Indo- US Workshop on

Highway and Airport Pavement Engineering: Challenges and Opportunities

From 30th – 31st July, 2010 at IIT, Kharagpur

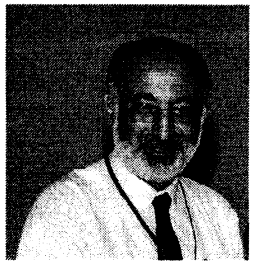
The Government of Orissa in Works Department vide Works Department No. EAP (Cell) – 46/09 (pt.) 10090/w Dt. 26th July, 2010 had deputed the following three officers from the Project Management Unit of Orissa State Roads Project to attend the "Indo- US Workshop on Highway and Airport Pavement Engineering: Challenges and Opportunities" being held from 30th – 31st July, 2010 at IIT, Kharagpur.

1. Sri Saroj Kumar Misra, Executive Engineer, PM Unit, OSRP
2. Sri Sameer Hota, Assistant Engineer, PM Unit, OSRP
3. Sri Akshay Kumar Sahoo, Assistant Engineer, PM Unit, OSRP

BRIEF NOTE by Delegates

The Trasportation Engineering Division of Civil Engineering Department of IIT, Kharagpur & RCG School of Infrastructure Design and Management, IIT, Kharagpur had organised a two-day workshop on Highway and Airport Pavement Engineering: Challenges and Opportunities (HiPAVE) 30-31 July, 2010 in IIT, Kharagpur in association with I.I.T., Madras , Worcester Polytechnic Institute, Worcester, USA and The University of Texas at El Paso, El Paso, USA. This workshop was organised under the auspices of Indo-US Science and Technology Forum and with support of number of organizations.

Brief narration of each session



Prof. Soheil Nazarain

Day 1: 30 July, 2010

Technical Session – I

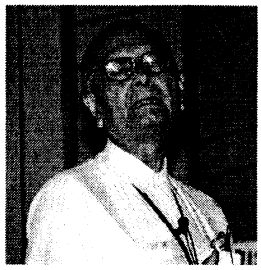
a.) Role of Research in Longlife Highway and Airport Pavements: by **Prof. Soheil Nazarain**, UTEP, El Paso, USA

b.) Improved Flexible Pavement Design: by **Prof. B. B. Padey**, IIT, Kharagpur

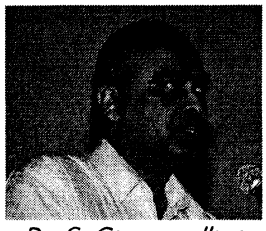
c.) Accelerated Damage to Pavements by Overloading – Issues and Possible Remedies: by **Dr. S. Gangopadhya**, Director, CRRI

d.) Human Resources Development Needs in Road Sector in India – Issues and Concerns :by **Prof. A. Veeraragavan**, IIT, Madras

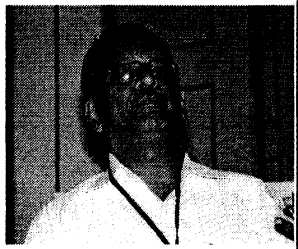
e.) Network-level Pavement Management System in India :by **Sri K. Sitaramanjaneyulu**, CRRI, New Delhi



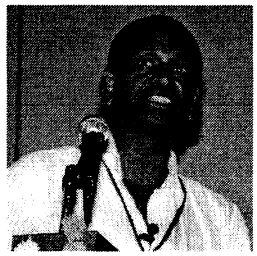
Prof. B. B. Pandey



Dr. S. Gangopadhya



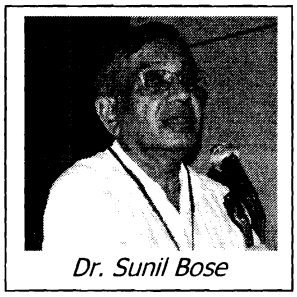
Prof. A. Veeraraqavan

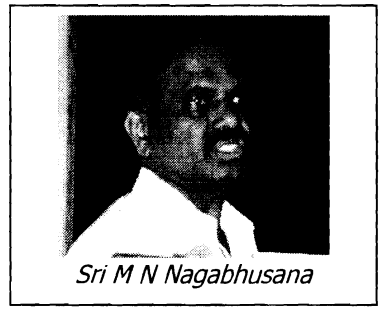


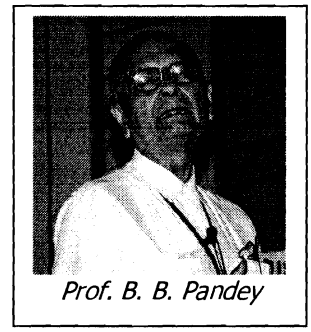
Sri K. Sitaramanjaneyulu

Technical Session – II

a.) Use of Accelerated Pavement Testing Facilitie for Road Development in India: by **Dr. Sunil Bose**, CRRI, New Delhi
b.) Flexible Pavement Failure Investigation – Some Typical Case studies: by **Sri M N Nagabhusana**, CRRI, New Delhi
c.) Hot, Warm, Half-Warm and Cold Bitumen Mixes: by **Prof B B Pandey**, IIT, Kharagpur

