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Assessment of Quality of Soil Compaction in a Construction Project Performed in the Campus of Majmaah University, KSA

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Abstract: ***The soil compaction process represents the nerve of the soil processing in the construction process. It determines and controls the quality of the pavement of flagstone and asphalt pavement. Yet, some contractors tend to spend less time in performing the soil compaction process in order to save time and money. This procedure affects the structure of buildings and makes it under the risk of tilting, sinking or collapse. Hence, the project owner should check up the quality of the soil compaction process to ensure avoiding these construction risks. Majmaah University in KSA is a new borne university where it has current construction projects that need following the application of the standard specifications in all the construction works. This project was performed to check out the quality of the soil compaction in the construction projects inside the campus of Majmaah University, KSA. Representative soil samples were taken from the field which represents the soil layers in some engineering construction projects currently performed at Majmaah University, KSA. Then, the engineering tests for the soil layers related to the compaction process in the field were done. Then, the standard proctor test was performed for the representative soil samples to detect the maximum dry unit weight and the percent of optimum water content for the soil samples in the laboratory of the civil and environmental engineering department at Majmaah university, KSA. Then, the assessment of the results of the soil compaction performed in the lab with the standard proctor test and specifications. Finally, the judgment on the compaction process for soil layers in the construction project achieved by the executive company in the campus of Majmaah University, KSA how much they meet the standard specifications.***

Keywords: Construction Project, soil, engineering tests, compaction, quality

1. Problem of Project

Construction companies may perform incomplete compaction for soil layers in its construction projects in order to save some financial profits. This procedure leads to various engineering problems in the engineering structures like cracks in walls and ceilings. This may lead also to the failure or collapse of the engineering structures.

2. Aims of Project

This project seeks to achieve multi purposes. First, to study the natural and engineering characteristics for soil layers utilizing both laboratory and fieldsoil engineering tests. Second, to assess the degree of meeting of the soil layer compaction procedure in the construction projects in Majmaah University, KSA to the engineering standards and specifications. Third, to provide valuable recommendations to treat any shortage in the soil layer compaction procedure in the construction projects in Majmaah University, KSA.

3. Apparatus and Tools

The apparatus and tools required to perform the engineering project in the soil mechanics engineering and foundation laboratory of the civil and environmental engineering department at Majmaah university, KSA are showed in Table (1).

Table 1: Apparatus and tools for project

No	Item
1	Sieve analysis set
2	Standard tamping rod
3	Standard proctor mold
4	Three compacted soil sample from the field .
5	Moisture content test set
6	Drying oven with a timer
7	Electronic weighing balance
8	Sand cone test set
9	Glass beakers of various size
10	Distilled water

Procedure and Steps to perform the engineering project

The first step was to detect the number and locations of the representative soil samples required to be taken from the field. The representative soil samples should cover the four sides and the center of the construction project site.

1) Taking representative soil samples from the field which represents the soil layers in some engineering construction projects currently performed at Majmaah University, KSA.
2) Performing the whole engineering tests for the soil layers related to the compaction process in the field.
3) Performing the sieve analysis test for the soil samples taken from the field.
4) Measurement of the amounts and percentages for the following components: aggregates, sand, mud and clay.
5) Performing the standard proctor test for the representative soil samples to detect the maximum dry unit weight and the percent of optimum water content for the soil samples in the laboratory of the civil and environmental engineering department at Majmaah university, KSA.

6) Assessment of the results of the soil compaction performed in the lab with the standard proctor test and specifications.
7) 6.Judgment on the compaction process for soil layers in the construction project achieved by the executive company in the campus of Majmaah University, KSA if they meet the standard specifications or not.

The Sieve Analysis Test

The five representative soil samples taken from the project site were weighted. Then, the soil samples were dried using the drying oven at (110.0 C) for (24 hours). Then, the dry soil samples were weighted. The sieve analysis test was applied on the soil samples utilizing the standard sieve set of standard diameters for such test. The sieve set was put on the standard mechanical sieve shaker for one hour shaking to separate the soil particles based on their diameters. Then, the mass, percentage and the cumulative percentage of soil retained on each sieve was measured. Finally, the percentage of gravel, sand, mud and clay were calculated in the soil samples.

Results of the standard proctor test for the soil samples are showed in Table (2).

