT research bureau and bridge office comments on draft final report. Finalize final report.

3. List of deliverables provided in this quarter by task (product date): Seismic loads on retaining walls and various embankments and how they compare with MonobeOkabe approach. Draft of curved bridge example. NJDOT proposed seismic design criteria.

4. Progress on Implementation and Training Activities: Prepared a journal paper for the new journal, *Journal of Bridge Engineering* titled " Impact of NCHRP 12-49 on Seismic Design of Bridges on Soft Soils in New Jersey", by H. Najm, H. Nassif, and H. Capers. A presentation was made on October 4, 2004 in a seminar sponsored by the Bridge Engineering Association on seismic design in New York City. And a conference paper was submitted to ASCE-SEI symposium in NYC in April 2005.

5. Problems/Proposed Solutions:

Total Project Budget	\$173,017
<b>Modified Contract Amount:</b>	
Total Project Expenditure to date	\$128,457
% of Total Project Budget Expended	74%

\* These are approximate expended amounts for the project; these estimates are for reference only and should not be used for official accounting purposes. For a more accurate project accounting please review the quarterly invoice for this project.