SUSTAINABILITY PRACTICES IN FOUNDATIONS

The construction industry can and needs to contribute to a more sustainable world. Accordingly, geotechnical works potentially have a significant share to offer. It can generally be achieved by adopting sustainable techniques and construction methods, reuse of foundation, etc.

Read about a case study on '*Re-use of old pile foundations in Amsterdam*' on Page 3, and an article titled '*Sustainability in Construction Industry*' on Page 8.

Volume 9 Book 3, July 2023

DFI of INDIA News

Quarterly Newsletter from
Deep Foundations Institute of India
www.dfi-india.org

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3

RE-USE OF OLD PILE FOUNDATIONS IN AMSTERDAM

Cover Story

- *Marcel Bielefeld, Allnamics Geotechnical & Pile Testing Experts, The Netherlands*

The question of the continued suitability of existing foundations arises when the function of the superstructure changes. This can occur when the superstructure is replaced or when the existing structure is expanded, leading to higher loads on the existing foundation.

Obviously, the re-use of an existing foundations can contribute to a more sustainable society. But this may not be the only reason why an existing foundation is to be re-used: new foundation works could cause nuisance for neighbors or even damage to the adjacent buildings, the construction lots could be too small for modern foundation equipment or the mobilization of piles or concrete mix could be challenging. Finally, the decision to re-use an existing and proven foundation may be simply economical, as it will not only reduce the construction cost, but also shorten the schedule. Whatever the reason, before the existing foundation can be re-used there has to be an investigation to determine whether:

- the existing foundation is able to resist the new loads?
- the integrity of the existing foundation is such that it can perform during the extended lifespan?

Obviously, the existing foundation was tested during its lifecycle, since after installation it was loaded and thus tested, albeit to loads that are unknown. The foundation behavior under these loading conditions can in part be assessed from the condition of the superstructure, e.g., through the presence of cracks, if any, and differential settlements in the superstructure. Especially the latter is a good indicator as the presence of differential settlements is a strong warning signal that (at least parts of) the existing foundation are no longer adequate. At the same time, it must be remembered that the absence of cracks and differential settlements are not a guarantee for a sound foundation.

To calculate the capacity of the existing foundation one can rely on the old engineering reports and drawings. However, the soil situation can have been changed (e.g., as a result of nearby foundation activities, ground water flow, dewatering, etc.), in which case the previously derived design values are no longer applicable. It seems therefore more appropriate to perform a new soil investigation in or near the existing foundation to calculate the capacity or to perform a load test. However, all the as-built parameters (such as pile length and diameter) have to be known for a reliable outcome of those calculations. And given the uncertainty regarding the accuracy of as-built drawings (if those are even available), it may be that the most appropriate approach is to perform a load test.

The result of a load test is the load settlement diagram, irrespective of foundation dimensions and other unknown or uncertain factors. With the load- settlement in hand, one can determine the settlement at the working load and even the foundation's ultimate capacity (if tested up failure), which means that the investment in a load test eliminates the uncertainty of the foundation behavior.

The most suitable load test type for an existing foundation depends on the project.

- A Static Load Test can be done under the existing superstructure, where this superstructure is used as counterweight. The foundation is

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cut loose from the superstructure and a jack is positioned in between. After setting up load cells and instrumentation to register the settlement, the load test can start. Limitations here are the available counterweight and the stresses in the superstructure caused by the load test.

- A Dynamic Load Test (or a High Strain Dynamic Test as per the ASTM terminology) can only performed when the superstructure is demolished. Once the foundation is freely accessible, this type of test can be performed as usual, albeit that the impact stresses have to be controlled very carefully, especially in older existing foundations. Consequently, the resistance may not be fully mobilized with a dynamic load test. Additional limitations of this test method are that the impact may cause vibrations that could affect adjacent buildings and the fact that the analysis method of the test results does not have a unique solution. The Signal Matching process to interpretate and simulate the soil behaviour will have multiple solutions for the bearing capacity with similar signal match qualities, and the selection of the solution will be up to the analyst.
- A Rapid Load Test is a quasi-static test, so the load settlement diagram can be generated directly, based on measured forces and measured displacements. The maximum stresses during a Rapid Load Test are similar to that of a Static Load Test, thus avoiding the risk of pile damage. Most of the limitations listed for a Dynamic Load test do not apply to this test method: there are no issues with maximum stresses in the pile or vibrations in adjacent buildings, and the interpretation method is straightforward, and independent from the engineer who performs the analysis of the test results. However, a Rapid Load Test does also require that the superstructure is no longer in place.

