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# Improving the physical property of soil by using lime and also reduce the settlement of raft foundation [A Review]

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## ABSTRACT

*The Settlement is defined "the vertical downward movement of the base of a structure is called settlement" and its effect upon the structure depends on its uniformity, its magnitude, the length of the time over which it takes place, and the nature of the structure itself. The foundation settlement of a structure may cause due to the following reasons: Plastic compression, Elastic compression, Ground water lowering, vibration, mining subsidence, underground erosion, etc. And the effect of foundation settlement damages the adjacent buildings. The reduction in settlement can be done by improving the soil properties (Density and Shear strength). And there are various method of ground improvement such as by mixing cement, lime, bitumen etc. In this paper we improve the soil properties by mixing the lime in it. And after that we will design the raft foundation and compare the settlement of the raft foundation on normal soil and improved soil by cement.*

***Keywords:Foundation settlement; Soil improvement; Comparison of settlement; Effect of settlement; Reduction in settlement; Raft foundation.***

## I.INTRODUCTION

The vertical downward movement of the base of a structure is called settlement and its effect upon the structure depends on its magnitude, its uniformity, the length of the time over which it takes place, and the nature of the structure itself.

Foundation settlement may be caused by some or a combination of the following reasons: Elastic compression, Inelastic compression (plastic compression), Ground water lowering, vibration, mining subsidence, underground erosion, etc.

The reduction in settlement can be done by improving the soil properties (Density and Shear strength). And there are various method of ground improvement such as by mixing cement, lime, bitumen etc. In this paper we

improve the soil properties by mixing the lime in it. And after that we will design the raft foundation and compare the settlement of the raft foundation on normal soil and improved soil by cement.


Fig.1 Shows the type of settlement

## II.EFFECT OF SETTLEMENT ON THE STRUCTURE FOUNDATION

If the structure as a whole settles uniformly into the ground there will not be any detrimental effect on the structure. But the connection which is held below the structure such as sanitary line, water connection pipe, and telephone etc. which can break if the settlement considerable. Such uniform settlement is possible only if the subsoil is homogeneous and the load distribution is uniform.According to experience, the differential settlement between parts of a structure should not be more than 75% of the normal absolute settlement.Fig.2 and Table1 which is given below shows.The different ways by which differential settlements can occur in a structure. Given Figure shows the absolute an permissible differential settlements for various types of structures. Foundation settlements must be estimated with great care for buildings, bridges, tower power plants and similar high cost structures. The settlements for structures such as fill earth dams, levees, etc. can be estimated with a greater of error.

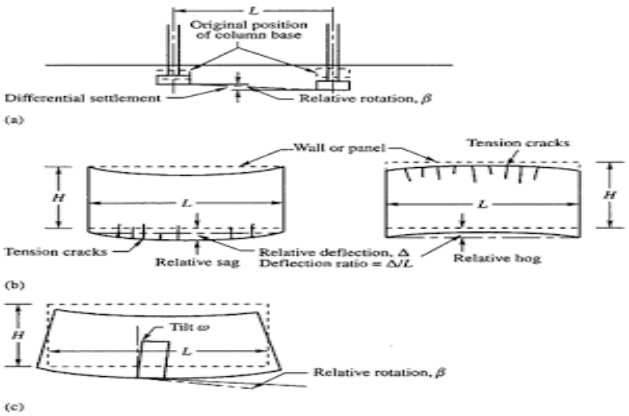


Figure2.Forframedandload-bearingwallstructures deferential settlement (after Worth and Burland), 1974.

**Table 1a Maximum settlements and differential settlements of buildings in cm. (After McDonald and Skempton, 1955).**

| Sl. no. | Criterion | Isolated foundations | Raft |
|---|---|---|---|
| 1. | Angular distortion | 1/300 | 1/300 |
| 2. | Greatest differential settlements | | |
| | Clays | 4-5 | 4.5 |
| | Sands | 3-25 | 3.25 |
| 3. | Maximum Settlements | | |
| | Clays | 7.5 | 10.0 |
| | Sands | 5.0 | 6.25 |

**Table 1b Permissible settlements (1955, U.S.S.R. Building Code).**

| Sl.no. | Type of building | Average settlement (cm) |
|---|---|---|
| 1. | Building with plain brickwalls on continuous and separate foundations with wall length L to wall height H | |
| | $L/H \geq 2.5$ | 7.5 |
| | $L/H \leq 1.5$ | 10.0 |
| 2. | Framed building | 10.0 |
| 3. | Solid reinforced concrete foundation of blast furnaces, water towers etc. | 30 |