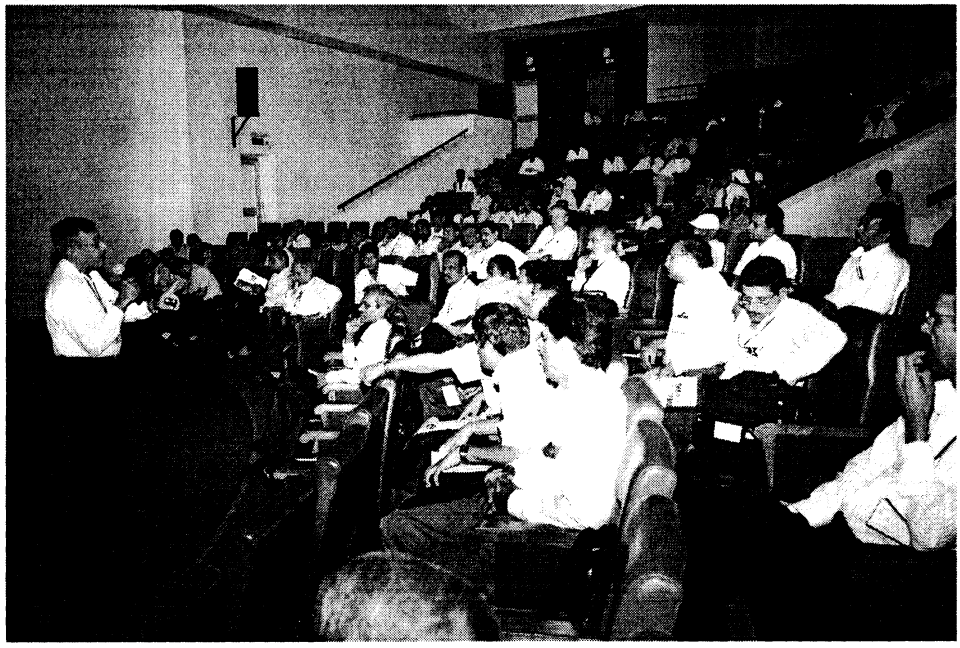

Dr. Sunil Bose

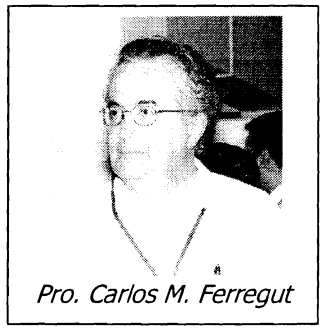

Sri M N Nagabhusana


Prof. B. B. Pandey

Technical Presentations

a.) Presentations by **M/s Alchemist** on RBI Grade 81 – Pavement Material" - A Cost Effective , Rapid, Environment Friendly Pavement Material
b.) Presentations by M/s GMR Infra on their business portfolio
c.) Presentations by M/s IPPL on use of "SoilTech MK-III" 3rd Generation Polymer Stabilizer for Road Construction"
d.) Presentations by M/s Ultra Technologies on Opening a new Dimension for Ground Penetration Radar




Pro. Carlos M. Ferregut

Day 2: 31 July, 2010

Technical Session – III

a.) Uncertainity Modelling and Reliability in Remaining Life Estimation of Pavements : by **Pro. Carlos M. Ferregut**, UTEP, El Paso, USA
b.) Pavement Design for National Highway Projects: by **Prof. S. K. Rao**, GMR Group
c.) Unmodified Binder Specifications for Better Pavements : by **Dr. Murali Krishnan,** IIT Madras
d.) Modified Binders – Their Suitability in Roadway Infrastructure: by **Dr. Vivek Tondon,** UTEP, El Paso, USA
e.) Characterization of Polymer Modified Binders: by **Prof M. Panda**, NIT, Rourkela
f.) Refinery Processing of Bitumen :by **Dr. P. Senthivel**, BPCL
g.) Research Needs of Indian Road Industry: by Sri Subbhiya R, L & T

Technical Session – IV

a.) Sustainable Pavements – the Time to Start is NOW : by **Dr. Rajib B. Mallick,** WPI, Worcester, USA
b.) In Quest of an Optimal Bituminous Pavement Design : by **Dr. Animesh Das**, IIT, Kanpur
c.) Pavement Design for Upgradation of International Apron at CSIA, Mumbai : by **Col. Tipnis**, ECC Division, L & T
d.) Top-Down cracking in Bituminous Pavements : **Prof. K. S. Reddy &** R. Sridhar, IIT, Kharagpur
e.) Rutting Characteristics of Bituminous Mixes : by **Dr. M A Reddy**, IIT, Kharagpur

Lessons Learnt:

1. Use of polymer modified asphalt binder enhanced the pavement service life (resistance to rutting) twice when compared to unmodified asphalt binder.

