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Review Paper on Soil Liquefaction and Earthquake

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Abstract - soil liquefaction also called earthquake liquefaction. In liquefaction the soil loses its strength and solid soil is behave temporarily as viscous liquid. One of the most severe episodes of liquefaction in modern time occurred in china during Tangshan earthquake of 1876. Some scientist estimate that an area of more than 2400sqm was subjected to severe liquefaction, which contributed to extensive damage that took place in southern part of city. Liquefaction may also be contribute in sand blows, which is called as sand boils or sand volcanoes. This case study is related to soil liquefaction.

Key Words: *Pore water pressure, soil boils, soil blasting, retaining wall, dynamic load, static load.*

1.INTRODUCTION :-

Due to the increment in pore water pressure the saturated cohesion less soil looses the strength this phenomenon called as soil liquefaction and hence reduced effective stresses due to dynamic loading. In soil liquefaction the strength and stiffness of a soil is reduced by rapid loading like earthquake shaking. The liquefaction is generally occurred in saturated soils are thesoils in which the space between individual particles is completely filled with water. The soil particles are pressurized by water. Before rapid loading or earthquake shaking can cause the water pressure which increase upto the point at which the soil particles can move with respect to each other.

Soil Liquefaction Phenomenon

Although earthquake often triggers this increase in water pressure but, activities like soil blasting may also caused the increment in water pressure. Due to liquefaction the strength of soil decreases and ability of soil decreases to support the contraction above it. Soil liquefaction is also dangerous for retaining walls, it exerts the higher pressure on retaining walls, it can can cause slide or tilt of retaining walls. This movement can cause destruction of structures on the ground surface and settlement of the retained soils

1.1.Definition:

"A phenomenon where by a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other change in stess condition, causing it to behave like a liquid (viscous)" is called as soil liquefaction.

1.2 Why does it occurs?

Liquefaction is phenomenon that leads to a soil suddenly losing strength. The most common as a result of ground shaking during a large earthquake. Not all types of soil get liquefy is an earthquake.

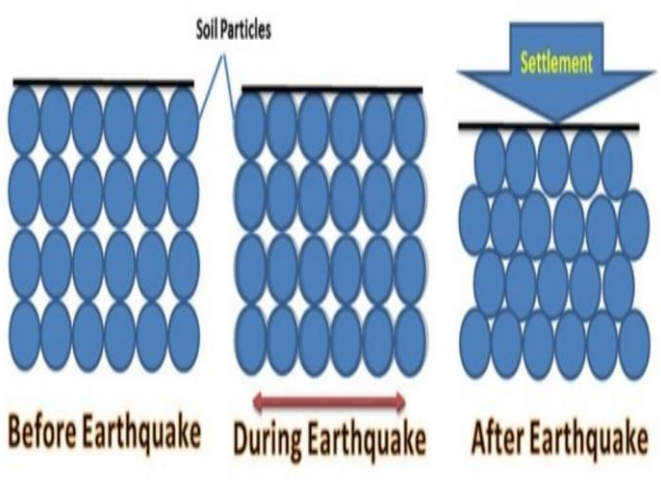
The following features of soils that potentially can liquefy

i) sandy soil

ii) silty soil

The above soil don't have the property of cohesiveness. They do not stick together as the way of clay soil do.

The soil which is below the water table, the all voids of sand and silt are filled with water. Dry soils above the water table wont liquefy. When the earthquake comes the shaking is violent and rapid that the sand and and silt particles try to compress the voids filled with water, but the water pushes back and pressure builds up until particles not start float in water. When the particles start to float the soil loses its strength and now we say that soil it gets liquefied. The soil which is previously solid is behave like fluid.



Process Of Liquefaction

Cyclic Mobility Liquefaction

2. TYPE OF LIQUEFACTION :-

2.1 Flow Liquefaction

Flow liquefaction is phenomenon in which the static equilibrium is destroyed by static or dynamic loads in soil deposit with low residual strength. It occurs when the static shears stresses in the soil exceeds the shear strength of the liquefied soil.

FlowLiquefaction

2.2 Cyclic mobility

Cyclic mobility is a phenomenon of liquefaction, triggered by cyclic loading, occurring in the soil deposits with the static shear stresses lower than the soil strength deformation due to cyclic mobility develop incrementally because of static and dynamic stresses that exist during an earthquake.

3. EFFECT OF LIQUEFACTION :-

3.1 loss of bearing strength

Whenever the soil get liquefy it lose the ability to support structure.

3.2 lateral spreading

Due to liquefaction the ground can slides dawn very gentle slopes. Lateral spreading mainly caused by cyclic mobility. It cause damage in foundation of structure, railway line, pipeline shaking at pile due to increment in lateral loads.

Lateral Spreading Liquefaction

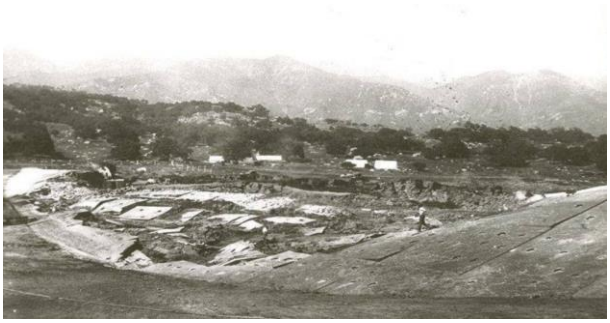
3.3 Sand Boil

From a buried liquefied layer the sand-laden water can be eject out and erupt at the surface to form sand volcanoes. The surrounding ground often fractures and settles.

Sand Boil Liquefaction

3.4. Flow failures

Flow failures are the catastrophic ground failure caused due soil liquefaction. These failures generally displace large masses of soil laterally. Flows develop in loose saturated sands or silts on relatively steeps slope.



Flow Failure Liquefaction

3.5. Ground oscillation
When the ground is flat or the slope is too gentle to allow lateral displacement, liquefaction at depth may decouple soil layers from the undertaking ground, allowing the upper soil to oscillate back and fourth and up and dawn in the form of ground waves.

These oscillations are usually accompanied by opening and closing of figures fractures of rigid structures such as pipeline and pavements.

3.6. Flotation
Light structures that are buried in ground can float to the surface when they are surrounded by liquefied soil.

4. FACTOR AFFECTING SOIL LIQUEFACTION :-

a) Soil type
b) Grain size and its distribution
c) Initial relative density
d) Vibration characteristics
e) Location if drainage and dimension of deposits
f) Surcharge load
g) Method of soil formation
h) Period under sustain load
i) Previous strain history
j) Trapped air

5. METHODS TO REDUCE LIQUEFACTION

PHENOMENON :-
a) Avoid liquefaction susceptible soil
b) Built liquefaction resistance structure
c) Use soil improvement techniques against liquefaction
d) Use vibro compaction
e) Dynamic compaction
f) Compaction grouting
g) Stone column

6. CONCLUSION :-
By above case study, we conclude that, the soil liquefaction is occurred in saturated or partially saturate cohesiveless soil. Due to earthquake shaking or sudden change in stresses the pore water pressure increase by which the solid particles of soil behaves like viscous fluid. Liquefaction majority occurred in sandy and silt soil.

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