STUDY OF STRENGTH, MODULUS OF ELASTICITY, ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF SOIL-CEMENT MIXTURE

Manish Pal, Assistant Professor, Department of Civil Engineering, N.I.T, Agartala, India
Partha Pratim Sarkar, Lecturer, Department of Transportation Engineering, N.I.T, Agartala, India
Dipankar Sarkar, Lecturer, Department of Transportation Engineering, N.I.T, Agartala, India
Kaberi Majumdar, Lecturer, Department of Electrical Engineering, T.I.T, Agartala, Tripura, India

ABSTRACT

Study deals with strength, Modulus of Elasticity, Resistivity and Conductivity of Soil-Cement Mixture. Ordinary Portland Cement is used in the soil. Four different mixes such as natural soil, soil +2% cement, soil + 4% cement and soil +6% cement have been considered in this study. All the test samples have been prepared at maximum dry-density (MDD) and cured under normal atmospheric condition for 7, 14, 21, 28, 35 and 42 days and also in oven at controlled temperature of 50°C for 2-days in the laboratory with a view to determining the equivalence of oven curing in terms of days of normal curing comparing strength and Modulus of Elasticity of samples. The result shows that on addition of cement in soil Optimum Moisture Content (OMC) decreases but change in dry-density is almost negligible. It is also noticed that the gain in strength, particularly Unconfined Compressive Strength (UCS) and Modulus of Elasticity of soil cement mixture are more if the more cement percentages are used for strengthening of soil. On the other hand strength and Modulus of Elasticity depend on days of curing. Rate of change of Unconfined Compressive Strength and Modulus of Elasticity upto 28 days is more but rate of change of Unconfined Compressive Strength and Modulus of Elasticity for 28 to 35 days or 35 to 42 days almost negligible. Knowing Modulus of Elasticity of 2-days oven cured samples, Modulus value of 28-days moist cured samples at ambient laboratory temperature may be calculated with help of calibration equation. Thus in short time period Modulus value can be achieved. For Electrical Conductivity and Resistivity a test pit is made in the ground by using different soil-cement mixture. Conductivity decreases with the increase of cement percentage but Resistivity increases with increase of cement percentage. The study examines the possibility of correlation between Unconfined Compressive Strength, Modulus of Elasticity and days of curing by regression analysis.

Key words: Soil-cement mix, Accelerated curing, Unconfined compressive strength, Modulus of Elasticity, Resistivity, Conductivity.
1.0 INTRODUCTION

Soil stabilization is the alteration of one or more soil properties, by mechanical or chemical means to create and improved soil material possessing the desired engineering properties. Soil may be stabilized to increase strength and durability or to prevent erosion and dust generation. Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and airfield pavements. In India the biggest handicap to provide a complete network of road system is its limited financial availability to build road by the conventional methods. Therefore, there is a need to resort to one of the suitable methods of low cost road construction. Under this circumstance use of locally available material after suitable treatment is only solution to meet the growth demand of road constructions. The constructional cost can be considerably decreased by selecting local materials including local soils for the construction of the lower layers of the pavement. If the stability of the local soil is not adequate for supporting wheel loads, the properties can be improved by soil stabilized techniques. The principle of soil stabilized road construction involves the effective utilization of local soil and other suitable stabilizing agent. Therefore the first and foremost task is to characterize the locally available soil and after proper assessment, suitable treatment is to be provided if required. Sub-grade soil is an integral part of the road pavement structure as it provides the support to the pavement from beneath. The sub-grade soil and its properties are important in the design of pavement structure. The main function of the sub-grade is to give adequate support to the pavement. And for this, the subgrade should possess sufficient stability under adverse climate and loading condition.

The present paper deals with study of strength, modulus of elasticity, electrical resistivity and conductivity of soil-cement mixture. Suitability of material for engineering purposes can be tested on the basis of strength, modulus of elasticity and durability. In the present investigation, soil has been mixed with cement and emphasis has been given on the strength aspect, particularly on the unconfined compressive strength of soil and soil-cement specimens and also on modulus of elasticity value. Unconfined compressed sample have been cured under normal atmospheric condition for 7, 14, 21, 28, 35 and 42 days and also in oven at controlled temperature of 50°C for two days in the laboratory to determine the equivalence of oven curing in the terms of days of normal curing comparing strength and modulus of elasticity of samples.

