



# Materials Laboratory Strategic Directions 07-09

6/30/2009

## Geotechnical

Task	Description
1	<p>Develop strategy and implementation plan (including estimated cost, time, and FTE's required) to develop plan to include new and existing geotechnical borings statewide in a GIS database, and begin implementation.</p> <p>a. Develop strategy and implementation white paper by Dec. 2007.            b. Get funding secured and boring log GIS database creation underway by July 2008.            c. Assigned to: Steve Lowell/Lynn Moses</p> <p><b>Status:</b> A GIS specialist was hired as of Oct. 2006. A model to use for database development has been selected (FHWA nationwide geotechnical database), A working group was established in August 2008 to begin carrying out the strategy to complete the database. However, we have recently discovered that the proposed FHWA database has serious flaws and cannot be used to help us accomplish this strategic direction. At present, we are developing a white paper that explains the issues we face is getting this developed. A new strategy and funding needs are yet to be established.</p>
2	<p>Develop GIS platform useful for geotechnical purposes.</p> <p>a. Identify target uses of the GIS platform and the layers needed by June 2008            b. Complete GIS platform by Dec. 2008.            c. Assigned to: Steve Lowell/Lynn Moses</p> <p><b>Status:</b> A GIS specialist was hired as of Oct. 2006, and an assistant has also been hired who is focused on project specific implementation as the platform is developed. Geotechnical workbench (version 1.0) has been completed, and we have been working with the GeoServices GIS group to achieve final implementation. Deployment is anticipated in July 2009.</p>
3	<p>Engineering geologists to work with regions that have state owned pits and quarries to identify marginal materials and to identify new sources of better materials. Begin with NE corner of the state and aggregates for HMA as pilot project.</p> <p>a. Complete pilot project by June 2009 and develop plan to advance this effort to other parts of the state.            b. Assigned to: Steve Lowell/Lynn Moses</p> <p><b>Status:</b> Pilot project is nearing completion Final report anticipated June 2009 (final draft has been reviewed and is about to be published).</p>
4	<p>Evaluate potential use of ring nets for rock slope stabilization through experimental features project.</p> <p>a. Complete experimental features project preliminary report by June 2009.</p> <p><b>Status:</b> FHWA approvals for experimental features project and waiver of "buy America" requirements have been obtained. Project design and construction has been completed. End of project constructability report has been reviewed and will be published June 2009.</p>

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5	<p>Implement liquefaction research by the U of W and others through updating the GDM and routine use of the liquefaction computer program produced as part of research project.</p> <p>a. Install liquefaction program and train staff in its use by Dec. 2008.</p> <p>b. Assigned to: Jim Cuthbertson</p> <p><b>Status:</b> Program is in final beta testing, and some staff have used it on a trial basis. Final report has been completed by Prof. Kramer, and the report has been published. Writing of GDM provisions has been completed. The beta review is nearly complete, and the liquefaction computer program appears ready to deploy. If there are no more issues, staff training will be developed and implemented by summer '09.</p>
6	<p>Develop expertise and strategies to more accurately assess construction dewatering needs, including geotechnical characterization during design, and development of contract provisions that will provide a more accurate basis for bidding with regard to construction dewatering.</p> <p>a. Hire licensed hydrogeologist, obtain computer design program(s) (e.g., MODFLOW) plus training, develop GDM guidance, and identify and develop specification changes by Dec. 2008.</p> <p>b. Assigned to: Jim Cuthbertson/Mark Frye</p> <p><b>Status:</b> Mark Frye attended Dewatering Conference in Nov '08. Based on the conference, we concluded that generic dewatering specs are not recommended. As WSDOT does detailed dewatering design rarely, the recommendation is to hire this service through consultants and have them develop site specific specifications for jobs when needed. Funding and support for a new Hydrogeologist was put on hold in July '08 due to funding issues. This task is considered 100% complete Dec '08.</p>
7	<p>Develop strategy with the Bridge Office, and implementation plan, to include assessment of seismic foundation stability problems (primarily liquefaction) as part of Bridge Office seismic retrofit program. This effort, once put into motion, would identify specific bridges that are vulnerable to foundation stability problems, an assessment of the potential risk to the bridge and impact to the public, and an estimate of cost to address the instability so that these needs can be prioritized for programming purposes.</p> <p>a. Develop strategy and implementation white paper by June 2009.</p> <p>b. Assigned to: Jim Cuthbertson</p> <p><b>Status:</b> A conceptual level strategy has been developed to begin addressing this need. This strategy includes a first cut identification of bridges located in areas mapped as having liquefiable soils. Using GIS, a map that combines bridge locations with areas that are susceptible to liquefaction has been developed, and the overall number of bridges affected has been determined. A more detailed evaluation has been performed for bridges in specific corridors (SR-167, SR-405, SR-5, and SR-90) within currently funded Nickel and TPA projects. A more detailed statewide action strategy will be developed as part of the next highway system plan update - Program Management, with help from the Bridge and Structures Office and the Geotechnical Division, will take the lead. Executive level discussions on this issue have taken place, and a folio and PowerPoint presentation on the issue has been developed. HQ Program Management has just formed a committee to consider what needs to be done to address this issue for key corridors, and Tony Allen will participate on this committee.</p>

