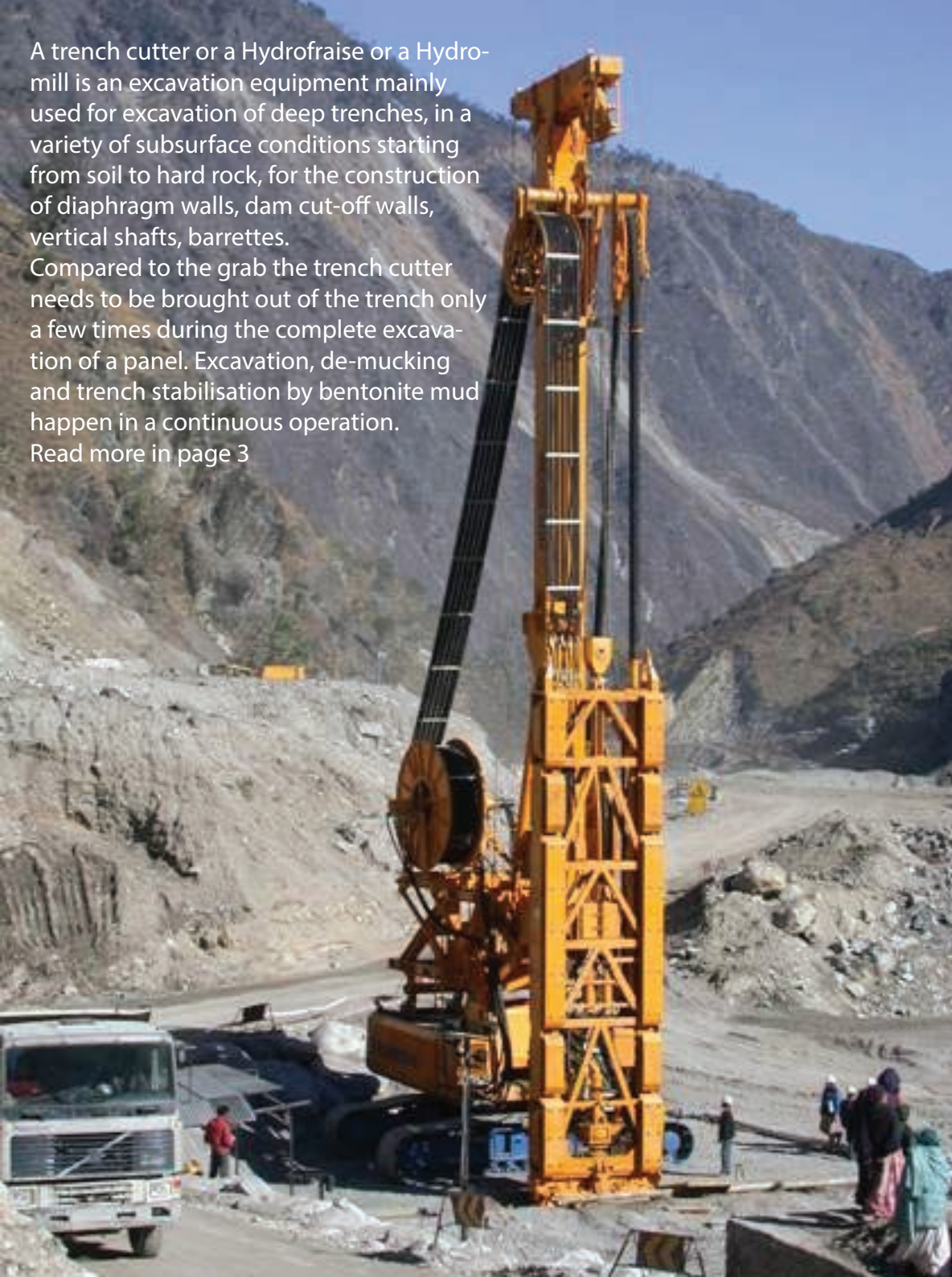


A trench cutter or a Hydrofraise or a Hydro-mill is an excavation equipment mainly used for excavation of deep trenches, in a variety of subsurface conditions starting from soil to hard rock, for the construction of diaphragm walls, dam cut-off walls, vertical shafts, barrettes.

Compared to the grab the trench cutter needs to be brought out of the trench only a few times during the complete excavation of a panel. Excavation, de-mucking and trench stabilisation by bentonite mud happen in a continuous operation.

