



## MAJOR PROJECTS | STUDIES UNDERTAKEN | COMPLETED

### 12th Five Year Plan Network Project “Development and Application of Technologies for Sustainable Transportation (SUSTRANS)”

Sustainable development is a holistic approach/practice that includes efforts to mitigate negative effects on every component of the road infrastructure and transportation system which are generally ignored in a conventional/traditional transportation system planning. Sustainable transportation system must therefore consider the integral approach covering interconnected issues such as social, economical and environment etc. The objectives of the present research include, design of a systematic and coordinated sustainable mass transportation system and non-motorised system by applying appropriate ITS technologies along with the development of indigenous driving simulator to evaluate the road users in terms of road safety. The present research has been conceived under the following two main modules (i) Transportation Module (8 work packages), and (ii) Road Module (7 work packages).

The salient highlights of the research work carried out recently under transportation module of this project are discussed herein. To study the quality enhancement of public transport system, the reliability aspect of quality parameters concerning Metro and Bus users was assessed based on the waiting time of respondents as shown in Figure 1.

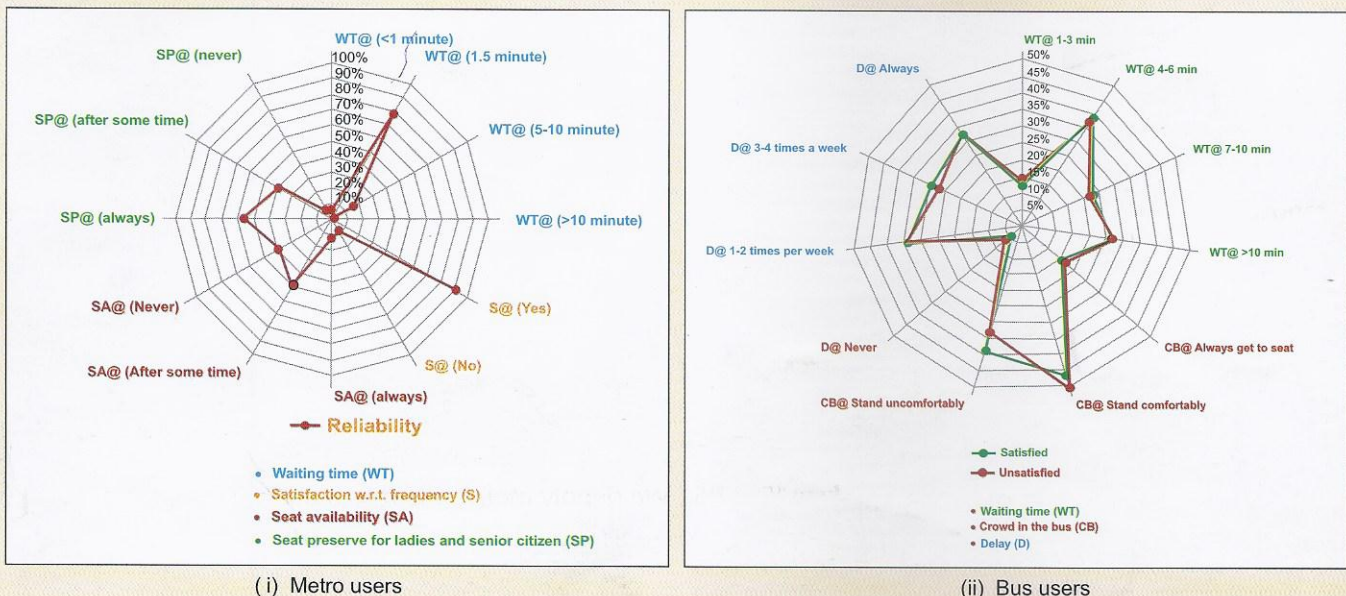


Figure 1: Characteristics of Metro and Bus Respondents (Reliability)

The last mile connectivity in terms of feeder mode characteristics are studied and given in Figure 2. The acceptance or satisfaction level of intelligent transport system (ITS) for public transportation is also studied by considering Mysore city and the results are presented in Figure 3.