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8	<p>Develop investigation and implementation plan for use of geogrids in pavement base coarse reinforcement and as subgrade reinforcement for pavements.</p> <p>a. Summarize results from nationwide survey by June 2008.</p> <p>b. Review research results obtained to date by others, and in consideration of nationwide survey results, determine what is known, and what is not known that needs to be known, developing preliminary design and use policies for geogrids for this application. Do by March 2009.</p> <p>c. Identify potential test sites where this trial design policy could be tested. Due by June 2009.</p> <p>d. Assigned to: Jim Cuthbertson</p> <p><b>Status:</b> The survey has been completed, but the final report on the survey is yet to be completed due to the heavy workload that has occurred during the past year. A draft final report for a pooled fund study on this subject (WSDOT is a study partner) has just become available and is in review.</p>
9	<p>Develop more detailed chapter for the GDM on foundation design for marine structures, addressing the specific needs of WSF.</p> <p>a. Complete final draft by June 2008</p> <p>b. Assigned to: Tony Allen/Jim Cuthbertson</p> <p><b>Status:</b> A major update to the GDM was completed by the end of 2006, and another update is underway, targeted for completion in Sept. 2009. The development of new guidance on design of marine structure foundations has been part of this effort but there is still much to do to complete that particular chapter. The chapter on marine structure foundations was updated in 2006 to include special design objectives for marine structure foundations.</p>
10	<p>Continue to develop geotechnical design procedures in LRFD format for aspects of foundation and wall design that are not currently in LRFD format (soil nail walls, micropiles, noise walls, reinforced slopes, etc.), primarily through continued participation in the AASHTO Bridge Subcommittee and various NCHRP panels, and possibly other research.</p> <p>a. This will be on-going; updated pile design provisions, new soil nail wall design provisions, and wall provisions are proposed for 2008.</p> <p>b. Assigned to: Tony Allen</p> <p><b>Status:</b> WSDOT hosted the mid-year meetings of the AASHTO T-3 and T-15 technical committees in late 2007, and a web based meeting in November 2008, where new or updated design provisions were generated/prepared. Updated geotechnical seismic provisions, including liquefaction design, and some updates to Section 11 on walls were completed and approved by AASHTO in May 2008. A major update to the pile design specifications has been submitted to AASHTO for voting in July 2009. Updated seismic provisions for walls are anticipated for 2010.</p>

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11	<p>Develop long range plan to fully implement MSE wall research (K-Stiffness Method).</p> <p>a. Complete research reports and publish updated design method in well respected journals – submit journal papers supporting the use of the K-Stiffness Method for high silt content soils by November 2007</p> <p>b. Work with other states/agencies to identify potential instrumented test walls, including those with lower quality backfill materials to establish accuracy of method</p> <p>c. Complete RMC research and coordinate with NCHRP study to broaden applicability of research to lower quality backfill materials and also to seismic conditions</p> <p>d. Prepare agenda item for AASHTO to include new design method in the AASHTO LRFD specifications</p> <p>e. Assigned to: Tony Allen</p> <p><b>Status:</b> Numerous journal papers on the K-Stiffness Method have been published or are in the publication process in a number of international and domestic journals. The most recent work has been done with the assistance of a visiting scholar from Japan, in which the K-Stiffness method was shown to be valid for a series of Japanese walls, broadening the applicability and acceptance of this research. The method has now also been expanded to lower quality backfill materials through the evaluation of Japanese and other full scale wall case histories, and the K-Stiffness method now has a proposed modification to accommodate the cohesion that is usually present in lower quality backfill materials. A lower quality backfill source for use in the RMC full scale walls has been obtained and testing has begun (two full scale RMC walls have been completed and another test wall, the final wall planned for this study, is under construction), so that this adaptation of the K-Stiffness method can be refined. The final experimental features project report for the SR-18 test walls is near completion. Analysis and numerical modeling of all the data is underway, including calibration work to adapt the method for LRFD wall design.</p>