

Flexible Pavement Assessment of Selected Highway in Srinagar Local Government, Jammu and Kashmir, India

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ABSTRACT: The condition and adequacy of the highway is often judged by the smoothness or roughness of the pavement, deficient pavement conditions can result in increased user costs and travel delays, braking and fuel consumption, vehicle repairs and probability of increased crashes. In this study the following processes were carried out: interview sessions with relevant parties, site observations, and site pictures were collected during observation, Manual survey of pavement and geotechnical laboratory of road subgrade soil was carried out in accordance to B.S 1377. Road RD5 and RD4 are in good condition, RD1 and RD2 are in fairly good state condition while RD6 and RD7 are in poor state condition. Compaction test, maximum dry density ranges from between 1420kg/m³ and 1722kg/m³, while the optimum moisture content ranges between 8.7% and 20.1% , Unconfined compressive strength test ranges between 16.88 kN/m² to 573kN/m² The values of California Bearing Ratio (CBR) of un-soaked soil samples were within the range of 10% and 55%. Result of analysis Jammu & Kashmir local Government area shows the subgrade materials under failed and unfailed portion of the roads are suitable.

On the basis of finding, the likely causes of failure may be due to inadequate drainage, poor design and construction, poor maintenances culture among others. It has been proposed that failed deteriorated beyond rehabilitation should be completely redesigned and reconstructed to standard, in addition, subsequent drains in Jammu & Kashmir Local Government should be constructed with reinforced concrete, and thickness of HMA asphalt subsequently increase.

KEYWORDS: Geotechnical Analysis, Manual Survey, Subgrade Material.

I.INTRODUCTION

Huge sums of money have been sunk into road development in Jammu & Kashmir The increasing traffic intensity, high tire pressure, increasing axle loads etc are causing early signs of distress to bituminous pavements throughout the road. The deterioration of the paved roads differs from those in the more temperate regions of the India. This can be due to the harsh climatic conditions and sometimes due to the lack of good pavement materials and construction practices. Pavement performance can be defined as the ability of the road to meet the demands of traffic and environment during its design life. The reduction in the performance level of the pavement with time is termed as deterioration. Flexible pavements deteriorate due to many factors, predominantly traffic, climate, material, construction quality and time. These multiple parameters make the process very complex. The condition of the road at any time can be predicted approximately using performance models.

For managing the transport infrastructure system, prediction and modeling of their performance are the main inputs as well as major challenges. The predicted deterioration play major roles at both network level and project level. The overall facilities can be planned for justifying the budget and resources with help of deterioration models. The planning and scheduling of the maintenance work for individual project is dependent on the time at which the section becomes deficient in service. This can be predicted through accurate deterioration models. Development of appropriate transportation policy and evaluation of the economic impacts also depend on the performance and interplay between the infrastructure facility and its user (traffic). One such example is the imposition of axle load limits, which is responsible for the damage of the pavement at exponential rates.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 10, October 2016

II. RESEARCH METHODOLOGY

A. RECONNAISSANCE SURVEY

Seven major roads labelled RD1-RD7 were selected and survey within the case study area. A detailed visual examination of the pavement surface including the taking of Photographs was performed to document location, severity, extent of distress, the width of the road, the wearing course of the road, specification of drainage, the thickness of the asphalt and shoulder width

B. PAVEMENT CONDITION SURVEY

Manual surface distress surveys are routinely conducted during the detailed evaluations that are carried out for candidate rehabilitation projects. In addition to distress surveys, this can include geotechnical investigations, strength testing, coring, and laboratory testing. The purpose of the project level manual distress surveys is to provide a more accurate and detailed investigation of the pavement deterioration in order to assist in determining appropriate rehabilitation treatments. The manual surface distress mapping method consists of a person walking the pavement section, identifying and classifying the existing distress features and plotting them on a map. Marking off the test section in advance at 10 metre intervals assists in the mapping and rating process. Based on the crack mapping and visual observation, the individual assigns the severity and density ratings for the distress types identified using the rating manual guidelines and photographs as references.

C. DRAINAGE CONDITION ASSESSMENT

Assessment of the surface and sub-surface drainage was conducted, as these elements contribute significantly to the overall Performance of the pavement structure, Surface drainage is judged by the ability of the pavement surface to drain water as well as not allowing water to pond either on the bituminous surfacing or on the shoulder.

D. INTERVIEW

One on one conversation with the staff of ministry of works and people within Jammu & kashmir environ, to understand people opinion concern design methodology, quality of design, traffic condition of road, and importance of the road the level of maintenances all this have to be taking to consideration to draw my conclusion.