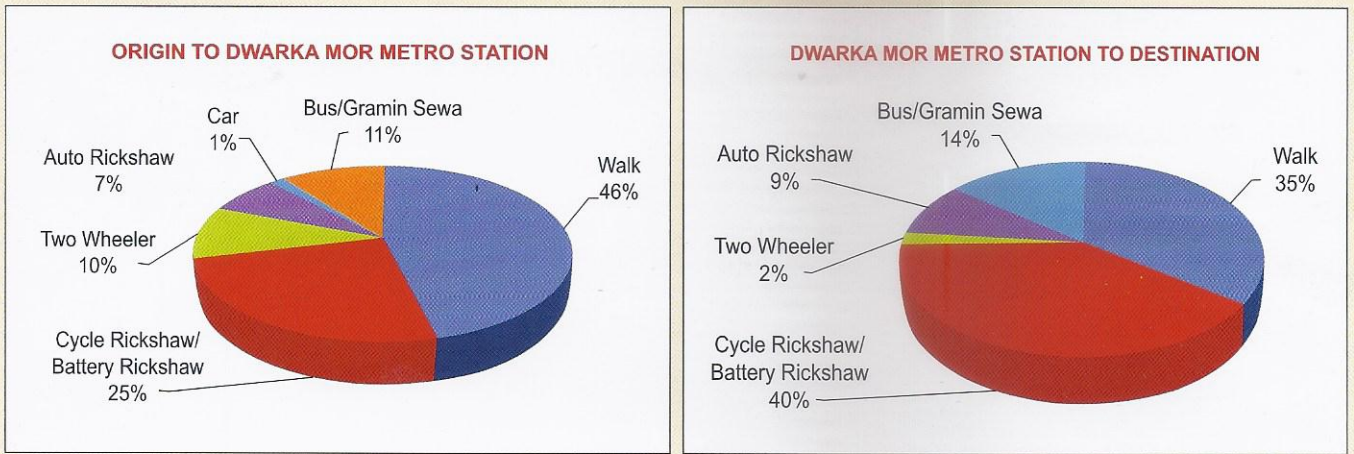


Figure 2: Last Mile Mode (Feeder Mode) opted by Users



Figure 3: Average Satisfaction Level of Respondents with respect to Advance Public Transportation Information System

For assessing the driving related abilities of drivers with psychomotor problems or impairments, Advanced Car Driving Simulator is currently under development under different stages as given in Figure 4. To achieve the overall objective of integration of public transportation system, the transport model is developed using four stage modelling technique utilising VISOM software for the city of Delhi. Accordingly models are developed and assignment of traffic has been done for the base year 2013 as shown in Figure 5.

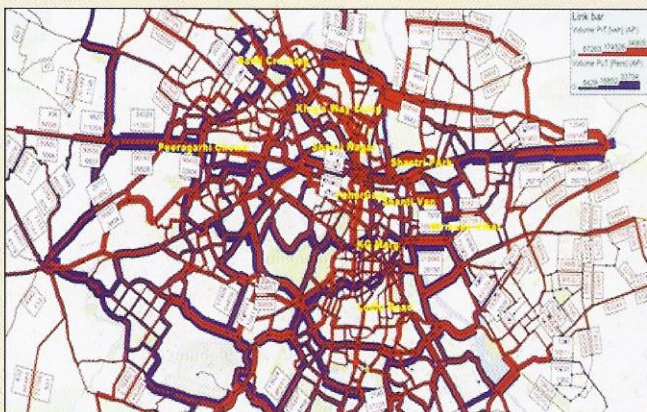


Figure 5: User Equilibrium Traffic Assignment for Base Year (2013)

