Collaborative Research on Web Dissemination of Geotechnical Data

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Introduction

Geotechnical investigations are routinely required for design and to obtain approval to construct all significant structures and buildings as well as for specific research purposes. Large quantities of data are consequently generated, much of them of interest and significant value to the broad geotechnical engineering and construction community as well as for university research. While the data are generally collected following current professional practices, consistent standards and quality practices are not generally followed. The large volumes of potentially valuable geotechnical data that have been collected over the years typically reside in the archives of local, state, and federal agencies and private sector organizations such as California Department of Transportation (Caltrans) and the transportation agencies of other states, the Federal Highway Administration (FHA), the California Geological Survey, (CGS, formerly California Division of Mines and Geology), the geological surveys of other states, the U. S. Geological Survey (USGS), federal agencies, private sector companies such as Pacific Gas and Electric (PG&E), national research-focused activities such as the National Geotechnical Experimental Sites (NGES), university-government-private sector cooperative projects such as ROSRINE (Swift et al, 2002), and the Pacific Earthquake Engineering Center (PEER) Lifelines Program. A number of efforts aimed at developing databases for archiving and web dissemination of geotechnical data are now in progress. These important efforts and the data collection absorb large resources. However, there are significant barriers to broadly accessing the data because common data format standards are lacking and optimally compatible data archiving and dissemination methods are not in place.

On October 4 and 5, 2001 the Consortium of Strong Motion Observation Systems (COSMOS) held a workshop entitled “Archiving and Web Dissemination of Geotechnical Data”, which was supported by the PEER Center Lifelines Program (COSMOS, 2002), and attended by 35 participants. The workshop was motivated by the vital need to ensure that important geotechnical data are readily available to the broad user community. The objective of the workshop was to develop consensus recommendations for classifying, archiving, and web dissemination of the various types of geotechnical data. The final product was a road map of development needs. The agenda was structured to better understand the common features and issues that have been identified by the various ongoing academic, industrial and government geotechnical database efforts and to address long-term infrastructure and funding requirements. Discussion papers were presented on life cycle development case studies of geotechnical databases, data dictionary and

data formatting standards, information architecture, data quality assessment criteria, experimental case studies and several industrial applications, in order to identify specific research and developmental needs and put forward recommendations. Following the presentations, breakout sessions were organized to address the key issues regarding archiving and web dissemination formats, develop an implementation action plan, and long-term funding support. The discussion papers together with the findings of the workshop are published in a proceedings (COSMOS, 2002). In addition to the state of practice discussion papers, the important central deliverable of the workshop was consensus recommendations that describe a clear path forward for implementing archiving and web dissemination of geotechnical data to meet user needs. The overall goal is to make geotechnical data assessable to a broad user base with a broad spectrum of needs.

Workshop Findings and Recommendations

An important finding of the COSMOS workshop based on the life cycle presentations and consensus of breakout group discussions is that the development of a virtual hub for web dissemination of geotechnical data is primarily a matter of applying existing technologies and developing and linking the organizational elements of the system. The primary needs are to: 1) characterize the functional requirements of a virtual data center, 2) define data formats, indexes, and exchange standards, and 3) describe and link the organizational components of the overall system.

A generalized overall concept of how a web-based virtual data dissemination center could be set up is illustrated in Figure 1. In this basic example data providers share as well as disseminate their data through one central, virtual system. The virtual data center hub would not house the data itself, but could house metadata and/or data indexes and translators that allow data to be accessed through the hub from various linked databases. The concept is that the data sources or providers would also be users themselves and the general user community could access data from all databases through the virtual hub.

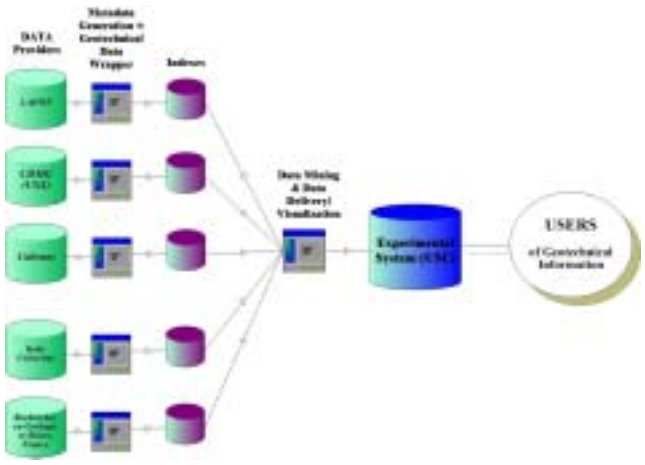

Figure 1. Schematic representation of a harvesting architecture for a web-based virtual geotechnical data center.