**Table 1c Permissible differential settlement (U.S.S.R Building Code, 1955.**

| | | Type of soil | |
|---|---|---|---|
| Sl.no. | Type of structure | Sand and hard clay | Plastic clay |
| 1. | Steel and reinforced concrete structures | $0.002L$ | $0.002L$ |
| 2. | Plain brick walls in multistory buildings | | |
| | for $L/H \leq 3$ | $0.0003L$ | $0.0004L$ |
| | $L/H \geq 5$ | $0.0005L$ | $0.0007L$ |
| 3. | Water towers, silos etc. | $0.004L$ | $0.004L$ |
| 4. | Slope of crane way as well as track | | |
| | for bridge crane track | $0.003L$ | $0.003L$ |

where, $L$ = distance between two columns or parts of structure that settle different amounts, $H$ = Height of wall.

## III.METHODOLOGY USED FOR IMPROVEMENT OF SOIL

Step-1 The Soil has been taken to line and grade, the subgrade could be sacrificed to the specified depth and width and then it would be partially pulverized. It is necessary to remove non-soil materials larger than 3 inches, such as, roots, stumps, turf, and aggregates. Scarification is to be done because of pulverized subgrade offers more soil surface contact area for the lime at the time of lime application

Step-2.The soil is generally scarified and the slurry is applied by distributor truck. Because lime in slurry form much less concentrated then dry lime, generally two or more passes are needed to provide the specified amount of lime solids. For preventing runoff and consequent non-uniform lime distribution, the slurry is mixed into the soil immediately after each spreading pass.

Step-3 Initial mixing is needed to divide the lime all round the soil and to initially pulverize the soil to prepare for the addition of water to initiate the chemical reaction for stabilization. Either during the process or immediately after, water should be added to ensure the complete hydration and a quality stabilization project.

Step-4.To provide complete stabilization, sufficient final pulverization of the clay fraction and thorough distribution of the lime throughout the soil are essential.

Step-5.Initial compaction is generally performed as soon as possible just after mixing, using a a vibratory pad foot type roller or a sheep foot roller. After the section get shaped, final compaction can be accomplished using a smooth drum roller. The equipment should be appropriate for the depth of the section being constructed.

Step-7. Before placing the next layer of sub base (or base course), the compacted subgrade (or sub base) should be allowed to harden until loaded dump trucks can operate without rutting the surface. During that time, the surface of the lime treated soil should be kept moist to aid in strength gain, this is called curing.


Fig.3 Steps of lime stabilization

## IV.EFFECT OF SOIL IMPROVEMENT

a. A reduction in the plasticity index: The soil suddenly switches from being plastic (yielding and sticky) to being crumbly (stiff and grainy). In past condition it is easier to excavate, load, discharge, compaction and levelling.

b. An improvement in the compaction properties of the soil: The maximum dry density drops, while the optimal water content rises, so that the soil moves into a humidity range that can be easily compacted. This effect is beneficial when used on soils with a high percentage of water After compacting, the soil has excellent load-bearing properties.

c. increase in bearing capacity of soil: In many cases, two hours after treatment the CBR (California Bearing Ratio) of a treated soil is between 4 and 10 times higher than that of an untreated soil. This reaction greatly relieves on-site transportation difficulties.

## COMPARISION OF SETTLEMENT OF RFT FOUNDATION ON NORMAL SOIL AND IMPROVE SOIL BY USING LIME

Now we have to cast the raft foundation. Place the raft on given soil and applied the suitable load which must be more than the bearing capacity of soil. And note down the settlement which takes place due to that load. Then after we will take improved soil by using lime and place the raft foundation on it and applying same load. Then we will notice that the settlement must be reduced. Because of lime stabilization.

## V.CONCLUSION

For reducing the settlement of the structure Lime is used as a good soil stabilizing materials for highly active soils which undergo through frequent expansion and shrinkage. Lime acts immediately and improves various property of soil such as carrying capacity of soil, resistance to shrinkage during moist conditions, reduction in plasticity index, increase in CBR value and reduce the compression with the increase in time. The reaction is very quick and stabilization of soil starts within few hours. Lime is used as stabilizing material in this paper and it helps to reduce the settlement of the structure.in this paper, after improving the soil we will construct the raft foundation. And place the raft on normal soil and notice the settlement. Then after again place the soil on improve soil by using lime and check the settlement on improve soil. The settlement must be reduce because of lime stabilization.

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