2. Long lasting pavements require adequate design, appropriate materials, proper construction techniques and timely maintenance and rehabilitation. To achieve this we have to have cradle-to-grave database containing design records, as built information and performance with time of all our road infrastructures.

3. There is an acute shortage of skilled staff at all levels including skilled labour, equipment operators, supervisors, junior, middle level and senior engineers with the contractors, consultants and government agencies. Human resource capacity augmentation in terms of the numbers and quality is the need of the hour.

4. M/oSRTH and NHAI has initiated Network Level Pavement Management System on NHs with the help of CRRI.

5. Accelerated Pavement Testing Facility now available with CRRI can significantly predict pavement deterioration models and assist in designing for Road Development in India.

6. Adoption of M-E design, Implementation of statistical-end result process control during construction phase, structural and functional performance monitoring system, engagement of

public policy makers for preservations of roads during and after construction phase will solve the accelerated damage to flexible pavements.

7. In India, the 10% overloading above the legal axle load limit causes 35% reduction of intended design life of flexible pavement like US Roads.

8. Selection of bitumen, aggregates ,bitumen content, grading of aggregates, air content, VMA, VFB, method of compaction, mix design method and performance based pavement condition monitoring determine the sustainability of highway pavements.

9. Low modulus bituminous mixes are susceptible to top-down cracking. Marshall Mix design method does not address the performance issues–rutting, fatigue etc. PMB -40 binder has high rut resistance. Fatigue lives of the dense bituminous mixes are found to be higher with small increment in binder content above optimum binder content. Rutting resistance of asphalt concrete mixes with un-modified asphalt binder is higher significantly as compared to the modified binder. Reduction of air voids below 3% results in higher rutting compared to higher air voids 7% irrespective of the type of binder used in the mixes. Higher bitumen content is needed in case modified binders when compared to unmodified binders.

10. The modifiers can be elastomers or plastomers and can be a new material or recycled one. Each modifier can alter characteristics based on rheology and aging or improve performance using different mechanisms.In Indian highway practice, the overlay requirements are generally based on BBD test results. BBD test result doesn't yield meaningful design if the existing pavement condition is poor, i.e. heavily cracked, raveled or rutted as worstly damaged roads are not fit for deflection measurement. BB deflections cannot portray camouflaged poor condition of the pavement and can give rise to misleading results.

11. Overlay requirements for existing pavement rehabilitation should be based upon DCP test results.Life estimation of new and existing pavement are commonly conducted with the help of NDT devices such as Falling Weight Deflectometer, Ground Penetration Radar, Seismic Pavement Analyzer, etc. Prediction of remaining life of the pavements can only be realistic if mechanical-empirical models using NDT results incorporating various uncertainties due to temperature conditions, loading, material properties, scaling effect in constructions.

12. Fatigue fracture life as per the IRC:37-2001(80% reliability)

    $Nf=2.21 \times 10\text{-}4x\ (1/\varepsilon t)^{3.89} \times (1/E)^{0.854}$

    (Annexure of IRC:37-2001)

    E values also are given in the Annexure.

    One has freedom to select binder

    Rutting(Plastic deformation of sub-garde) has not been a problem as per IRC:37 design. But rutting and bleeding are two common phenomenon besides Top-down cracking(TDC).

13. Predictions of Performances of existing flexible pavement can be done interms of reliability analysis of the structural system by use of Monte-Carlo simulation, Taylor Series expansion, and development of ANN model. The Monte-Carlo simulation based mechanistic-empirical pavement design /analysis method and models study can provide useful experience for the development of future flexible pavement design and analysis procedures.

14. There are two more methods besides the empirical methods and limiting shear and deflection methods of flexible pavement analysis , namely

Regression methods

- based on pavement performance or road tests (AASTHO , 1961)

Empirical – mechanistic methods

- This method of design is based on mechanics of materials that relates an input, such as a wheel load, to an out put or pavement response, such as stress or strain.

- Shell method, 1977

– Asphalt Institute method, 1981

15. Four types of bituminous mixture for pavements are now a days used.

1.	Hot mix	above 150^0C
2.	Warm mix	1200C -135^0C
3.	Half warm mix	< 100^0C
4.	Cold mix	ambient temperature.

All of them can be designed to be stable under traffic .Mix design principles are same for 1 and 2.Less CO2 emissions in 2,3 and 4.

Hot-mixed hot laid bitumen-aggregate mixture is the most popular surfacing in the world. Less energy consumption and subsequent reduction of emission of green house gases can be achieved if WMA, HWM and cold mix mixes are to be used to get a sustainable paving practice.

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05-08-2010

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