Fig. 1: Timber Piles of the Foundation

An important factor in selecting the test method, is the moment of testing. If the question about reuse of the existing foundation has to be made prior to demolishing the superstructure, then static load test is the only available option. If the superstructure is only partly demolished, a rapid load test can be performed.

When the load test shows that the existing foundation can be re-used, there is still an important question that remains: will the existing foundation have an adequate remaining design life? To answer that question the potential for future foundation material deterioration (as a result of corrosion in case of steel piles, alkali-silica reaction or loss of cover in case of concrete piles, and dry rot and decay for timber piles as shown in Figure 1) needs to be assessed through inspection, in-situ testing (such as wall thickness measurements, Schmidt hammer and timber penetration hammer) and laboratory testing.

Contd. on Page 15

Message from DFII Vice Chair

The DFI of India Newsletter continues to serve as a window - showcasing the developments in deep foundation industry in India, presenting the high-end technologies, reporting events in India & abroad, technical notes from foundation engineers and researchers and inviting views and opinion of the stalwarts in the industry and academia.

My association with DFI traces its roots in 2005, which saw publication of a paper in the 30th Annual DFI conference at Chicago, USA. Being a passionate deep foundation researcher, academician during that time and now a practicing engineer from industry, DFI had always been close to my heart and actions. I had been associated with DFI of India (DFII) since its inception in 2011, with core contributions commenced formally with formation of its Indian chapter in April 2013.

Today, DFII has made a distinct imprint on the construction industry, serving as a national body, taking onus for possible entry and dissemination of technologies for India, sharing state of art practices, attending to training needs of skill sets and creating awareness in the domain of deep foundations. DFII sub-committees like *DFII Committee for Geotechnical Characterization of Foundations (DCGCF) and Continuous Flight Auger (CFA)* piling technology Implementation, *Women in Deep Foundations* (*WIDF)* and *Groundwork* are de-centralized operations having targeted interest in line with DFII's vision. *DCGCF* strives to improve standards of geotechnical investigations, provide laboratory and field training programmes while *CFA* pile sub-committee works to promote use of CFA piles in Indian scenario, and targets to come up with a standard guideline in line with IS 2911 series. Helical piling is another thrust technological domain which is being tapped by DFII for its applications in India. Student's outreach programme *Groundwork* operates to supplement students with practical design prowess, organizes quizzes to prepare themselves as future torch bearers for this industry. *Groundwork* also organizes online programme where presentations from global experts provides new options for creative and young minds. It is worthy to mention here of special efforts taken to empower professional women of foundation industry and girl-students to take up careers in deep foundations through *WIDF*. *WIDF* wing of DFI is particularly active in India and provides an inspiring platform for women for professional venture in this field.

On technological front, India needs to embrace new technologies with greater vigour. These are necessary for accelerating progress, improved efficiency in terms of speed and fuel efficiency and hence, meet ever increasing infrastructural requirements. Several deep foundation technologies practiced globally are at doorstep of India, awaiting an opportunity to tapped to their best potential. With infrastructural growth in India on fast track, these technologies and research outputs must be disseminated, adapted and put to economic use for rapid progress of the nation.

Apart from CFA and Helical pile technologies, DFII also eyes on promoting new technologies like Rigid inclusions for soft soil embankment supports, Rapid Impact Compaction (RIC) for loose and random fill compactions, Screw piling, Micro-pile walls, Vibro-jet Sheet

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pile driving to name a few. DFII leverages initiatives from corporates and individuals with zest to bring and upgrade these technologies. Together we can witness significant transformation of Indian foundation industry. As the foundation industry advances, Sustainability and foundation re-use is a watchword of today for a liveable future. DFII strives to create awareness on foundation optimization by reducing consumption of ecologically critically materials like concrete and reinforcement with intention of contributing to sustainability goals of infrastructure projects. Workshops to address sustainability and foundation re-use, popularize regular use of EFFC-DFI Carbon calculators are the thrust areas of DFII.

