His Majesty's Government of Nepal
Ministry of Works and Transportation
Department of Roads

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HMIS News

A NEWSLETTER FROM THE PLANNING BRANCH

DATA COLLECTION

Visual Pavement Condition Survey

The assessment of the condition of the pavement is an integral part of the pavement management. The assessment is generally carried out throgh a) Visual Condition and b) Instrumentation Survey. The visual condition survey is based on the field observation of the distress of the pavement. The Instrumentation Survey includes the measurement of the surface roughness and other techniques on the assessment of the structural strength of the pavement and the pavement resistance to the moiving vehicles.
This note is mainly concerned with the methodology of conducting visual condition survey of the pavement and determining the condition of the road in terms of good, fair and poor using the index obtained from the visual survey.
The Department of Roads (DoR) is been carrying out visual condition

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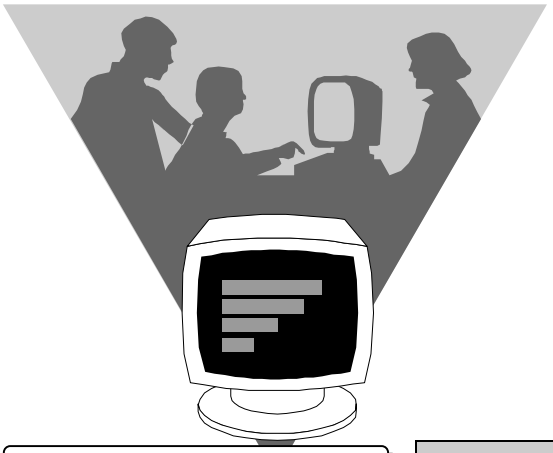
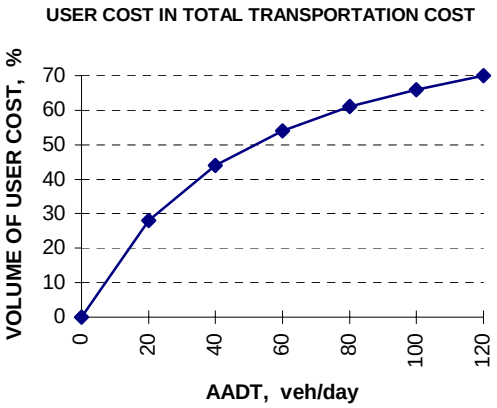


ROAD USER COST

ement Condition on Road User Cost

he ultimate goal of DoR is to minimize total transportation cost (TTC). The total transportation cost consists of Construction, Maintenance and Road Users cost. The user cost plays dominant role in TTC. For a low traffic volume road(AADT=20) in a plain consists of only 28 % of TTC , where as it's fraction increases upto 70 % for the road with 120 AADT. For roads with traffic volume more than 250 veh/day the user cost consists of 75-95% TTC.traffic.



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VISUAL PAVE COND_SURVY (cont'd from page 1)

survey of the strategic network since 1992/93 through the activities under Maintenance and Rehabilitation Coordination Unit

Inside this issue:

TO CONTACT US:

The Highway Management Information System(HMIS) is located in the Planning Section of the DOR.
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(MRCU). The data are stored in the Highway Management Information System established at the Planning Branch of DoR. To make the system of yearly collection of the data on a sustainable basis, the department has decided to start conducting the visual condition survey through the Planning Branch from this fiscal year as part and parcel of the branch programme.

Road pavement deteriorate over time under the combined effects of traffic and weather. Road deterioration is usually predicted through five separate distress mode, i.e.

cracking	formation of cracks in pavement surface
ravelling	loss of material from wearing surface
Potholes	open cavity in road surface with at least 150 mm dia. and at least 25 mm depth
rutting	a deep narrow track left in pavement by a wheel
roughness	deviation of a surface from a true planar surface with characteristic dimension that affect the vehicle dynamics, ride quality, dynamic load and drainage typically in ranges of 0.1 to 100 m wave lengths and 1 to 100 mm amplitudes.

