

**PROCEEDINGS OF NATIONAL GET TOGETHER ON
ROAD RESEARCH & ITS UTILISATION (NGT 2010)
Organised by CRRI, 5-6, March 2010**

Central Road Research Institute (CRRI), New Delhi organised the National Get Together on Road Research & Its Utilisation (NGT 2010) on March 5-6, 2010 at New Delhi. The National Get-Together had the following objectives:

- (a) To provide a forum for intensive interaction between road researchers and user agencies towards identification of R&D thrust areas required in the road and road transportation sector
- (b) To create an opportunity for in-depth discussion on various aspects of R&D findings available and on measures for their increased utilisation.

The National Get-together on Road Research and its utilisation was sponsored by 32 organisations from India and abroad and was attended by more than 425 delegates representing PWDs, NHAI, MORTH, RITES, DDA, DMRC and various R&D & academic institutions. In the inaugural session, welcoming the delegates and other Guests, Dr.S.Gangopadhyay, Director, CRRI brought out the objectives of National Get-Together and stated the need of an efficient infrastructure system in road sector. Dr.Gangopadhyay also mentioned that with the ongoing highly ambitious programme such as NHDP, PMGSY, it is the opportune time to position ourselves into R&D activities on road and transportation sectors appropriately and effectively.

The Get-Together was inaugurated by Prof. Samir K Brahmachari, DG, CSIR and Secretary, DSIR. In his address Prof.Brahmachari emphasised the need to dedicate more efforts on R&D activities towards developing better / improved technologies which are economically viable. Sustainable development, recycling of construction material minimising vehicular pollution, reducing urban congestion are some of challenges which need urgent attention.

Dr. M.P. Dhir, Former Director, CRRI was the Chief Guest on this occasion. Dr. Dhir referred the need of massive R&D efforts to create road infrastructure which lasts longer, making optimal use of natural resources and where possible conserve construction materials using recycling technologies. Sh. T.K. Amla, Organizing Secretary, NGT read the messages of good wishes received from many important dignitaries for the success of the National Get-Together. Sh.Sudhir Mathur, Head, Geotechnical Division proposed the vote of thanks.

During NGT-2010 a technical exhibition was also organised and in which about 22 organisations including CRRI took part and displayed their products. On this occasion, a souvenir containing messages of good wishes from dignitaries and paper of general interest was released by DG, CSIR. A total number of seven technical sessions were held during which various aspects related to road and road transportation sector were discussed. The Get-together concluded with a panel discussion. Brief details regarding presentations made in various sessions and recommendations emanating there from are given below:

Technical Session – I (Flexible Pavements)

Prof.B.B.Pandey, IIT, Kharagpur chaired the session. Prof.Satish Chandra, IIT, Roorkee co-chaired. The session included presentations from five eminent speakers, namely:

1. Decision support system for highway pavements – Dr.A.Veeraragavan, IIT, Madras
2. Recent trends in pavement design – Dr.K.S.Reddy, IIT, Kharagpur
3. Rheology of modified binders – Dr.Muralikrishnan, IIT, Madras
4. GIS Based National Highway information system – Dr.B.K.Durai, CRRI
5. Development of management system for maintenance planning and budgeting of high speed road corridors – Shri K.Sitaramanjaneyulu, CRRI

Flexible pavements being widely used and most sought after type of pavement in the country, the gathering had more expectations in the form of technical outcome of continued research. The presentations and deliberations met this very well and initiated active debates and lively discussions with a gamut of information. Dr.Veeraragavan compared the national highways of olden days with the present ones making special reference to distresses and impact of proper maintenance. Dr.Muralikrishnan gave a comprehensive overview of modified binders with reference to their rheological performance. Prof.K.S.Reddy highlighted the differences in empirical, semi-empirical and mechanistic design methods and stressed the need for paying due importance to the strength properties during the design process. Dr.B.K.Durai brought out the methodology and approach for developing a sustainable GIS based information system for our national highways as envisaged in a major on-going R&D project of CRRI. Shri K.Sitaramanjaneyulu explained how important it is to develop a 'Pavement Maintenance Management System' for the country's high speed corridors for properly planning and budgeting the available resources on the one hand and providing better quality of service to road users on the other.

