

## International Course on Dissemination of HDM-4

From 10<sup>th</sup> to 21<sup>st</sup> October 2011 at CRRI, New Delhi

The Government of Orissa in Works Department vide Works Department Letter No. EAP (Cell) - 121/2011 9733/w Dt. 22<sup>nd</sup> September, 2011 and Letter No. EAP (Cell) - 121/11 10156/w Dt. 1<sup>st</sup> October, 2011 had deputed the following three officers from the Project Management Unit of Orissa State Roads Project to attend the "International Course on Dissemination of HDM-4" being held from 10<sup>th</sup> - 21<sup>st</sup> October, 2011 at Central Road Research Institute (CRRI), New Delhi.

1. Er. Fakir Mohan Panigrahi, Executive Engineer, PMU
2. Er. Ramesh Chandra Panda, Assistant Engineer, PMU
3. Er. Subhansu Sekhar Swain, Assistant Engineer, PMU

### Brief Note by Delegates

The Central Road Research Institute (CRRI), New Delhi had organized a 10 days training programme on Dissemination of HDM-4 from 10<sup>th</sup> - 21<sup>st</sup> October, 2011 for disseminating the knowledge about when, where and how to use the software especially for economic evaluation of pavement maintenance management projects broadly focusing on Pavement management system using economic decision making process in HDM-4 and its application areas, Foundation course on HDM-4 modeling process and operational details of HDM-4 software with hands on exercises.

The course content of the training programme is listed below:

Date	Session	Description of Topic	Faculty
10-10-2011	Session-1	Registration & Inauguration	Director, CRRI
		Introduction with participants and course details	Dr. D. Tiwari
	Session -2	HDM- 4 Overview	Dr. D. Tiwari
		Basic Flexible Pavement Design (AASHTO & IRC Methods)	Dr. D. Tiwari
	Session -3	Flexible Pavement Deterioration	Sh. K. Sitaramanjaneylu
		Flexible Pavement Maintenance	Sh. M.N. Nagabhushana
	Session -4	Sub-base and Sub-grade Layer	Sh Guru Vittal
11-10-2011	Session-1	Rigid Pavement Design	Sh. Binod Kumar
	Session -2	Rigid Pavement Deterioration	Sh. Satandar Kumar
		Rigid Pavement Maintenance	Sh. J.B. Sengupta
	Session -3	Data collection Equipments (BBD & FWD)	Sh. R.K. Srivastava
	Session -4	Automated Data Collection (Vehicle)	Sh. Pradeep Kumar
		PMS Data Management	Sh. Mohan Rao
		Discussion Time/ Special Lecture	Dr. D. Tiwari

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12-10-2011	Session-1	Traffic - pattern & Speed Flow Models	Sh. Velmurugan
	Session -2	Vehicle Fuel Consumption Parameters	Dr. Ravindar Kathiyar
		Road User Cost Parameters	Sh. Madhu Errampalli
	Session -3	Economic Appraisal of Projects	Dr. B.K. Durai
	Session -4	Vehicle Emission	Dr. Neeraj Sharma
Road Deterioration Model		Dr. D. Tiwari	

Date	Session	Description of Topic	Faculty
13-10-2011 to 21-10-2011	All Sessions	Understanding and creation of Aggregate Values and Tables	Dr. D.Tiwari, Sh. R.K.Srivastava, Sh. Mohan Rao and Ms. Kamini Gupta
		Understanding and creation of speed flow relationships, traffic	
		Understanding and creation of pattern and environment parameters	
		Understanding and creation of Road Network	
		Understanding and creation of Vehicle Fleet	
		Creation of Maintenance Standards	
		Creation of Maintenance Standards	
		Creation of improvement standards	
		Creation of Projects (Section level analysis)	
		Understanding Distress Parameters and Calibration Factors	
		Understanding Vehicle Parameters (PCSE, Vehicle Cost, Annual KM, Working hours, Value of Time Cost Etc.)	
		Understanding Economic Indicators	
		HDM-4 Report Reading and Interpretation	
		Maintenance and Upgrading of Unsealed Road	
		Maintenance of Bituminous Road	
		Effect of time and work standards in road Maintenance	
		Strengthening and Upgrading of Paved road	
		Capacity Enhancement (Realignment widening, Lane addition, Bypass)	
		Concrete Road Maintenance	
		Upgrading Bituminous Pavement to Concrete	
Calibration of deterioration models			
Calibration of vehicle parameters and sensitivity Analysis			
Creating Road Sections for Network Level & Policy			

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		Analysis	
		Program Analysis & Budget	
		Moving to HDM-4 Version 2	
		Post course evaluation and discussion session	
		Certificate distribution and Course adjournment.	