Since 2012, DFII had been organizing annual conferences on the theme of *Deep foundations technologies for Infrastructure developments in India* since 2012. This year, this mega event is scheduled at Vadodara between 5 -7 October. It will not be an understatement to mention about intensive planning and hard work that go before culmination of these conferences. Response to this event is massive and pouring in form of sponsorships, exhibition booth bookings and delegate registrations. All stakeholders and supporters are encouraged to capitalize on this event for their business and professional growth.

While having stated above facts, deep foundations mission ahead is challenging; but with joint efforts and awareness drive, it is very much achievable. My sincere appeal to students, young engineers, professionals and corporates to throng activities through memberships or being part of sub-committees and contribute to sustainable visions of DFI of India.

With thanks and best wishes...

- Dr Sunil S. Basarkar
Vice Chairman, DFI of India

12th Annual Conference on Deep Foundation Technologies for Infrastructure Development in India

Oct 05 - 07, 2023
Registrations are Open!!!

DFI-India 2023: 12th Annual Conference is scheduled during 5th –7th October 2023 at Vadodara, Gujarat. The conference is a major event in the Indian Deep Foundation Industry and will be attended by leading deep foundation professionals and companies in India. The conference offers a special session, keynotes, paper presentation and debates on the latest techniques and future trends in the deep foundation industry in India and worldwide. The conference will also showcase the latest technologies and equipment through exhibition by various stakeholders in the foundation construction industry.

Join us for the fun and flare and network with the largest gathering of national and international practitioners in Deep Foundations .

Registration is open. For more information and registration, visit: https://www.dfi.org/india2023

Corporate Member Advertisement

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 to activities@dfi-india.org

SUSTAINABILITY IN CONSTRUCTION INDUSTRY

The construction industry can and needs to contribute to a more sustainable world. Accordingly, geotechnical works potentially have a significant share. In this context, Bauer understands "sustainable products for geotechnical works" as those that may cause less emissions and increase the sustainability of construction activities. The key parameter to sustainable products for geotechnical works is the optimisation of processes on site needed to fulfill the client's building task, including the selection of technologies and construction methods with minimum environmental impact and minimum carbon footprint.

Site traffic is overstraining the world's big towns and cities. The sealing of areas continues to consume the natural environment required for global climate preservation. Each decision taken for a structure affects the carbon footprint and general sustainability. Cooperation based on partnership working together effectively and unobstructed also possible to construct a sustainable structure. The United Nations Sustainable Development Goals (SDG's) goals include ecological, economic and social aspects, some with particular relevance for geotechnical works, see figure 1.

Fig. 1: Specific SDG's and postulated targets of the UN, with relevance for geotechnical works

Sustainability of Geotechnical Works

Significant reduction of energy, water and emissions embodied in the construction materials and construction processes further contribute to achieving environmental and climate protection goals. All these parameters directly correlate with construction works and geotechnical works. All life-cycle stages of a structure need to be considered for the planning and construction phase. To do so, it might be reasonable to also consider the effective product quality as an essential parameter for environmental quality. When the achieved product quality increases the potential service life or reduces efforts for maintenance or repair, quality shall also be rated for its contribution to sustainability. Bauer Spezialtiefbau examines and evaluates the potential for sustainability in the specialist foundation industry in the in-house Working Group referred to as "Product Sustainability", on an international level with aiming on a normalized and "harmonized" system. Several tangible fields of activity have been identified and are prioritised to continuously develop from a basic idea status to an in-house state of the art.

Geothermal Activation of the Ground

The geothermal activation of geotechnical construction elements helps in reduction of the greenhouse gas emissions produced by a building over its

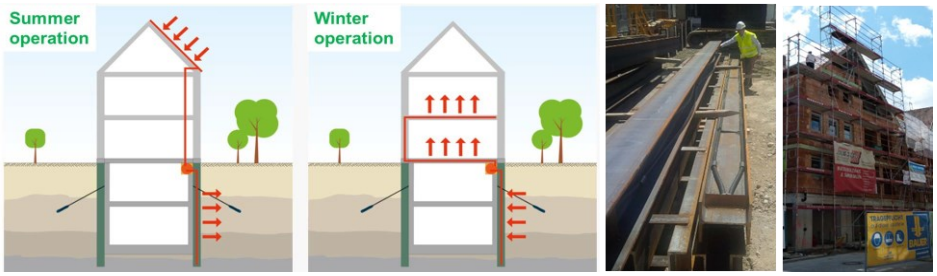

Fig. 2: Application of geotechnical elements to activate geothermal energy for buildings, with geothermal probes attached to steel beams ready for installation into the MIP wall, for a dwelling in Füssen, Germany.