At the end of the session, many significant and important points were discussed. The following recommendations emerged:

1. The existing maintenance policies of the road agencies need to be reviewed with focus on road management system and service to road users.
2. Timely preventive maintenance which costs much less than rehabilitation can do wonders for preserving costly road assets.
3. Assessing and promoting benefits through a well conceived maintenance programme is the requisite of the day.
4. The traditional methods of execution of projects involving modified binders need a relook.
5. Simplistic notions while selecting and using modified binders may defeat the very purpose of using them.
6. The selection and use of modified binders should be done carefully. Rheological performance of bituminous binders also needs consideration. Awareness raising through seminars and inclusion of topic in training programme for consultants and road agencies would be of help.
7. There is a need to consider material properties like ageing of binder and the non-linear behaviour of mix while designing pavements.
8. It is essential to base pavement design on the performance data.
9. Damage caused due to vehicular loading needs to be considered in pavement design. Advantage can be taken of the APTF facility acquired by the CRRI.
10. National guidelines to be formulated considering designing for long lasting pavements.
11. Good data base is a key ingredient to develop and use a 'Pavement Management System'.
12. GIS based information system can have more versatility for providing information for any road development and management system.

Technical Session – II (Rigid Pavements)

This session was chaired by Shri P.L.Bongirwar, former Secretary, PWD Maharashtra. Shri M.C.Venkatesha, Consultant co-chaired. Three eminent speakers, Dr.L.R.Kadiyali, former Chief Engineer (MORTH) & Consultant, Shri S.A.Reddi, former Joint Managing Director, Gammon India and Consultant and Shri V.K.Sinha, former DG (RD), MORTH made presentations in this session. Dr. Kadiyali made a presentation on R&D needs in case of rigid pavements. He underlined the need to take up R&D on temperature differential in rigid pavement, lateral placement of vehicles, tyre pressure scenario, effect of concrete shoulders, composite action due to DLC base, strength gain in concrete pavement with age, use of fly ash, etc. Shri Reddi made a presentation relating to need for value engineering in case of rigid pavements. He underlined important issues like permitting use of natural gravel, limiting the cementitious material content, etc. Shri V.K.Sinha made a presentation on 'New Dimensions in Design and Construction of Rigid Pavements'. In his presentation, he stressed issues like reducing the cost of construction, enhancing life and flexural strength of rigid pavements and steps to be taken up, R&D efforts needed in this regard. After detailed deliberations and interventions from the floor, the following recommendations emerged:

1. Design traffic volume considered in India in case of rigid pavements as per IRC is 25 per cent of total traffic volume which is quite high as compared to AASHTO and PCA, where it is 6 per cent. A rational input should form the basis for design traffic volume.
2. Field study to validate temperature differential, at different depths of concrete slab should be carried out at different regions across the country.
3. Field study should be done to consider actual tyre pressure to be used in design of rigid pavement.
4. The maximum amount of cement permissible in cement concrete mixes in India is 425 kg/m³ while in most parts of the world it is 350 kg/m³. This aspect needs further R&D.
5. The strength of concrete i.e. compressive strength of 28 days and 90 days to be considered for evaluation of strength of the mix.
6. The use of higher size coarse aggregate upto 31.5mm should be encouraged instead of limiting the size up to 20 mm in paving concrete.
7. Study of concrete mix using sand manufactured from the crushers is needed as there is shortage of natural sand.
8. Use of local materials for construction of concrete road i.e. fly ash, local aggregates etc. should be emphasised.
9. Modern concrete technologies like self compacting concrete should form part of R&D.
10. Preventive maintenance of the concrete pavement is the need of the day.
11. R&D should be carried out to find out the correlation between core strength and equivalent cube strength under actual field conditions.

Technical Session – III (Accelerated Pavement Test Facility)

The Accelerated Pavement Test Facility (APTF) session deliberations were divided into two parts, a 'Presentation and Discussion Session' followed by 'APTF Inauguration and Demonstration'. Both the sessions were well attended by the delegates and the approach was well conceived as was visible by the active and lively participation of all concerned. Prof. D.V.Singh, former Director, CRRI chaired the session and also inaugurated the APTF facility of the institute, while Shri G.Sharan, former DG (RD), MORTH co-

chaired the session. The session had three presentations namely by Dr.Sunil Bose of CRRI, Mr. Louw Du Plessis of CSIR(SA) and Shri Salil Gokhale of Dynatest Corporation, during which the presenters highlighted how valuable the APTF facility is for India. The views were echoed by the chairman and co-chairman as also by many experts present in the audience including Prof. Justo and Prof.Las Lo Gaspar (FEHRL). It was observed that as highway engineers, our mission must be to find optimal solutions to build, operate and maintain our road/highway network in the best possible condition while making the most judicious use of taxpayer money.

