Deterioration of Rural Road Pavement Caused by Heavy Vehicular Traffic, A Case Study of Wanpora Road

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Abstract
All road agencies have now given a serious thought over the repair of the deteriorated old road pavements as they by certain key methods become serviceable as well. These roads once mend can give a good life span and hence become economical too. The pavement deterioration over time is caused by a combination of factors; however, traffic loads play a key role in consumption of pavement life. The deterioration of the road pavement can become life threatening to the people travelling all over and most importantly the vehicular damage comes into play because of the deteriorated pavement. These roads must be selected for the maintenance when they are still effective in order to avoid a rapid deterioration after a certain limit. The main objective of this paper is to investigate the relative damage of pavements using laboratory and field data and adopting the right method of maintenance and apart from that this paper also includes some traffic diversion measures that can help to reduce the loading on the said Road which can in turn lead to less deterioration.By adopting good patching methods, we can give the pavement a good life at reasonable cost. In This paper I have made an analysis on a rural road where the heavy vehicular Traffic spoils the road pavement.. Conclusions are drawn from the overall study conducted on this road stretch followed by some useful recommendations.

Keywords
Deterioration, Strengthening, Maintenance, Heavy Vehicular Traffic, Pavement.

I. Introduction

The increase in the heavy vehicular traffic over the years will continue in near future. In case of developed countries, there is a shortage of funds required for new infrastructure projects, both for constructing them and more significantly towards their maintenance and repairs. The position in the context of a developing country like India is obviously far worse. As a result, more and more roads are deteriorating and the existing pavement structure as a whole is often found to be inadequate to cope up with the present traffic.

The proper strengthening and maintenance of roads(is urgently required to ensure balanced regional development and alleviation of poverty as they connect the villages and other small town centres harbouring backwardness. A majority of these roads do not have traffic worthy pavement. . Most of the existing flexible pavements in the network broadly have thin bituminous layers. These bituminous pavements, in general, have a problem that they get deteriorated with time. With the increasing use and awareness of pavement management systems and the growing emphasis on asset management of pavement infrastructure, it is important to strengthen the maintenance components of these systems and particularly the preventive maintenance component .The most recent definition of preventive maintenance by AASHTO Standing Committee on Highway states that preventive maintenance is “a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional conditions of the system (without increasing structural capacity” .The road stretch used for this study is about 7kms long from Hafroo Batpora – Wanpora which is about 20kms away from Srinagar City and it connects with the National Highway.

II. Need of Study

The study of the strengthening of the Road Pavement in an Arterial road of District Budgam (J&K) which is a single way road and has may key points in its way e.g stone crushers, Brick' kilns etc. This Road pavement gets deteriorated of and on because of Heavy vehicular loading trucks plying over this pavement. In the present work, some of the Existing pavement laboratory investigations, have been made with which the details of embankment and subgranular base with their soil test analysis is made. The project also shows us the traffic survey made on the proposed road to check out the flow.The road is very weak performance wise and hence needs to be strengthened.

III. Methodology

Routine and periodic maintenance are the two kinds of maintenances which are usually carried out based on scheduled and condition-responsive except inlays, in which it is always defined in terms of condition-responsive works.

1. Routine Maintenance

The routine maintenance works on bituminous roads, whose effects on pavement performance are modelled, comprises patching, crack sealing, edge-repair, and drainage works . Drainage maintenance is an important works activity that prevents accelerated pavement deterioration. Edge-repair is not critical for multi-lane highways. Other routine maintenance works include vegetation control, and repairs to road appurtenances**.** Their effects on pavement performance are not modelled endogenously, and therefore, only their costs are considered in an analysis**.** Patching and cracking are critical ones and discussed below.

2. Patching

It is used to repair potholing, wide structural cracking, and raveling. The user may specify patching to repair the individual surface distresses, or a combination of all the three distresses. If more than one kind of patching works is applicable in any analysis year, then patching works specified to treat the three distresses will override those specified to treat the individual distresses. It is assumed that potholing, wide structural cracking, and ravelling have priorities in that order, and no patching is performed to fix

ISSN : 2394-2975 (Online)
ISSN : 2394-6814 (Print)

these individual distress-areas until those of higher priorities are completely repaired

3. Crack Sealing

It treats transverse thermal cracking and wide structural cracking. However, it is assumed that crack sealing is not applied to treat wide structural cracking if the area of wide structural cracking exceeds 20 %. When crack sealing is performed, it is assumed that the treatment of transverse thermal cracking takes priority over that of wide structural cracking, and no crack sealing is performed to fix wide structural cracking until transverse thermal cracking is completely repaired.

4. Periodic Maintenance

The periodic maintenance works on bituminous roads comprises of preventive treatment, resealing, overlay, mill and replace, inlays, and reconstruction.