Proposed Future Work

As a consequence of these recommendations, a pilot project proposal is currently under consideration to design a basic system for archiving and web dissemination of geotechnical data,

and to plan and conduct a workshop to review and obtain input and consensus from the geotechnical community. Researchers from California Geological Survey (CGS), California Department of Transportation (Caltrans), the United States Geological Survey (USGS) and the Pacific Gas and Electric Company (PG&E) have agreed to participate in a pilot project, which is scheduled for completion in December 2002.

A pilot virtual geotechnical data dissemination hub will be designed by addressing the following specific technical needs: 1) definition of geotechnical data user scenarios for a pilot virtual geotechnical data center system that links the participating data providers' geotechnical databases, 2) development of a data dictionary standard for the pilot system that is expansible to a larger system that links multiple databases (Turner and Roblee, 2001), 3) integration of these results to implement the pilot system, and 4) planning and implementation of a workshop (scheduled for December 2002) structured to obtain geotechnical community consensus and deliver a workshop proceedings that will serve as an expanded implementation plan for development of a web-based system for archiving and linked dissemination of geotechnical data. Work Groups each consisting of 5 to 7 researchers from government agencies, industry and academia (CGS, Caltrans, USGS, University of Illinois National Center for Supercomputing Applications (UI NCSA), PG&E, CEC, University of California Santa Barbara (UCSB), COSMOS, University of New Hampshire (UNH), Engineering and Software Consultants Inc., Los Angeles Department of Water and Power (LAWP), University of Southern California (USC), Earthsoft Inc., Federal Highway Administration (FHA), Brigham Young University (BYU), and Rockware Inc.) are currently being organized to work on each of these tasks. The Work Groups will meet together to initiate the project and an interim project meeting will be held to share progress and plan the remaining efforts needed to complete their respective tasks. At present, both CGS and Caltrans are actively working on technical solutions for participating in the virtual hub, and the USGS and PG&E participants have just recently organized small groups of researchers to participate in this planned pilot project.

On a much larger scale than this pilot, CGS is currently developing an extensive GIS mapping web site for data dissemination and interactive mapping of liquefaction and landslide hazards (Vaughan et al., 2002). The contribution of CGS geotechnical data to the pilot project is one small part of the CGS "WebMap" project currently underway (Real and McGuire, 2001). The CGS WebMap is aimed at facilitating public access to Seismic Hazards Mapping data and meeting the demand for GIS data that can be integrated with commercial desktop GIS packages. Internally, the CGS WebMap will provide a cost effective means for distribution of their data, as well as real time release of zone maps, which is mandated by the Seismic Hazards Mapping act of 1990. CGS views the result as highly economic in terms of saving time and resources, and also meets their regulatory obligations (the law states that copies of official (paper) maps be submitted to affected cities, counties and state agencies having jurisdiction over lands containing and area of seismic hazard). The CGS web site is scheduled for release in 2002. The pilot virtual geotechnical data hub will be designed to directly query and disseminate CGS geotechnical data through the final configuration of their data via the pilot hub according to whatever policies CGS develops. Details and lessons learned during the CGS WebMap project are beyond the scope of this paper, and will be presented at the DGO 2002 conference.

Caltrans researchers are presently working on several applications aimed at automated processing and delivery of geotechnical data over the Internet (Grimes and Turner, 2002). The goal of the Caltrans data dissemination project is to allow users easy access to geotechnical data from previously tested locations, such as bridges. The files consist of detailed information about test locations and contain hundreds or thousands of numerical entries such as depth, resistance, angles, etc. The system being created at Caltrans will be coordinated with the development of the pilot virtual geotechnical hub. Thus the hub will also be able to query and disseminate Caltrans geotechnical data through the hub interface, directly subject to any rules and regulations imposed by Caltrans. Similar efforts and coordination at the USGS and PG&E are being discussed at this time.

Over the long-term, the main objective of this project is to extend the pilot system and develop a web-based system linking multiple databases of other government agencies, universities and private companies, capable of serving the broad needs of practicing geotechnical and earthquake hazards professionals for efficient access to geotechnical data (e.g. Figure 1).

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