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Performance Evaluation of Flexible Pavement Using DCP on NH-18

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Abstract

An efficient and adequate transportation system is one of the key indicators of a nation's prosperity, its developmental status, and overall economic growth. India, being the second most populous and the tenth larger industrialized country in the world, has extensive road transportation system. The roads pass through areas with extreme climatic conditions from heavy rainfall to desert conditions; diverse terrains from plains to extremely high mountain pleads and varying soil grades rocky and gravelly to marshy land. Over the past four decades, the share of total rail and road traffic carrying passengers and goods has gradually increased from about 24 percent and 11 percent, respectively, in 1951 to about 80 percent and 58 percent, respectively, in 1990. Road length has increased correspondingly, from 0.4 million km in 1951 to 2 million km, giving a road density of 59 km/100km2. Because of fast and ever-increasing industrial, commercial, and other socioeconomic development activities, the road transport vehicle population, particularly vehicles population, particularly vehicles carrying goods, has also increased phenomenally during this period.

Efforts are under way in India to develop national pavement design procedures that are based on mechanistic principles to replace current pavement design methods, such as the California bearing ratio, which are based on an empirical approach. Construction in stages is currently I vogue because of the paucity of resources. Manual construction methods, used for many years, are gradually being replaced by mechanized methods, especially for the arterial road network and high-density corridor. The engineer's judgment and experience are relied upon heavily in decision making for maintenance and rehabilitation of the road network. Ad hoc M&R norms are established for assessing maintenance budgets; such norms are not based on scientific or systematic studies undertaken for the purpose.

Because of economies in road transportation, overloading by truck operators is common. The majority of the arterial road system experiences overloading, as much as 18 to 20-tonne axle loads versus the permissible legal limit of 10.2 tonnes. The existing road network has shown signs of premature distress because of the unexpected demands of growing traffic volume and heavier axle loads. The network has fallen short of its structural capacity and hence it is greatly overstrained. The funds allocated for road development programs have been decreasing constantly over the years as a percentage of the gross national product (GNP). The majority of allocated funds are utilized for providing M&R measures to the existing network rather than for new construction. The funds being provided for the arterial road network are on the order of 50 to 60 percent of the amount needed.

With this background, in the present study, a road sections were identified in Kurnool district, Andhra Pradesh to carry out the pavement performance study on distresses. For the selected stretch data was collected on rutting, raveling, potholes, edge failures, traffic, etc and soil samples of the subgrade for the determination of laboratory or insitu moisture content. The detailed analysis was performed using NCSS statistical tool and to develop a pavement performance model for the selected stretch.

Introduction

The accurate prediction of pavement performance is important for efficient management of road infrastructure. At the network level, pavement performance prediction is essential for rational budget and resource allocation. At programming level, pavement performance prediction is needed for adequate activity planning and project prioritization while at project level it is needed for establishing and designing the necessary corrective actions such as maintenance and rehabilitation.

Several performance prediction models have been proposed over the years. The models vary greatly in their comprehensiveness, their ability to predict performance with reasonable accuracy, and input data requirement. Most of these models are empirical and were developed for use under particular traffic and climatic conditions. Few of the models are of mechanistic – empirical type in which some of the input parameters are calculated using mechanistic models.

This report gives brief review of the existing models, particularly those models that are being used or under development in the local countries. The report forms part of the preparatory work for the present project on deterioration models for flexible pavements.

Pavement: The term pavement is used in this report to mean the whole road structure with all of its layers and not just the surfacing layer.

Flexible pavement: A pavement type in which bituminous mixtures are used as surfacing materials.

Pavement performance: Pavement performance is a measure of the in-service condition of the pavement. Performance is often expressed in two ways; the first is structural performance which is expressed in terms of distresses such as cracking and the second is functional performance expressed in terms of serviceability, which in turn might be function of distresses such as rutting and roughness. The term performance in this report refers to the general condition of the pavement, including its structural and functional condition, unless otherwise specified.

Pavement deterioration: Represents a negative change in performance or condition of the pavement, i.e, an increase in distresses or decrease in serviceability.