5. Resealing Works

Resealing without shape correction can repair surface distress but cause little change to roughness or structural strength of the pavement. However, resealing with shape correction can achieve some reduction in roughness through the filling of depressions and repair of damaged areas. Resealing works resets surface distresses, surfacing age, and preventive treatment ages to zero, and thereafter the pavement condition is considered to be new. Single surface dressing without shape correction, double surface dressing without shape correction, cape seal without shape correction, and slurry seal operations have no effect on rutting.

6. Overlay

It is specified using new surfacing thickness, layer strength coefficient, surface material, and construction defect indicator for bituminous surfacing. Overlay work resets surface distresses to zero, and thereafter the pavement condition is considered to be new.

7. Mill and Replace

It involves the removal of all or part of the existing bituminous surfacing and replacing it with a new bituminous surfacing. It is usually performed to correct defects that have occurred mainly due to poor construction quality and the bituminous material being too rich or brittle, or where the road surface levels need to comply with some requirements related to drainage facilities, bridge underpasses, and other such structures. Information on new surfacing thickness, layer strength coefficient, surface material, and depth of milling are required to specify mill and replace works.

8. Inlays

It is a special works activity considered under rehabilitation that is normally applied to treat rutting along wheel paths. To define an inlay works, the percentage of total carriageway area to be repaired and the construction quality factors should be specified.

IV. Results and Discussions

Maximum weight of material to be retained on each sieve at the completion of sieving shall be as follows:

Table 1 : Maximum Weight of Material to be Retained on Each Sieve

IS Sieve Designation	450mm Dia. Sieves (kg)	300mm Dia. Sieves (Kg)
80MM	15	6
20MM	4	2
4.75MM	1.0	0.5

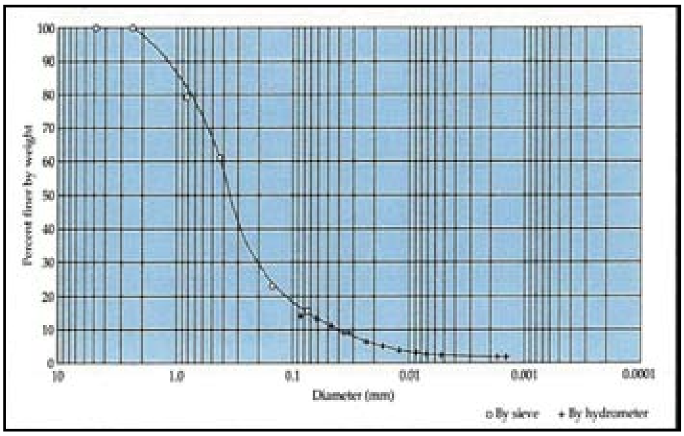

Fig.1

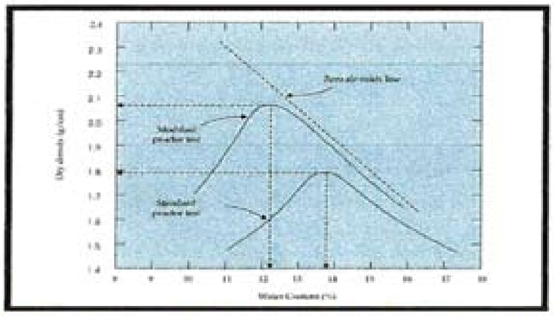

Figure 3. Modified Proctor Test Curve (Dry Density vs Mositure Content)

Note:1 g / cm^3 = 9.81 kN/m^3

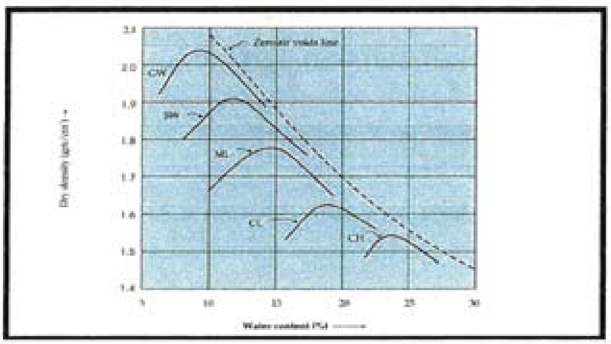

Fig. 2

Table 2: Typical Values of Maximum Dry Density and Optimum Water Content

Type of Soil	BS Light Hammer (proctor)test BS Light Hammer (AASHO) test		BS Light Hammer (AASHO)test	
	I. Max.dry density (kN/m3)	II. Optimum water Content (%)	Max.dry density (kN/m3)	Optimum water content (%)
Clay	15.2	28	18.2	18
Silty Clay	16.3	21	19.1	12
Sandy Clay	18.1	14	20.4	11
Sand	19.0	11	20.6	9
Gravel-sand-clay mixture	20.0	9	22.0	8