During the session, many significant and important points came up. The following recommendations emerged:

1. The investment in road infrastructure is investment in our future and hence we should make judicious investments in our road networks backed by R&D and optimally manage these assets.
2. The APTF facility has tremendous potential for R&D and field application in highway engineering and road infrastructure development and help save money for tax payers in the long run. For this purpose, as highway engineers, our mission must be to find best possible solutions to build, operate and maintain our road/highway network in the best possible condition.
3. The APTF is the ideal, simple and effective tool for better understanding of pavement behaviour within a much shorter time frame and also to predict the performance of any combination of pavement layers under real life trafficking and environmental conditions with high level of confidence. For the successful implementation of APTF program, there shall be protocol to run and share the data
4. Innovative ideas can be implemented and pavement design models can be calibrated with confidence without costly errors, eliminating the use of hit and trial methods.
5. APTF research is needed to significantly improve road conditions in India. South Africa is one of the ideal partners to share knowledge in this respect.
6. Implementation of APTF results is as important as the research itself. This would be possible when stakeholders themselves realise the full potential.
7. We need to identify stakeholders and get their support for tangible benefits from APTF. MORTH, NHAI, NRRDA, PWDs and Rural Roads Agencies in the states are such prospective stakeholders. CRRI should take on the responsibilities to serve as the nodal agency for APTF research programmes.
8. Collaboration and mutual understanding is critical between various agencies and stake holders.
9. APT is tried and tested methodology in developed countries, hence, it would lead to new era of road research and field application in India.
10. APTF should be effectively used to study; pavement design verification and optimisation, pavement materials, effect of construction variability on pavement life, effect of heavy trucks on pavement structure, new materials(polymer modified bitumen mixtures, foamed bitumen, full depth recycling, high strength concrete pavement, composite pavement -UTW), effect of moisture damage, evaluation of pavement markings, paint markings, instrumentation and sensors, high capacity paving blocks, long-term performance of locally available marginal materials, etc.

Technical Session – IV (Traffic Engineering, Transportation Planning and Environment)

Dr.T.S.Reddy, former Scientist, CRRI chaired this session. Prof.P.K.Sarkar from SPA, New Delhi co-chaired. Prof.P.K.Sikdar, former Director, CRRI, Prof.S.L.Dhingra, IIT, Bombay and Prof.Arun Atri from Jawaharlal Nehru University made presentations in this session. Prof.Sikdar in his presentation talked about issues like urban traffic congestion, dynamic traffic management based on environmental control, importance of simulation in traffic studies, ITS application, sustainable transport, etc highlighting the need to improve traffic conditions in cities so as to make them liveable again. Prof.Dhingra in his address

discussed issues related to research trends in traffic engineering and transportation planning. Prof.Atri made presentation on the topic 'Road Surface Reflectivity (Albedo): Research for altering the urban radiation balance'. All the three presentations were well received and there were lively floor interventions. After detailed deliberations, following recommendations emerged:

1. Urban Traffic congestion problem needs to be researched. The emphasis should be on segregating non-motorised transport and two wheelers from rest of the traffic, by providing adequate pedestrian facilities and bus priority measures. Traffic congestion data should be collected based on integration of GPS and GIS technologies.
2. Dynamic traffic management measures should be evolved on the basis of environment control through computerised and coordinated systems of traffic control, intelligent transport system and automatic traffic measurement techniques.
3. Planning for vulnerable road users, design and development of system for education and training of NMT operators and users.
4. Road safety: Accident data collection and investigation method is to be simplified. More road user behaviour studies are needed. Road Safety audits are to be done extensively. For enhancing skill of road safety auditors, training arrangements need to be made.
5. ITS applications in public transport, transport planning for different land uses, parking and for the urban poor.
6. Much of the applied research is required to adapt the known theories to the local conditions for appropriate calibration.
7. The impacts of transportation systems on human society and environment which include air and noise pollution, ecological impacts, social and economic impacts and travel impacts are to be researched.
8. Road surface 'albedo' has significant impact on local micro-climate by affecting the radiation scenario. In this direction extensive research is required under real conditions by including the reflectivity of many surface types, taking into account the contributions made to the road surface radiation by surrounding buildings and incorporating the road surface temperature increase on account of vehicular traffic.

Technical Session – V (Geotechnical Engineering)

This session discussed aspects pertaining to geotechnical engineering issues related to road construction. Prof.Swami Saran, IIT, Roorkee (Retd) chaired this session. Prof.Yudhbir, IIT, Kanpur (Retd) co-chaired. Shri Sudhir Mathur, Head, Geotechnical Engineering Division, CRRRI made a brief presentation highlighting, an interesting project on 'Soil Nailing' presently being undertaken by CRRRI at Delhi. In his presentation he explained about salient details of the project and highlighted the challenges faced while designing the system of nails to support non cohesive fine sand deposit confined between 135 year old masonry retaining walls, through which ROB is being constructed using box pushing technique.