NEED FOR THE STUDY:

The purpose of the review was to find out the strengths and the weaknesses of present model in order to provide basis for more detailed evaluations, selection and improvement of models.

1. Performance prediction models represent a key element of road infrastructure asset management systems or pavement management systems. Thus successful implementation of these systems depends heavily on the performance prediction model used as the accuracy of the predictions determines the reasonableness of the decisions.
2. Several pavement performance prediction models have been proposed over the years. Many of these models are developed for application in a particular region or country under specific traffic and climatic conditions. Therefore they can not be directly applied in other countries or conditions.
3. Although much research has been devoted to performance modelling of pavements, a comprehensive model that can predict pavement performance accurately has yet to be developed.

The available models can be broadly classified into three groups; empirical, mechanistic-empirical and subjective models. Various empirical models are proposed for application at network and project levels. The mechanistic-empirical models are often developed in connection to design systems and therefore have not been widely applied in pavement management systems (PMS), but have the potential to be applied at a network level. The subjective models are mostly developed for strategic (investment) planning at the network level.

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Thus, the review showed that there is a need to develop improved models for use both at the network level and the project level. In order to develop such improved models, it is recommended to take the following steps in the present study.

1. Poor available data and resources. Development of performance prediction models requires large amount of data on real pavements. There are test sections or reference sections in most of the places for which data of various level of detail are available. It is therefore important to pool these data to obtain a good basis for improvement of performance models.
2. Use the available data from test sections, heavy vehicle simulator and other sources to evaluate existing performance prediction models.
3. Select suitable models based on the evaluation and identify areas that need improvement.
4. Improve the selected models especially with regard to climatic effects and studded tire use to make it suitable for Nordic conditions.
5. Implement the improved models in each country.
6. Agree on recommended test methods so that material evaluations can be conducted using the same procedure in each country.
7. Agree on a uniform procedure for traffic data collection and processing.

LITERATURE REVIEW

Definition of performance:

Performance is a general term for how pavements change their condition or serve their intended function with accumulating use. Performance means something different when it is used at project level or on a network level. And performance changes its meaning again if the network is at the level of a district, a state or province, or of a nation.

At project level, performance is defined by the distress, loss of serviceability index and skid resistance, loss of overall condition, and by the damage that is done by the expected traffic.

At district network level, performance is defined not only by the condition and trends of individual projects but also with the overall condition of the network and with the level of performance that is provided by each type and functional class road.

At state or province level, there is less concern with the conditions and trends of individual projects byt with measures of the overall condition of the pavement network in each geographical subdivision, especially as they reflect the need for present and future funding, the effects on user costs, and overweight fees.

The performance the national network is almost solely concerned with matters of policy and economics, especially in records to cost allocation, fund apportionment, and equity in taxation, all of which are affected by the needs of individual states or provinces.

Each of these networks requires a variety of different kinds of performance model for its proper management.

Performance Prediction Models and their Use in Road Infrastructure Management Systems

Preservation of road infrastructure asset requires a systematic approach involving condition assessment and performance modelling, program optimization and development of tactical and strategic plans. A very important part of such approach is the use of pavement performance models, which allow the forward prediction of future condition based on present condition under a defined range of future loading and maintenance scenarios. The successful implementation of road asset management systems or pavement management systems (PMS) is strongly dependent upon how well future pavement condition, as predicted by the performance prediction models of the system, agrees with observed behaviour and local engineering knowledge of the road network under consideration.

Pavement materials will deteriorate under the influence of loads and climatic effects. The stresses

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caused by heavy loads may result in microcracking in asphalt materials and may also cause permanent deformation in pavement layers. Skid resistance will be reduced as a result of changes in surface texture due to aggregate polishing or bleeding. Frost heave may cause cracking and deformation, while spring thaw can considerably reduce the permissible stresses in the unbound materials. With time, microcracking can develop into macrocracking, allowing water to penetrate into the pavement, and so on. Ideally a pavement performance model should capture this deterioration process in a comprehensive manner (considering all influencing factors). Unfortunately, this process of material deterioration is quite complex and difficult to model.