**Lessons learnt:**

HDM-4 is a software for economic evaluation of investment decisions on road projects (Projects have different definitions in the software application). Through HDM-4, values of Economic Indicators are derived from the cost benefit stream. HDM-4 does not suggest the most appropriate maintenance work to be done in a road project, on the contrary it only shows the effect of different work standards on the road which are to be constructed (or suggested) by the Engineer. All such projects are economically evaluated. The Highway Development and Management Tools (HDM-4) is the extended version of Highway Design and Maintenance standard Model (HDM-III). HDM-4 provides a harmonised systems approach to road management with adaptable and user friendly software tools. It is a powerful tool to provide a powerful system for the analysis of road management and investment alternatives.

Inside each maintenance alternative, logically selected maintenance works with their respective application (intervention) times are given. A different invention time of the same maintenance work may produce altogether different output. Any number of alternatives may be tested at the same time in a single run of HDM-4.

To run the HDM-4, inputs given for the first year will be the initial conditions. Models inside HDM-4 predict the condition of road which would be deteriorated due to traffic load and environment.

HDM-4 software gives a cost benefit based result. Cost of a project refers to the expenditure to be incurred for maintenance and improvement of the road sections under the project which is known as Road Agency Cost (RAC). Benefits are obtained from the different costs of transport users under better alternative and the base alternative which is known as Road User Cost (RUC).

Economic Indicators, derived in the Economic Evaluation are (i) Internal Rate of Return (IRR), (ii) Net present value (NPV) and (III) Benefit cost ratio (BCR). After meeting the technical criteria, if the above indicators are within acceptable range of an alternative then the alternative is shortlisted for further consideration for Investment Decision.

Investment decision is taken not only on the basis of techno-economic evaluations but there are other considerations as well.

Through HDM-4 analysis, it is possible to know which work will be most appropriate for maintenance, rehabilitation or up gradation of roads under a given circumstance. Therefore inputting data is very important.

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Through HDM-4 the analysis can be made either for a section of road, or for a group of roads or for a road network. Accordingly the process is known as Section Analysis Project Level Analysis or Network Analysis respectively.

The uses of HDM-4 are

- Appropriate maintenance policy of a road network.
- Approximate budget allocation required for maintenance of road network.
- Prioritisation of the sections for maintenance.
- Maintenance under budget constraint.
- Sensitivity of different parameters on the maintenance cost such as traffic growth, traffic composition, and axle load and traffic congestion.
- For developing pavement management system.

As the software is hard coded and a proprietary item, direct input to HDM-5 from a large data base is not possible nor can the results be shown directly to a GIS platform.

Applications of HDM-4 in the function of highway management process are (i) Planning (ii) Programming (iii) Preparation and (iv) Operation.

The Analytical frame work of HDM-4 is based on the following effects/conditions of the life cycle of a road pavement (15 to 40 years)

- Road deterioration
- Road work effects
- Road user effects

The modelling of Road user effects (RUE) in HDM-4 comprises the following

- Motorised Vehicle (MT) speed, operating costs & travel time.
- Non-motorised Transport (NMT) speed and operating costs.
- Road safety.
- Socio Economic and Environmental Effects.


Roads after constructions undergo process of deteriorative due to (i) Traffic loading (ii) Environmental weathering and (iii) Effect of inadequate drainage system.


The application of HDM-4 in planning can be obtained with following analysis.

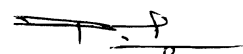
- (i) Strategic Analysis:- deals with entire network or sub networks of road organisation.
- (ii) Programme Analysis – deals with prioritisation of road projects is to a one year or multiyear work programme under defined budget constraints.
- (iii) Project Analysis – Evaluation of one or more road projects or investment options where economic indicators are determined for the different investment options.

HDM-4 is also one of established models for decision support component within a complete road management system. The integrated sub systems are –

- Data collection
- Database management
- Decision support
- Management information

  
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HDM-4 configuration is the management of all of the default data to be used within the analysis. This is most important part of HDM-4 analysis as erroneous input will lead to erroneous result. The sensitive parameters would be evaluated and entered carefully to get best results.

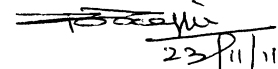
The road determination frame work developed for HD4 is much more flexible and is able to handle a wider range of pavement type.

  
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Er. Ramesh Chandra Panda  
Assistant Engineer, PMU

  
Swain  
23/11/2011

Er. Subhansu Sekhar Swain  
Assistant Engineer, PMU

  
23/11/11

Er. Fakir Mohan Panigrahi  
Executive Engineer, PMU