Read more in page 3



Volume 1, Book 1, April 2015

# DFI of INDIA News

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Quarterly e-Newsletter from  
Deep Foundations Institute of India  
[www.dfi-india.org](http://www.dfi-india.org)

## DFI of India Executive Committee 2015-2017

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 Dr. Niranjana Swarup, CIDC, New Delhi  
 Prof A Srirama Rao, President, IGS, New Delhi

## Coming Events

National workshop on PILE FOUNDATIONS – ADVANCES IN DESIGN AND CONSTRUCTION PRACTICES organised by DEEP FOUNDATIONS INSTITUTE OF INDIA in association with INDIAN GEOTECHNICAL SOCIETY (Bhubaneswar Chapter) on 25 April 2015 at The Institution of Engineers (India), Sachivalaya Marg, Unit-IV, Bhubaneswar (Odisha). Er. L M Tripathi, Secretary of IGS Bhubaneswar Chapter is the Organizing Secretary.  
 Visit the link for more details <http://www.dfi.org/events/DFI-India-Workshop-BhubaneswarApr2015.pdf>



## From Chairman's Desk

"Tamasoma Jyothirgamaya" is part of a three line prayer in Sanskrit and it means "lead me from darkness to light" which is same as "lead me from ignorance to knowledge." Although this is meant for realizing the ultimate truth philosophically, in a material sense it is very much suited to the field of foundation engineering and construction. More often, in deep foundations construction we do not have the benefit of seeing what we construct. Foundation construction is comparable to a blind shot, if suitable methods of measuring and monitoring are not employed. If we have a way to know or indirectly see what we construct, particularly while we are constructing, we are not only relatively comfortable but also have a greater chance of constructing it right. Dissemination of this knowledge of constructing foundations in the right way using the latest technologies, is the main objective of Deep foundations Institute of India. There are several matured foundation technologies that are not tapped in India for accelerating the development of India's much needed Infrastructure. Several technologically advanced high productive and safe foundation equipment are yet to be used in India. Yet there are many individuals and companies doing great innovative and challenging foundation and geotechnical works in India that go unnoticed or unpublished. DFI of India News intends to capture all these and present to the Indian Geotechnical Engineer.

It will be our constant endeavor at DFI of India to devise ways and means to promote the professional practice and growth of Deep Foundations and Geotechnical Engineering Industry in India. I am sure that the DFI of India News Quarterly would be able to put together, issue after issue, the latest that is happening in our field both in India and in the rest of the world. And I do hope that every geotechnical engineer would benefit from the contents and also contribute articles and ideas to take it to greater heights.

I wish to congratulate Mr.I.V.Anirudhan for his tireless efforts in producing innovative and eye catching design of the issue and Dr. Sunil Basarkar, Mr.Y.Harikrishna and Mr.Ravi Kiran Vaidya for lending their unstinting support to ensure that the issue sees the light of the day. I wish the quarterly a bright future and patronage by all stake holders of the Indian and International Foundations Industry.

DR. K.S. RAMAKRISHNA, CHAIRMAN, DFI OF INDIA

DEEP FOUNDATIONS INSTITUTE OF INDIA

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## The cover picture

**Trench Cutter/Hydrofraise/Hydromill:** A trench cutter or a Hydrofraise or a Hydromill is an excavation equipment mainly used for excavation of deep trenches, in a variety of subsurface conditions starting from soil to hard rock, for the construction of diaphragm walls, dam cut-off walls, vertical shafts, barrettes. It is called by different names by the manufacturers of this equipment, Ex., "Trench Cutter" by BAUER Maschinen GmbH, Germany, "Hydrofraise" by Soletanche Bachy, France and "Hydromill" by Casagrande Spa, Italy. While there are some differences among these equipment, the main purpose and function remain the same, i.e., deep trench excavation. A series of vertical rectangular panels are excavated following a sequence to form a continuous wall made of reinforced concrete in the case of diaphragm wall and a plastic concrete wall in the case of dam cut-off walls. The trench cutter is hung from a base machine or a heavy crane located alongside the trench and is lowered into the trench with hoisting system comprising of hydraulic winches and wire ropes. The trench cutter is powered by a hydraulic system located in the base machine or crane.