Measures of Pavement Performance

Pavement performance have been expressed in terms of individual pavement distress (such as rutting, cracking etc), pavement condition index, which is often a composite measure involving both the functional and structural condition, and pavement serviceability index, which includes user's evaluation of the condition of the pavement.

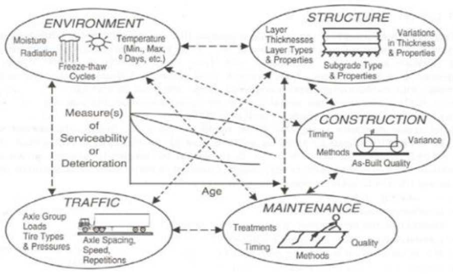

Figure 1: Factors affecting pavement performance (Haas 2003)

Pavement Performance Prediction Models

One of the most profound challenges facing pavement managers and engineers has been the development of performance or deterioration prediction models. Several performance prediction models have been proposed over the years, some of which are simple and others more complex. Ralph Haas (2003) grouped the many performance prediction models into classes which indicate their basis as follows:

- Empirical, where certain measured or estimated variables such as deflection, accumulated traffic loads etc are related to loss of serviceability or some other measure(s) of deterioration and pavement age, usually through regression analysis.
- Mechanistic – empirical, where certain calculated responses, such as subgrade strain, pavement layer stresses and strains etc, together with other variables such as accumulated traffic loads, are related to loss of serviceability or some other measure(s) of deterioration through regression analysis or a model which is calibrated (i.e. the coefficients are determined) by regression analysis.
- Subjective, experience based where serviceability loss or other measure(s) of deterioration vs. age are estimated, for different combination of variables, using Markovian transition process models, Bayesian models etc.

Study Methodology and Data Collection

In the previous chapter, a detailed over view regarding the various previous studies on pavement performance was discussed. Further specific scope of the work, arrived at from the literature review, was also presented. Detail regarding the proposed methodology for the present study is presented in this chapter. For the purpose of Pavement Performance Study (PPS) in Andhra Pradesh the following road stretches is selected for the study in the Kurnool district based on the selected parameters and criteria, and different major cities between on NH-18 are presented in Table. 3.1

S.No.	Name cites	District	Road name	ROAD LENGTH	population	Rain-fall intensity(mm)
1	KURNOOL	KURNOOL	NH-18	369 km	4,78,124	704
2	ORVAKALLU				4,866	579
3	NANDYAL				2,11,787	836
4	ALLAGADDA				26,375	800
5	CHAGALAMARI				47,076	798
6	MYDUKUR	KADAPA			72,356	719
7	KHAJIPETA				48,784	734
8	CHENNUR				48,654	691

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9	KADAPA				3,44,078	725
10	RAYACHOTI				90,814	605
11	PILERU	CHITTOOR			61824	760
12	CHITTOOR				1,74,640	1048

Table. 3.1 Different cites on NH-18

STUDY AREA DISCREPTION

Kurnool is a district in Andhra Pradesh, India Kurnool District has an area of 17600 km2, and a population of 4,78,124 of which having 704mm annual rain fall. The district is bounded by Mahbubnagar district to the north, Prakasham district to the east and Kadapa district to the southeast, , and Karnataka state to the west, Anantapur district to the south . Kandanavolu' which in course of time came to be known as Kurnool. Kurnool is well known for its temples. The Kurnool district headquarter is Kurnool city.

Transport at Kurnool: Kurnool is considered as the Gateway of Rayalaseema as one must pass through Kurnool to reach Kadapa or Chittor or Anantapur districts while travelling from Hyderabad. Kurnool is having the third largest bus station in Andhra Pradesh after Hyderabad and Vijayawada. Kurnool is connected to most cities and towns in Andhra Pradesh as well as to Bengaluru and Chennai by the Andhra Pradesh State Road Transport Corporation (APSRTC) and the Karnataka State Road Transport Corporation (KSRTC). National Highway 7 connects Kurnool to Hyderabad (210 km, 4.5 hours), Anantapur (140 km, three hours), Hindupur {245 km, 5.5 hours} and Bengaluru (360 km. The State Highway 51 connects to Srisailam, Vinukonda, Guntur, Vijayawada. The National Highway 18 Kurnool-Chittoor connects the city to Panyam, Nandyal,Allagadda,Ahobilam(near to the highway),Mahanandi(near to the highway),Maidukuru, Kadapa, Rayachoty Pileru, and Chittoor.