The first four distress is included in simplified visual pavement distress survey method developed with the assistance from World Bank to suit the local condition. The method is mostly focused to the collection of data for planning periodic maintenance activities. Roughness measurement is conducted in a separate Roughness Survey by using Bump Integrator mounted in a vehicle. Rally Haldometer is used to measure the distance as the marker post based on referencing system developed has not been yet placed in field.

Unlike the differential distress measurement done for HDM, in the simplified pavement distress method the surface distress is given by cumulative index called *Surface Distress Index*(SDI). SDI is a 6 level rating index from 0 to 5. The rating 0 indicates the pavement surface without any visual defects, whereas 5 indicates maximum possible deterioration. Besides, shoulder condition rating in 0 to 4 scale is also done. The three predominant major types of pavement distress present in the given sample section is also noted. Condition rating of side drain structures carried out on last two years has been abandoned from this year as proper drainage system is prerequisite for any kind of Pavement Management system. Pavement distress survey is usually done in last 100 m sample section in each km for gravelled and blacktop roads in strategic road network.

Surfacing distress viz. *cracking*, *ravelling* and *potholes* are generally characterised by extent and severity. Two more surfacing distress i.e. maintenance *patch* and *bleeding* could also be included for bituminous pavement.

Extent is usually measured in area of distress i.e. sum of rectangular areas circumscribing manifest distress (line cracks are assigned a width dimension of 0.5 m), expressed as percentage of the carriageway area.

Severity is defined by using the subclass of the surfacing distress modes. For blacktop road :

cracking

1. Narrow cracks - Interconnected or line narrow cracks of 1 - 3 mm width
2. Wide cracks - Interconnected or line cracks of 3 mm or greater

ravelling

Ravelling - < 20 mm depth
Scabbing - > 20 mm depth

potholes

potholes
exposed base
Short Edge Break- > 100 mm, < 5 m length
Long Edge Break- > 100 mm, > 5 m length

Deformation distress viz. rut depth and roughness are continuous in nature. Only the severity of the deformation distress is measured

rutting

1. Shallow rutting - rut depth <= 15 mm
2. Deep rutting - rut depth > 15 mm

The rating of the given pavement section is done using a special matrix/table based on the extent and severity of individual manifest distress.

Surface Distress Index is used to make not only the decision on selecting the type of treatment to be carried out for the particular section of the road, but also used to establish and forecast the trend of the future deterioration of the pavement. It is an very effective tool for recording the performance of the maintenance operation and planning the Periodic Maintenance as part of the Planned Maintenance activities.

The condition of the road and indication of the type of treatment needed, based on the defined range of SDI, is given in the following table.

SDI Range		Type of Treatment
0 - 1.7	Good	Routine and Recurrent Maintenance
1.8- 3.0	Fair	Routine and Recurrent + Periodic Maintenance
3.0 - 5.0	Poor	Backlog Maintenance or Rehabilitation or Reconstruction

The roads under good and fair condition are classified as maintainable roads where planned maintenance activities could be planned and implemented. Where as, for the roads under poor catogories a fair degree of costly treatment in terms of rehabilitation or reconstruction is necessary to bring the road under maintainable condition. Only ad hoc, responsive maintenance is possible on roads in poor conditions.

Averaged SDI in combination of averaged roughness could also be used to define the road condition for heavily traffic road using the matrix (table 1). But it should be noted that the range specified above will vary depending upon the pavement type and has to be calibrated to the context of Nepal.

Pavement deterioration with the accumulation of water on pavement while the depressed shoulder could accelerate edge break. For network level planning Pavement prediction performance models with IRI, SDI and structural capacity as indexed parameters and using main distress types and shoulder rating as thresholds have to be developed/calibrated for the condition of Nepal.