Mechanical or hydraulic grabs have been in use for the excavation of deep trenches. The main difference between a grab and a trench cutter is in the way the trench excavation is carried out and in the way excavated soil is removed. In the case of a grab, the trench is advanced by excavating and removing the muck by the grab. Every time the bucket is full or partially full with the excavated material, the equipment has to bring the grab out of the trench to dispose of the material. As this may lead to trench stability issues such as side wall collapse due to suction generated at the time of removal of the grab extreme care is called for in trenching and management of stabilizing fluid (bentonite or polymer mud). This risk is minimized when a trench cutter is employed for trenching because the equipment cuts and pumps out the excavated soil through a process called reverse mud circulation and bentonite mud is under constant circulation. Compared to the grab the trench cutter needs to be brought out of the trench only a few times during the complete excavation of a panel. Excavation, de-mucking and trench stabilisation by bentonite mud happen in a continuous operation.

The Trench Cutter has three main parts, the guide frame, the cutter wheels and the mud pump. The guide frame serves the purpose of providing sufficient pressure to the cutting surface, stability to advance the excavation and to properly align the trench in vertical, longitudinal and lateral directions and to accommodate the cutter wheels at the bottom of the trench cutter and the mud pump just above the cutter wheels. The cutter wheels fitted with cutting teeth, viz., standard, round shank chisels, roller bits with tips made of tungsten carbide depending on the composition and hardness of the soil or rock to be excavated, rotate in the opposite direction in a vertical plane. In the process the soil or rock is cut and the cut material is mixed with the circulating bentonite and fed to the mud pump which in turn would transport the fluid to the desanding unit situated at a convenient location on ground. At the desanding unit the cut material is separated by mechanical screens and hydro-cyclones and the cuttings are dropped on to the ground for disposal and the de-sanded bentonite mud is sent back into the trench. The bentonite systems comprises of bentonite mixing, stabilizing and storage. It is the life line of the entire trenching operation. One important advantage of a trench cutter is its ability to cut into concrete of adjacent panel to form water tight and monolithic concrete wall. There is no need to use stop ends to separate the excavation panel from the neighboring panel- KSR

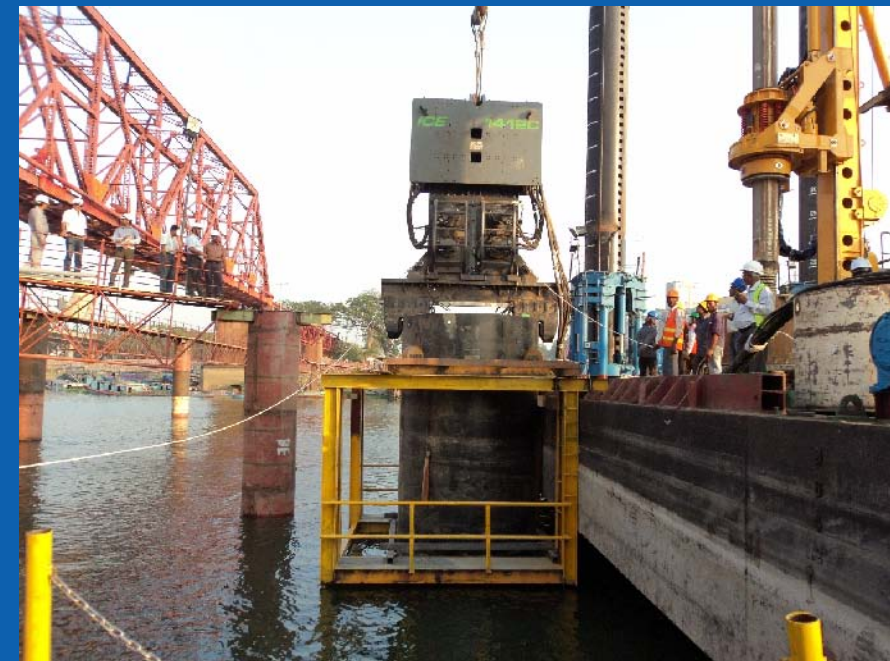
ICE vibratory hammer 1412C driving 2.5 m casings upto depths of 31 m at Bhairav bridge in Bangladesh. The company is AFCONS-IRCON JV. This is the biggest diameter piles driven to date in Indian subcontinent.

To drive 2.5m dia casing of thickness 20mm upto 31 mtrs, ICE Vibratory Hammer model 1412C was selected. The Eccentric moment of 1412C is 110 kgm and centrifugal force 2300 kN.

This 1412C with the above parameters has an amplitude of 6, which is appropriate and the piles hare being driven easily with a driving speed of 1m in 20 seconds.