The four railway stations in Kurnool District are Kurnool Town, Adoni, Nandyal and Dhone junction. Adoni is on the Chennai-Mumbai Railway Line and several trains run daily to these cities and New Delhi. Nandyal is on the Guntakal -Vijayawada line and has daily trains to Hyderabad, Vijayawada, Bengaluru, Vishakhapatnam and Howrah. Dhone junction is situated on the Guntakal - Secunderabad / Vijayawada line. All the trains which pass through Nandyal and Kurnool pass through this junction.

The nearest airport is Rajiv Gandhi International Airport, at Hyderabad, three and half hours drive from Kurnool City.

GUIDE LINES FOR SELECTION OF ROAD SECTION

The test sections have been selected based on the following criteria.

1. The length of test section to be 1000m, starting from a land mark item (like the sign board of 273+550 to 274 of the road).
2. Test sections are to be selected to represent different combinations of subgrade soil type, pavement type and composition, traffic intensity, annual rainfall. Sections are to be selected on straight reaches.
3. The test sections are to be selected to cover as far as possible the following three variables.

- Sub grade soil type,
- Annual rainfall, and
- Traffic intensity

The selected stretches were inspected manually.

Figure 3.1 View of selected stretch in Kurnool District (NH-18)

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OVERVIEW OF THE METHODOLOGY

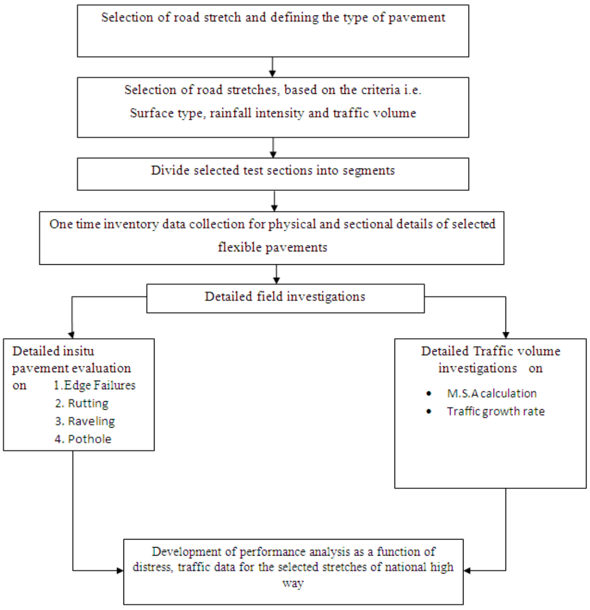

Figure 3.2 Study Methodology

Fig 3.3 India map

Fig 3.4 A.P map

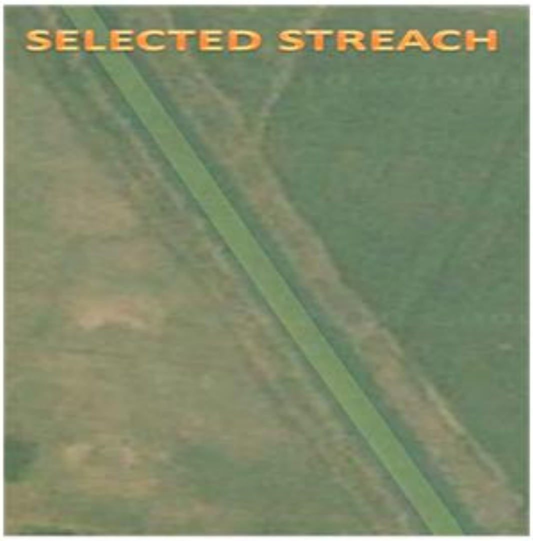

Fig 3.5 Selected stretch

Fig 3.6 NH-18

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In the above map the shows the our selected stretch, these are taken from google earth the first picture represents the India map and the second picture represents the A.P map and third picture shows the National Highway-18 and finally the selected stretch by considering above mentioned guide lines are respected stretch is selected.