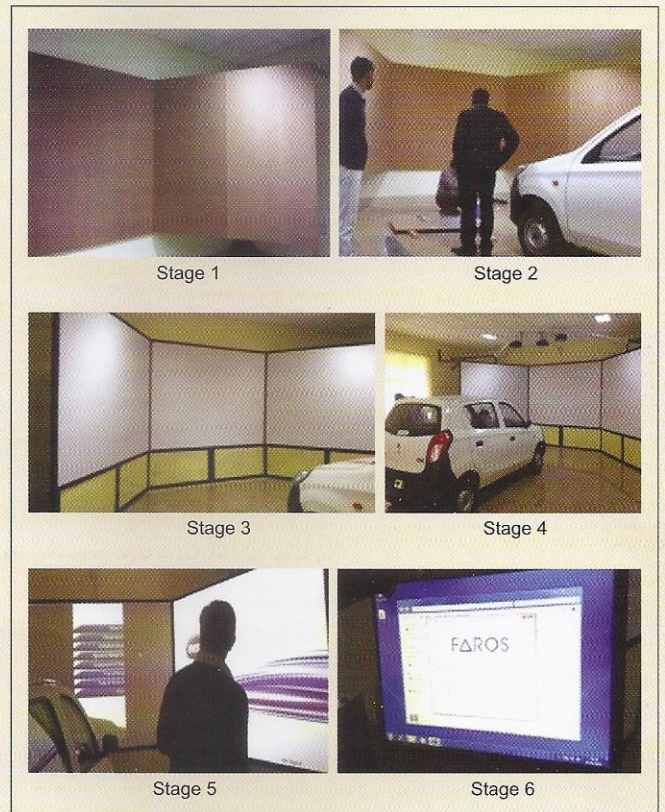


Figure 4: Stages of Development of Advanced Car Driving Simulator

## Managing Traffic Congestion using GIS Technology

Over the years, Geographic Information System (GIS) has emerged as one of the most efficient technological tools in the field of transportation engineering. The capabilities of GIS have been extensively used in different countries to identify various roadside friction points that impact the speed of vehicle on urban arterials. In this regard, the speed of every vehicle is almost impossible to track on a roadway using the conventional methods; and hence there is a need to deploy modern technology such as Global Positioning System (GPS) for tracing the speed of vehicles. Consequently, the average speed is deduced based on the sample of vehicles traversing over the defined trap length spread over a period of time or area.

There are various influencing factors that affect the speed of vehicle on the road, such as width of road, surface condition of road, construction work on roads (e.g. work undertaken for Metro Rail construction), various land uses that attract motorized / pedestrian traffic bound for hospitals and institutional/commercial areas etc.. Mapping out these factors using GIS capabilities can help in the assessment and management of traffic congestion.

Under this study, an attempt has been made to assess the influence of roadside friction locations on varying width of carriageways in Delhi region. In this regard, quantification was done for each friction point and its influence on the traffic speed was evaluated.

Delhi has one of the highest road densities in India. Major roadways include the Ring Road and the Outer Ring Road, which had a traffic volume of 110,000 vehicles per day in 2001. Total road length of Delhi is now about 32,500 kms including 388 kms of National Highways. Owing to inadequate development of rail based modes in Delhi, the city is heavily dependent on road based modes of transportation (93 per cent of the total trips performed in the city are made by using road based transport system). As a result of this, the road length within the city has grown by 4.53 per cent per annum i.e., from a mere 8380 kms in 1981 to as high as 20,487 kms by 1990, which at present in (2013) stands at a total of 32,500 kms, the highest in the country. The city also has the highest road density of 1284 km/ 100 sq.km. of area. In the present study, five locations were selected in South Delhi area, the locations are shown in the Figure 6.

