Controlled Modulus Columns (CMCs) are vertical semi-rigid inclusions designed to obtain a composite material (soil + inclusions) with controlled stiffness and they represent one of the best ground improvement technologies to date in terms of speed of construction, quality-control, reliability, range of applications and cost. Read more on page 2.

Below is a large diameter piling being done near Dulles International Airport, Washington DC in USA. The pile diameter is 84 inches (2100mm). The piles are for an infrastructure project for Metro line. Single pile is used for a pier. The depth is about 10m.
Controlled Modulus Columns

Controlled Modulus Columns, CMCs, are vertical semi-rigid inclusions designed to obtain a composite material (soil + inclusions) with controlled stiffness and they represent one of the best ground improvement technologies to date in terms of speed of construction, quality-control, reliability, range of applications and cost. CMC was developed first in France (1994) by Menard Company working as Design & Built soil improvement contractors. The technique was developed to meet technical, financial and quality requirements of a constantly more demanding ground improvement market.

CMC columns are made of low-strength cement grout injected under low pressure through a hollow stem equipped with an auger unit which causes lateral soil displacement and hence, minimum spoil obtained during installation. CMCs are installed without surface vibration. The construction method does not involve water jetting or the use of compressed air. Hence, CMCs are most suitable for environmentally sensitive applications as in the case of highly urbanised areas.

Over the last 20 years the technique found wide application for foundations of various infrastructure facilities like Tank, airport aprons, small height industrial & commercial buildings, Embankments, MSE walls, wind mills etc.

Contributed by: Sandeep Sahu, (Country Manager), MENARD India, F7/11, Wave First Silver tower, D-6, Sector 18, Noida – 201301, Email:sandeep.sahu@menard-asia.com

Large Diameter Bored Piles

Large diameter piling being done near Dulles International Airport, Washington DC in USA. The pile diameter is 84 inches (2100mm). The piles are for an infrastructure project for Metro line. Single pile is used for a pier. The depth is about 10m. This picture is the cross hole sonic logging being done on set concrete.

Courtesy: Mr. Mohan Ramanathan, ACT, Chennai
DFI of India Monthly Meetings: I am happy to report that DFI of India is now widely known in the geotechnical professional circles across India. The Executive Committee Members (EC Members) of DFI of India are located in different parts of the country and they are helping to improve the outreach. For the convenience of all EC Members, monthly meetings are being held on “Go To Meeting” platform, taking advantage of Internet. DFI of India also organised one physical EC Meeting in September 2015, at IISC Bangalore to coincide with the DFI-India 2015 Conference. DFI of India provided travel and accommodation to the EC Members. We could not conduct EC Meetings in November and December due to unexpected heavy rains and floods in Chennai region that caused major disruption to general life and to communication network.

Weekly Conference Calls with DFI HQ: Weekly conference calls are being held between DFI and DFI of India, to plan and execute events successfully and to discuss other DFI of India business/plans. Thanks to DFI HQ for meticulously planning and coordinating these weekly conference calls- they are of immense help in not only planning the events but also in keeping up the tempo.

DFI of India Quarterly Workshops: DFI of India has been able to step up its activity in the year 2015. We have been able to organize all the four workshops, as planned, in this year. The first quarter workshop at Bhubaneswar in the East, the second quarter workshop at Surathkal in the South-West, the third quarter workshop in Bangalore in South of India and the fourth quarter workshop in Baroda (Vadodara) in the North-West part of India. On behalf of DFI of India I thank Er. Laxmikant Tripathy, Dr.V. Balakumar, Prof. GL Sivakumar Babu, Dr. P. Raghuviree Rao, Mr. Ravi Kiran Vaidya, Mr.J.V.Anirudhan, Dr. S. Basarkar and several others for their sincere efforts and enthusiasm which made every workshop very successful.

DFI-India 2015 Conference: A two-day conference on “Deep Foundation Technologies for Infrastructure Development in India was successfully organized by DFI of India, in association with Indian Institute of Science (IISc) Bangalore, Indian Geotechnical Society (IGS) Bengaluru Chapter during September 29-30,2015 at IISc Bangalore. A one-day pre-conference workshop on Piled-Raft Foundation Systems was also held at the same venue on September 28, 2015.