Table 2: Results of the standard proctor test for the soil samples

No.	Particle Type	Percentage
1.	Gravel	37.6 &
2.	Sand	53.0 %
3.	Mud and Clay	9.4 %

Grain Size Distribution Curve

Then, the grain size distribution curve was drawn to show the gradation of soil particles. The curve showed good gradation for the soil particles. Figure (1) shows the results.

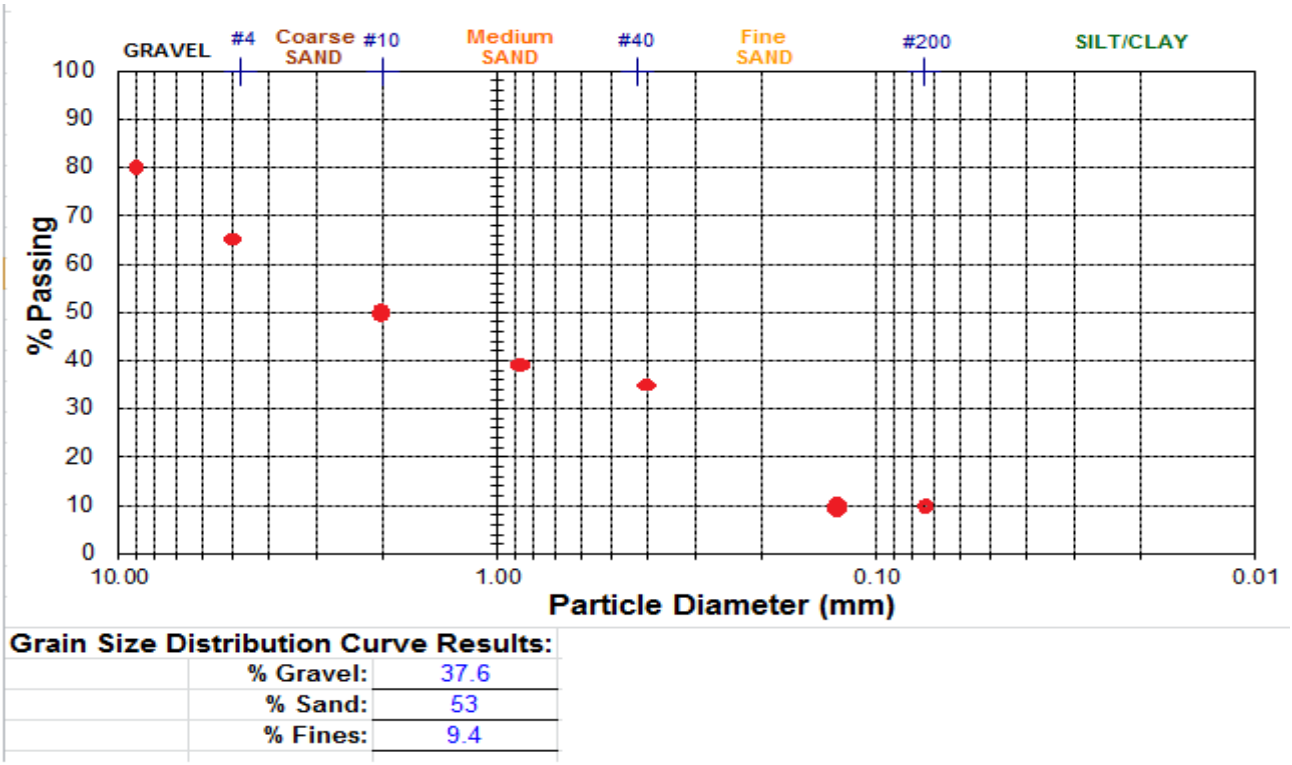

Figure 1: The grain size distribution curve for the soil layers

Standard Proctor Test

The standard proctor test was performed on the representative soil samples to detect the maximum dry unit weight and the percent of optimum water content for the soil samples in the laboratory of the civil and environmental engineering department at Majmaah university, KSA.

Each soil sample was tested after the addition of extra (2.0 %) water content. The soil samples. Soil samples were mixed well then were put in the compaction mold over three layers. Each layer was compacted with (25) standard strokes utilizing a tamping rod weighs (2.50 kg) and a length of (30.5 cm). Then, the mass and the unit weight if the compacted soil were calculated. Finally, the mass of the compacted soil was measured. The, the unit weight of the compacted soil was calculated. Then, the percentage of the optimum water content were calculated for the soil samples.