E. SAMPLE COLLECTION/ LABORATORY TEST

Thirteen trail pits were dug at a depth of 0.5m to 0.7 on the failed and unfailed portion of the seven roads in Jammu & Kashmir Local Government area, and the aim is to carry out series of laboratory test of the subgrade layer of the pavement.

The following laboratory tests were carried out such as; particle size distribution (sieve analysis), specific gravity, compaction and California bearing ratio (CBR). All the tests were carried out in geotechnical laboratory of Department of Civil Engineering R& B Lab. Srinagar (J&K).

III. RESULT AND DISCUSSIONS

A. INTERVIEW

This involves an interrogative conversation with the staff of Local Government Ministry of Works and the populaces to find out necessary information about the roads; Ranging from time of construction, importance, and maintenances routing.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 5, Issue 10, October 2016

Route	Description	Time of Construction	Maintenances routine
RD1	Panthachowk	2010	None
RD2	Lasjan	2012	None
RD3	Railway	2011	None
RD4	Pohru chowk	2009	None
RD5	Nowgam	2009	None
RD6	Chanapora	2006	None
RD7	Sanatnagar	2007	None

B. PAVEMENT CONDITION SURVEY

The manual surface distress mapping method was carried out for 7 roads so as to determine the extent of failure of the road. The predominant distress failure on the road is Pothole and cracks. The Survey was carried out for 50m of the road RD5 and RD4 are in good condition, with little distress on the pavement surface in some road area. RD1 and RD2 are in fairly good state condition while RD6 and RD7 are in very poor state. During the survey, road furniture such as shoulder, walkway and median were invariably absent in all roads as specified by the Highway Manual.

Table 2: Pavement Condition

Route	Description	Length of	Wide of	Predominate distress	Severity No.
RD1	Panthachowk	36	7.30	Cracks	Severe
RD2	Lasjan	1	8.2	Longitudnal cracks	Low
RD3	Railway	0.5	8.3	Pothole	Severe
RD4	Pohru chowk	0.7	8.0	Pothole	Low
RD5	Nowgam	0.4	8.64	Longitudinal cracks	Low
RD6	Chanapora	0.7	8.0	Pothole	Extensive
RD7	Sanatnagar	0.8	7.4	Pothole	Throughout

C. DRAINAGE CONDITION ASSESSMENT

It is observe that most of the drainage are in bad that is Irregular shape, present of debris and Present of weeds in the drainage. RD1 road is earth drain, while RD2-RD6 drainage are block wall. There is no adequate drainage in RD7

D. SAMPLE COLLECTION AND GEOTECHNICAL TESTING:

13 trial pits were dug from 7 selected pavements with each pavement having two pits except for RD7 at considerable intervals. The depth ranges from 0.6 – 0.7m on failed sections of the selected pavements. The pavements considered were RD1, RD2, RD3, RD4, RD5, RD6 and RD7.

Sample	RD1	RD1 failed	RD2	RD2 failed	RD3	RD3 failed	RD4	RD4 failed	RD5	RD5 failed	RD6	RD7	Rd7 failed
% passing sieve 0.075 mm	54	45	34	22.2	35.8	42.8	34.3	19.8	38.2	46.6	37.2	34.4	38.6
Liquid limit (%)	35.9	29.5	19	27.8	23.2	35.1	21.5	21	22.0	26.9	18.2	28	17.2
Plastic limit (%)	30.3	26.8	6.9	19.75	18.2	39.8	18.6	-	15.9	33.6	16.0	16.83	12.7
Plastic index (%)	5.6	2.7	12.1	8.05	5.05	4.7	2.9	-	7	12.9	2.3	11.2	4.5

International Journal of Innovative Research in Science, Engineering and Technology

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Max. dry density (kg/m)	1.46	1.54	1.53	1.38	1.66	1.42	1.73	1.69	1.66	1.63	1.69	1.66	1.66
Optimum moisture content %	16	14.2	14.3	20.1	12.2	11.30	8.7	9.6	10.2	11.6	9	12	10.18
Unconfined compressive strength (UCS)	71.7	151.9	304	97.42	42.2	84.38	42.2	16.9	232	92.8	118	590.7	54.6
Cohesion	35.8	76	152	48.7	21.1	42.19	21.1	8.45	116	46.4	59	295.3	27.3
CBR un-soke (%)	10	55	46	38	10	19	44	33	18	15			
AASHTO	A-4	A-4	A-2-7	A-2-7	A-4	A-4	A-2-4	A-1-b	A-4	A-6	A-4	A-2-7	A-4
USCS	ML	SM	SC	SC	SM	SM	SM	SC	SM	SC	SM	SC	SM
Specific, GS	2.7	2.56	2.8	2.52	2.61	2.53	2.71	2.63	2.72	2.6	2.1	2.4	2.3

D. SPECIFIC GRAVITY, GS

The specific gravity of the soil sample ranges from 2.1 to 2.8. The highest specific gravity value is sample RD2. According to specification, a good lateritic material should have specific gravity ranging from 2.5 to 2.75. Only RD1, RD3 RD4, RD4 Failed, RD5, RD6 Failed satisfied this above condition.