The present paper deals also with study of electrical resistivity and conductivity. However, soil has own resistivity and conductivity depending upon the water content, compaction and composition with other material. Resistivity and conductivity of soil-cement mix according to different percentage of cement have been studied.

2.0 METHODOLOGY OF STUDY

The Strength and modulus of elasticity of soil is dependent on its dry density to a great extent. Again dry density is the direct quantitative measure of compaction. So compaction
plays a very important role in road construction and is regarded as a design tool. In this study soil has been mixed with different percentages of cement mixes. Preparation of samples has been made by following way:

a) Preparation of Mix: Different percentages of cement are mixed thoroughly with dry soil. The cement is mixed with soil at 2%, 4% and 6% by dry weight of soil. Cement is mixed in three to four batches. After drying the soil, all lumps are broken by wooden mallet and screened through 4.75 mm IS Sieve. Each batch of soil is first hand mixed with cement as thoroughly as possible and then compaction water is added and the mixture is again hand mixed for even distribution of moisture. In this way, cement is added in three to four installments with corresponding addition of compaction water until the mixture is uniform. Optimum moisture content of the mix is found with standard Proctor Test conforming to IS 2720 (part 8). For both accelerated and normal curing system cylindrical soil samples for 3.8 cm diameter and 6 cm height have been prepared at dry density corresponding to their optimum moisture content.

b) Compaction of Mix: The moisture content desired to achieve maximum density for different soil cement mixture varied from 15.89 % to 16.78%. Dry density of the soil-cement mix is found to vary from 16.78 KN/m3 to 16.85 KN/m3.

c) There are three important variable associated with curing of stabilized mixture. These are temperature, time and moisture regime. Laboratory curing procedures are different from field curing procedures. The field curing consists of periodical sprinkling of water or applying asphaltic surface membrane. Laboratory curing on the other hand is normal curing in desiccators at ambient temperature and may be accelerated in temperature-controlled oven. In the study of unconfined compressive strength and modulus of elasticity of soil & soil cement mixture have been determined in oven curing system and as well as in moist curing at laboratory summer temperature. For both accelerated and normal curing system, cylindrical soil samples of 38 mm diameter and 60 mm height have been prepared at dry density corresponding to their optimum moisture content. In case of accelerated curing, the samples have been cured in oven at 50°C for 2 days, whereas the samples have been cured for 7, 14, 21, 28, 35 and 42 days at desiccators at the ambient temperature for the normal curing. The study deals with the unconfined compressive strength and modulus of elasticity of three different mixes such as natural soil, soil + 2% cement mix, soil + 4% cement mix and soil + 6% cement mix respectively.

d) For evaluation of resistivity and conductivity, a test pit is made in the ground. The length of test pit is seven times of the depth and width. Size of test pit is considered as 3.5m x 0.50m x 0.50m. Test dry soil is moist in optimum moisture content and placed the moist soil in the test pit to about one fifth of pit height and compacted the soil 25 times with the help of rammer. Similarly, remaining four layers are provided in the test pit for complete filling. The test is conducted by driving four metal spikes to serve as electrodes into the ground along a straight at equal distances (As shown in fig.7). A direct voltage is imposed between the two outer potentiometer electrodes and the potential drop is measured between the inner electrodes Similarly test is conducted for soil-cement mixes in three different percentages of 2%, 4%, 6%.
3.0 PROPERTIES OF SOIL AND SOIL-CEMENT MIX

The properties of the soil and soil cement mixes have been presented Table 1 and 2. It has been observed that dry density of plain soil is 17.60 KN/m$^3$ and optimum moisture content is 18.39%. The optimum moisture content has been found to decrease with addition of cement with soil, however change in dry density is almost negligible.