DFI of India Quarterly Magazine: One of the highlights of DFI of India 2015 activities is the launching of DFI of India Quarterly magazine. Thanks to the great efforts of Mr.I.V.Anirudhan, Dr. S. Basarkar, Mr. Y. Harikrishna and Mr. Ravikiran Vaidya - the editorial team steered by Mr. Anirudhan. We have introduced a novel practice of one EC Member at a time, writing an article in place of the usual article, “From the Chairman's Desk”. This is to give opportunity to each EC Member to express his views, his dreams and his plans of how to take the DFI of India forward so that it scales new heights with every passing year. We have also introduced a practice of requesting each of our veterans from the Indian Geotechnical Profession to write an article with a view to take the benefit of their invaluable experience and wisdom. The feedback we are getting is that the magazine is improving in quality and content. Our main aim is to somehow inculcate, among our Indian Geotechnical field professionals, the habit of documenting and reporting the interesting aspects of every project of geotechnical importance. I am sure this would benefit the magazine as well as the profession at large.

Operator Training: Imparting training to the foundation equipment operators and other frontline staff was identified by DFI of India as one of the top priority activities to improve safety, quality, and productivity of foundation construction works. Mr. Mohan Ramanathan, EC Member is requested to coordinate this important activity because of his knowledge of the Indian Construction Industry, his international exposure and his resourcefulness. He attended the DFI Annual Conference in Oakland Calif in October 2015. Going by the experience of the previous two years this important initiative undoubtedly needs a lot of concerted and sustained effort. We do hope the construction industry in India understands the need for skills in foundation construction and supports the efforts of Mr. Mohan Ramanathan and Ms. Mary Ellen Large, DFI Technical Activities Manager, to get this initiative off the ground in 2016.

Technology Implementation: New technologies implementation is a key initiative of DFI of India. Continuous Flight Auger Pile (CFA) has been identified as the first technology of potential application in India. Mr. Jeyson Samuel, EC Member is requested to coordinate this initiative. He got Mr. Aravind Shrivastava, Chief Engineer and Head of Designs in Nuclear Power Corporation of India interested in this technology. Recently Mr. Shrivastava informed me that we could use one of his project sites, Hissar in Haryana for the trials. Efforts are on to take this forward in 2016.
Forthcoming Events

One Day National workshop on
Deep Foundation Technologies for Infrastructure Development of Andhra Pradesh 12 March 2016

DFI of India in association with IGS Guntur Chapter and Department of Civil Engineering, University College of Engg. & Tech., Acharya Nagarjuna University, Guntur is organizing a one day national workshop on Deep Foundation Technologies for Infrastructure Development of Andhra Pradesh. The workshop will be held at Deichman Hall, Acharya Nagarjuna University, Nagarjuna Nagar, Guntur - 522510, A.P. India on 12th March 2016.

Government of Andhra Pradesh is building Amaravati, the new capital city as a world class city, on the banks of river Krishna. Capital Region Development Authority (CRDA) is the nodal center for realizing the dream of the people and the vision of their leaders. Vijayawada and Guntur, the twin cities, will also become part of the capital region. When completed Amaravati will be an ideal blend of heritage and modernity. Several infrastructure projects are being planned for the capital region and also for several other parts of Andhra Pradesh. It is going to be the most happening place for at least the next 50 years and these projects need sound technologies that ensure economy, quality, safety, environmental sustainability and speed of construction. Latest foundation technologies meet all these goals. Geotechnical Engineers will have enormous opportunities to use their knowledge, experience and the latest technologies. The main objective of this workshop is to introduce latest foundation technologies to those involved in planning, design and execution of these projects. Major cities in India embraced new technologies to help the execution of infrastructure projects in a more efficient and economical way. These technologies, by being energy efficient, bring in several green benefits. This workshop is intended to reach out to the owners and planners of projects, designers, practicing engineers and students, particularly from Andhra Pradesh, and to present the latest foundation technologies along with case studies.

CONTACT: Dr. T.V.S. Varalakshmi, Workshop Organising Secretary, Asst. Professor, Dept. of Civil Engineering, University College of Engineering & Technology, Acharya Nagarjuna University, Nagarjuna Nagar-5222510, Guntur Dt., A.P., India, Mobile Phone +91-9703504939
Prof. M. Rama Rao, Hon. Secy., IGS, Guntur Chapter, Mobile Phone +91-9490847570, Email: ramarao.muvvala@gmail.com
Mr. T. Satya Murthy, Managing Director, Singa Engineering, Hyderabad Mobile Phone +91-9440258787, Email: singaengineering@yahoo.com.sg

DFI-India 2016: 6th Conference on Deep Foundations Technologies for Infrastructure Development in India