After the introductory remarks by the Chairman, Prof.Yudhbir, made a brief presentation stressing the importance of geomorphology and geology aspects with respect to landslide studies. Dr.R.K.Bhandari, former Director, CBRI, Roorkee then made a presentation entitled 'Lost Identity of Geotechnical Engineering Science in the Dazzle of Modern Technology'. He explained lucidly that due to latest and continuous improvements in modern technologies coming up so widely in all areas of engineering, including Geotechnical Engineering, the very basic and important data/information on soil properties and existing ground conditions are being overlooked by the designers and engineers. He stressed that the geotechnical engineer should gather all minute and relevant information from the site, which may be further used and

correlated with other field data, collected using modern techniques or gadgets for an effective design and evolving remedial measures.

Prof.M.R.Madhav, IIT, Kanpur (Retd) spoke on 'Recent Advances in Geotechnical Engineering'. He emphasised on advances made in the field of ground improvement, use of geosynthetics for construction of considerably high RE walls, providing Green Solutions through Bioengineered Slopes and reduction of carbon foot print in geotechnical engineering. He said notable achievements made in ground improvement field include improved rollers; geotextile wrapped granular piles, electro-osmosis to accelerate consolidation, etc. He told about the benefits of bioengineering as a method for slope stabilisation and gave details about 24 m high and 40 m high RE walls being constructed in the country. He added that, reduction of carbon foot print in various works of geotechnical engineering has now assumed significance due to global warming and called for estimation of CO₂ emissions from different design alternatives before selection of a suitable alternative.

Prof. B.V.S.Viswanadham from IIT, Bombay, then made the presentation on 'Model Studies on the Performance of Reinforced Highway Slopes'. He explained how, by using the technique of centrifuge modelling, geotechnical engineering problems can be solved. He showed through case studies, efficacy of this technique to simulate field loading conditions and behaviour of RE walls.

The following recommendations emerged:

- (1) Adoption of modern and advanced technologies for geotechnical investigations related to road projects, without overlooking the basic important data
- (2) Judicious and proper use of remote sensing and satellite imagery data with proper understanding of their importance.
- (3) Wider application of biotechnical measures for strengthening the slopes for slope stabilisation as well as environmental protection.
- (4) Re-look into the way geotechnical engineering techniques are being adopted so as to reorient them to reduce carbon foot print for achieving sustainable development.
- (5) Encourage use of model studies in geotechnical engineering field.

Technical Session – VI (Sponsors Presentation Session)

This session was chaired by Shri N.K.Sinha, former DG (RD), MORTH and Sh.K.Sitaramanjaneyulu, Scientist, CRRI introduced the session by pointing out the important and critical role of the industry in the present context of building economical, durable and safe roads. Sh.N.K.Sinha, in his remarks mentioned that industry should actively participate in development of stabilisers for cost effective roads, sophisticated equipment for assessing maintenance needs, road furniture for road safety, etc. The following agencies made the presentations:

1. M/s Dynatest Corporation
2. M/s Vinergy International (P) Ltd
3. M/s 3M Industries
4. M/s DuPont (I) (P) Ltd
5. M/s Midwest Vaco
6. Prof. Las lo Gaspar (FEHRL)
7. M/s Ultra Technologies
8. M/s Tridox Solutions

In his closing remarks, chairman mentioned that all the presentations were very informative and interactive and thanked all the presenters for the same.

Technical Session – VII (Bridge Engineering)

The session was chaired by Sri. A.D.Narain (President, ICT, New Delhi and former DG(RD), MORTH and co-chaired by Shri.M.V.B.Rao, former Scientist, CRRI, New Delhi. Three invited talks were delivered by Prof. D.N. Trikha (former Director, SERC (Ghaziabad), Mr. Mahesh Tandon (Managing Director, M/S Tandon Consultants and Dr. K. Ramanjaneyalu, Deputy Director, SERC, Chennai. In the beginning of this Technical Session, Dr.Lakshmy Parameswaran briefly summarised about the mandate of the Bridges and Structures division of CRRI and highlighted some of the recent achievements. The following recommendations emerged:

