ASCE INDIA SECTION

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ASCE's *Civil Engineering* magazine reaches out to more than 144,000 civil engineers across the world

Members are encouraged to contribute features/ articles/ brief technical notes on Indian civil engineering projects to share the experience of challenges, uniqueness, and importance to promote the profession of civil engineering

If you wish to showcase a civil engineering project that you are involved in or know about, you may like to get in touch with Ms. Laurie Shuster, Managing Editor, CE Magazine, at lshuster@asce.org with your feature proposal

1.1 Technical Lecture on Concrete Pavement Design, 9th August, 2012, ASCE-IS SR

Prof. Lev Khazanovich, Department of Civil Engineering, University of Minnesota, Minneapolis gave a lecture on **Mechanistic-Empirical Design of Concrete Pavements: Past, Present, and Future** on Thursday, 9th August, 2012 at 11:00 am in the Department of Civil Engineering, Indian Institute of Science, Bangalore. The extract of the lecture is as follows and is relevant to Indian conditions in the context of code making for highways suiting Indian conditions.

The overall objective of developing the mechanistic Empirical pavement Design Guide (MEPDG) was to provide the highway community with validated, state-of-the -practice technologies, for the design of new and rehabilitated pavement structures, based on mechanistic-empirical principles. MEPDG was not envisioned as the final solution for all the pavement design problems, but rather an important milestone in the continuous improvement of the pavement design methodology. The Project 01-37A chosen in this regard aimed to provide an equitable design basis for both rigid and flexible designs in terms of traffic, subgrade, reliability, and climate. The immediate challenges faced by the project were the recalibration of models from ESALs for traffic characterization to axle spectra and the characterization of the subgrade in order to adequately model the real soil behaviour. One of the main challenges faced by the project for both the flexible and rigid designs was the integration of the Enhanced Integrated Climate Model (EICM) into the cumulative damage calculations. The need for computational efficiency in the structural response modelling was also emphasized, for the effective calibration of the design models using available pavement data. During the course of the development of the MEPDG, a few unexpected challenges were encountered, the first of which required the reconsideration of Westergaard's assumptions to account for the observed top-down fatigue cracking. Another impediment faced by the researchers in an attempt to incorporate the concepts of reliability, was the merging of the Monte Carlo simulation with the damage accumulation procedure. As this proved to be computationally demanding for flexible pavements, the current version of the MEPDG does not account for the effect of design input variability on the design reliability. Great care was taken to improve the user interface that significantly contributed to the wide adoption of the MEPDG upon its public release. The study also highlights that further studies are required to address specific

deficiencies in the MEPDG such as the incorporation of longitudinal cracking, built-in curling characterization, slab-base interaction and an increased focus in the direction of rehabilitation design procedures. As the MEPDG is very flexible, it has been proposed by the developers as a platform for future developments that can be continuously refined through continuing research. Similar efforts are required in India by Indian Roads Congress and other agencies involved in road construction in India.

1.2 Lecture on Monopile Foundations, 9th August, 2012, ASCE-IS SR

Dr Gopal Madabhushi, Reader in Geotechnical Engineering, University of Cambridge, Cambridge U.K. presented a lecture on "Monopile foundations for Offshore Wind farms" On Thursday, 9th August, 2012 at 5:00 pm in the Department of Civil Engineering Indian Institute of Science, Bangalore. Dr. Gopal explained in details the need for the study, and the studies that are being conducted by his group in this direction.

The need for renewable energy sources in the world today lead to the increased attention and popularity for “Offshore wind farms”. Offshore wind farms often contain hundreds of turbines supported at heights of 30m to 50m. In Europe, the first offshore wind facilities were installed in the early 1990s where there was limited land available for onshore wind energy production. Later they moved to wind turbines offshore to take the advantage of higher wind speeds, smoother and less turbulent airflows, larger amounts of open space, and cost-effective turbines. Now, more than 15 offshore European wind facilities with turbine ratings of 450 kW to 4 MW exist offshore in very shallow water depths of 5 to 15 m. The development and operation of offshore wind facilities are followed and wind sensors are provided to detect the direction of maximum wind speed and thereby collect maximum amount of energy. Different types of foundations are,

Monopile Foundations **-** This is a simple design in which the wind tower, made of steel pipe is supported by the monopile either directly or through a transition piece. Compared to the gravity base foundation, the monopile has minimal and localized environmental impact. The monopile is the most commonly used foundation for offshore wind turbines in shallow water depths, as they are flexible in design.

Torpid Foundation **-** The tower is pinned by three-legged or four-legged steel jackets to small diameter steel piles or caissons. This foundation is suitable for deep water and has great scope for future development.

Gravity Based Caisson Foundations **-** The principle of gravity based foundation is an in-place mass sitting on top of the soil to prevent the monopile from moving. To lower the in-place mass, it is common to apply suction force between the soil and the gravity base foundation side skirts, resulting in less material used.

