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Walayar Dam Road : A Case Study

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***Abstract*—Pavement deterioration starts directly after opening of the road to traffic, this process starts very slowly so that it may not be noticeable, and over time it accelerates at faster rates. To ensure the risk of premature failure is minimized, it is necessary to use the best practice method in planning, design, construction and maintenance of the road. In this study attempts have made to improve Walayar dam road which is heavily deteriorated. And it is suggested that the existing poor condition and the problems in the Walayar dam road can be eliminated by using fly ash in the subgrade layer of the pavement and proper design.**

INTRODUCTION

A flexible pavement failure is defined by formation of pot holes, ruts, cracks, localized depressions, settlements, etc. The localized depression normally is followed with heaving in the vicinity. The sequence develops a wavy pavement surface. The failure of any one or more components of the pavement structure develops the waves and corrugations on the pavement surface or longitudinal ruts and shoving. Pavement

Unevenness may itself be considered as a failure when it is excessive. The subject of pavement failure/distress is considered to be complex as several factors contribute to its deterioration and failure Walayar Dam road is the only road which provides access to Walayar Dam, Forest training institute, Forest school and Wood depot. More than 100 families depend on this road for their daily transportation purposes. So the pavement must be of good condition and provide safe and convenient travel facilities to the road users.

I SCOPE AND OBJECTIVES

In the present study, attempt is made to study the existing road condition of Walayar dam road and to study how fly ash may be effectively utilized in combination with the soil to get an improved soil material which may be used in various soil structures. Soil collected from the site has been used in this experimental investigation. Following are the objectives of the present work:

1) To carry out survey on pavement distress in Walayar dam road.

2) To identify frequency of distress present and the causes of distresses .

3) To suggest remedies and solutions for those distresses.

II SITE INVESTIGATION

The pavement condition survey has been conducted to tails determine the various distresses of the pavement. At every 100m interval the various defects has been noted. The details given in table 1.

III SAMPLE COLLECTION

The samples of soil are collected from 3 different location such as starting point, middle and end point of the road at the depth more than 150mm. The collected samples are packed in a water tight container and transported to the laboratory.

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IV ENGINEERING PROPERTIES OF SOIL

In the following table properties of the soil are given. It is determined by conducting various tests on soil as per IS code procedures. The maximum dry density of the soil is found to be low and CBR value of soil is also very less. Hence we suggest to improve the properties of soil by doing stabilization.

V MATERIALS USED FOR STABILISATION AND PROPERTIES OF MATERIALS

For the stabilization of soil we use fly ash as the admixture

1. Soil; Properties of the soil is given in the table 2
2. Fly ash

TABLE 1: Pavement condition survey

DISTANCE	FAILURES							
	POTHOLES		LONGITUDINAL CRACKING	TRANSVERSE CRACKING	BLOCK CRACKING	ALLIGATOR	EDGE CRACKING	BLEEDING
		NO.S						
0-100m	✓	13	✓				✓	
100-200m	✓	20	✓	✓	✓		✓	
200-300m	✓	22	✓				✓	
300-360m	✓	30	✓	✓	✓	✓	✓	
360-400m	✓	34	✓	✓	✓	✓	✓	
400-430m	✓	27	✓	✓	✓	✓	✓	
430-500m	✓	20	✓				✓	
500-600m	✓	52	✓	✓	✓		✓	
600-700m	✓	33	✓				✓	
700-800m	✓	36	✓	✓	✓	✓	✓	✓
800-900m	✓	29	✓				✓	
900-1000m	✓	31	✓	✓	✓	✓	✓	✓

TABLE 2: Properties of soil

Sl No	PROPERTY	VALUE
1	Natural moisture content	18.41%
2	Specific Gravity (G)	1.418
3	Sieve analysis: Coefficient of curvature,C_C Uniformity coefficient,C_U	 0.694 4
4	Liquid Limit	40%
5	Plastic Limit (W_P)	11.11%
6	Shrinkage Limit (W_S)	16.2%
8	Maximum Dry Density (γ_d)	1.864g/cc
9	Optimum Moisture Content (OMC)	11%
10	CBR	1.88%