Suretech Infrastructure Pvt Ltd are the dealers for ICE in the Indian subcontinent and this machine was commissioned by their Service team.

– Courtesy Mr. Sujith Mukherjee, Sure Tech Infrastructure P Ltd, Mumbai



Each newsletter will have a cover picture that represents modern construction equipment / method. Each reader can contribute to this feature. What we need is a good quality picture and a 500 word write up.

## Company Profile



Global Presence - Local Focus: Keller Ground Engineering India Pvt. Ltd. "Building on our strengths"

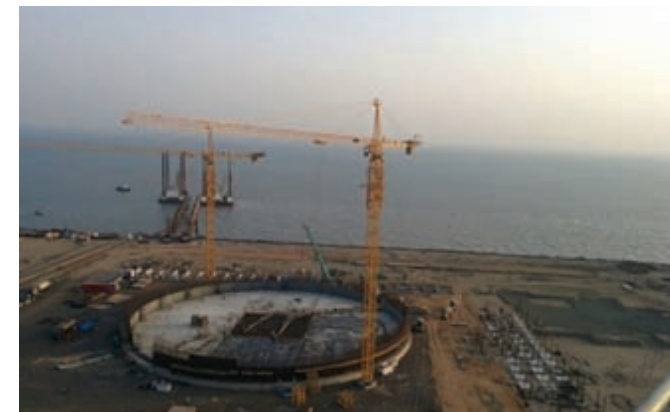
**Keller India** is 100% subsidiary of **Keller Group Plc.** headquarters at London having annual sales of £ 1.6b. From its origin in 1860 to the present day, Keller has been built on two things above all – engineering excellence and a commitment to continual innovation. Keller's business is the solution of soil and foundation problems for the construction industry. From operating centers in Europe, America, Asia and Australia, Keller routinely works in over 40 countries around the world undertake the full range of ground engineering solutions worldwide.

Keller operates in India through its subsidiary, Keller Ground Engineering India Private Limited, with registered office at Chennai and branch offices at Mumbai, New Delhi, and Hyderabad. Keller's services in India are used across the entire construction spectrum from industrial, commercial housing and infrastructure projects to specialized requirements. Keller's challenge is to carryout complex ground engineering works by using self-developed procedures and ideas resulting in "**Optimal Foundations**" (cost effective design & build solutions). The main emphasis is on Ground Engineering especially on Heavy Foundations (bored cast in-situ piles), Deep Vibro Techniques (Soil Improvement using Vibro Compaction and Vibro Stone Columns), Grouting Techniques, Earth Retention Systems and Ground Anchor Works.

Safety of the workforce is priority for work force and to customers. Keller seeks to deliver projects safely using "**Think Safe - Work Safe - Go Home Safe**" framework and always endeavor to improve safety standards to reach ultimate goal of Zero Injuries.



Installation of large diameter Bored Piles for LNG Storage Tanks in Gujarat, India



Ground Improvement works (Vibro Compaction & Stone Columns) for LNG Storage Tanks in Gujarat, India

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Navajyothi Residency,  
Telecom Nagar,  
Gachi Bowli,  
Hyderabad - 500032.  
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info@kellerindia.com www.kellerindia.com



## Company Profile

## L&T GeoStructure partner in total solution... adding value...

L&T GeoStructure is a part of L&T Construction – the construction arm of Larsen & Toubro Limited, India's largest technology, engineering, construction and manufacturing company. L&T GeoStructure is a unique entity, formed to focus on foundation and ground improvement-related business. We are a strong and professional foundation specialist team with the knowledge of design, equipment and methods to execute and supervise sophisticated foundation works.

### Business areas:

We have expertise in the areas of large diameter piling, piling, diaphragm walls, cut-off walls, secant pile walls, sheet piles, marine and riverfront structures, intake structures, deep foundation-supported bridges, ground improvement, soil investigation, hard-rock boring, microtunneling and water retaining structures.

### Why L&T GeoStructure?

- One-stop solution provider
- Design & Build expertise
- Extensive experience
- Focussed approach to safety
- Exceptional quality
- Reliable partnership

### What differentiates us?

**Large diameter piling** – A first in India! L&T GeoStructure successfully executed piles of diameter 2500mm and depth about 33m in very hard rock strata at Chennai CMRL site. These large diameter piles contribute significantly to time and cost savings, thereby creating value for the customer.