**Table 1: Properties of soil Used in the Study**

<table>
<thead>
<tr>
<th>Grain size distribution</th>
<th>Specific gravity</th>
<th>OMC</th>
<th>Maximum Dry Density</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>11.3%</td>
<td>2.75</td>
<td>18.39%</td>
<td>17.60 KN/m$^3$</td>
<td>39.9%</td>
<td>23.7%</td>
</tr>
<tr>
<td>Silt</td>
<td>56.1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clay</td>
<td>32.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: Properties of Soil-Cement Mix used in the Study**

<table>
<thead>
<tr>
<th></th>
<th>Soil + 2% Cement</th>
<th>Soil+4% Cement</th>
<th>Soil 6% Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMC</td>
<td>16.78%</td>
<td>16.15%</td>
<td>15.89%</td>
</tr>
<tr>
<td>MDD</td>
<td>16.85 KN/m$^3$</td>
<td>16.80 KN/m$^3$</td>
<td>16.78 KN/m$^3$</td>
</tr>
</tbody>
</table>

*Note: OMC = Optimum moisture content, MDD = Maximum dry density*

![Graph](image.png)

Fig.1: Variation of Optimum moisture Content with respect to Cement Content.

4.0 UNCONFINED COMpressive STRENGTH

The cured samples in different system are tested to failure in unconfined compression at a constant rate of deformation of 1.25 mm/min. The normal cured samples of soil and three different soil-cement mixes tested for 7, 14, 21, 28, 35 and 42 days unconfined strength and the accelerated cured samples have been tested for 2 days strength. The unconfined compressive strengths under normal curing and accelerated curing (2-days at 50$^o$C) are given
in Table 3. The variation of the unconfined compressive strength over the number of curing days is shown in figure 2.

**Table 3: Unconfined Compressive strength under Normal curing and Accelerated curing (2 days at 50^\circ C)**

<table>
<thead>
<tr>
<th>Mix type</th>
<th>7 Days</th>
<th>14 Days</th>
<th>21 Days</th>
<th>28 Days</th>
<th>35 Days</th>
<th>42 Days</th>
<th>Accelerated Curing 2 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>0.231</td>
<td>0.297</td>
<td>0.376</td>
<td>0.435</td>
<td>0.439</td>
<td>0.443</td>
<td>0.405</td>
</tr>
<tr>
<td>Soil + 2% Cement mix</td>
<td>0.295</td>
<td>0.356</td>
<td>0.413</td>
<td>0.516</td>
<td>0.521</td>
<td>0.529</td>
<td>0.497</td>
</tr>
<tr>
<td>Soil + 4% Cement mix</td>
<td>0.573</td>
<td>0.733</td>
<td>0.817</td>
<td>0.922</td>
<td>0.937</td>
<td>0.950</td>
<td>0.905</td>
</tr>
<tr>
<td>Soil + 6% Cement mix</td>
<td>0.988</td>
<td>1.305</td>
<td>1.418</td>
<td>1.568</td>
<td>1.575</td>
<td>1.593</td>
<td>1.511</td>
</tr>
</tbody>
</table>

![Fig 2: Variation of UCS (N/mm^2) with respect to days of curing.](image)

The variation of the Unconfined Compressive strength for all types of mixes over curing periods is found almost same nature. The rate of change of Unconfined Compressive strength of soil and soil-cement mixture up-to 28 days is more but rate of change of Unconfined Compressive strength for 28 to 35 days or 35 to 42 days are almost negligible. It can be observed from the above table that 2-days strength of oven cured soil samples at 50^\circ C is equivalent to the strength of 25.59 days strength of samples cured at room temperature by comparing from the 42 days UCS test result through linear interpolation. And for soil-cement mix, 2 days strength of oven cured sample at 50^\circ C is equivalent to the strength of 26.30 days, 26.67 days and 26.55 days for 2% cement, 4% cement and 6% cement + soil respectively. The regression equation for the trends of the variation for each type of mixes have been generated to correlate the numbers of curing days and corresponding Unconfined Compressive strength for the specific type of the soil used in this study which are given in equation number 1 to 4:

For only Soil
UCS = 0.017 D + 0.114, \((R^2 = 0.987)\) \hspace{1cm} (1)

For Soil + 2% Cement content

UCS = 0.015 D + 0.182, \((R^2 = 0.964)\) \hspace{1cm} (2)

For Soil + 4% Cement content

UCS = 0.028 D + 0.393, \((R^2 = 0.993)\) \hspace{1cm} (3)

For Soil + 6% Cement content

UCS = 0.05 D + 0.689, \((R^2 = 0.985)\) \hspace{1cm} (4)

Where, UCS = Unconfined compressive strength, \(D=\) Days of curing.

