Evening Talk on "The 1400MW Coal Fired Power Plant Project, Jimah, Negeri Sembilan – Reclamation and Pile Testing"

By: Geotechnical Technical Engineering Division Committee

This talk was given by Engr. Sridhar Krishnan, Engr. Lee Sieng Kai and Engr. Teh Kim Ong at The Institution of Engineers, Malaysia on 3 August, 2007. It focused on three key geotechnical aspects of the 1,400MW Coal-fired Power Plant Project at Jimah, Negeri Sembilan: the reclamation and soil improvement works; the use of the Global Strain Extensometer (GloStrExt) Method for the instrumentation of driven prestressed spun concrete and bored cast-in-place piles; and the application of High Strain Dynamic Pile Testing (HSDPT) Method to jointed prestressed spun concrete piles.

THE PROJECT

Engr. Sridhar Krishnan opened his talk with a brief overview of the 1,400MW Coal-fired Power Plant Project at Jimah, Negeri Sembilan. He explained that Jimah Energy Ventures Sdn Bhd, an Independent Power Producer (IPP), had entered into a 25-year Power Purchase Agreement (PPA) with Tenaga Nasional Berhad (TNB) on 10 August, 2004, to develop finance, design, build, operate and maintain the power plant. The first of two 700MW units will begin commercial operation in January 2009; the second unit becomes operational six months later. The overall estimated construction cost is RM 6.1 billion. Construction of the plant began on 1 January, 2005; when completed, it will be the fourth coal-fired power plant in Malaysia after the 1,600MW Kapar (Port Klang, Selangor), the 2,100MW TNB Janamanjung (Manjung, Perak) and the 2,100MW Tanjung Bin (Tanjung Bin, Johor) Power Plants.

RECLAMATION AND SOIL IMPROVEMENT WORKS

After giving a brief overview of the Project, Engr. Krishnan proceeded to describe the reclamation and soil improvement works. He detailed all aspects - theoretical, practical and contractual - of the works. A highlight of his talk was on the significant problem of delayed water drainage observed with hydraulically-placed large-scale marine sand reclamation fills - this delay has a major adverse impact on the consolidation process of underlying soft clays. Engr. Krishnan explained that to counter the above phenomenon, extensive dewatering works were carried out as part of the soil improvement works.

Those who wish to know more about the reclamation and soil improvement works on this Project are referred to the paper titled "Performance of PVD and Surcharging in Reclamation Works for a Power Plant in Negeri Sembilan, Malaysia," published in the March 2008 issue of the Geotechnical Engineering Journal of the Southeast Asian Geotechnical Society.

IMPROVED GLOSTREXT METHOD

In the second part of the talk, Engr. Lee Sieng Kai presented the performance of various instrumentation schemes that were specifically designed for the pre-production testing of driven prestressed concrete piles and bored cast-in-place piles. The testing programme covered the entire gamut of static load tests, from static axial compression, to static axial tension, to static lateral load tests.

Engr. Lee noted that a highlight of the pre-production pile testing programme was the pioneering use of the Improved Global Strain Extensometer (GloStrExt) Method, a deformation monitoring system that uses advanced pneumatically anchored extensometers and a novel analytical technique to monitor loads and displacements down the shaft and at the toe of driven prestressed concrete piles. Engr. Lee then led the audience through the results of the testing programme. The results clearly demonstrated the ability of the Improved GloStrExt Method to yield accurate, consistent and reproducible measurements of shortening/elongation and strain throughout the testing process.

Detailed results of the testing programme can be obtained from the paper titled "A Novel Approach to the Performance Evaluation of Driven Prestressed Spun Concrete Piles and Bored Cast-In-Place Piles," published in the Proceedings of the 10th International Conference on Piling and Deep Foundations (Amsterdam, The Netherlands: 2006)

HIGH STRAIN DYNAMIC PILE TESTING

In the third and final part of the talk, Engr. Teh Kim Ong outlined the stepwise approach used in the development of a set of practical driving and final set criteria for production prestressed concrete piles. He explained that in the first step of the approach, wave equation analyses were performed using the GRLWEAP Program to select suitable pile driving equipment, assess pile drivability and driving stresses, and develop a set of preliminary driving and final set criteria for the various sizes of prestressed concrete piles. Keeping the results of the wave equation analyses in view, a high strain dynamic pile testing programme that included pile driving monitoring and dynamic load testing at end-of-drive and re-strike was planned and implemented.