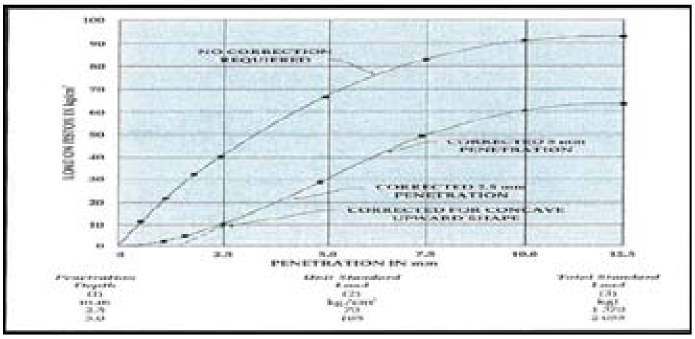

Fig. 4

Table 3 : Modified Proctor Test

Volume of Mould	3094cc				
Mass of Empty Mould	3318				
Mass of compacted soil and Mould		9147	9516	9917	9666
Mass of compacted soil	5476	5829	6198	6599	6348
Bulk (Wet density)	1.77	1.884	2.003	2.133	2.052
MOISTURE CONTENT DETERMINATION					
Mass ofwater	4	6.8	6	9	8
Mass of dry soil	46	54	44	51	42
Moisture content (%)	8.7	11.11	13.64	17.6	19.07
Dry Density	1.628	1.696	1.782	1.856	1.743

Results: Maximum dry Density = 1.865 g/cc
Optimum MC content = 17%
Remarks:-Falls under the category of permissible, as per the specifications,

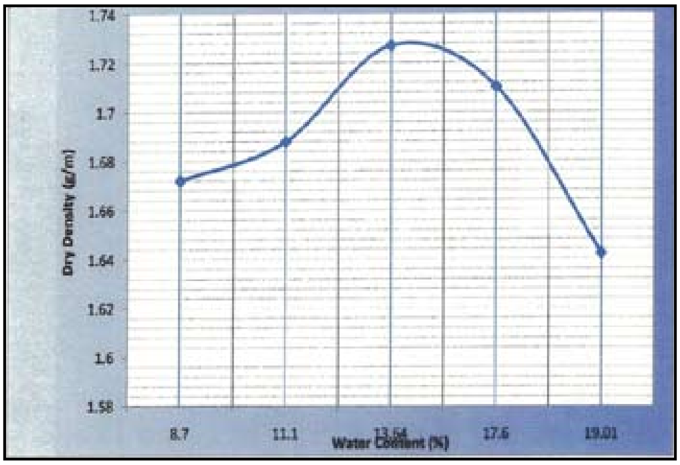

Fig. 5

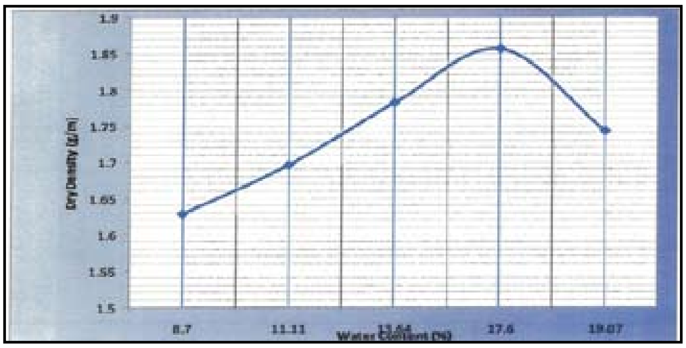

Fig. 6

V. Conclusion

Based on this study, the following conclusions have been made:

1. The attention of highway agencies has been changed from construction of new pavements to maintenance and rehabilitation of already existing ones.
2. On evaluation it was found that the total existing pavement thickness of the road is less than the Designed overall pavement.
3. After excavation and installation of utilities the infill was not compacted properly due to which with due course of time the soil compacted under the wheel load has affected the entire pavement. Water affects the entire road as too much of water in the base materials weakens the road water allowed remaining on top of gravel or blacktopped road weakens when combined with traffic causes potholes, cracking and rutting, if improperly channelled water causes soil erosion etc and breakdown too.
4. There are some differences in maintenance classification and definitions among highway agencies.
5. Pavement maintenance should be carried out before its deterioration is apparent.

VI. Recommendations

1. Regular maintenance procedures should be implemented so as to maintain the design serviceability and increase the life span of this road.
2. If existing roads are excavated for utilities before laying of the pavement the proper compaction should be done. .
3. A proper coordination between various agencies that are responsible for the laying of utilities and the construction of roads.
4. The heavy vehicular traffic on the said road should be diverted

ISSN : 2394-2975 (Online)
ISSN : 2394-6814 (Print)

towards the adjacent roads.

5. There should be a proper drainage system so as to avoid water logging in the area.

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