			SDI		
			GOOD	FAIR	POOR
			0 - 1.7	1.8 - 3	3.1 - 5
ROUGHNESS	GOOD	0 - 4	**G**	**F**	**P**
	FAIR	3 -7.7	**G**	**F**	**P**
	POOR	5.5-15	**F**	**P**	**P**
	VERY POOR	15 +	**P**	**VP**	**VP**

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The combination of SDI value and distress types collected for each sample section gives an indication of type and severity of the individual distress which could be used to predict the rate of deterioration of the pavement. In future the prioritisation for maintenance funding will be based on the level of traffic, importance of the link, age and the rate of deterioration of the pavement.

The shoulder ratings could be used to define the shoulder maintenance needed. It will also help to predict the deterioration rate as the raised shoulder could increase the pavement deterioration with the accumulation of water on pavement while the depressed shoulder could accelerate edge break. For network level planning pavement prediction performance models with IRI, SDI and structural capacity as indexed parameters and using main distress types and shoulder rating as thresholds, have to be developed/calibrated for the condition of Nepal.

Effect of Pavement Condition...(cont'd from page1)

The quantities of resources consumed i.e. liters of fuel, numbers of tires, man-hour of labour are determined togather with vehicle speeds - a functions of the characteristics of each type of vehicle & geometry, surface type, current condition of road. Costs are then found by multiplying the various resource quantities by user specified unit costs and adding allowance for depreciation, interest, and overhead costs and for time values of passenger delay & cargo holding.

With respect to vehicle operating costs, major primary research studies were conducted by various institutions in Kenya (1971-75) Caribbean (1977-82), Brazil (1975-84) and India (1977-83). One of the most important conclusions emerges from the studies is that the major influence of the road roughness on the operating cost. These effects are generally larger in very badly deteriorated paved roads.

Local variation in economic circumstances, traffic compositions, average vehicle conditions, driver behaviour and road characteristics for a given country arises the needs to calibrate the models based on local research studies. Comprehensive attempt to estimate vehicle operating costs for Nepal is included in VLD report 1987 on the study of the Road Transport Industry for the feeder road project. In 1992 with the initiation of MRCU the Indian VOC relationship was customized for Nepalese condition with the assistance of transport economist from TRL. A simple spreadsheet based model was prepared. In 1993 it was updated and improved with some modification of some of the coefficient and addition of VOC parameters limits. Later in 1994 VOC relationships for mini buses and trucks were also included in the model.

The VOC models developed were mainly the function of roughness, average curvature, rise and fall, and roadwidth. But very little information is available on the geometric parameters of the road. Hence for the network level maintenance strategy planning the VOC equations were generalized with certain assumptions:

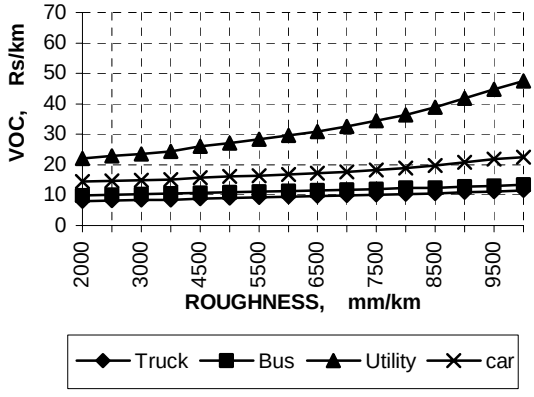
1. Instead of taking Average curvature for each links, mean value is taken for road section in hill, rolling and plain terrain.

	Average value for		
	Hill	*Rollin*	*Plain*
Avg. Curvature, deg/km	**600**	**300**	**50**
Rise & Fall, m/km	**50**	**3**	**2**

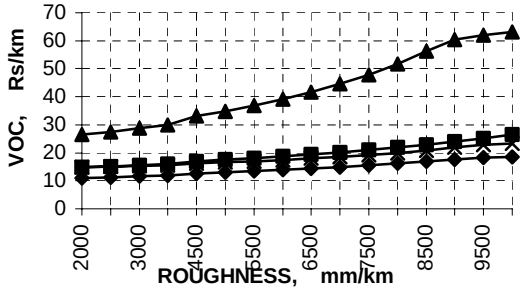
2. Same VOC models are to be used for paved and unpaved roads.