5.0 EVALUATION OF MODULUS OF ELASTICITY (E)

The modulus of elasticity is the measure of the stiffness of any layer of pavement. Therefore, evaluation of sub-grade is an essential step to design the other layers. The in-situ evaluation of subgrade is not always possible. In this particular study, unconfined compressive stress has been utilized for determination of the modulus of elasticity of the soil specimen compacted at Optimum moisture content. In this case modulus of elasticity has been found out for failure stress as well as 50% of the failure stress under normal and accelerated curing. Table 4 and 5 are presenting the modulus of elasticity at failure stress and at 50% of the failure stress respectively for all types of mixes used in the study.

**Table 4: Modulus of Elasticity (N/mm²) at failure stress under normal and accelerated curing**

<table>
<thead>
<tr>
<th>Days of Curing</th>
<th>Only Soil</th>
<th>Soil + 2% Cement</th>
<th>Soil + 4% Cement</th>
<th>Soil + 6% Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Curing</td>
<td>Accelerated Curing</td>
<td>Normal Curing</td>
<td>Accelerated Curing</td>
</tr>
<tr>
<td>2</td>
<td>--</td>
<td>5.763</td>
<td>--</td>
<td>17.35</td>
</tr>
<tr>
<td>7</td>
<td>3.531</td>
<td>--</td>
<td>9.923</td>
<td>--</td>
</tr>
<tr>
<td>14</td>
<td>3.972</td>
<td>--</td>
<td>12.110</td>
<td>--</td>
</tr>
<tr>
<td>21</td>
<td>4.550</td>
<td>--</td>
<td>14.251</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>5.284</td>
<td>--</td>
<td>18.441</td>
<td>--</td>
</tr>
<tr>
<td>35</td>
<td>5.293</td>
<td>--</td>
<td>18.620</td>
<td>--</td>
</tr>
<tr>
<td>42</td>
<td>5.301</td>
<td>--</td>
<td>18.892</td>
<td>--</td>
</tr>
</tbody>
</table>
Table 5: Modulus of Elasticity (N/mm²) at 50% failure stress under normal and accelerated curing

<table>
<thead>
<tr>
<th>Days of Curing</th>
<th>Only Soil</th>
<th>Soil + 2% Cement</th>
<th>Soil + 4% Cement</th>
<th>Soil + 6% Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Curing</td>
<td>Accelerated Curing</td>
<td>Normal Curing</td>
<td>Accelerated Curing</td>
</tr>
<tr>
<td>2</td>
<td>--</td>
<td>7.660</td>
<td>--</td>
<td>23.390</td>
</tr>
<tr>
<td>7</td>
<td>2.811</td>
<td>--</td>
<td>8.955</td>
<td>--</td>
</tr>
<tr>
<td>14</td>
<td>5.772</td>
<td>--</td>
<td>14.713</td>
<td>--</td>
</tr>
<tr>
<td>21</td>
<td>6.435</td>
<td>--</td>
<td>18.250</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>8.736</td>
<td>--</td>
<td>25.632</td>
<td>--</td>
</tr>
<tr>
<td>35</td>
<td>8.784</td>
<td>--</td>
<td>25.811</td>
<td>--</td>
</tr>
<tr>
<td>42</td>
<td>8.925</td>
<td>--</td>
<td>25.992</td>
<td>--</td>
</tr>
</tbody>
</table>

The variation of the modulus of elasticity at failure stress and 50% of the failure stress with respect to the period of curing is presented in Figure 3 and 4. The variation of the modulus of elasticity for all types of mixes over curing periods is found almost same nature. The rate of change of modulus of elasticity of soil and soil-cement mixture upto 28 days is more but rate of change of modulus of elasticity for 28 to 35 days or 35 to 42 days are almost negligible. The developed modulus of elasticity after 28 days with moist curing is almost equivalent with modulus of elasticity developed after 2 days with accelerated curing as shown in the Table 4 and 5.

