# Strengthening and Widening of Flexible Pavement

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**Abstract**

Pavement design is a difficult work. Traffic loading is heterogeneous, mix of vehicle, traffic load, axle type, load distribution and over the pavement design life. Pavement material responds to stress influencing, temperature, moisture, loading rate and other factors. A traffic survey is needed for existing roads that are need for up-gradation to pavement strengthening. Traffic surveys conducted in the region from the basis for deciding the number of traffic lanes and Road way width pavement design. Traffic survey is to establish the Average Annual Daily Traffic (AADT).Expected outcome of the proposed work are evaluation of sufficient overlay over the existing surface. Widen the road as per traffic requirement. Check out their strength after overlay and free flow of vehicles.

**Key word** Pavements, CBR, bitumen,

**Introduction**

Roads are damaged rapidly due to the heavy mixed traffic and adverse climatic conditions in dust is formed and during rain mud is formed due to the combined effect of traffic and rain water washing away the soil binder from the surface the stone aggregate comes out on the surface layer. If there is great surface wearing deterioration or giving patch works also application of good binding materials full under the influence of strengthening. The strengthening will be carried but base on geotechnical investigation of sub- grade solid.

**Impact**

The maintenance operations involves the investigation of road condition, resolves the problem and adopting the most suitable steps. If the pavement is well designed and constructed, they require maintenance. If the pavement has to support increased wheel loads and load repetitions the payment rapidly distressed. Un-evenness is uncomfortable for driver or passenger to travel. Un-evenness is extremely uncomfortable for a driver or passenger to travel over its stretch so a pavement with a seriously damaged top surface is strengthen to make it functionally serviceable which is get by providing a another layer over existing pavement so it that way top enhance a its longevity as a rapid increase in larger commercial vehicle like truck buses occupy greater space so it is necessary to widen the road as per the traffic requirement.

**Material and Methodology**

The main focus of this paper is to provide strength and make pavement sufficient wide. There are so many tests perform to determination of strength and survey and leveling also. Survey and leveling was field work for widening of pavement.

**Standard Proctor Compaction Test**

- Determination of maximum dry unit weight which can be used for specification of field compaction.
- Relationship between the moisture content and density of soils.

  **a) Maximum Dry Density**



 

Table No.1 Maximum Dry density

| Determination No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Added water content % | 6 | 8 | 10 | 12 |
| Mass of mould + compacted soil (g) | 6.539 | 6.640 | 6.556 | 6.489 |
| Mass of mould (g) | 4.11 | 4.11 | 4.11 | 4.11 |
| Mass of compacted soil (g) | 2.429 | 2.530 | 2.446 | 2.379 |
| Bulk density g/cm$^3$ | 2.429 | 2.530 | 2.446 | 2.379 |
| Dry density g/cm$^3$ | 2.291 | 2.343 | 2.224 | 2.124 |

**b) Optimum Water Content:**

Table No 2 Optimum Water Content

| Container No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Mass of container + wet soil (g) | 73.8 | 68.78 | 64.28 | 72.15 |
| Mass of container + dry soil (g) | 68.72 | 63.54 | 58.51 | 64.94 |
| Mass of water (g) | 5.08 | 5.24 | 5.77 | 7.21 |
| Mass of container (g) | 7.3 | 7.23 | 6.84 | 7.67 |
| Mass of dry soil (g) | 61.42 | 56.31 | 51.67 | 57.27 |
| Water content % | 8.27 | 9.3 | 11.17 | 12.59 |

**California Bearing Ratio Test**

Table gives the standard loads for different penetrations for the standard material with a C.B.R. value of 100%.