3.6. Grain size distribution

The percentage of the sample passing through No 200 BS for soil sample RD1, RD1 failed, RD2, RD2 failed, RD3, RD3 failed, RD4, RD4 Failed, RD5, RD5 Failed, RD6, RD7, RD7 failed are 54%, 45%, 34%, 35.8%, 38.2%, 46.6%, 37.2%, 34.4%, 38.6%. According to Federal Ministry of Works and Housings specification (1972) only soil samples RD2 and RD8 are suitable for use as subbase and subgrade material because the soil particle passing through sieve No.200 is less than 35%.

E. COMPACTION

Indian standard light was used. The maximum dry density ranges between 1420kg/m³ and 1722kg/m³, while the optimum moisture content ranges between 8.7% and 20.1%. Soil sample characterized by high value of maximum dry density and low optimum moisture content is best suitable as subbase and subgrade material. Sample RD4 has the highest maximum dry density and lowest optimum moisture content and RD2 Failed has the lowest maximum dry density and highest maximum moisture content. The Jammu & Kashmir Specification for Road and Bridge Materials recommends that for a material to be used as generally as fills it should possess MDD greater 47 kg/m³, OMC less than 18%. Making RD2 failed unsuitable for fills.

F. UNCONFINED COMPRESSIVE STRENGTH (UCS)

The values of the unconfined compressive strength of the soil ranges from 16.88kN/m² to 572.89 kN/m². Strength while the cohesion and undrained shear strength ranges between 8.44 kN/m² and 572.89 kN/m². According to Das (2009), the consistency of soils having an unconfined compressive strength of 50-100 kN/m² can be classified as medium, those having unconfined compressive strength of 200-400 kN/m² are classified as very stiff. And those exceeding 400 kN/m² are classified as hard. Based on this assumption. RD1, RD3, RD4 and RD4 soil samples are classified as soft soil. RD1 Failed, RD2 Failed, RD3 Failed, RD4, RD6 failed and RD7 failed soil sample falls in categories of medium, while RD2 soil sample is very stiff and RD7 is hard, with the highest unconfined compressive strength.

International Journal of Innovative Research in Science, Engineering and Technology

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G. CALIFORNIA BEARING RATIO (CBR)

The un-soaked California bearing ratio of the sample ranges from 10% to 55%. RD1 Failed has the highest California bearing ratio value recommends that for soaked samples the values of CBR for subgrade, subbase and road base should not be less than 10%, 30% and 80% respectively. All the soil satisfied the condition to be used as subgrade. Soil sample RD1, RD3, RD3 Failed, RD5 and RD5 Failed are not suitable for subbase. None of the soil sample is suitable for base

IV. CONCLUSIONS AND RECOMMENDATION

A. CONCLUSION

The assessment of the flexible pavements in Jammu & Kashmir Local Government Area reveals that there is a high degree of distress on the pavements some of the predominant defects are edge cracks, alligator cracks, potholes, and longitudinal cracks. These defects may have occurred as a result of inadequate drainage facilities, Poor design and construction, infiltration of surface runoff to the underlying course, thickness of asphaltic cement and poor soil material at some sections of the roads. The interrogation with the officials in the Local Government Ministry of Work shows that proper maintenance of the roads is not performed.

The severe roads condition in terms of surface defects are those of RD7 (Sanatnagar road) and RD6 (chanapora Road) with high severity pothole. RD1, RD2, RD3, RD5, RD6 has a low severity of cracks and pothole, while RD4 is in very good condition. Most of the selected pavement in Jammu & kashmir do not have adequate drainage that is, inadequate pavement section, Presence of debris and weeds in drainage and absent of drainage in RD7(Sanatnagar Road) and RD4(Railway Road) has adequate drainage

B. RECOMMENDATIONS

- i. Roads which have deteriorated beyond rehabilitation should be completely redesigned and reconstructed to standard.
- ii. Subsequent drains in Jammu & kashmir Local Government should be constructed with reinforced concrete.
- iii. Agencies concerned with the maintenance of flexible pavements in Jammu & kashmir Local Government Area, should adopt an effective routine maintenance schedule for safe and comfortable operation of such pavements.
- iv. Standard of construction and design should be improved.
- v. More academic research should be carried out on mapping and engineering geology of Jammu & kashmir Local Government Area.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 10, October 2016

APPENDIX





ISSN(Online) : 2319-8753
ISSN (Print) : 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 10, October 2016

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