DATA COLLECTION

Table 3.6 Data Collection

No of Visits	Date of visit	Data collected
1	25-01-2016	Rutting depth measured
2	20-02-2016	Traffic data collection(24 hours)
3	28-02-2016	Test conducted on soil sample
4	28-02-2016	Observations of different failures
5	21-03-2016	Traffic data collection(24 hours)
6	03-04-2016	Rutting depth & failures observed
7	06-04-2016	Traffic data collection(24 hours)
8	13-04-2016	DCP Test conducted on road

RESULTS AND DISCUSSIONS

History of present road

This selected stretched is a part of National Highway-18 near govendapalli. The length of previous road is 188.396 and this road 188.752 is km. The road connects Kurnool district and chittoor district with a total combined population of 777829. The sub grade soil is gravel_morrum, the rain fall intensity is greater than 883mm and the maximum and minimum temperatures are 490 and 280 C respectively, this road was constructed under phase four. For the purpose of pavement performance and traffic growth rate the test section was selected at 273+550 to 274+550.

Existing design of road

The selected section is consists of different layers of pavement consists of bituminous concrete layer of thickness 40mm,dense bituminous concrete layer of thickness 110mm,wet mix macadam layer of thickness 250mm,granular sub base of 200mm, sub-grade of 500mm and reaming as embankment as shown below.

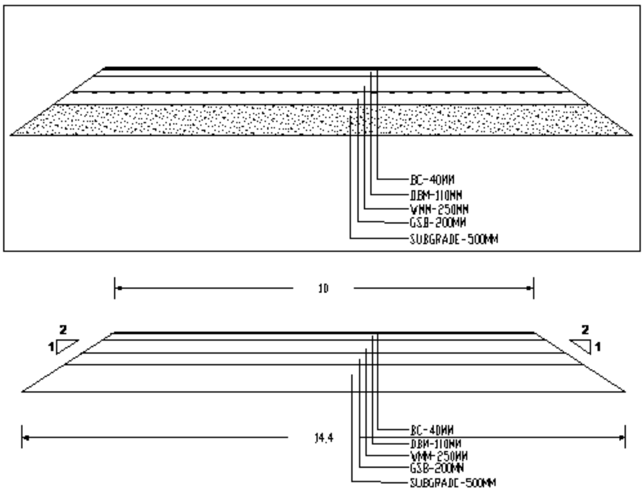

Fig.4.1 cross section of existing road

The grade of bitumen used is -------19mm+10mm+SD+FILLER+CRMG-60 grade of Bitumen

The material used in the DBM------40mm+20mm+10mm+SD+FILLER+Bitumen

The materials used in the WMM---40mm+20mm+10mm+SD+WATER

The material used in the GSB-------CRUSHED STONE/NATURAL GRAVEL+SD

The material used in the sub grade—GRAVELLY SOIL/MOORUM

Fatigue (Alligator) Cracking

Fig 4.2- Fatigue cracking

Description: Series of interconnected cracks caused by fatigue failure of the HMAsurface (or stabilized base) under repeated traffic loading. In thin pavements, cracking initiates at the bottom of the HMA layer where the tensile stress is the highest then propagates to the surface as one or more longitudinal cracks. This is commonly referred to as "bottom-up" or "classical" fatigue cracking. In thick pavements, the cracks most likely initiate from the top in areas of high localized tensile stresses resulting from tire-pavement interaction and asphalt binder aging (top-down cracking). After repeated loading, the longitudinal cracks connect forming many-sided sharp-angled pieces that develop into a pattern resembling the back of an alligator or crocodile.