The correlation between the modulus of elasticity (E) determined at failure stress under moist curing with the number of curing days are given in Equation number 5 to 8 for different adopted soil and soil-cement mixes. Similar kinds of correlation for the modulus of elasticity (E) at 50% of failure stress have been developed as shown in the Equation no 9 to 12.
For soil at failure stress,
\[ E = -0.001D^2 - 0.134D + 2.560, \quad (R^2 = 0.964) \]  (5)

For soil + 2% cement at failure stress
\[ E = -0.006D^2 + 0.591D + 5.612, \quad (R^2 = 0.957) \]  (6)

For soil + 4% cement at failure stress
\[ E = -0.015D^2 + 0.130D + 11.32, \quad (R^2 = 0.961) \]  (7)

For soil + 6% cement
\[ E = -0.043D^2 + 3.042D + 32.74, \quad (R^2 = 0.992) \]  (8)

For soil at 50% of failure stress
\[ E = -0.006D^2 + 0.466D - 0.04, \quad (R^2 = 0.97) \]  (9)

For soil + 2% cement at 50% of failure stress
\[ E = -0.015D^2 + 1.251D + 0.419, \quad (R^2 = 0.969) \]  (10)

For soil + 4% cement at 50% of failure stress
\[ E = -0.029D^2 + 2.258D + 6.831, \quad (R^2 = 0.989) \]  (11)

For soil + 6% cement at 50% of failure stress
\[ E = -0.065D^2 + 5.469D + 5.063, \quad (R^2 = 0.941) \]  (12)

*Where, \( E \) = Modulus of Elasticity, \( D \) = Days of curing.*

Calibration of Modulus value for accelerated curing at 50 % of failure stress

![Calibration of Modulus value](image)

**Fig 5: Calibration of Modulus value**

Calibration equation:
\[ T = 0.486 C^2 - 2.792 C + 13.83 \]  (13)
Where \( T \) = Percentage of calibration of obtained Modulus value for oven curing at 50°C corresponding to 50% of failure stress.

\[ C = \text{Percentage of Cement Mixed with soil} \]

\[ E_{\text{mean 28}} = E_{\text{mean 2}} \left(1 + \frac{T}{100}\right) \quad (14) \]

Where: \( E_{\text{mean 28}} \) = Mean modulus of elasticity of sample after 28 days normal curing corresponding to 50% of failure stress,

\( E_{\text{mean 2}} \) = Mean modulus of elasticity of sample after 2 days oven curing at 50°C corresponding to 50% of failure stress

Knowing Modulus of Elasticity of 2-days oven cured samples, Modulus value of 28-days moist cured samples at ambient laboratory temperature may be calculated with help of calibration equation. Thus in short time period Modulus value of 28 days can be achieved.

6.0 RESISTIVITY AND CONDUCTIVITY EVALUATION

Resistance is a property of a substance which opposes the flow of electric current through it. The resistance of a material depends upon its length, area of cross section, type of material, purity and hardness of material. Resistivity (Ohm-m) is usually the resistance (ohm) between two opposite phases of unit cube of the material. Reciprocal of resistance i.e. \( 1/R \) is conductance. On the other hand conductivity is the reciprocal of the resistivity and it is the conductance between the two opposite phases of unit cube. Unit of conductivity is Siemens/m. However, soil has own resistivity and conductivity depending upon the water content, compaction and composition with other material. Table 6 and 7 shows the resistivity and conductivity value according to different percentage of cement. Resistivity is calculated by the following formula

\[ \rho = \frac{2\pi DE}{I} = 2\pi DR \]

Where, \( \rho \) = resistivity

\( D \) = distance between electrodes (m)

\( E \) = potential drop between outer electrodes (volts)

\( I \) = current flowing between outer electrodes (amperes)

\( R \) = resistance (ohms)