The maximum dry density of the soil is found to be low and CBR value of soil is also very less. Hence we suggest to improve the properties of soil by doing stabilization

VI METHOD OF TESTING

The blending operation was carried out manually and care was taken for uniform mixing as per the procedure given in IS:2720. Laboratory tests are carried out in accordance with the specification of relevant Indian Standards. To find the optimum percentage of fly ash to be added to improve the properties of soil we conducted tests on various proportions of fly ash. Following are the mixes used for testing,

Table 3: various mixes

sl.no	Mix designation	Proportions of flyash used(%)
1	M1	0
2	M2	10
3	M3	12.5
4	M4	15
5	M5	17.5
6	M6	20

VII RESULT AND ANALYSIS

A Compaction characteristics

IS heavy compaction tests were carried out on different proportions of soil and fly ash in accordance with the procedure laid in IS:2720 so as to study their moisture-density relationship. The results of Modified Procter test conducted on various proportions are shown below.

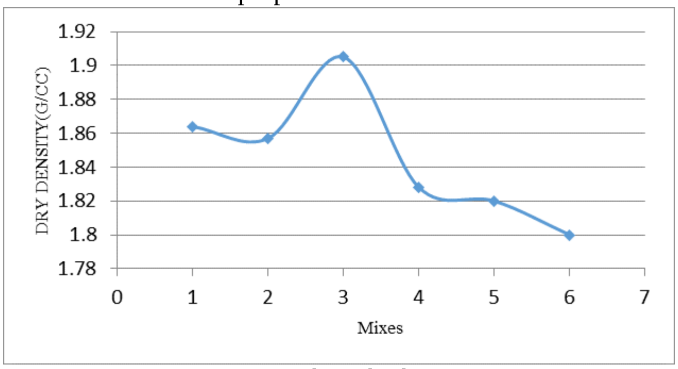

Fig 1: sample v/s dry density

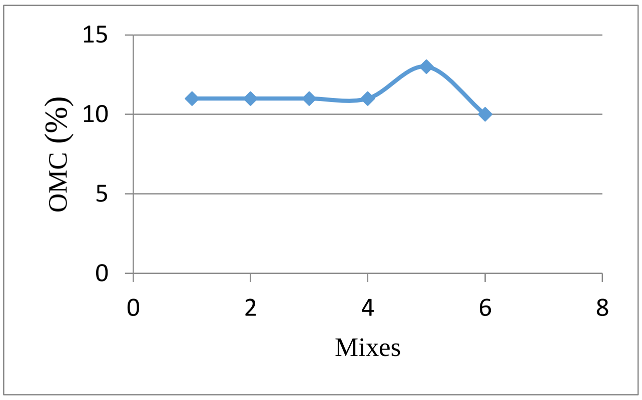

Fig 2: sample v/s OMC

The soil samples having higher maximum density mean it have greater strength and stability. Here the highest value of dry density is 1.905g/cc and is at 12.5% of fly ash and corresponding optimum moisture content is 11%.The variation of maximum dry density with various proportions of fly ash is first increasing up to 12.5% of fly ash and then it gradually decreased to 1.8g/cc. This variation of dry density is depends on the amount of fly ash and moisture content. From the obtained result, it is clear that the soil sample attain its maximum dry density and hence greater stability when the fly ash is at 12.5% with optimum moisture content of 11%.

B Strength characteristics

California Bearing Ratio(CBR) tests were carried out under soaked conditions on soil mixed with the different proportions of fly ash so as to study their load bearing capacity. The result of California Bearing tests conducted on various proportions are given in the chart below.