**Diaphragm walls using trench cutters** – L&T GeoStructure successfully completed diaphragm wall panels using trench cutters for depths varying from 25 – 30m at metro and commercial projects across India. With this technology, we created value for the customer.

**Top-down construction method** – We are one of the pioneers of the top-down construction method. This has the advantage of simultaneous working both above and below ground, thus resulting in significant time savings.

**Ground improvement** – L&T GeoStructure has established its presence in the market by successfully executing ground improvement solutions on 'design and build' basis for various high-rise structures across India. We offer a combination of piles and stone columns to avoid liquefaction.

**Hard rock boring** – L&T GeoStructure has the expertise and equipment to drill in very hard strata where uniaxial compressive strength is greater than 100 MPa. This exploration in challenging geotechnical strata, creates value for the customer.



10,000 nos of BCIS piles at a refinery in Kochi



Piles of dia 2500mm and depth 33m in hard rock strata for metro stations in Chennai



20m deep secant pile walls and 3 levels of anchors at Chennai



1200mm dia 40m deep piling on D&B mode, and capacity proven with instrumented load tests in Noida



27m deep d'wall on D&B basis, creating 5 basements in Bengaluru

### CONTACT US:

L&T GeoStructure  
Mount Poonamallee Road,  
Manapakkam, Chennai 600 089, India.  
Ph: +91 44 2270 4306, Email: geost@Intecc.com  
Website: www.Intecc.com



## Members News

## DFI India Members -2015

### Corporate Member Class IV

Kanappan S, L&T Geostructure  
Ananthakumar T S, L&T Geostructure  
Rajan S N, L&T Geostructure  
Kumaran M, L&T Geostructure  
Jeyson J. Samuel, L&T Geostructure  
Sivannarayana K V, L&T LEL  
Kiran Kumar K, L&T LEL  
Bairagi Kondapalli Bairagi, WET  
Mohan Chinta B V K, WET (IW)  
Shilpa Surath, Infra - HC (METRO)  
Sivaprasad P, Infra - HC (DEFENCE)  
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Jasmine Nisha, B&F (CBA)  
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Praveen Kumar G R, L&T - TPPC  
Sivarama Sharma B, L&T Divisional Corporate

### Corporate Member Class III

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Sridhar Valluri, Keller Ground Engineering India Pvt. Ltd.  
Madan Kumar Annam, Keller Ground Engineering India Pvt. Ltd.  
Ramadas V V S, Keller Ground Engineering India Pvt. Ltd.  
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Saday Kumar Mishra, Keller Ground Engineering India Pvt. Ltd.  
Satish Vegesna, Keller Ground Engineering India Pvt. Ltd.  
Arunkumar Sekar, Keller Ground Engineering India Pvt. Ltd.  
Sangeen Nayak, Keller Ground Engineering India Pvt. Ltd.

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Prakash Bansod, Afcons Infrastructure Limited  
Sree Rama Krishna Kalavacharla, Deep Foundations Institute of India  
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Sandeep Talwar, Super Drilling Pvt Ltd  
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**Government affiliated and students**  
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Muthukumaran K., National Institute of Technology, Trichi

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Manohar Pakade, N H Division No.14, Nagpur  
Abhijit Patki, Project Management Group  
Ravikiran Vaidya, Geo Dynamics  
Haresh Karnani, Sambo C.M.C  
Salim John, Tebodin Consultants & Engineers  
Ambily A P, M N Dastur & Co P Ltd  
Narayan Kumar Agarwal, RVR Projects Pvt Ltd  
Durga Charan Kiran L, L&T Geostructure

### Post by Dr. Sunil Basarkar, Executive Committee Member

"ITD Cementation India Limited bagged an order of dredging and reclamation works for the Container Terminal no. 4 at Jawaharlal Nehru Port Trust at Mumbai. The contract value is Rs. 2168 crores. The work involves reclamation at both land and marine conditions, with respective areas of more than 940000 and 250000 sq. m respectively, using Prefabricated Vertical Drains (PVDs)."

DFI members can post their professional achievements, corporate achievements, awards, other news related to geotechnical profession here.

Please send the details 15 days before every quarter, April, July, October and December

## GROUND IMPROVEMENT FOR FOUNDATIONS OF RESIDENTIAL PROJECT

### INTRODUCTION

Deep foundations like Bored Cast-In-Situ piles and driven piles have historically been the foundation of choice for major buildings and other structures constructed in the silty/clayey sand sub-soils of Chennai.