Contd.

lifetime. Geothermal heat used for large projects such as the prestigious "The Circle" project at the Zurich Airport, an enormous building complex for which Bauer constructed geothermal piles, prove the feasibility of this technology.

With regards to geothermal activation, deep soil mixing is deemed an ideal execution method, due to the beneficial heat transfer from soil to the geothermal probes when fixed to the structural steel beams installed. This idea is part of a patent granted to Bauer Spezialtiefbau. For a project in the city of Füssen, Germany, a dwelling with 14 housing units, involving the construction of Mixed-In-Place (MIP) retaining walls, 1 kW of electricity was successfully used to generate 5.5 kW of heat. Figure 2 shows the schematic function as well as pictures from the execution of this particular kind of pilot project for which Bauer won the innovation award of the Bavarian construction industry association in 2019.

Apart from geothermally activated foundation elements, geothermal heat can also be used directly: As part of a large investment program, BAUER Foundations Philippines, Inc was commissioned to carry out geothermal bores for a geothermal power plant in the Philippines. Multiple bore holes with a diameter of 1,200mm are constructed to depths upto 150m.

Transports and Equivalent Carbon Footprint

The traffic volume as an indicator for noise emission and air pollution, or the equivalent carbon emission (CO2eq), expressing the product carbon footprint (PCF), can already act as a quantifiable measure for product sustainability. The application of EFFC/DFI Carbon Calculator to compare the Product Carbon Footprint of a retaining wall executed with standard D-Wall technology versus MIP technology is described in detail in Figure 3.

It has been proven again that the major advantage of the Mixed-in-Place technology is to save material and reduce transports. The other variation was to replace the conforming jet-grout plug by a silicate gel grout plug

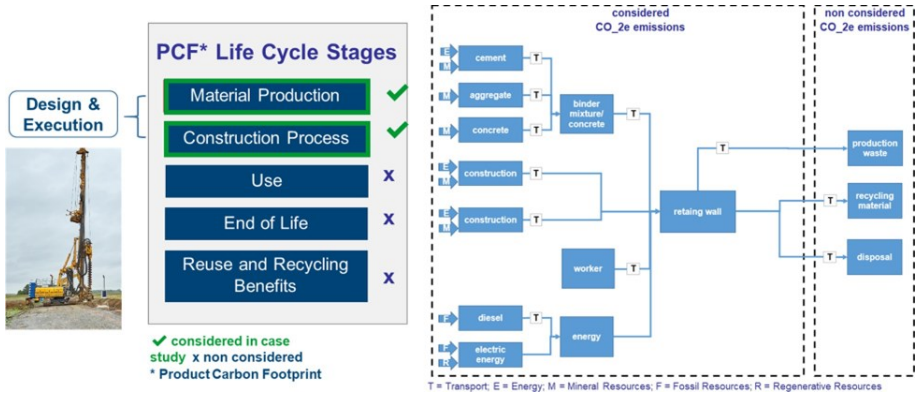

Fig. 3: Product Carbon footprint calculation process considered for geotechnical works

which is another great factor to reduce the carbon footprint for QH Track, by leaving the soil in place and only filling the pores, thus using less material and producing no backflow for disposal. The graph in Figure 4 shows that replacing the conforming solutions, i.e. diaphragm wall and horizontal jet-grout plug, can save more than 50% of CO2eq emissions, by

