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Selection of Ground Improvement Technique for Adjoining Structure near Costal Area

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Abstract: Every Civil engineering project have its own unique characteristics. The success of projectbased on Good returns in less financial investment. The engineer must take a determination on how bestto achieve the desired goals required by providing a workable solution for each project encountered. Ifany stage ground Improvement required, it would not be impact any negative. Ground improvement shallhelp positively to make success of project. The results of any ground improvement technique shall begive required safe stable ground, minimum financial impact, less time period and no disturbance toexisting establishment, not additional material need to procure etc.The Marine soil or Soft soil present in approximately 19 hector area near Haji Ali stretch. The main 8 arminterchange are coming in same part. There for heavy foundation required stable ground at least 20.00Tm2 bearing capacity. The required bearing capacity can't achieve in such critical area. Hence groundimprovement required. After improvement technic mentioning required to confirm the settlement. studythe various construction method adopting for improve the soil or ground. Every method had it's ownpros and cons, which will help to decide the most suitable method for problematic soil to improve itscapacity. So it can be available to carry each type of civil engineering structures. Selection of methodbased on situation and required results, here are taken case study of Coastal road project. Projectduration and economy also main factor affecting on selection

Keywords: Soil, Site Selection Costal Road, Stone Method

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GROUND IMPROVEMENT TECHNIQUES

Ground improvement and ground modification refer to the improvement in or modification to the engineering properties of soil that are carried out at a site where the soil in its natural state does not possess properties that are adequate to withstand the load of the structure. The improvement may be accomplished by drainage, compaction, preloading, reinforcement, and grouting, electrical, chemical, or thermal methods. Among the various soil stabilization procedures, the most suitable one is selected depending upon the type of soil available, time, cost involved etc.

Following are the recent methods of ground improvement Techniques used for stabilization of soil:

- Vibro Compaction
- Vacuum Consolidation
- Preloading of soil
- Soil stabilization by heating or vitrification
- Ground freezing
- Vibro-replacement stone columns

- Mechanically stabilized earth structures
- Soil nailing
- Micro-piles
- Grouting
- Chemical Soil Stabilization

VIBRO-COMPACTION METHOD OF GROUND IMPROVEMENT

Vibro-compaction, sometimes referred to as Vibro-flotation, is the rearrangement of soil particles into a denser configuration using powerful depth vibration**.** Vibro Compaction is a ground improvement process for densifying loose sands to create stable foundation soils. The principle behind vibro compaction is simple.

Figure 1: Vibro Compaction

Advantages of Vibro Compaction Method:

- Reduction of foundation settlements.
- Reduction of risk of liquefaction due to seismic activity.
- Permit construction on granular fills.

VACUUM CONSOLIDATION OF SOIL FOR GROUND IMPROVEMENT

Vacuum Consolidation is an effective means for improvement of saturated soft soils. The soil site is covered with an airtight membrane and vacuum is created underneath it by using dual venture and vacuum pump. The technology can provide an equivalent pre-loading of about 4.5m high conventional surcharge fill. Vacuum-assisted consolidation preloads the soil by reducing the pore pressure while maintaining a constant total stress.

The applications of Vacuum Consolidation of Soil:

- Replace standard preloading techniques eliminating the risk of failure.

- Combine with a water preloading in scare fill area. The method is used to build large developments on thick compressible soil.
- Combine with embankment pre-load using the increased stability

Figure 2: Vacuum Consolidation

GROUND FREEZING

Ground freezing is the use of refrigeration to convert in-situ pore water to ice. The ice then acts as a cement or glue, bonding together adjacent particles of soil or blocks of rock to increase their combined strength and make them impervious. The ground freezing considerations are Thermal analysis, Refrigeration system geometry, Thermal properties of soil and rock, freezing rates, Energy requirements, Coolant/ refrigerant distribution system analysis.

Ground freezing is a construction technique used in circumstances where soil needs to be stabilized so it will not collapse next to excavations, or to prevent contaminants spilled into soil from being leached away. Ground freezing has been used for at least one hundred years. Ground freezing is also used to provide regional groundwater barriers around mining operations for gold and other minerals, oil sands or oil shales. It is often referred to as ground freezing, soil freezing, or freeze wall. The ground freezing process involves drilling and installing a series of relatively closely spaced pipes and circulating a coolant through these pipes. The refrigerated coolant extracts heat from the ground, converting the soil pore water to ice resulting in an extremely strong, impermeable material. It is the most positive method of ground improvement used in the underground construction and mining industries.

Figure 3: Deep Shaft

Deep shafts are the most common application of ground freezing. The freeze pipes are drilled and installed around the perimeter of the proposed shaft to do the required depth. The circulation of the coolant is initiated until a frozen zone ranging from 1 to ten meters is formed. The inside of the shaft is then excavated and lined and the freezing system turned off. Ground freezing is used extensively in the tunneling industry. Tunnel applications use several different approaches. The most common involves horizontally drilling the freeze pipes around the tunnel perimeter very similar to the frozen shaft approach.

Applications of Ground Freezing Technique

- Temporary underpinning
- Temporary support for an excavation
- Prevention of groundwater flow into excavated area
- Temporary slope stabilization
- Temporary containment of toxic/hazardous waste contamination

VIBRO-REPLACEMENT STONE COLUMNS

Vibro-Replacement extends the range of soils that can be improved by vibratory techniques to include cohesive soils. Reinforcement of the soil with compacted granular columns or "stone columns" is accomplished by the top-feed method. The important Vibro-replacement stone columns are Ground conditions, Relative density, Degree of saturation, Permeation.

Principles of Vibro-Replacement Technique

The stone columns and intervening soil form and integrated foundation support system having low compressibility and improved load bearing capacity. In cohesive soils, excess pore water pressure is readily dissipated by the stone columns and for his reason, reduced settlements occur at a faster rate than is normally the case with cohesive soils.

There are different types of installation methods which can be broadly classified in the following manner:

- Wet top feed method
- Dry bottom feed method
- Offshore bottom feed method

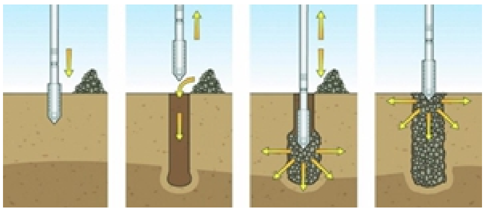

Figure 4: Step by Step Stone Column

Table 1: Summary of Vibro Replacement Method

Principle	• Reinforcement • Drainage
Applicable soil(s)	• Mixed deposits of clay, silt and sand • Soft and ultra soft silts (slimes) • Soft and ultra soft clays • Garbage fills
Applications of Vibro-Replacement	• Reduction of foundation settlement • Improve bearing capacity/reduce footing size requirements • Reduction of the risk of liquefaction due to seismic activity • Slope stabilization • Permit construction on fills • Permit shallow footing construction
Effect(s)	• Increased shear strength • Increased stiffness • Reduced liquefaction potential

Common applications	• Airport taxiways and runways • Chemical plants • Storage tanks & silos • Pipelines • Bridge abutments and approaches • Offshore bridge abutments • Road and railway embankments
Maximum depth	• 20-40 m
Land / offshore application	• Both

CONCLUSION

Stone columns improves the bearing capacity and reduces the settlement of weak soil strata Owing to rapid consolidation due to the accelerated dissipation of excess pore water pressure into the drainage path formed by stone columns, construction can be started quickly Thorough subsoil investigation from bore logs supplemented by penetration tests and other insitu test results should be strictly carried out before designing the stone column Stone columns when installed at a distance of 4.87m or more eliminates the damage caused by vibrations

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