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Bleeding

Fig 4.3 bleeding

Description: A film of asphalt binder on the pavement surface. It usually creates ashiny, glass-like reflecting surface (as in the third photo) that can become quite sticky.

Block Cracking

Fig 4.4 block cracking

Description: Interconnected cracks that divide the pavement up into rectangular pieces. Blocks range in size from approximately 0.1 m2 (1 ft2) to 9 m2 (100 ft2). Larger blocks are generally classified as longitudinal and transverse cracking. Block cracking normally occurs over a large portion of pavement area but sometimes will occur only in non-traffic areas.

Rutting

Rutting of pavement can represent a major hazard to users as well as being an early indicator of pavement failure. Rut depth measurements are therefore usually included in most of the road monitoring programmers. Rutting is defined as the difference in elevation between the straight edges resting on two high points to the lowest point on the pavement surface. In the present investigation the rut depth was measured using 3 m straight edge positioned at different locations across the profile and the high and low points were determined. From this the rutting was calculated.

Table 4.5.1; Rutting values towards Kurnool during first visit(25-01-2016)

Rutting values on NH-18 Date:25-01-2016							
Towards Kurnool							
Chainage	**LWP**	**RWP**	**Total**	**Avg=X**	**X^2**	**Mean=X_m**	**S.D**
273+550	5.5	7	12.5	6.25	39.0625		
273+600	5	8	13	6.5	42.25		
273+650	5	7	12	6	36		
273+700	4.5	12	16.5	8.25	68.06		
273+750	5	11	16	8	64		
273+800	6	9.5	15.5	7.75	60.06		
273+850	6.5	10	16.5	8.25	68.06		
273+900	4	8	12	6	36		
273+950	5.5	7	12.5	6.25	39.0625		
274+000	6	6.5	12.5	6.25	39.0625	**6.28**	**1.08**
274+050	5	7	12	6	36		
274+100	4	8	12	6	36		
274+150	4	6.4	10.4	5.2	27.04		
274+200	4	6.7	10.7	5.32	28.30		
274+250	2.5	8	10.5	5.25	27.56		
274+300	3	6	9	4.5	20.25		
274+350	5	7.5	12.5	6.25	39.6025		
274+400	5	8	13	6.5	42.25		
274+450	4	6	10	5	25		
274+500	4	9	13	6.5	42.25		
274+550	3	9	12	6	36		
Max rut depth in the test section							
Characteristic Rut Depth = X_m+(2*S.D)=**8.44mm**							

Table 4.5.2; rutting values towards kadapa during first visit

Towards Kadapa							
Chainage	**LWP**	**RWP**	**Total**	**Avg=X**	**X^2**	**Mean=X_m**	**S.D**
273+550	3	5	8	4	16		
273+600	4	2.5	6.5	3.25	10.56		
273+650	8	7	15	7.5	56.25		
273+700	6	5	11	5.5	30.25		
273+750	3.4	4	7.4	3.7	13.69		
273+800	4.5	6	10.5	5.25	27.56		
273+850	5	5	10	5	25		
273+900	4.7	5	9.7	4.65	21.6225		
273+950	4	5	9	4.5	20.25		
274+000	3	6.5	9.5	4.75	22.56	**5.67**	**1.73**
274+050	6	9	15	7.5	56.25		
274+100	11	7	18	9	81		
274+150	4	5	9	4.5	20.25		
274+200	4	5	9	4.5	20.25		
274+250	3	6	9	4.5	20.25		
274+300	9	9	18	9	81		
274+350	9	6	15	7.5	56.25		
274+400	7	10	17	8.5	72.25		
274+450	5	5	10	5	25		
274+500	4.3	5	9.3	4.65	21.6225		
274+550	9	4	13	6.5	42.225		
Max rut depth in the test section							
Characteristic Rut Depth = X+(2*S.D)=**9.13mm**							

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Table 4.5.3RUTTING VALUES during second visit(03-04-2016)