Given their acceptance in the construction community, driven pile foundations were initially selected as the foundations for this four storey residential project in Porur, Chennai. The main concern with the driven piles was the safety of the personnel and the disturbance caused to the neighborhood while installation.

The reconsideration of the type of foundation system with respect to the geotechnical analysis gave a thought to the ground improvement. Hence, the developer has contacted M/s Keller India to execute the ground improvement works. The concept of ground improvement is illustrated in Figure 1.

M/s Geotechnical SolutionsA1, Chennai carried out soil investigations to establish soil profile and to suggest suitable foundation for the proposed development.

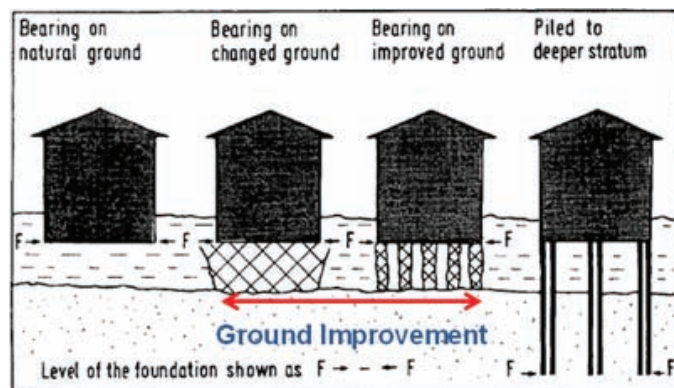


Fig. 1 Concept of Ground Improvement

## TECHNICAL ARTICLE

As per the soil investigation report, the site is a reasonably plane and uniform subsoil and shear strength profiles were found across the area. The topsoil is medium stiff to stiff silty clay of medium to high plasticity up to about 2.0m followed by clayey silty very fine sand of medium relative density. Thin layers of soft sandy clay and loose to very loose clayey silty sand are encountered till 5m to 6m depth.

Ground water table was encountered at about 3.0m below the existing ground level.

### GROUND IMPROVEMENT

Critical review and analysis was made for the project loading conditions and appropriate ground improvement technique using dry vibro stone columns has been chosen. Vibro stone columns using dry bottom feed method was considered as installation technique. In the dry method, the columns are installed by displacement technique (without removing any soil). Hence, the site environment would be comparatively clean and tidy. Sequence of installation of Vibro Stone Columns is illustrated in Figure 2.

This technique employs Keller's state-of-the-art equipment Vibrocat, which ensures properly formed compacted vibro stone columns to the required diameter and depth. The technique provides effective drainage paths to ensure rapid consolidation. It also has a built-in real time computer monitoring system to provide quality control on compaction effort throughout the construction process.

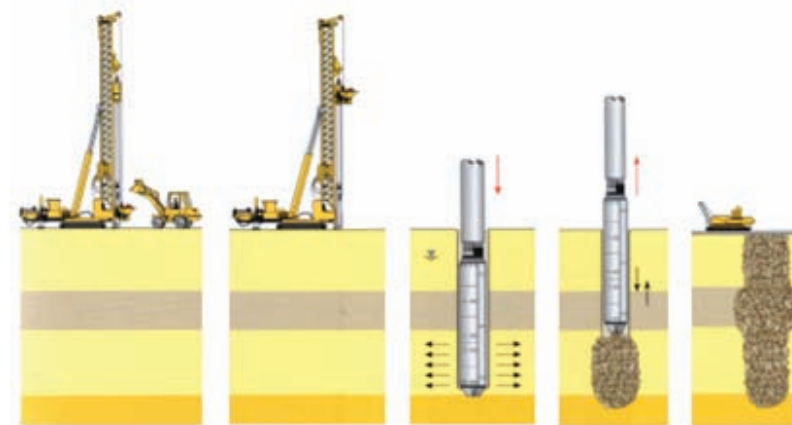


Fig. 2 Sequence of stone column installation



## GROUND IMPROVEMENT FOR FOUNDATIONS OF RESIDENTIAL PROJECT IN CHENNAI

A total area of about 5500m<sup>2</sup> under the raft foundation was to be treated. The raft was divided into six pours. Column loads from the super structure vary from 25 T to 185 T. Though the raft foundation shall transmit uniform pressure to the bearing soil, denser grid was adopted for pour with heavier columns. Typical cross section of ground improvement is illustrated in Figure 3.