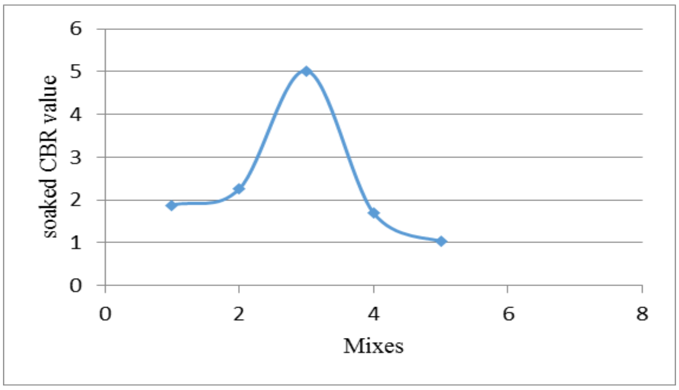

Fig 3: samples v/s CBR

Soaked CBR value represents the worst soil condition. Initially,the variation of CBR value with the addition of fly ash is increasing. For sample 3 maximum CBR value is obtained. Then the variation shows a decreasing pattern. CBR value of 12.5% increased by 3.14% when compared with the normal soil.

VIII DESIGN OF FLEXIBLE PAVEMENT

The pavement design is done for 10% and 12.5% addition of fly ash. The other values of CBR are very less than that required for the design.

Following chart shows the pavement composition of selected samples as per IRC:37-2001.

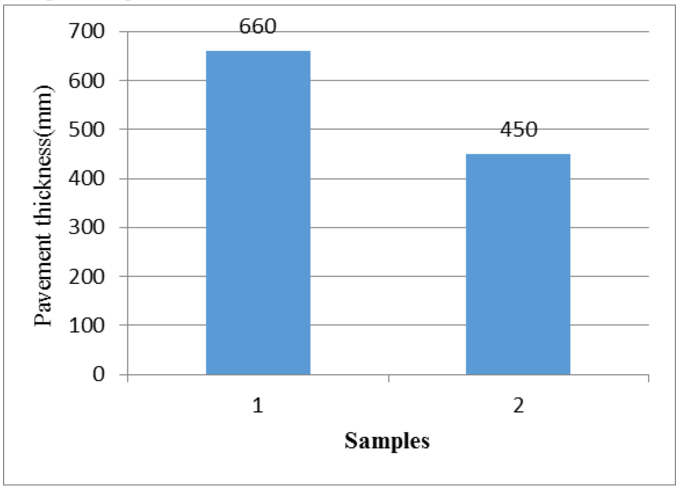

Fig 4: Sample v/s total thickness

The pavement thickness required to the corresponding CBR value of sample 1 is 660 mm while that for the sample 2 is 430mm.The thickness of pavement for further addition of fly ash has been reduced up to 230 mm. Thus stabilization saves the cost of construction of pavement and also it helps to improve the strength of the soil.

IX COST ANALYSIS

Based on PWD rates cost analysis is done for the pavement construction on soil with 10 % and 12.5% addition of fly ash for a length of 1 km.

Following table gives the construction cost of pavement,

Table 3 Cost Analysis

Sl.No	Subgrade layer	Total construction cost of the pavement
1	Soil with 10% fly ash	5130976
2	Soil with 12.5% fly ash	3753380

At 12.5% addition of fly ash the cost reduced by 27% when compared with 10% addition of fly ash.

X CONCLUSION

Based upon the above study following conclusions can be drawn:

1. Properties of soil and traffic conditions are the two main factors to be thouroughly analyzed while designing a pavement.
2. Pavement condition survey showed the worst condition of pavement. It proves that the already existing pavement is not capable of taking the wheel load that acts on the pavement.
3. The results show that the addition of fly ash improves the strength of soil. A total of 6 sample proportions were tested and we suggested sample 3(fly ash 12.5%) as the suitable proportion for the proposed pavement stabilisation. By doing stabilisation total pavement construction cost is reduced upto 27%.

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4. Transportation facility of the WALAYAR DAM ROAD can be increased by Re-construction of the road, by stabilizing sub grade soil using fly ash, it reduces the thickness of pavement thereby cost of construction.

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