Project Title	*Agmt./Task No.*	*Item No.*	*Agency Bgt. No.*
SPR-3(072) Strength and Deformation of Mechanically Stabilized Earth (MSE) Walls at Working Loads and Failure	**SPR-3(072)**		
Research Agency	*Start Date*	*Estimated Completion*	*Revised Completion*
Royal Military College of Canada	**12/1/99**	**04/30/04**	**12/31/10**
Principal Investigator(s)	*Technical Contact*		
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Funding Source	*Schedule Status*		
WA, NY, ID, CA, WY, ND, MN, OR, AZ, AK	☐ On schedule ☐ Ahead of schedule ☒ On revised schedule ☐ Behind schedule		
Research Area			
Geotechnical			

Original Estimated Cost	*Revised Cost*	*% Funds Expended*	*% Work Completed*
$360,104	**$690,000**	**87%**	**91%**

Objective

Develop a design procedure for the internal stability of MSE walls, especially those reinforced with geosynthetics.

Project Progress:

1. A paper was published in the journal Soils and Foundations (Japanese Geotechnical Society) that proposes a new design method for steel multi-anchor walls.

2. A paper was published in the ASCE Journal of Geotechnical and Geoenvironmental Engineering that examines the accuracy of the AASHTO Simplified Method for steel reinforced soil walls by comparing predicted loads to measured loads.

3. About 50 sets of data from pullout testing of steel strip reinforcement have been collected from Japanese sources. This will allow us to investigate the accuracy of the current FHWAS and AASHTO pullout models for these materials which have not been subjected to scrutiny for more than 30 years.

4. LRFD calibration of steel reinforced soil walls using the AASHTO Simplified Method has been completed. Papers have been submitted for peer review.

5. A paper was submitted to the journal Geotechnique that evaluates the accuracy of the BS8006 method for calculation of reinforcement loads and strains under serviceability conditions.

6. A paper was submitted to ASTM Geotechnical Testing Journal that re-evaluates the interpretation of geosynthetic in-soil pullout testing. New models for pullout of geosynthetic reinforcement and interpretation are proposed based on a statistical treatment of more than 470 test results.

7. A second paper was submitted to ASTM Geotechnical Testing Journal that describes a new test protocol for the connection creep testing of segmental retaining walls. This protocol is a necessary precursor for the statistical analysis of connection creep data collected by the PI.

8. A paper published in the Canadian Geotechnical Journal last year won the 2008 Gzowski Medal for the best paper published in civil engineering in Canada. This medal is the oldest engineering medal in Canada. This is the second time the PI has won this

award. The paper is: Bathurst, R.J., Allen, T.M. and Nowak, A.S. 2008. Calibration concepts for load and resistance factor design (LRFD) of reinforced soil walls, Canadian Geotechnical Journal Vol. 45, pp. 1377–1392. This paper sets the background for the LRFD calibration technique being used to perform LRFD calibration of steel and geosynthetic reinforced soil walls.

New Period Proposed Activity:

Begin testing of Wall 14 (Phase 5).

Continue with LRFD calibration of BS8006, AASHTO and K-stiffness Method for geosynthetic reinforced soil walls.

Continue with LRFD calibration of AASHTO and K-stiffness Method for steel reinforced soil walls and submit papers to peer-reviewed journals.

Continue with large-scale transparent soil pullout box testing.

Continue with development of numerical database that will be used to fill in data gaps for further refinement of the K-stiffness Method.

Publications recently submitted, in press or published:

Huang, B., Bathurst, R.J. and Hatami, K. 2009. Numerical study of reinforced soil segmental walls using three different constitutive soil models, ASCE Journal of Geotechnical and Geoenvironmental Engineering (in press)

Miyata, Y. and Bathurst, R.J. 2009. Measured and predicted loads in multi-anchor reinforced soil walls in Japan, Soils and Foundations, Vol. 49, No.1 1-10.

Bathurst, R.J., Nernheim, A., Miyata, Y. and Allen, T.M. 2009. Predicted loads in steel reinforced soil walls using the AASHTO Simplified Method, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Vol. 135, No. 2, 177-184.

Bathurst, R.J., Nernheim, A., Walters, D.L., Allen, T.M., Burgess, P. and Saunders, D. 2009. Influence of Reinforcement Stiffness and Compaction on the Performance of Four Geosynthetic Reinforced Soil Walls, Geosynthetics International, Vol. 16, No. 1, 43-59.

Miyata, Y. and Bathurst, R.J. 2009. Measured and predicted loads in multi-anchor reinforced soil walls in Japan, Soils and Foundations, Vol. 49, No.1, 1-10.

Bathurst, R.J., Huang, B. and Hatami, K. 2009. Numerical modeling of geosynthetic reinforced soil walls. Chapter 4 in Linear and Non Linear Numerical Analysis of Foundations, (J. Bull Editor), Taylor & Francis, New York, NY, 131-157.

Nernheim, A., Bathurst, R.J., Allen, T.M., Walters, D.L. and Nelson, R. Influence of facing batter on the performance of three geosynthetic reinforced soil walls, Canadian Geotechnical Journal (in review)

Huang, B., Bathurst, R.J., Hatami, H. and Allen. T.M. Influence of Toe Restraint on Reinforced Soil Segmental Walls, Canadian Geotechnical Journal (in review)

Huang, B. and Bathurst, R.J. Evaluation of soil-geogrid pullout models using a statistical approach, ASTM Geotechnical Testing Journal (in review)

Bathurst, R.J. and Huang, B. Evaluation of soil-geogrid pullout models using a statistical approach, ASTM Geotechnical Testing Journal (in review)

Bathurst, R.J., Huang, B., Nernheim, A., Miyata, Y. and Allen, T.M. Predicted loads and strains in geosynthetic soil walls using BS8006, Geotechnique (in review)