### QUALITY CONTROL & MONITORING

The installation of each stone column is recorded by the use of an automated computerized recording device fitted to the equipment. This instrument yields a computer record (M4 Graph) of the installation process in a continuous graphical mode, plotting depth versus time and power consumption (compaction effort) versus time. Further, diameter of the stone column and consumption of backfill are continuously monitored by the site personnel.

### LOAD TEST

Load tests are the best way to assess the improved soil quality. The size of the test pad and the magnitude of the test load can vary according to the vibro stone column layout, treatment depth, load and type of structure. Routine Stone Column Load tests were performed to ascertain the effectiveness of design and performance of the ground improvement works. The observed settlements are within the acceptable limits for the applied design load intensity of 100 kPa. Load test arrangement is shown in Figure 5 and observed results are presented in Figure 6.

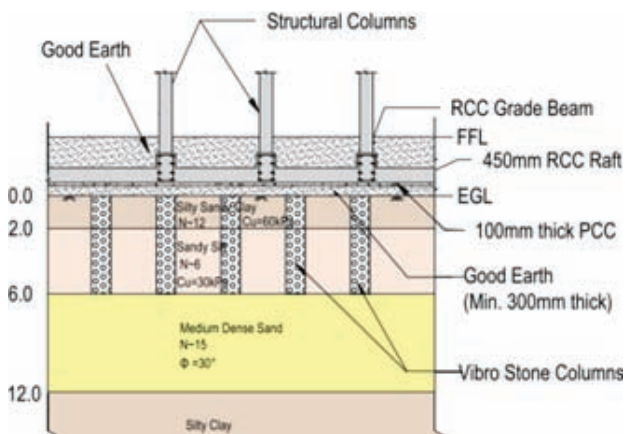


Fig. 3 Typical cross section of ground improvement



Fig. 4 Installation of Vibro Stone Columns in progress

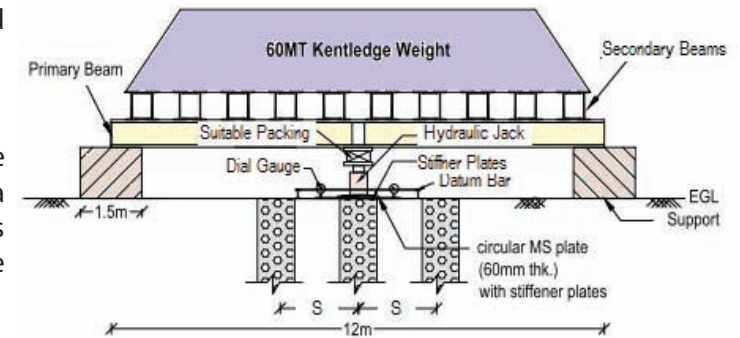


Fig. 5 Plate load test set up

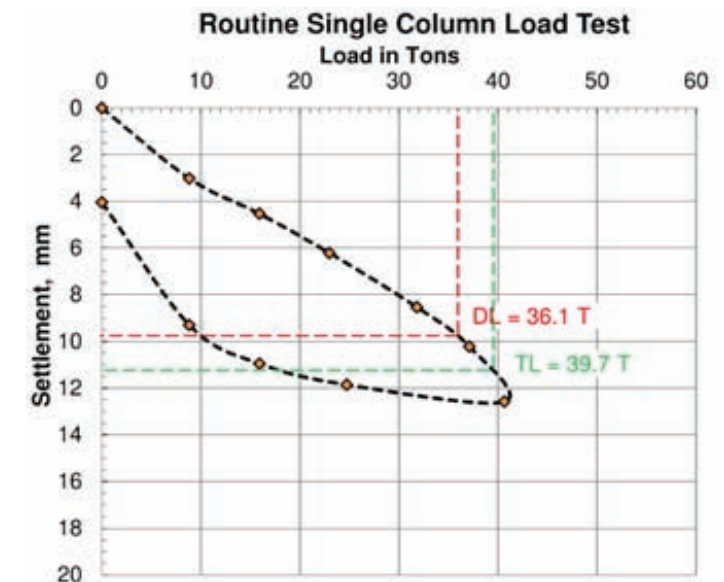


Fig. 6 Load vs Settlement curve



## GROUND IMPROVEMENT FOR FOUNDATIONS OF RESIDENTIAL PROJECT IN CHENNAI

### SETTLEMENT MONITORING

Success of the foundation system needs to be proved by full scale monitoring of foundation settlement during and after completion of the project. A total number of 14 locations were identified to monitor for settlement during and after construction. This selection of 14 numbers is based on the number of concrete pours in overall raft foundation i.e., 2 locations per each pour or unit of raft foundation. The measured settlements are substantially lower than the predicted settlement, which proved the efficiency of the raft foundation resting on improved ground.