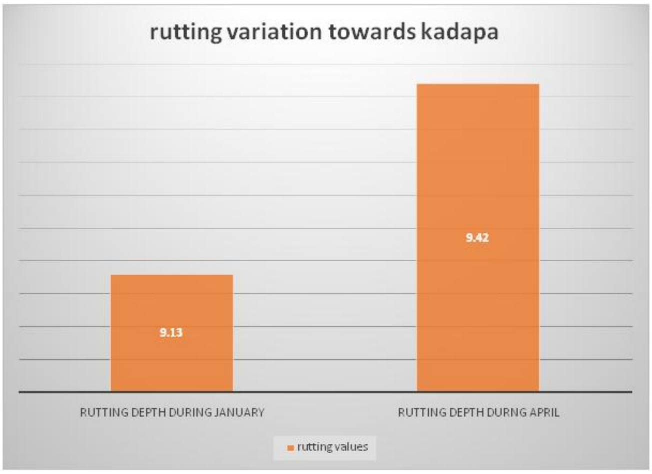
Rutting values on NH-18 Date:03-04-2016							
Towards Kurnool							
Chainage	LWP	RWP	Total	Avg=X	X^2	Mean=X_m	S.D
273+550	5.8	7.3	13.1	6.55	42.9		
273+600	5.2	8.1	13.3	6.65	44.22		
273+650	5.1	7	12.1	6.05	36.6		
273+700	4.7	12.3	17	8.5	72.25		
273+750	5	11.2	16.2	8.1	65.61		
273+800	6.2	9.9	16.1	8.05	64.80		
273+850	6.7	10.4	17.1	8.55	73.10		
273+900	4.3	8.3	12.6	6.3	39.69		
273+950	5.8	7.2	13	6.5	42.25		
274+000	6.4	6.7	13.1	6.55	42.90	6.5	1.0
274+050	5.2	7.1	12.3	6.15	39.82		
274+100	4.3	8.3	12.6	6.3	39.69		
274+150	4	6.5	10.5	5.25	27.56		
274+200	4.1	6.9	11	5.5	30.25		
274+250	2.8	8.2	11	5.5	30.25		
274+300	3.3	6.5	9.8	4.9	24.01		
274+350	5.2	7.7	12.9	6.45	41.6		
274+400	5.4	8.1	13.5	6.75	45.56		
274+450	4.2	6.3	10.5	5.25	27.56		
274+500	4.1	9	13.1	6.55	42.9		
274+550	3.2	9.2	12.4	6.2	38.44		
Max rut depth in the test section							
Characteristic Rut Depth = X_m+(2*S.D)=8.5mm							

Table 4.5.4; rutting values during second visit

Towards Kadapa							
Chainage	LWP	RWP	Total	Avg=X	X^2	Mean=X_m	S.D
273+550	3.2	5.3	8.5	4.25	18.06		
273+600	4.1	2.7	6.8	3.4	11.56		
273+650	8.3	7.3	15.6	7.8	60.84		
273+700	6.5	5.2	11.7	5.85	34.22		
273+750	3.7	4.4	8.1	4.05	16.4		
273+800	4.6	6.3	10.9	5.45	29.7		
273+850	5.2	5.1	10.3	5.15	26.5		
273+900	4.8	5.2	10	5	25		
273+950	4.4	5	9.4	4.7	22.09		
274+000	3.2	6.7	9.9	4.9	24.5	5.9	1.76
274+050	6	9.3	15.3	7.65	58.5		
274+100	11.4	7.5	18.7	9.3	87.4		
274+150	4.3	5.2	9.5	4.75	22.5		
274+200	4	5.3	9.3	4.65	21.6		
274+250	3.2	6	9.2	4.6	21.6		
274+300	9.4	9.3	18.7	9.35	87.42		
274+350	9.2	6.1	15.3	7.65	58.5		
274+400	7.3	10.4	17.7	8.85	78.3		
274+450	5.2	5.2	10.4	5.2	27.04		
274+500	4.5	5	9.5	4.75	22.5		
274+550	9.2	4.3	13.5	6.75	45.56		
Max rut depth in the test section							
Characteristic Rut Depth = X_m+(2*S.D)=9.42mm							