September 9-10, 2016 • IIEST Shibpur • Kolkata, India

Event Description

Deep Foundations Institute of India (DFI of India), in collaboration with the Indian Institute of Engineering Science and Technology, Shibpur Jadavpur University, Kolkata and Indian Geotechnical Society, Kolkata Chapter, will host DFI-India 2016: 6th Conference on Deep Foundations Technologies for Infrastructure Development in India on September 9-10, 2016 at the IIEST Shibpur, Kolkata, India. This two-day conference follows previous successful DFI of India annual conferences since 2011 and will focus on technology developments and case histories on the following topics:

1. Drilled Piling Systems (viz., bored piles-land and marine, drilled displacement piles, continuous flight auger piles, micro piles)
2. Driven Piling Systems (driven cast-in-situ piles, precast piles, marine piles)
3. Ground Improvement (mass stabilization, deep soil mixing, jet grouting, densification, grouting technologies, reinforcement, liquefaction mitigation)
4. Deep Excavation Systems (slurry/diaphragm walls, sheet piles, earth retention, contiguous and secant pile walls, soil nailing, soil and rock anchors)
5. Soft Soil Engineering in Underground Space Applications (tunnel support, ground water control, etc.)

Papers of practical importance showcasing latest technologies in the areas of geotechnical investigation, analysis and design including seismic aspects, computer software, tele-networking, instrumentation, testing, monitoring, tremie concreting, geo-materials, installation/construction equipment and methods, with supporting data on improvement of quality, productivity, safety and sustainability will be presented. The conference will be of particular interest to contractors, developers, local and government representatives, designers, consultants and educators involved in geotechnical design and construction. Equipment, material and instrumentation suppliers, contractors and other vendors will present their products and services in the Exhibit Hall. The conference will be preceded by a one-day workshop on September 8, 2016 on Soft Soil Engineering in Underground Space Utilization, including topics related to ground improvement, consolidation, preparation of soft soils for tunneling and other underground applications. Updated details on the event as plans evolve can be found at www.dfi-india2016.org.
Retaining Structure for Berth at Krishnapatnam

Extracts from the presentation by Dr Ir Chandramohan P.V., Navayuga Engineering Company Ltd, at DFI India 2015 at IISc Bangalore

T Panels of the retaining section

Initial cross section of the berthing system

Cross section of berth

Trenching tool

This page is allotted for a nominal fee of Rs 10,000/- per issue for the profile of a reputed company involved in the deep foundation industry to showcase its capability in the field. Please contact DFI of India at dfiindiaoffice@gmail.com for supporting us. This is more than an advertisement since it carries your mission statement.
Retaining Structure for Berth at Krishnapatnam

1. Reinforcement lowering into the trench
2. Concreting
3. Extraction of stop-end frame
4. Waterbar
5. Exposed T panel

This page is allotted for a nominal fee of Rs 10,000/- per issue for the profile of a reputed company involved in the deep foundation industry to showcase its capability in the field. Please contact DFI of India at dfiindiaoffice@gmail.com for supporting us. This is more than an advertisement since it carries your mission statement.
Soil Improvement Technologies in the Case of Liquefaction

Extracts from the presentation by Prof. Dr.-Ing. Rolf Katzenbach, Director of the Institute and Laboratory of Geotechnics - TU Darmstadt, at DFI India 2015 at IISc Bangalore

Deep compaction

- compaction of granular soil material
- reduction of permeability
- prevention from liquefaction
- increasing of the stiffness and the shear strength (at cohesive soil material in combination with gravel)

Stability assessment of slope systems

Is a slope sensitive against liquefaction?

- no
- yes

Groundwater station

Stress calculation

Core drillings, lab tests

Soil mechanics

Water pressure (such as of old mining)

Quantity of the effects (loads) E

Initial

Fluid mechanics

Quantity of the resistance R

Dump is unstable steady state

Unstable equilibrium (gR = E)

not stable

Design/dimensioning/execution of soil improvement measures

Deep compaction - methods using riding vibrators

- slim steel elements, vibrated into the soil using riding vibrators
- method is also known as Müller Resonant Compaction Method (MRC-Method)

- only granular, non-cohesive soil material
- depth ≤ 15 m below surface
Technical articles / presentations of relevance are invited from the readers. Please prepare the document in MS word format along with good quality figures and pictures.