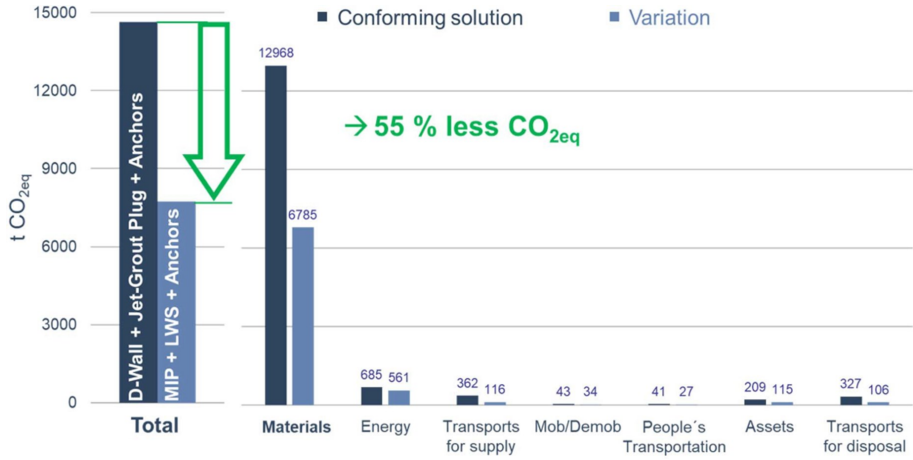

Fig. 4: CO_{2eq} balances for the geotechnical works at QH Track

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the variation of MIP retaining wall and silicate gel permeation grout plug to cut off the excavation pit from ground water. It further reveals that emissions are predominantly saved due to less material consumption, followed by substantial savings of >100 t CO2eq due to energy consumption and transports for supply and disposal. For both solutions, ground anchors were considered for tie-back at this stage.

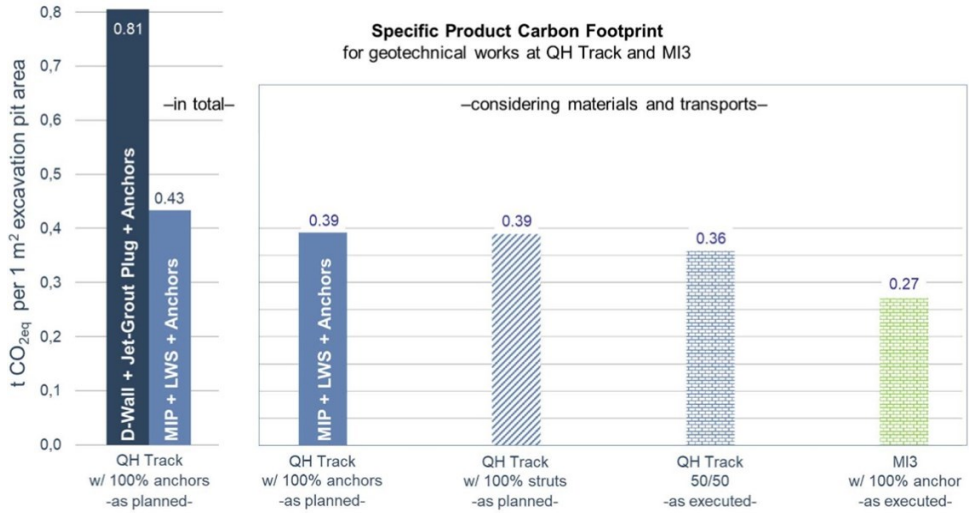

Fig. 5: Normalised CO2eq balance result for two projects, QH Track and MI3

For the comparison in figure 5 the equivalent CO2eq emissions are related to a m²-unit size of the excavation pits' plan area. This way of normalisation allows to compare "QH Track" with the neighboring site named "MI3" executed immediately afterwards with the same sustainable technologies applied. Whereas the scaling down to a unit size seems inappropriate in general, it is deemed acceptable in this case, since both sites have very similar boundary conditions. The comparison is further limited to the material related contributors to carbon emissions of the actual geotechnical works, which makes out more than 90% (0.39/0.43) of the total PCF.

The other quantifiable factor, in addition to the PCF, is the number of transports required to operate the construction site. Not only the MIP technology but even more the permeation grouting technology (here: using Bauer's silicate gel "LWS") help to excessively reducing traffic volume, immediately sparing the local environment from exposure to noise, dust,

