Dynamic Passive Pressure on Abutments and Pile Caps

PI's Profs. Rollins and Gerber

Quarterly Report Nov 2006 -Jan 2007

During this quarter, analyses of the damping data from Task 3 (passive force tests) was completed and a draft final report on the Task 4 (Pile Cap Connection) testing was written. Final editing of the draft is about 2/3 complete. Plans were also developed for an alternative reaction system involving anchors for Test 5

Damping Analysis Results

The pile cap used in the tests was 3.67 ft high, 17 feet wide, and 10 feet deep in the direction of loading. The cap was supported by 12 steel pipe piles and the upper 4 m of the soil profile consisted of stiff clay with occasional sand layers. Backfill was only placed on only one side of the cap. The backfill consisted of a dense gravel (Relative Compaction = 98%) extending from the cap for a distance of six feet and a loose silty sand (Relative Compaction = 88%) extending from six feet to 15 feet beyond the cap. This geometry was intended to simulate the compaction often required of backfill near a cap and the relatively loose natural material beyond the compacted zone.

Lateral load was applied using two hydraulic actuators with a combined capacity of 1200 kips. Load was applied incrementally to define the static load-deflection curve. In addition, at each deflection level 15 cycles of loading were applied dynamically with a frequency slightly less than 1 Hz and an amplitude of about 0.1 inch. This was about the maximum rate that could be delivered using the pump system which could supply 60 gallons per minute. The static load-deflection curve exhibited the conventional hyperbolic curve shape with the tangent stiffness decreasing with displacement. However, the dynamic stiffness at each increment tended to increase somewhat with deflection level, but, then decrease with increasing numbers of cycles.

The damping ratio was computed for each cycle of loading at each displacement level using the area of the load-deflection loop divided by the area under the static load deflection curve. A plot of the measured damping ratio as a function of deflection level and number of load cycles is provided in Figure 1. Typically, the damping ratio varied between with a relatively narrow band from 25 to 33%. The damping ratio decreased from the high to the low value as the deflection increased and as the number of cycles increased. However, the number of cycles had much more influence on the damping ratio than the deflection level.

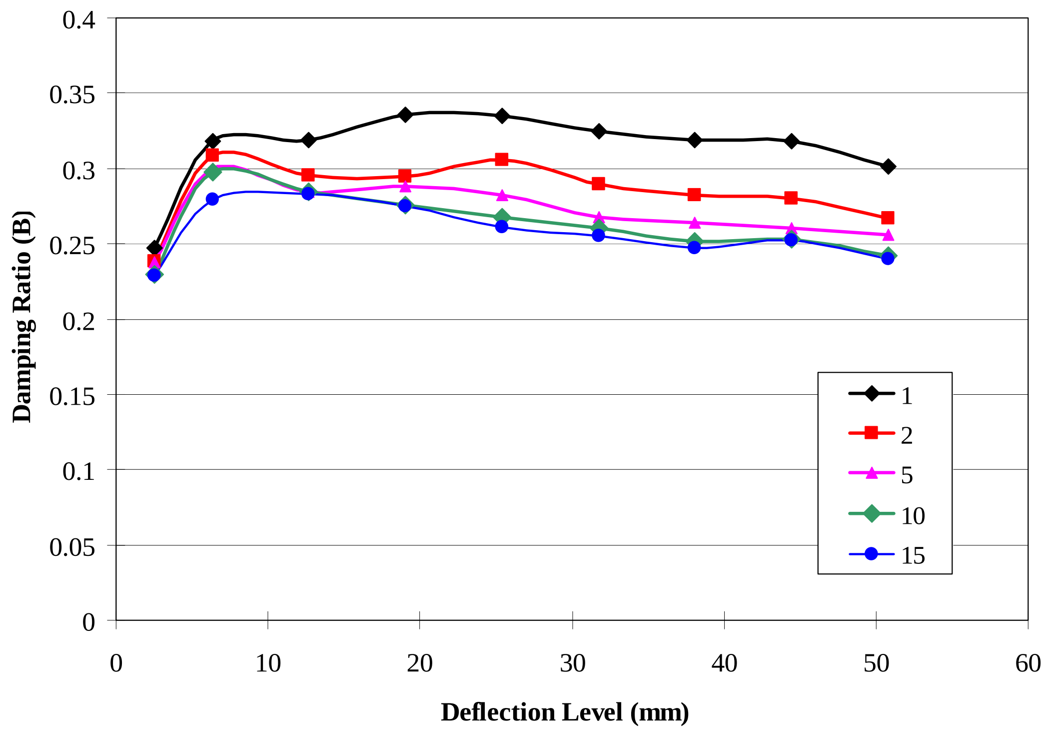

Figure 1 Damping ratio as a function of deflection level and number of load cycles for the pile cap in loose silty sand with 6 ft of dense gravel adjacent to the cap.

Plans for the Next Quarter

1. A draft final report on the Task 3 test will be prepared.

2. A final report will be completed on the pile cap connection tests associated with Task 4.

3. The reaction system necessary to conduct tests associated with Tasks 5 and 6 will be constructed over the next two quarters so that testing can proceed.

Budget Considerations

At the end of the quarter, $57,885 had been expended on work associated with Tasks 1, 2, 3 and 4. The total budget associated with the project tasks is $265,395. Therefore, approximately 22% of the budget has been spent for these tasks. We estimate that approximately 25% of the work on the project has now been completed. Therefore, the project appears to be on track from a budget standpoint.

Revised Schedule

Because of delays associated with the re-construction of the reaction system, the project schedule has been revised to the following schedule.

Task 1 From 1 Aug 2005 To 31 Feb 2006
Task 2 From 1 August 2005 to 1 April 2006
Task 3 From 1 April 2006 to 1 June 2007
Task 4 From 1 June 2006 to 1 May 2007
Task 5 From 1 May 2007 to 1 March 2008
Task 6 From 1 June 2006 to 1 April 2007
Task 7 From 1 July 2007 to December 2007