Pavement Evaluation by Benkelman Beam of State Highway Section (Waghodiya Crossing to Limda)

Prof. A.A. Patel¹ Dhaval V. Lad²
¹Assistant Professor ²M.E (Transportation)
¹²Department of Civil Engineering
¹²Parul Institute of Engineering & Technology, Waghodia

Abstract— Nowadays, highways, pavements, bridges, parking garages and other exposed structures are becoming functionally obsolete or deteriorating due to repeated application of vehicular loads and due to the effect of climatic parameters. Nondestructive structural evaluation of pavements is an important part of the pavement management. In the structural evaluation of flexible pavement the pavement deflection is measured by the Benkelman Beam. Rebound deflection is used for overlay design. A detailed pavement condition survey is done on State Highway 158 (Waghodiya crossing to Limda) and the road condition is evaluated structurally. The present study is evaluates the overlay thickness for State Highway 158 Waghodiya crossing to Limda.

Key words: Structural Evaluation, Deflection, Overlay

I. INTRODUCTION
Transportation infrastructure plays a lead role in economic growth and development of country. India has the second largest highway and road networks system on the world. They carry almost 90 percent of the country’s passenger traffic and 65 percent of its freight. However, most highway in India are narrow and congested with poor surface quality. Also India’s village does not have access to all weather roads.

Pavements are one of the most important part of any transportation system. Pavements are the key elements of infrastructure of the country, whose functions are to promote transport activities, economic activities and to improve the standard of living.

There is a great need for the effective and efficient management and maintenance of the road network. For suggesting an efficient maintenance strategy, evaluation of pavement performance is very necessary. All structures are designed to fail at some point but the life of structure is extended by the maintenance and rehabilitation activities. Maintenance of asphalt pavement is, therefore an important task in keeping the transport system, and the economy, of the country running.

Quality of the road surface, stiffness and thickness of pavement layers are important parameters which influences the performance and efficiency of roads. Pavement evaluation plays a very important role in repair and rehabilitation of existing roads and quality control of new roads.

The aim of the thesis has been structural evaluation of existing flexible pavement by Benkelman beam method and find out deflection of pavement. Then after calculate the thickness of overlay of flexible over flexible pavement as per IS standard.

II. NEED OF THE STUDY
A good road management is necessary, and maintenance and rehabilitation actions must be taken with good timing. Pavement rehabilitation activities, though not as spectacular as the construction ones, are of major importance for protecting the initial important investments made for development of transportation infrastructure. Major economic losses will continue unless improved capabilities for rehabilitation design are provided to meet today's highway traffic needs, as most projects today include rehabilitation design. Improved rehabilitation designs will lead to longer lasting and more cost-effective rehabilitated pavement.

- Maintenance and rehabilitation actions must be taken for strengthening of pavement.
- Give a good riding quality to the road users.
- Also reduction in number of accidents.
- Safe and efficient movement of traffic.

III. OBJECTIVE OF STUDY
Objectives for the present studies are as follows:
- Carry out the surface condition and traffic survey.
- To evaluate the structural condition of pavement by using Benkelman beam test.
- To carry out soil sample and testing.
- To calculate the thickness of overlay layer pavement.

IV. DEFINITION OF PAVEMENT EVALUATION
Pavement evaluations are conducted to determine functional and structural conditions of a highway section either for purposes of routine monitoring or planned corrective action. Functional condition is primarily concerned with the ride quality or surface texture of a highway section. Structural condition is concerned with the structural capacity of the pavement as measured by deflection, layer thickness, and material properties.

V. STUDY AREA PROFILE
In this method find out the location where we should improve the roadway network. Pavement condition should be rough or at the stage of failure, so that there are some maintenance or rehabilitation. My site is Waghodia crossing to Limda section of state highway 158. Map of site shown below, which is indicate by blue line. Total length of stretch is 11.7 km, nearby area has been developed very fast in last few years. In this stretch many companies, colleges and residential projects are there so that the traffic volume should be increased further days. There are many college buses also loaded trucks travel on the road. So that the
pavement condition become rough, unsafe for road users due to heavy traffic.

Fig. 1: Study Area

The salient features of the Road Section are:
(Waghodiya crossing to Limda)
- Length of the stretch: 11.7 km.
- Type of Pavement: Bituminous.
- No. of lanes: 4 lanes.
- Divided/Undivided: Divided.
- Type of Shoulder: Rough Shoulder.
- Surrounding Environment: Rural.
- Type of traffic: Mixed traffic.

VI. VISUAL SURVEY

Visual condition surveys cover aspects of both functional and structural pavement condition, but generally serve as a qualitative indicator of overall condition.

A. Rutting:

is a surface depression in a wheel path and is a load-associated distress.

Fig. 2: Rutting

B. Patching:

An area of pavement that has been replaced with new material to repair the existing pavement.

Fig. 3: Patching

C. Pothole:

A pothole may be defined as any localized loss of material or depression in the surface of a pavement.

Fig. 4: Pothole

VII. STRUCTURAL EVALUATION

There are different Non-destructive tests to evaluate the structural condition of existing pavement. There are various NDT to find out deflection of flexible pavement. Falling Weight Deflectometer (FWD), Dynamic Cone Penetrometer (DCP), Ground Penetrating Radar (GPR), Seismic Pavement Analyzer (SPA), Rolling Dynamic Deflectometer (RDD), Benkelman Beam Deflectometer (BBD). The most widely used method in India has been Benkelman Beam Deflection (BBD) method.

Deflection should be found out by Benkelman beam deflection test. It should be used to find out the overlay thickness of the flexible over flexible pavement as per IRC-81 1997.

Also soil sample is taken at the site through at the pavement composition survey locations. Hence the soil tests that have to be conducted are Moisture content test (Standard Proctor test), Sieve analysis (for soil classification) and Atterberg limit tests (for Determination of PI value).

VIII. CONCLUSION

- The visual observation for rutting, patch work, potholes and cracks can explain weak spots of pavement.
- The Benkelman beam study should be carried out of junction waghodiya crossing to limda.
- Calculate the overlay thickness on existing flexible pavement in terms of bituminous macadam.
- The visual observation and Benkelman beam deflection correlates each other as per the IRC-81 1997 guidelines.

REFERENCES

deflection technique and rehabilitation of flexible pavement for state highway 188 (sarsa junction to vasad junction)


[8] Department of transportation, division of engineering services, Transportation Laboratory, “Methods of test to obtain flexible pavement deflection measurements for determining pavement rehabilitation requirements”.


ANNEXURE-I

A. For Recording Deflection Data:

<table>
<thead>
<tr>
<th>Name of Road:</th>
<th>Date and Time of observation:</th>
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</thead>
<tbody>
<tr>
<td>Section:</td>
<td>Climate Condition:</td>
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<tr>
<td>No. of traffic lanes:</td>
<td>Air Temperature:</td>
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<tr>
<td>TABLE 1: Weather Temperature correction is to be applied</td>
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<table>
<thead>
<tr>
<th>CHAINAGE (M)</th>
<th>SID E</th>
<th>DIAL GAUGE READING</th>
<th>TEMPERATURE</th>
<th>REBOUND DEFLECTION</th>
<th>TEMPERATURE CORRECTION</th>
<th>SEASONAL CORRECTION</th>
<th>CORRECTED DEFLECTION(X)</th>
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<td>D o D i D f</td>
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Table 1: For Recording Deflection Data

ANNEXURE-I

B. Analysis of Test Data:

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<td>Pavement Temperature:</td>
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<table>
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<tr>
<th>Location of test point</th>
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Table 2: Analysis of Test Data