**Soil Improvement Technologies in the Case of Liquefaction**

**Deep compacton - vibro compaction**
- vibrator sinks into the soil due to dead load and vibration
- settlements at the surface
- additional granular material necessary

- only granular, non-cohesive soil material
- depth ≤ 60 m below surface

**Deep compacton - vibro replacement compaction**
- vibrator sinks into the soil due to dead load and vibration
- additional granular material necessary

- soil material with fine grain sizes
- depth ≤ 26 m below surface

**Deep compacton - falling weight (dynamic intensiv compaction)**
- Falling weight ≤ 40 t, falling height 10 m – 40 m
- stabilisation layer with d > 1 m for compaction works necessary

- granular soil material with silt mass < 15%
- compaction depth: 8 m - 10 m
Auger Cast-in-Place Drilled Displacement (ACIPDD) Pile

Auger cast-in-place (ACIP) piles and drilled displacement piles are being increasingly used as foundation elements for structures. Depending on the specific rotary piling technology used, responses ranging from those associated with non-displacement to those associated with full-displacement piles are obtained. Modifications in the installation of ACIP piles have led to the development of displacement piles that produce larger lateral soil displacements than ACIP piles.

The soil displacement produced during the installation of these piles can vary from that of a partial- to a full-displacement pile. The soil displacement is enhanced by using modified drilling tools that laterally displace the soil and also by providing additional vertical thrust during the augering process. This technology is available due to a remarkable development in piling rig hydraulics in recent years that has produced rigs with torque capacity ranging from 150 to 500 kNm.
Photo Feature

Auger Cast-in-Place Drilled Displacement (ACIPDD) Pile

Real-time Digital Readout Box

Calibration of Grout Pump
Checking the Flow
Placing Plug

Soil Drilling
Pressure Grouting on the Way Up
Installing Temporary Top Form

Technical photo feature of relevance are invited from the readers. The feature shall preferably illustrate a modern technology or testing procedure. Please prepare the feature with six to eight good quality pictures with brief and crisp description.
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Please prepare the feature with six to eight good quality pictures with brief and crisp description.
Auger Cast-in-Place Drilled Displacement (ACIPDD) Pile

**Final Product**

**Remedial Action Required**

**APGD PILE PRODUCTION SUMMARY**

<table>
<thead>
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<th>DATE</th>
<th>NO. OF PILES INSTALLED</th>
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Many publications of DFI are available from OneMine.org, a web-based document library containing over 100,000 articles, technical papers and books from organizations all over the world. DFI Members can access OneMine at no additional cost, while non-members can purchase and download documents for $25 per download.
Gujarat is a leader in business activity in the country. With increased emphasis on better infrastructure and permissions likely to be granted for taller structures, it is expected that the pile foundation industry will grow in size during the next few years. With this focus and to create awareness about the right practices for pile and piled raft foundations, Indian Geotechnical Society – Baroda Chapter & Deep Foundation Institute of India organized a day National Seminar on Recent Trends in Pile and Piled raft Foundation, on Friday, 4th December, 2015.

The seminar was on a very focused theme and covered most of the aspects of pile foundations from design, construction, testing and use of latest equipments for pile installations. The seminar also included discussion about marine foundations and driven pile foundation systems. The authors were well known authorities in their respective field in India and had several years of both national and international experience.

Invited experts for the seminar were:
- Dr. K.S. Ramakrishna..President DFI India
- Dr. Sunil Basarkar..AGM (Technical Services), ITD Cementation, Mumbai
- Viral Patel..Partner, Associated Engineers, Mumbai
- Dr. Deepankar Chowdhury, Professor, IIT Bombay, Mumbai

Ravikiran Vaidya, Principal Engineer, Geo Dynamics, Vadodara

Viral Patel, Partner, Associated Engineers, Mumbai

Since this was a field oriented seminar with specific application of promoting good practices in deep foundations, the seminar was very well received and the event was attended by contractors, designers, consultants, testing laboratories and academic and government bodies. Some of the prominent bodies who attended include Gujarat Engineering Research Institute, Gujarat Police Housing, Vadodara Municipal Corporation, faculty of various engineering colleges like Parul, Navrachana, Babaria, Sigma etc.

The seminar was inaugurated by Chief Guest, Dr. Vivek Kapadia, Director, GERI and presided by Prof. A.N. Misra, Dean, Faculty of Technology and Engg., M.S. University, Baroda. More than 100 participants have taken advantage of the seminar. The participation certificates were also distributed to all the delegates attending the seminar. To encourage more participation, low registration fee of Rs. 500/- was kept. The seminar was held at I. G. Patel Seminar Hall, Faculty of Social Works, Opp. Fatehgunj Post office. Fatehgunj, Vadodara – 390002.
Deep Foundations Institute of India is regularly conducting workshops, symposiums and conferences in association with other organizations with similar interests.