### CONCLUSION

The ground improvement works were completed within 6 weeks (as against 6 months to that of pile foundations) that was made possible through effective project management.

The project is getting delivered to the end users ahead of time as a result of construction speed of alternative foundation solution (i.e. 6 months vs. 6 weeks) marking a milestone in ground Modification. The savings in time is key to 'success' of ground Improvement benefiting the entire cycle involving End Users, Suppliers, Bankers and Developer.

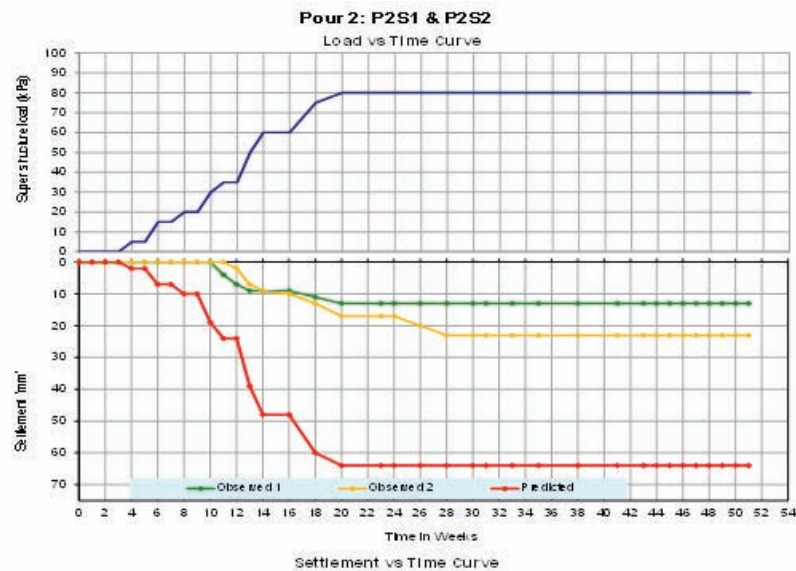


Fig. 7 Predicted and observed settlements



Fig. 8 Completed Structure

Article by Keller India, Chennai



## BECOME DFI OF INDIA MEMBER TO HAVE ALL THE BENEFITS OF DFI MEMBER

### 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 and books from DFI and organizations all over the world - at no cost

Visit [www.dfi.org](http://www.dfi.org) to know more and to become a member and to know more

## WHAT CAN DFI DO FOR YOU?

### Corporate Membership

Corporate Memberships are available in varying classes based on the type, location and size of organization. Each DFI Corporate Member organization, regardless of class, is represented by two employees, designated as DFI Corporate Member Representatives. Larger Corporate Member organizations can name additional employees as Corporate Individual Members. In addition, several discounted memberships are offered. View the table of Membership Classes.

Affiliate Corporate Membership allows multiple-office Corporate Member organizations to illustrate their geographical diversity by registering branch and/or affiliate offices as Corporate Members with their own website listing and representatives. The Affiliate must share the same name as the parent Corporate Member organization.

Non-Commercial Corporate Membership allows non-commercial organizations such as government agencies, associations, societies and union organizations to join DFI with their own website listing and representatives.

Sustaining Membership Status is reserved for Corporate Members who contribute to a special Sustaining Membership Fund managed by the DFI Educational Trust, for the purpose of furthering DFI's educational goals.

### Individual Membership

Practitioners can join DFI as Independent Individual Members to keep abreast of developments in deep foundations and play an important role in contributing to the consensus voice of DFI. In addition, several discounted individual memberships are offered.

Corporate Member Employee Individual Membership allows employees of registered Corporate Member organizations to join DFI.

Government Employee Individual Membership allows public sector employees including federal, state and municipal agencies to join DFI.

Student Individual Membership is allowed for students who provide a copy of their school ID with submission of their application.

Emeritus Individual Membership is reserved for individuals who have been members of DFI, either as Representatives of Corporate Members or as Individual Members for a minimum of 10 continuous years, and who have reached the age of 65 years and have retired from full-time employment.

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Editorial team: Anirudhan I.V, Y. Harikrishna, Ravikiran Vaidya

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