3. No Congestion of traffic is taken into account and the road width is taken as 7 m.

AVERAGE VEHICLE OPERATING COST FOR PLAIN TERAIN



AVERAGE VEHICLE OPERATING COST FOR HILLY REGION



The average vehicle operating cost in Rs/km for various types of vehicle increases with increase of pavement roughness. The average VOC for plain, rolling terrain and hills for newly built DBST road with roughness about 2500 mm/km are Rs. 8.17, 9.34,11.31 respectively. An increase of roughness from 2500 mm/km (for new DBST) to 9000 mm/km could cause 33, 39 and 56 % VOC in plain, rolling and hilly terrain respectively. That is for a 100 km long poor condition road with roughness 9000 mm/km and AADT 1000 veh/day the Total vehicle operating cost increases up to Rs 99 316 500, 136 218 000 and 232 286 000 respectively. This could give a general idea why the proper maintenance of the road is essential. A policy could also be developed to charge a fraction of the savings due to keeping the road in good condition as toll tax from the road users .

PERSONNEL INFORMATION SYSTEM

The Road Sector Skill Development Unit (RSSDU) has installed a Personal Information System (PIS) software developed by a local consultant- Unlimited Software. Bio-data records received from DoR employees are now being entered. The PIS contains all relevant information about DoR employees including length of service, education, training received, employment records like promotion, postings, etc. The purpose of PIS is to maintain up-to-date personal records of all DoR employees and provide relevant information to the management to assist in decision making in various matters such as posting, promotion, trainings, recuirtment, retirement, etc. The RSSDU requests all DoR employees who have not yet done so to complete the bio-data cards supplied to them already, at the earliest and submit to the Unit.

The Personal Information System (PIS) is capable of processing data and provide following reports instantly:

* Bio-data report
* Seniority of employees in current position
* Current work-place list
* Employees experience detail
* Employees profile
* Training records
* List with female/male employees
* Qualification records
* Service length
* Staff retirement details
* Training by subjects
* Work experience in various fields
* Work experience by Geographic locations

1. Road Master Plan (PIP) project has started from october.

2. Process of hiring environmental consultant to elaborate Guidelines for Road sector is in progress

ON GOING ACTIVITIES

RMP Cyclic Maintenance Component

Introduction : The Cyclic Maintenance Component is one of five distinct technical components within the Road Maintenance Project which is an integral part of the Road Maintenance and Rehabilitation Project (RMRP). The main aim of the RMRP is to ensure that the condition of the strategic road network is improved effectively and that a sustainable capability is developed within Nepal to maintain that network. The RMP, funded by the Overseas Development Administration (ODA), with counterpart funds from HMGN, will provide much of the technical assistance for the overall RMRP. The Cyclic Maintenance Adviser and Team have been operating from within the Maintenance Branch of the DOR Headquarters since May 1994 and with the combined efforts and coordination between other DOR Branches has promoted a sustainable approach to the planning and implementation of cyclic resealing projects.

Objectives: The Cyclic Maintenance Component will generate a capability within the DOR to plan and manage the cyclic resealing programme, whilst local consultants and contractors will develop their respective expertise through a series of resealing training contracts. Cyclic resealing is considered to be the most cost-effective operation to improve the serviceability of bitumen roads in Nepal, as an essential element of planned periodic maintenance, and well-recognised in the DOR strategy document published in July 1995. The term "cyclic resealing" assumes that very little additional work is required before applying a single or double seal surface dressing to the existing (bitumenised) pavement, other than minor patching and edge repairs. ODA's financial assistance may extend later to regraveling, once local contractors have shown an effective response during the initial stages of the RMP.

The development of the consulting and contracting industry, as an immediate objective of the Cyclic Maintenance Component, is also particularly related to the RMRP, whereby over 600 km of resealing should be accomplished up to 1999, under a periodic maintenance programme using local consultants and contractors, some of whom may well have received training within the RMP.