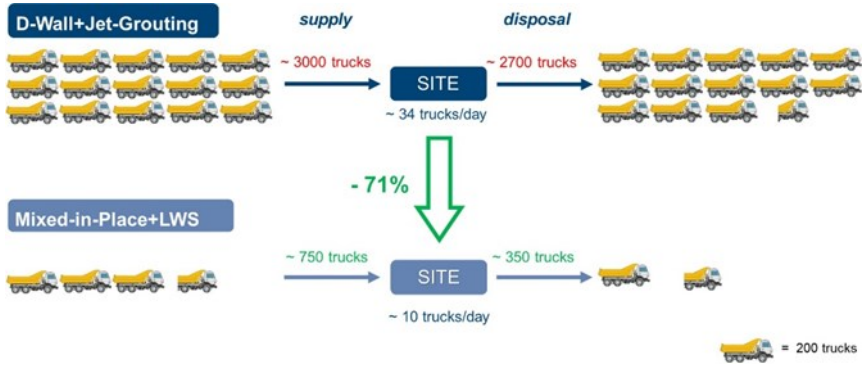

Fig. 6: Comparison of traffic volume for the geotechnical works at QH Track using the conforming solution (DW+JG) in contrast to the variation (MIP+LWS)

and exhaust fumes, all contributing to more sustainability of construction. A substantial saving of more than 70% is determined for the geotechnical works for the aforementioned QH Track construction site, see figure 6.

Conclusions and Outlook

Sustainable construction are implemented in geotechnical works and should be considered a growth field. To achieve sustainability goals, it needs a benchmark system and sustainable credits must have a monetary unit of measurement, set in an appropriate political and eventually contractual framework. A cooperation based on partnership including the specialist contractor is essential to mutually develop the best sustainable solutions,

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from the outset, with as few boundaries as possible. For minimising the environmental impact of geotechnical works to fulfil the construction task, optimisation of material, design and execution for sustainability goals becomes the major challenge for specialist foundation contractors. Furthermore, transportation of material, supplied to site or disposed from site, contribute to the sustainability goals. The ongoing digitization of construction processes will strongly support in opening up these potentials. Sustainable products in the specialist foundation sector are no longer a utopian notion. Many of these ideas are already implemented at the sites to assume responsibility for the future generations' possibilities. The Hauptverband der Deutschen Bauindustrie (Central Federation of the German Construction Industry) and the Deutsche Gesellschaft für Nachhaltiges Bauen (German Sustainable Building Council) are working together to establish a certification system for sustainable geotechnical works to complement the full life-cycle assessment.

Authors

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BAUER Spezialtiefbau GmbH

(Florian Bauer & Karsten Beckhaus are Members of the Management Board & Marcus Daubner is heading Digitalisation in BAUER Spezialtiefbau GmbH, Germany.)

Event	S3 2023	DFI-India 2023	DFI48	Conference on Foundation and Decarbonization and Re-use
Date	Aug 8-10, 2023	Oct 05-07, 2023	Oct 31 - Nov 3, 2023	May 28-30, 2024
Venue	Boston, Massachusetts	Vadodara, Gujarat	Seattle, Washington	KIT, Amsterdam, Netherlands

DFI-India 2023: 12th Annual Conference Chair Message

Dear Readers,

It is great pleasure to welcome you all to the 12th Annual Conference on Deep Foundation Technologies for Infrastructure Development to be held in Vadodara, India from 5th to 7th October, 2023. The conference is co-hosted by DFI India and IGS Baroda Chapter. Vadodara is the vibrant and cultural city of Gujarat and boasts of excellent rail, road and flight connectivity. This annual conference is the flagship event of DFI and is eagerly looked forward by construction companies, consultants, equipment manufacturers, testing companies, academicians who derive great benefits due to the quality of lectures and discussions with experts around the world. The Vadodara conference has already received an overwhelming response from sponsors and exhibitors as almost all the exhibition stalls and sponsorships are booked in June itself. The participants list include the Who's who of the deep foundation industry with all the key experts that matter gathering under one roof. Kudos to all the participants, the committee members and the management team for the hard work which will further ensure the conference to be a grand success.

The conference consists of a special session on Day 1 for "Deep Excavations" which is now so widely used in urban infrastructure. I am pleased to announce that Professor John Endicott world renowned Geotechnical Engineer, AECOM Fellow and Expert in Deep Excavations has agreed to present the keynote lecture of this special session. The special session also consists of several other invited presentations by worldwide and Indian experts thus setting the tone of the conference by providing information and knowledge on latest trends worldwide.