1. Development of deterioration models for life cycle cost analysis of bridges relevant to different regions of India and its application in the GIS based Bridge Management System
2. Scour depth determination on real time basis and identification of scour critical bridges
3. Self compacting concrete application using different types of cements manufactured in India
4. Remote health monitoring by instrumentation for important bridges.
5. Development of artificial aggregates and evaluate its application in bridge construction
6. Performance evaluation of high performance concrete and high performance steel for bridge construction
7. Development of cost effective retrofitting options using fibre reinforced plastics (FRP)
8. Development of safety systems to prevent accidents/mishaps during bridge construction
9. Design approaches of integral bridges which eliminate/minimise bearings and expansion joints and which enhance performance against blasts and earthquakes.
10. Computer controlled construction in bridge engineering
11. Manufacturing based R&D is necessary for the development of cost effective Mobile Bridge Inspection Unit, Technology for indigenous production of bridge expansion joints and development of robots for bridge maintenance.
12. A National Mission is to be initiated for seismic protection of bridges
13. Health assessment of masonry arch bridges
14. Development of high performance lightweight concrete decks for replacement/ rehabilitation of bridges
15. Development of accelerated rapid repair techniques for bridges
16. Development of performance based design specifications for design of bridges

As most of the research topics identified pertaining to bridge engineering are multidisciplinary in nature, contributions from engineers and scientists of different disciplines would be necessary and it was felt necessary to formulate the projects involving various CSIR laboratories, academic institutions and industry to find solutions.

Concluding Session – Panel Discussion

Dr.M.P.Dhir, former Director, CRRI chaired the concluding session. The panellists included Prof.C.E.G.Justo, Emeritus Professor, Bangalore University & presently Director, Karnataka State Road Development Corporation Ltd, Sh.S.S.Nahar, CGM, NHAI, Shri Nirmal Jit Singh, former DG (RD), MORTH,

Shri D.P.Gupta, former DG(RD), MORTH, Prof. Las lo Gaspar, FEHRL, Dr.Sunil Bose, Sc G, CRRRI and Dr.S.Gangopadhyay, Director, CRRRI.

The following issues/ challenges faced by Transportation and Highway Professionals in the present context were highlighted:

1. Road sector facing acute capacity constraints
2. Rapid growth in personalized traffic especially cars and two wheelers
3. Growing congestion in the road network of 1st and 2nd order metropolitan cities
4. Migration of labour force towards urban settlements resulting in slums
5. Lack of guidelines for transport planning for small and medium size towns
6. Need for highway capacity manual for Indian conditions of mix traffic
7. Ribbon development especially along national highways
8. Traffic calming techniques need on roads passing through settlements
9. More than half of the oil products consumed in India is by the road transport sector alone

The following recommendations emerged:

1. R&D efforts need pro-active role from all stake-holders
2. Need for dedicated efforts by R&D institutions/researchers
3. Requirement to complete R&D projects in time so that results could be utilised in the field in a meaningful manner.
4. To evolve performance based and alternate specifications for different regions in country based on detailed study of performance characteristics of locally available materials.
5. Studies on performance of polymer/crumb rubber modified bitumen
6. Use of multi-grade bitumen
7. Use of waste/marginal/ alternative materials in road construction
8. Design of pavements keeping in view the vehicle overloading based on mechanistic principles and accounting for material characteristics through the Accelerated Pavement Testing Facility (APTF) being set up in CRRRI.
9. To use modified local aggregates extensively in place of traditional base course aggregates
10. Cemented materials – better suited to the sub-base layer where the additional strength and stiffness can provide a superior “anvil” for the compaction of the overlying layer(s)
11. Planning for vulnerable road users, design and development of system for education and training of NMT operators and users.
12. Road safety: Accident data collection and investigation method need to be simplified. More road user behaviour studies are needed. Road Safety audits are to be done extensively.
13. ITS applications for public transport, transport planning for different land uses and parking and for the urban poor.
14. The impact of transportation systems on human society and environment which include air and noise pollution, ecological impacts, social and economic impacts and travel impacts, are to be researched.
15. The NGT on road research should be a regular feature and CRRRI being an Apex Centre for road research in India should continue to lead this effort.



DG (CSIR) Arriving at CRRRI



DG (CSIR) Inaugurating Technical Display Stalls



DG (CSIR) Visiting the Technical Exhibition



DG (CSIR) Releasing the Proceedings



Dr.M.P.Dhir,Chief Guest at the Inaugural Function Addressing the audience



Technical Session – I Flexible Pavements



Technical Session – II Rigid Pavements



Technical Session – III APTF



Technical Session – IV Traffic Engg, Transportation Planning & Environment



Technical Session – V Geotechnical Engineering



Technical Session – VI Bridge Engineering



A view of the audience



Concluding Session-Panel Discussion