The resealing training contracts: Under the RMP a series of 14 resealing training contracts, totaling 350 km should be established throughout the five year programme, commencing with two contracts in the first year and expanding to three, four and then five in the final year. The training aspect of the resealing contracts is accentuated and is not restricted to local consultants or contractors. The training opportunities, within the RMP, will be extended to DOR personnel through secondment to the local consultants during the design and supervision phases, besides possible overseas attachments on academic courses that would broaden the recipient's knowledge and further enhance his/her worth to the DOR and thereby promote the desired sustainability.
To identify the most appropriate locations for the first two resealing training contracts (Packages 1 and 2), the Cyclic Maintenance Team have examined the extent of the strategic network, eliminated the committed projects and those under consideration by other aid agencies, and have concentrated on those bitumenised roads, wholly maintained by the DOR, in good or fair condition, and generally about 25 km long. Following this procedure the first training contracts (Package 1 and 2) were selected.

The next three resealing training contracts (Packages 3, 4 and 5), were selected in a similar manner. However in addition extensive use was made of the database dRoads, a part of the Highway Management Information System (HMIS). A comprehensive list of sections of highways and feeder roads in "good" and "fair" condition (Surface Distress Index < 3.0) with related roughness measurements (IRI) and traffic (ADT, surveyed or estimated) was developed and sections were ranked accordingly. Without the use of the HMIS, the prioritisation procedure would have been less objective and less defensible, and for the next set of resealing training contracts (Package 6, 7, 8 and 9) this exercise will be repeated, and updated by referring to the latest data available and confirmed by site inspections and discussions within the DOR Headquarters and the Divisions as appropriate. The locations of these resealing training contracts are:

Pack.	Road	Desription	Length (km)
1	F 35	Anbukhaireni to Gorkha	24.69
2	H 14	Dhangadhi to Atariya to Godavari	22.98
3	H 1	Junction at Bardhaghat to Butwal	26.00
4	H 4	Kadmaha Chowk towards Gaighat	20.73
	F 4	Rupani towards Kunauli	10.26
5	H 7	Charali towards Ilam	16.00

The selection of local consultants For Packages 1 and 2 an invitation for local consultants to submit an interest in the two resealing training contracts was published in July 1994 and a "short list" of 17 consultants was approved. Subsequently eight proposals were received on 30 September 1994, (all but one submission was either a joint venture or association with another firm). The financial evaluation for Package 1 was undertaken and the report submitted and approved to proceed financial negotiations in December. Similarly the same Evaluation Committee have examined the technical proposals for Package 2 and the subsequent report was approved to commence financial negotiations in January

Successful but protracted negotiations with both consultants were completed which resulted in the consultants for Package 1 (CEMAT /DEVTEC in association with the Central Road Research Institute , India) commencing their services on 1 March whereas the consultants for Package 2 (ITECO/TAEC) commenced their services on 5 April.

A "short list" of 16 local consultants for Packages 3, 4 and 5 was based on the responses for Packages 1 and 2 and subsequently nine proposals were received , three for each package, (only three consultants failed to respond or form a joint venture). The Evaluation Committee is currently assessing these responses, such that the financial negotiations for Package 3 may proceed shortly, whilst further progress is made towards selecting the consultants for Packages 4 and 5.

The selection of local contractors: Local contractors have been informed about the RMP and the cyclic resealing programme, through a workshop in September 1994. There is ample capacity and interest within the contacting industry to become involved in the series of 14 resealing training contracts planned over the next few years. To advance the engagement of local contractors the PQ documents have been prepared jointly by the local consultants for Packages 1 and 2. The PQ notice was published recently and 37 local contractors requested the PQ documents, of which 34 responded with an application. The local consultants are currently examining these responses and are likely to produce their evaluation report shortly.

Summary: There have been lengthy procedures associated with the engagement of local consultants to design and supervise Package 1 and 2 and, similarly with the engagement of local contractors to undertake these resealing training

contracts. However, the mutual cooperation between the DOR, the International and local consultants has lead to the partial achievement of the overall objectives of the cyclic maintenance component i.e. to develop the existing skills within all parties and improve and expand the knowledge associated with cyclic resealing.