Results of Standard Proctor Test

After calculating the unit weight of the soil samples, the figure of dry unit weight of soil versus the moisture content figure was drawn for the soil samples. Figure (2) shows the results. The maximum dry unit weight for the soil samples was found to be (2.40 g/cm^3). The percentage of optimum water content for the soil samples was found to be (7.80 %). This unit weight is indicated avery good level of compaction procedure. Comparing the results of compaction in the field by the compactors with the compaction tests results of the laboratory showed that the field compaction was between (97.20% – 98.30%) in comparison with the compaction results in the laboratory. Table (3) shows the detailed results for the percentage of compaction for the five representative soil samples comparing with standard lab compaction results. Figure (2) shows the dry unit weight of soil versus

the moisture content for the soil samples compacted in the field.

Table 3: Detailed results for the percentage of compaction for the five representative soil samples comparing with standard lab compaction results

Sample No.	1	2	3	4	5
Compaction (%)	98.10	97.20	98.25	97.55	98.30

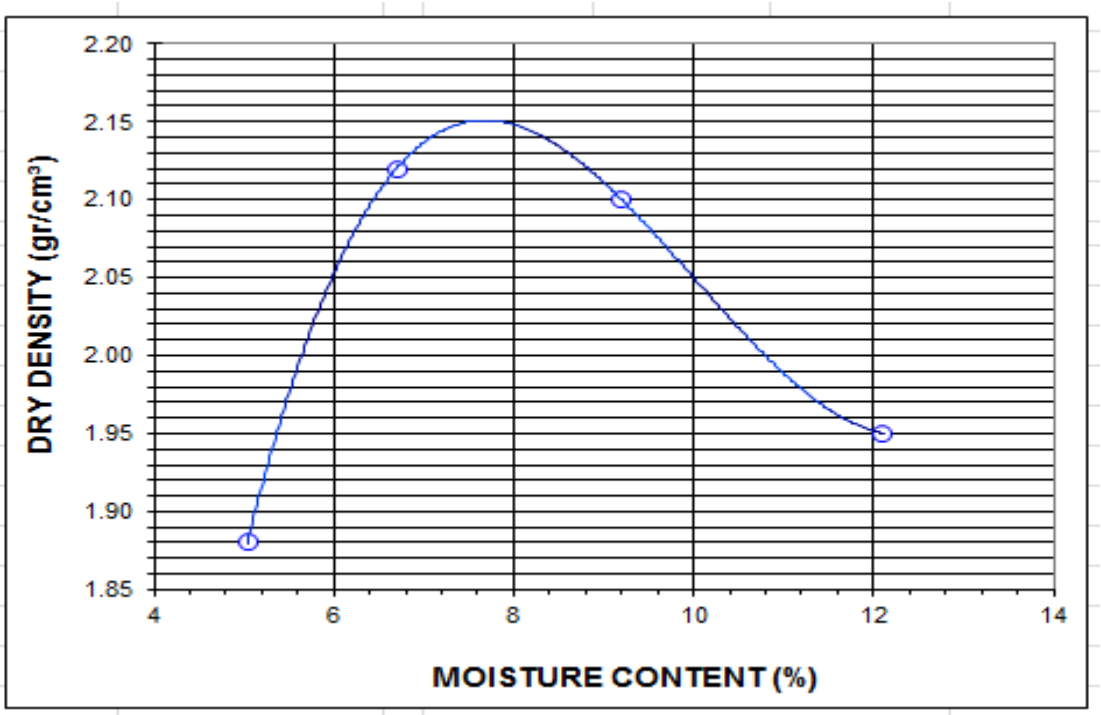

Figure 2: Dry unit weight of soil versus the moisture content for the soil samples compacted in the field

4. Results and Conclusions

The research study showed through the sieve analysis test for the tested soil sample that the soil samples showed that the soil particles grain size distribution was meeting the standard engineering specifications.

The research study showed also that comparing the results of compaction in the field by the compactors with the compaction tests results of the laboratory showed that the field compaction was between (97.20% – 98.30%) in comparison with the compaction results in the laboratory

The research study concluded that the soil types and texture was suitable for such construction use.

The research study concluded also a very good level of compaction procedure applied by the compactors in the field.

5. Acknowledgement

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