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Soil Liquefaction: Biggest Challenge in Civil Engineering

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Abstract:

Is Soil liquefaction the biggest challenge faced by a Civil Engineer? What is Soil liquefaction? How many of us know the actual causes and after effects of Soil Liquefaction? What are the factors to be considered before selecting a particular site for any kind of construction?

Introduction

For a civil engineer, it is a common.myth that Structural Engineering is the most interesting field. Once a civil engineering graduate opts for further studies in his subject,Viz Masters in civil engineering, the first preference is always Strictures. The limited seats in esteemed universities and the hype associated with the title" masters in Structures" makes it a good catch.Personally,I,myself opted for the same due to the hype and competition associated with the title M-Tech in Strictures. After spending almost two decades in various esteemed organizations doing detailed engineering to engineering management and further project and construction management,I came face to face with SoilLiquefaction. Somehow, the projects where the organisation where I was associated with, never dealt with this issue. The subject somehow always eluded me. So when I came face to face with a typical site where it occurred, I dug myself into the world of soil mechanics. And trust me when I say that soil in itself is a vast and deep subject, let alone its uniqueness and profile swings. Infact soil is the very basic strata which plays almost all the major and pivotal part in the long-term durability and reliability of any structure, big or small.

So what is soil liquefaction? After digging a bit deep into the subject, I tried asking other civil engineering professionals Just to spread awareness. It came as abig surprise to me that majority of them were not aware of the term and its dangerous hazards. it is a term which needs more mentioning and one need to be accustomed with it the way term earth quake& settlement is relatable.; It is a hazard that affects many locations around the world. Soil liquefaction is one of the most common issues that cause foundation failure for loose or moderately dense sand or granular soils. When liquefaction occurs, the soil strata will change from solids to liquefied state. It will soon soften the soil and result in soils' strength loss and large deformation such as ground settlement and cracks. Liquefaction is most likely in areas with loose coarse-grained soils at or near the ground surface, which have poor drainage and are saturated with water.When a strong earthquake strikes an area saturated with groundwater, the shaking can cause the soil to temporarily lose its stiffness due to increased pore water pressure and behave as a liquid,When this happens, the soil loses its ability to support structures which its supposed to. Liquefaction can cause entire buildings that do not have a proper foundation designed to take care of this issue, to suddenly sink and tilt over. .

Lucky are those organisations where land is purchased after conducting proper soil investigation. In rare cases, it happens in such a way that a particular kilometres stretch is identified as potential site and conducting proper soil investigation without purchase of land becomes impossible. In those circumstances, one tend to go with assumptions. One theory can be looking at the soil map of India and going with it for further processing like bidding Another option might be to collect the data from neighborhood, similar projects executed. This becomes rather difficult as nearby areas of an upcoming transmission line would be mostly barren land with no history of soil data as backup. In this scenario, the bidder is almost forced to assume considering soil map criteria. All said and done, risk analysis done, when land is purchased and sublet to the contractor, comes the biggest surprise.Thats when the actual soil investigation happens. In rare cases the difference between assumption and actual can be alarming. Especially when the soil is found to be liquifiable.

Nowadays, most evaluations of earthquake hazards include an assessment of liquefaction potential because liquefaction is a major cause of foundation failure(causing damage or collapse of buildings, bridges and other structures), unequal load distribution of transport infrastructure, as well as any buried structures.Soil type is very important for assessment of this hazard.. Clay content, liquid limit, and water content are used to evaluate the potential initiation of soil liquefaction. The methods that can be used to evaluate liquefaction are the standard penetration test (SPT), cone penetration test (CPT), dynamic cone penetration test (DPT),Shear test and various auxiliary tests based on recommendations of the soil investigation agency.Various methods to mitigate soil liquefaction have been designed to improve soil strength and quality. Methods such as Vibro compaction, dynamic compaction, and use of vibro stone columns are suggested by agencies undertaking such improvement methods all over the world. Multinational companies like Menard and Keller has done extensive studies in this area and provide technology based solutions based on individual soul types. The basic concept is to make the loose soil dense by injecting chemical or granular material in to the soil to a depth upto which it's liquifiable and thereby making it a dense medium .the excess water is thereby reduced and the soil bearing capacity is improved considerably. Later the strength of the soil is assessed by conducting Standard Penetration Test (SPT) and shallow or deep foundations can be designed as per the case of loading.

The soil map of India may be revised considering a mention to soil susceptible to liquefaction, approximate for obvious reasons. May be soil types may be divided into different stretch and each stretch subjected to drilling to a certain depth to assess the soil profileans data compiled and modelled on the basis of various similarities of terrain and soil types . The modelling might be further subject to future revision as and when required and data can be assimilated accordingly. This might help in assessing the soil conditions before a particular land is owned by a potential developer.

Conclusion

Soil , itself is a major subject and deserves equal of not more importance in deciding the future and durability of any structure, minor or major in nature. Soil liquefaction needs to be taught and mentioned in the technical parameters of a tender document bin case data is available. It is the major hazard associated with earth quake and the actual support for any civil engineering marvel.