DFI-India 2015, Bangalore
28-30 September 2015

Photos from Conference on Deep Foundation Technologies for Infrastructure Development in India, DFI-India 2015 at Bengaluru
DFI-India 2015 at Bengaluru - photos cont..

Cultural Event

The Organisers - Dr. Raghuveer Rao and Prof. G.L. Sivakumar Babu

Report on DFI Worldwide Activities

3rd International Symposium on Deep Foundations, Mexico City, Mexico

DFI, along with TC-214 of the ISSMGE through the Mexican Society of Geotechnical Engineers (SMIG) and the Geo-Institute of ASCE, organized the symposium on November 11-12, 2015. Approximately 300 attendees and 33 exhibitors participated. The sessions included information on deep foundations, excavations and mass soil improvement and concluded with a roundtable discussion on new design and construction technologies for deep foundations in Mexico. The panel of experts agreed that good communication among the entire team of project owners, designers, contractors and equipment manufacturers was necessary to allow designers to dare to be innovative and to propose new techniques to owners. Contact staff@dfi.org for copies of the proceedings.

2016 DFI Middle East Conference, Dubai, UAE

This Third Edition of the conference organized by DFI's Middle East Chapter in collaboration with the American University of Dubai aims to provide an opportunity for the region's geotechnical engineering practitioners and academicians to interface, exchange information and experience, and present the latest developments in the field of foundation design and construction. It is being held on May 11-14 at the University. The chapter also recently elected new officers and will be led by new chairman Emad Sharif, manager of the Arab Center for Engineering Studies in Dubai, UAE. Vice Chair is Salah Al Dilimi Rail Infrastructure Maintenance manager in the Rail Agency within the Roads and Transport Authority, Dubai, UAE and Secretary/Treasurer is Nick Chittenden regional manager for underground construction in the Middle East at BASF.

SuperPile ’16, Chicago, IL, USA

DFI brings its SuperPile event to Chicago, Illinois on June 7-9, 2016 and registration is open at www.dfi-superpile.org with over 50 exhibit booths and numerous underwriting options available. Over 45 presentation proposals were received and the organizing committee, led by Andrew Verity, chair of DFI's Driven Pile Committee and national account manager for Terracon, is hard at work finalizing the technical program. This year the conference will open with the Osterberg Memorial Lecture which was established by Loadtest Inc. in 2009 to honor Dr. Jorj O. Osterberg, a pioneer of geotechnical engineering known for inventing the Osterberg Cell. This year's lecturer is Dr. David K. Crapps, P.E. of Schmertmann & Crapps in Gainesville, FL. Additionally the Ben C. Gerwick Award for Innovation in the Design and Construction of Marine Foundations will be presented at the conference luncheon.

International Conference on Deep Foundations, Seepage Control and Remediation, (DFI's 41st Annual Conference), New York, NY, USA

Registration is now open at www.deepfoundations2016.org for this not to be missed conference where an anticipated 1000+ geo-professionals are expected to gather to present, discuss, and debate all aspects and current challenges pertaining to the advancement of the deep foundation, earth retention, and seepage control and remediation industries. Almost 200 abstracts were received for consideration by the technical committee by authors from 20 countries. Sessions in the deep foundation technical track will focus on planning and mitigation, design
WHAT CAN DFI DO FOR YOU?

Overview
DFI is an international association of contractors, engineers, suppliers, academics and owners in the deep foundations industry. For more than 30 years, we have brought together professionals for networking, education, communication and collaboration. As a member, you help create a consensus voice and a common vision for continual advancement in the planning, design and construction of deep foundations and excavations.

Find Common Ground. Become a Member of DFI
Network with thousands of members and industry professionals worldwide
Get involved locally through DFI’s active presence in Europe, India and the Middle East
Strengthen your knowledge base and obtain practical information at seminars, short courses, workshops and conferences
Collaborate with colleagues by joining one of 15 active Technical Committees, Regional Chapters or a DFI group
Stay informed through the flagship Deep Foundations magazine and the peer-reviewed DFI Journal
Gain visibility with a corporate member listing on the DFI website, which has 20,000 views each month
Connect and communicate with industry peers through social media such as DFI’s LinkedIn Groups
Access OneMine.org and download up to 100,000 articles, technical papers & books from DFI & organizations all over the world - at no cost

Visit www.dfi-india.org OR www.dfi.org to know more and to become a member