The conference also offers seven keynote lectures on a variety of themes like Sustainable Geotechnics, Investigation and Reuse of Existing Foundations, Offshore Geotechnics, Helical Piles, Advances in Construction and QA/QC of Deep Foundations etc., which will be led by five speakers of international repute and two experts from India offering the elite of information and knowledge sharing available across the globe. The conference is planned in such a way, that there is adequate time for networking and gala evenings through the three days. The entire event will be held in Hotel Surya Palace which is centrally located and a leading four-star hotel in the city. I recommend early room booking at discounted rates to avoid last minute disappointments in case you want to stay at the conference venue itself.

In addition to the conference, Vadodara offers a variety of options for the global and the local traveler. There is a planned optional visit to the Statue of Unity, the tallest statue in the world on 8th October and

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which is about two hours' drive from the city. Vadodara has a grand Laxmi Vilas Palace, built by Maharaja Sayajirao Gaekwad III, who ruled the princely state of Baroda from 1875 to 1939, covering an area of 500 acres. This is the largest private home built till date and four times the size of Buckingham Palace and is a heritage marvel. There are museums and galleries including a rare collection of Raja Ravi Verma paintings. The Maharaja Sayajirao University of Vadodara is one of the largest residential university in the country and offers panoramic views of its architecture which is more than 100 years old including one of the largest domes in Asia. Navratri the biggest festival of Gujarat will be round the corner and thus ethnic shopping is an added attraction. There is a planned spouse tour which will ensure that the family or spouse has a good time when the respective delegate is busy with the conference and networking.

At this moment I would also like to highlight my journey through the DFI of India. My first memories of attending DFI Conference goes back to 1996 which was held in great grandeur in Mumbai. After a considerable pause, the DFI was to India in 2009 due to the singular efforts of Dr. K.S. Ramakrishna and Er. Anirudhan. Today the seed that was nurtured has grown into a tree and the Vadodara conference hopes to be a testimony of that effort.

The DFI Annual Conference offers great learning and opportunity to showcase work done and demonstrate talent. The website has a plethora of resources. The DFI library is an ocean of documents with relevant material available for each of the focused area of operation within deep foundations. The guidelines and specifications published by DFI are used as contract specifications in various tenders worldwide. I have personally benefitted a lot by attending these conferences and also contributing as an EC member and now a core committee member. Thus, I strongly recommend all to be a DFI member in corporate or individual capacity and take advantage of the various events, lectures, library and networking.

On behalf of DFI of India, IGS Baroda Chapter and as Conference Chair, I once again warmly welcome all the participants, companies, sponsors, resource persons to Vadodara and assure you of a memorable event.

Thank you and Best Wishes

- Er. Ravikiran Vaidya

DFII 2023: 12th Annual Conference Chair

DFII Technical Committee News & Reports

DFII Committee for Geotechnical Characterisation for Foundations

DFII conducted its first 5-days training program for working Geotech lab technicians for the year 2023-24 at National Academy of Construction Hyderabad during 14—18 June'23 . The program was jointly organised by DFII and NAC. More training programs are planned in different regions of India. Upcoming training programs in 2023 are planned at Cengrs Geotechinca, Noida, Renuka Consultants, Thane, L&T, Chennai.

An online bi-monthly webinar series is also planned by the Committee to emphasize proper geotechnical investigation and good work/tender practices. Details will be rolled out soon.

DFII Training Committee on Foundation Technologies

DFII Training committee successfully conducted an online program on 'Support Fluids for Foundation Construction' with the assistance of DFI US on 28-29 April'23. It is the third training program overall and first in 2023. The Training Committee planned another online training program on 'Tremie Concreting for Deep Foundations' during early September 2023. Details of expert speakers, topics and schedule of the program will be shared soon. More training programs are planned in 2023 on topics like Working Platform, Tool Management for Construction Equipment, etc.

DFII Student Outreach Committee—Groundwork

DFII Groundwork committee successfully conducted three webinars for the months February, March & April 2023,

Third **webinar**, a technical presentation was delivered on 20 April'23 on the topic 'Deep Foundation Construction for Modern Bridges', delivered by Er. Ekhlaq A Khan, Chief Engineering Manager, L&T Construction, Mumbai. More webinars are planned in this series. Details will be released soon.

Groundwork Committee also called application for DFII Student Awards 2023 under two categories, Masters Project and PhD Research. Winners will be awarded during DFII 2023 Annual Conference in Vadodara.