**Table 6: Resistivity value (in ohm-m) of Soil-Cement Mix**

<table>
<thead>
<tr>
<th>Days of Curing</th>
<th>Only Soil</th>
<th>Soil + 2% Cement</th>
<th>Soil + 4% cement</th>
<th>Soil + 6% cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>47.610</td>
<td>58.250</td>
<td>80.290</td>
<td>97.520</td>
</tr>
<tr>
<td>14</td>
<td>47.730</td>
<td>63.770</td>
<td>92.330</td>
<td>121.350</td>
</tr>
<tr>
<td>21</td>
<td>47.741</td>
<td>70.830</td>
<td>115.450</td>
<td>135.690</td>
</tr>
<tr>
<td>28</td>
<td>47.823</td>
<td>86.250</td>
<td>127.690</td>
<td>143.770</td>
</tr>
<tr>
<td>35</td>
<td>47.839</td>
<td>86.790</td>
<td>127.850</td>
<td>143.920</td>
</tr>
<tr>
<td>42</td>
<td>47.830</td>
<td>86.930</td>
<td>128.100</td>
<td>144.250</td>
</tr>
</tbody>
</table>
Fig. 6: Variation of Resistivity with respect to days of curing,

Table 7: Conductivity value (in Siemens/m) of Soil-Cement Mix

<table>
<thead>
<tr>
<th>Days of Curing</th>
<th>Only Soil</th>
<th>Soil + 2% Cement</th>
<th>Soil + 4% cement</th>
<th>Soil + 6% cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>0.0210</td>
<td>0.0172</td>
<td>0.0125</td>
<td>0.0103</td>
</tr>
<tr>
<td>14</td>
<td>0.0210</td>
<td>0.0157</td>
<td>0.0108</td>
<td>0.0082</td>
</tr>
<tr>
<td>21</td>
<td>0.0209</td>
<td>0.0141</td>
<td>0.0087</td>
<td>0.0074</td>
</tr>
<tr>
<td>28</td>
<td>0.0209</td>
<td>0.0116</td>
<td>0.0078</td>
<td>0.0070</td>
</tr>
<tr>
<td>35</td>
<td>0.0209</td>
<td>0.0115</td>
<td>0.0078</td>
<td>0.0069</td>
</tr>
<tr>
<td>42</td>
<td>0.0209</td>
<td>0.0115</td>
<td>0.0078</td>
<td>0.0069</td>
</tr>
</tbody>
</table>

Fig. 8: Variation of Conductivity with respect to days of curing

From the Table 6 & 7, it is seen that for any particular soil cement mix if days of curing increases then Resistivity value increases and conductivity value decreases. The variation of the resistivity and conductivity for all types of soil cement mixes over curing periods is found almost of same nature. The rate of change of resistivity and conductivity of soil-cement mixture upto 28 days is more but rate of change of resistivity and conductivity for 28 to 35 days or 35 to 42 days are almost negligible. But rate of change of Resistivity and conductivity for only soil is negligible and it is linear in nature.
7.0 CONCLUSION

The result shows that on addition of cement in soil Optimum Moisture Content decreases but change in dry-density is almost negligible. It is also noticed that the gain in strength, particularly Unconfined Compressive Strength and Modulus of Elasticity of soil cement mixture are more if more cement percentages are used for strengthening of soil. On the other hand strength and Modulus of Elasticity depend on days of curing. Rate of change of Unconfined Compressive Strength and Modulus of Elasticity upto 28 days is more but rate of change of Unconfined Compressive Strength and Modulus of Elasticity for 28 to 35 days or 35 to 42 days are almost negligible.

The study reveals that 2-days strength of oven cured soil samples at 50°C is equivalent to the strength of 25.59 days strength of samples cured at room temperature. And for soil-cement mix, 2 days strength of oven cured sample at 50°C is equivalent to the strength at 26.30 days, 26.67 days and 26.55 days for 2% cement, 4% cement and 6% cement + soil respectively. Therefore, it is observed that accelerated curing will effect sufficiently in saving of time of investigation in the laboratory. Moreover, the determination of the modulus of elasticity (an important parameter in design of the pavement) in this process is very simple and can be determined in the laboratory within very short period of time.

Besides, for any particular percentage of cement mix, electrical resistivity value is increasing and electrical conductivity value is decreasing with days of curing. Electrical resistivity value of minimum soil-cement mix (2%) comes higher by about 1.82 times than the resistivity value for plain soil and electrical conductivity value of minimum soil-cement mix (2%) comes lower by about 0.55 times than the conductivity value for plain soil.

REFERENCES