Table No. 3 Penetration of plunger (mm) Vs Standard load (kg )

| Penetration of plunger (mm) | Standard load (kg) |
|---|---|
| 2.5 | 1370 |
| 5.0 | 2055 |
| 7.5 | 2030 |
| 10.0 | 3180 |
| 12.5 | 3600 |

**Result**

**Observation and calculation**

Table No. 4 Penetration Of Plunger (mm) Vs Load Dial Reading (mm)

| Sr. no. | penetration of plunger (mm) | load dial reading(mm) |
|---|---|---|
| 1 | 0.0 | 0 |
| 2 | 0.5 | 13 |
| 3 | 1.0 | 18 |
| 4 | 1.5 | 24 |
| 5 | 2.0 | 44 |
| 6 | 2.5 | 50 |
| 7 | 3.0 | 54 |
| 8 | 4.0 | 57 |
| 9 | 5.0 | 64 |
| 10 | 7.5 | 75 |
| 11 | 10 | 84 |
| 12 | 12.5 | 96 |

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**Calculation**

CBR value at 2.0 mm penetration-

50×6.6/1370 = 24.087

CBR value at 5 mm penetration-

64×6.6/2055 =20.554

**Determination of Liquid limit**

**Plasticity Index**

Table No 5 Sample 1

| Container Number | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Wt.of Container + Wet Soil | 56.110 | 52.96 | 43.70 | 43.39 |
| Wt.of Container + Dry Soil | 43.55 | 42.58 | 35.30 | 35.89 |
| Loss of Moisture | 12.56 | 10.38 | 8.40 | 7.50 |
| Wt. of Container | 14.0 | 16.51 | 14.52 | 13.53 |
| Wt. of Dry Soil | 29.55 | 26.08 | 20.80 | 22.39 |
| Moisture Content(%) | 42.50 | 39.80 | 40.38 | 33.50 |
| No.of Blows | 18 | 22 | 28 | 32 |

| | Value | Permissible Value |
|---|---|---|
| Liquid Limit | 36.50% | <70.00% |

Table No 6 Sample 2

| Container Number | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Wt.of Container + Wet Soil | 60.00 | 58.75 | 55.15 | 46.56 |
| Wt.of Container + Dry Soil | 40.84 | 46.37 | 44.47 | 39.17 |
| Loss of Moisture | 14.20 | 12.40 | 10.64 | 7.39 |
| Wt. of Container | 14.0 | 16.50 | 14.5 | 13.5 |
| Wt. of Dry Soil | 31.84 | 29.79 | 29.97 | 25.67 |
| Moisture Content (%) | 44.60 | 41.48 | 35.50 | 35.79 |
| No.of Blows | 18 | 28 | 29 | 38 |

| | Value | Permissible Value |
|---|---|---|
| Liquid Limit | 37.00% | <70.00% |

**Plastic limit**

Table No 7 Sample 1

| Container Number | 1 | 2 | 3 |
|---|---|---|---|
| Wt. of Container + Wet Soil | 21.23 | 20.85 | 19.2 |
| Wt .of Container + Dry | 20.33 | 19.81 | 18.51 |



 

| Soil | | | |
|---|---|---|---|
| Loss of Moisture | 0.90 | 1.04 | 1.05 |
| Wt. of Container | 16.5 | 15.5 | 14.0 |
| Wt. of Dry Soil | 3.83 | 4.31 | 4.15 |
| Moisture Content (%) | (mc1) 23.50 | (mc2)24 .15 | (mc3) 25.29 |

| | Value | Permissible Value |
|---|---|---|
| Plastic Limit | 24.31% | <45% |

Plasticity index= LL-PL= 12.69%

Table No 8 Sample 2

| Container Number | 1 | 2 | 3 |
|---|---|---|---|
| Wt. of Container + Wet Soil | 20.4 | 21.37 | 23.21 |
| Wt. of Container + Dry Soil | 19.5 | 20.07 | 21.71 |
| Loss of Moisture | .90 | 1.30 | 1.50 |
| Wt. of Container | 15.5 | 14.5 | 15.5 |
| Wt. of Dry Soil | 4.00 | 5.57 | 6.21 |
| Moisture Content(%) | (mc1 )22. 50 | (mc2)2 3.34 | (mc3)2 4.15 |

| | Value | Permissible Value |
|---|---|---|
| Plastic Limit | 23.33% | <45% |

Plasticity index= LL-PL= 13.17%

**Conclusion**

After that the all test results became positive which are essentially required for the pavement design. These test results was very help full for us to design the pavement.

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