CFA Pile Technology Implementation Committee

For the year 2023-24, the DFII CFA Pile Committee is planning to conduct few technology promotional webinar programs for different stakeholders. It is encouraging to know that the CFA piles are already being constructed in multiple Indian projects.

The committee is also working on the draft BIS Guideline for CFA piling under CED 43 committee. DFII is hopeful that the BIS Guidelines will help consultants, contractors, and owners, to adopt the CFA piling technology in India

WiDF India Group

WiDF India team revived its online webinar series 'Civil Engineering Careers – Connect and Grow' First webinar was conducted on 24 May'23 on the theme 'Opportunities & Experiences for women engineers outside India.' We thank the panelists **Ms. Bushra Khan**, Technical Engineer, Bauer International, UAE and **Dr. Minu Treesa Abraham**, Alexander von Humboldt Fellow, RWTHAachen, Germany. The program is moderated by Ms. Geethanjali, Senior Manager Engineers India Limited Gurugram. The webinar series will resume after October.

The team is now working on developing a session during DFI-India 2023 annual conference in Vadodara during 05—07 Oct'23. More details will be out soon.

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Fig. 2: One of the evaluated old bridges in Amsterdam, the Isa van Eeghenbrug

In the old inner cities of The Netherlands, evaluating existing foundations is nowadays common practice, not only for buildings, but also for structures like bridges as shown in Figure 2. Over time the traffic on the bridges in Amsterdam changed from light traffic of people, horse and carriages to that of cars and trucks, resulting in a tremendous increase in the foundation loads. Inspections had to assess the adequacy of these existing foundations whenever bridge decks are replaced to meet the current functional requirements.

And as mentioned above, in case of a load test the test result is the load settlement diagram, such as shown in Figure 3. These results provide a very interesting insight in the behaviour of old timber piles. The assumption had been that these piles, that were installed between 1600 and 1940, had a capacity between 60 and 120 kN. However, the results indicated that the actual capacity may go as high as 420 kN, which easily explains why the existing foundations may very well be able to accommodate these tremendous increases in foundation loads.

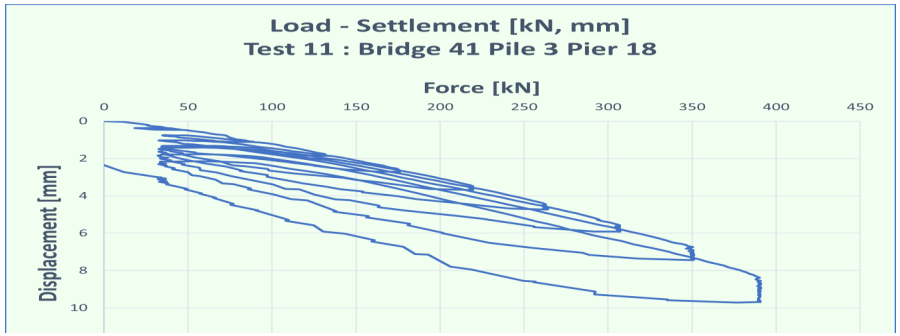

Fig. 3: Result of the static load test: the load settlement of one of the piles of bridge 41

One common misunderstanding regarding foundation re-use is that the existing foundation must be able to accommodate the entire loading from the superstructure. When the outcome of a foundation assessment is that the remaining design life is acceptable, but that the existing foundation has inadequate capacity to meet the new demands, there are still options to reuse the existing foundation. The superstructure can be designed such that loads are redistributed to an acceptable level for the existing foundation or piles can be added to supplement the existing foundation. However, such a hybrid foundation introduces a new design challenge, which is the differences in settlement between old and new foundation elements.

In any case, when the existing foundation can be re-used, it will give the owner significant advantages in costs and in construction time. And it will also contribute to a more sustainable society, where re-use, reduce and recycle is the standard.

See for the full paper:

RE-USE OF OLD PILE FOUNDATIONS IN AMSTERDAM

Remco Offenberg, Martijn van Delft & Marcel Bielefeld, Allnamics Geotechnical & Pile Testing Experts, DFI-EFFC International Conference on Deep Foundations and Ground Improvement: Smart Construction for the Future, May 18–20, 2022 – Berlin, Germany

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