Engr. Teh then proceeded to discuss the details of the pre-production pile testing programme. He explained that what started as a one-time testing effort had to be extended to three phases due to significant structural integrity problems with the larger 600mm-diameter piles at the end of the second phase of testing, three of five 600mm-diameter piles showed severe integrity anomalies during installation, this despite careful and extensive monitoring. An extensive set of trials was then planned and implemented to investigate the various possible causes for the integrity problems – the possible causes investigated included adverse subsoil conditions, improper pile driving methods, adverse side-effects of bitumen slip coating and pre-boring, and

inadequacies in the structural design of piles and pile joints. Finally, modifications to the standard pile joint details were found to improve the integrity of the piles during installation and were therefore adopted for the production piles.

Engr. Teh ended his talk by presenting the set of driving criteria that was finally formulated along with the special notes that drew attention to the effects of temporary pauses and excessive impact force during soft driving. Details of results of the high strain dynamic pile testing programme are available in the paper titled "High Strain Dynamic Testing of Jointed Prestressed Spun Concrete Piles for the 1400MW Coal Fired Power Plant Project in Negeri Sembilan, Malaysia," published in the Proceedings of the 16th Southeast Asian Geotechnical Conference (Kuala Lumpur, Malaysia: 2007).

A brief but lively question-and-answer session concluded the evening talk. It is noteworthy that although the three speakers covered broad, wide-ranging and diverse topics, there was a common thread that ran throughout – all uniformly emphasized the overarching importance of a committed and cooperative relationship among the project owner, design/builder, specialist subcontractors and suppliers as key to the Project's success in effectively anticipating and preemptively dealing with potential pitfalls and problems.

About 100 people attended the talk and they showed their appreciation to the speakers in loud applause. ■

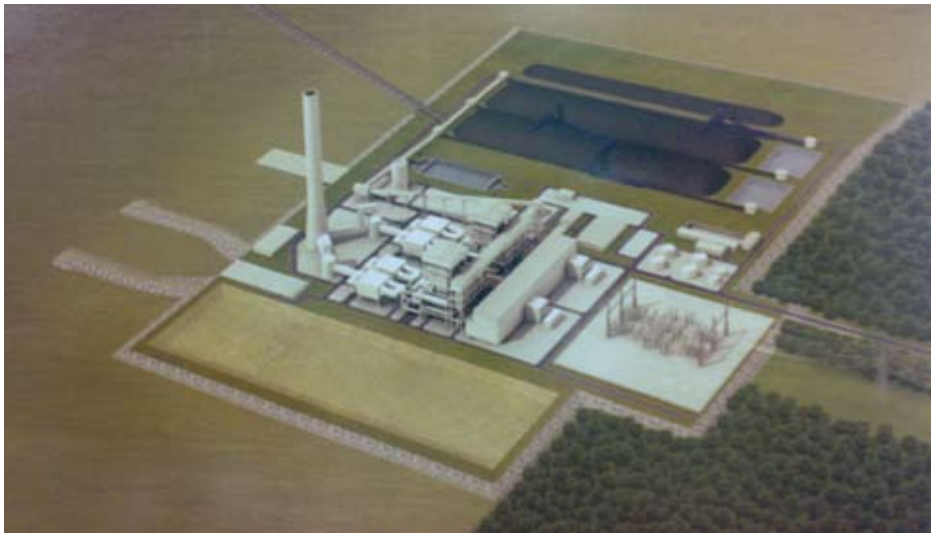

Figure 2: ERM model