From the Tables, it can be observed that there is significant variation in rut depth i.e. maximum rut depth is 12 mm towards Nandyal and 11 mm towards Kadapa for january and depth is 12.3 mm towards Nandyal and 11.4mm towards Kadapa for March respectively. This may be due to the many factors such as traffic, sub grade moisture content etc. One can observe from above data that in both instances the rut depth is within the limits (5 and 20 mm) as per IRC:SP:20 and IRC 37-2001 respectively. In some instances for 50 mm subsection, the sample data reported that there was no rutting when the profile indicated significant rutting. The pictorial variation of rut depth and average rut depth of all the selected test stretches are presented in Figure.

Graph 4.1.1 shows variation rutting depth towards Kurnool



Graph 4.2.1 shows variation rutting depth TOWARDS KADAPA

From the Figure it is clearly seen that the characteristic rut depth has been increased from January 2016 (8.44mm) to April 2016 (8.5 mm) towards nandyal and it has been increased from January 2016 (9.13mm) to April 2016 (9.42 mm) towards kadapa. This may be due to increase in the number of the wheel passes on the pavement.

CONCLUSION

Based on the filled investigation and analysis
In this paper the nominal effects of pavement roughness on vehicle-pavement interaction aredemonstrated. Pavement roughness is the primary cause for moving dynamic tyre loads on pavements. Control and management of pavement roughness can aid in limiting the magnitude of moving dynamic tyre loads on a pavement.

Although it has been known for long that pavement roughness deteriorates with traffic and time, the effect on moving dynamic tyre loads and structural pavement lives could not easily be quantified. In the paper a simplified and practical method is demonstrated that can be used to obtain an initial quantification of the effects of pavement roughness on these parameters, based on input data from the vehicle population and pavement roughness.

In this investigation it is observed that the maximum characteristic rut depth is 9.42 mm.. This values is well within the limit of permissible value given by IRC 37 - 2002. It is concluded that the rate of rut depth progression is relatively increasing, and it has increased from 5 mm to 9.42 mm since the last 10 months.

It is further concluded that the traffic volume on this road is comparatively high compared to the last year traffic data . Specially commercial vehicles per day is very high.

By conducting the DCP test we conclude that the strength of the existing road is good.

REFERENCES

1. Shankar. S (2005)Project Report On Assessment Of Pavement Condition Adopting Maintenance Management Techniques For NIT-KU By Pass And NH Transportation Division NIT-Warangal

2. Kumar, P. (2002). Report of the Visit to Army Area for Remedial Measures, IIT Roorkee. 2002..

3. Sanjiv Aggarwal*, Prof. (Dr.) S.S. Jain** & Dr. M. Parida "Development Of Pavement Management System For Indian National Highway Network"Indian Institute Of Technology, Rookie – 247667 (Uttaranchal) Paper No. 502

4. Prozzi, J. And Madanat, S. (2003). "Incremental Nonlinear Model For Predicting Pavement Serviceability." J. Transp. Eng., 129(6), 635–641.

5. Chen, P.E., Chih-Hsien Lin., Erwin Stein., and Jurgen Hothan (2004). "Development of a Mechanistic-Empirical Model to Characterize Rutting in Flexible Pavements." Journal of Transportation Engineering, 140 (4), 519-525.

6. Dawson. A.R., Kolisoja.P., Vuorimies.N., and Saarenketo.T. (2007). "Design of Low-Volume Pavementsagainst Rutting." Transportation Research Record, 1989, Transportation Research Board, National ResearchCouncil, Washington, D.C., 165-172.

7. Deacon,J.A., Harvey,J.T., Irwin Guada, Lorina Popescu, andMonismithC.L. (2002), "Analytically Based Approach toRutting Prediction",Transportation Research Record, 1806, Transportation Research Board, National ResearchCouncil, Washington, D.C.

8. Coonse, J. (1999), Estimating California Bearing Ratio of COHESIVE piedmont Residual soil using the Scala Dynamic Cone Penetrometor, Master's thesis, North Carolina State University, Raleigh, N.C.