From the comparison of the three types of foundations, it was found that the monopile foundation has the longest lifetime, but the torpid and gravity based foundations have more lateral strength. The main disadvantage of the monopile foundation is that it requires more time and cost to construct and position them and that it can be used only for shallow water depths up to 30 m. Understanding this long term behaviour of monopiles is one of the main objectives of current research at Cambridge. The preferred foundations for these tall structures are large diameter monopiles due to their ease of construction in shallow to medium water depths. These monopiles are subjected to large cyclic, lateral and moment loads in addition to axial loads. These foundations will experience millions of cycles of loading during their design life.

In UK, monopiles were used to pass through shallow layers of soft, poorly consolidated marine clays before entering into a stiffer clay/sand strata. One of the biggest concerns with the design of monopiles is their **long term behaviour** under very large numbers of cycles of lateral and moment loads. The current design methods rely heavily on stiffness degradation curves for clays available in the literature that were primarily derived for earthquake loading on relatively small diameter piles with relatively small numbers of cycles of loading. Extrapolation of this stiffness deterioration to large diameter piles with large numbers of cycles of loading represents the key risk factor in assessing the performance of offshore wind turbines. Thus there is a need for more experimental, analytical and numerical investigations on these types of foundations subjected to cyclic loading.

1.2 Lecture on Monopile Foundations, 9th August, 2012, ASCE-IS SR

While the growth of application of geosyntehtics is quite rapid in the last decade, there are still issues and challenges at various steps of this technological implementation starting from design, product manufacturing, quality of execution to quality issues at the site. Geoinfra 2012 was organized by Osmania University College of Engineering, Hyderabad, along with Sai Master Geoenvironmental Services (SAGES) Pvt Ltd., in association with IGS India Chapter and ASCE India Southern Region, with an aim to bring in all the stakeholders – product manufacturers, end users, policy makers and technology providers – on to one platform to discuss those issues and challenges, in promoting this technology which is touted as robust and economical.

The former Director General (Roads) Sri A V Sinha graced the occasion as Chief Guest in the inaugural session attended by more than 200 participants in Osmania University Civil Engineering Department, which was presided over by the Vice-Chancellor Sri S Satyanarayana. The Organising committee chairman Dr GVSS Raju, Chief Engineer (R&B), Government of Andhra Pradesh and Technical Committee Chairman and pioneer of Geosynthetics applications in India Dr G V Rao who spoke on the occasion and voiced the dire need for organizing this conference. A book, edited by Dr G V Rao and Dr G V S S Raju, titled "**Advances in Geosynthetics**" was released on this occasion.

The two-day conference was divided in to 6 sector-oriented sessions, viz., Highways, Railways, Water Resources, Environment, Quality Assurance and Natural Fibres. In each of these sectors, eminent speakers gave key note presentations. Er. MurariRatnam, Director, CSMRS;Er M Venkatraman, Er Mohan Tewari, Managing Director, IRCON;Er Hitesh Khanna, Director , IRCON, ErRizvi/Ojhafrom RDSO Lucknow; Prof GLSivakumar Babu, IISc, Bangalore; Prof K Rajagopal, IIT Madras; Sri AC Gupta, CBIP, New Delhi; Dr Ashok Desai, BTRA, Sri Jaswant Kumar, NHAI made presentations pertaining to various sectors. The representatives from various manufacturing organisations, ErMangesh from Reinforced Earth Co. India, Sri AshishGharpurefrom Maccaferri, Mr Shahrokh Bagli from Strata Geosystems, ErPradipDutta, TechFab India, Sri PL Bongirwar,Advisor, L&T, ErI.S.N.Raju, egis India,Sri SatishNaik, BestGeotechniques, Mumbai, Dr. Jimmy Thomas, Kochi,ErP.T.Raju, Geosol Associates, Hyderabad, Sri Pradeep Choudhury, National Jute Board, Kolkata, presented their views and case studies bringing out various issues in execution leading to lively interactions from the participants. Dr MVS Sreedhar, one of the conveners of the conference, compered the whole two –day conference and also presented his work on Geosynthetics. More than 175delegates attended this two-day conference from various organisations like Dept of Roads and Buildings, Government of A.P., Indian Railways, NHAI, NTPC and few executing agencies, like MVR Projects, KVR Projects and Consulting organizations like egis India and JCE Engineering.

Chief Guest of Inaugural function, Er. A V Sinha addressing he gathering

A panel discussion with eminent personalities was held as a concluding technical session prior to the valedictory. Dr AshoK Desai graced the valedictory function, where in the sponsors of the event were given a plaque. During the valedictory, Dr GVSS Raju, Chief Engineer (R&B), honored Dr GV Rao hailing him as 'Father of Geosynthetics in India'. The two-day conference ended with a road-map with milestones which will be pursued through various organisations like IGS India Chapter and CBIP. This event was sponsored by various organisations, viz., Tencate India, Maccaferri India, Techfab Industries, Garware Wall-Ropes, Archana Structural Engineering, Strata Geosystems, Geosol Associates, M Venkata Rao Infra Projects, JCE Engineering and Management Services, Reinforced Earth India, KVR Constructions and National Jute Board.