The five locations are listed below:

- Ashoka Road
- Lodhi Road
- Delhi Cantonment
- Munirka To Vasant Kunj Road
- IIT Delhi To Mehrauli Road

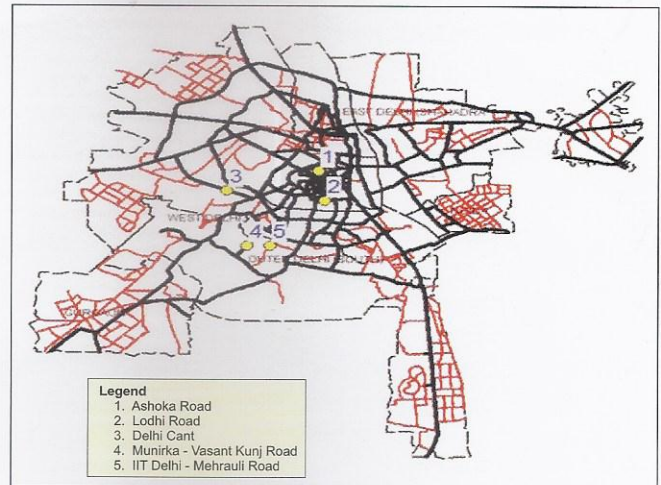


Figure 6: Map indicating the Road Segments considered under the study

Friction factors are defined as all those actions related to the activities taking place by the side of the road and sometimes within the travelled way (like bus stops, unauthorized parking), which interfere with the traffic flow on the travelled way. They include, but not limited to, the pedestrians, bicycles, non-motorized vehicles, parked and stopping vehicles, bus stops, petrol pumps on the side roads etc. These factors are normally very frequent in densely populated areas in the developing economies. In this study, initially friction point locations were identified on the selected road corridors and subsequently the influence of these factors on traffic performance measures was assessed. Google Earth was used to demarcate the identified road side friction points on the study corridors.

The following observations are made based on the results obtained:

- The average speed after considering all the runs, using the performance box data are as follows; Lodhi Road-18.09 km/hr, Ashoka Road-19.36 km/hr, IIT to Mehrauli Road-15.75 km/hr, Delhi Cantonment area-17.96 km/hr. The maximum speed recorded for Munirka segment (friction point free segment) is 22.38 km/hr. All the roads mentioned are arterials roads on which speeds are expected to be more or less same, but due to the friction points prevailing on these corridors, it is influencing the speed reduction. The speed reduction observed on Lodhi Road is 52.13%, Ashoka Road is 59.71%, on IIT to Mehrauli Road is 77.19% and on Delhi Cantonment area is 36% when compared with the Munirka to Vasant Kunj Road section which is devoid of roadside friction.
- All the friction points do not remain active for the entire day. The activation times are different for each point. The Jay walking resorted by pedestrians to cross the road is observed to be

more pronounced during the morning and evening peak hour traffic period whereas the bus stop friction is almost active for the entire day.

- The influence of friction points on traffic speed shows that the influence of bus stops is upto 93.96% (on the IIT Delhi segment of the Mehrauli Road).

- The impact of the pedestrian crossing roads and parking of vehicles on the roads would have a negative influence on speed varying from 19% to 64% whereas the bus stops located without the proper provision of bus bays would reduce the speed of vehicle to the tune of 24% to 43%.

## JAROSITE - A Waste Material in Pavement Construction

Jarosite, a waste of Zinc metallurgical industries, contains silica sand, clay and combustible additives like sea coal and water. The leaching test results have shown that Jarosite is non-leachable and non-hazardous waste.

A laboratory study was conducted to investigate the performance of fresh and hardened concrete containing discarded Jarosite as a replacement of fine aggregate. Concrete performance was evaluated with respect to compressive strength, flexural strength and abrasion resistance. On the basis of results generated during the study, following conclusions are drawn.

- Jarosite is a very fine material. Its higher fineness



Figure 7. Fine Powder of Jarosite

influences most of the properties of green and hardened concrete.

- It reduces the workability of concrete mix. In other words, water demand of mix increases when finer Jarosite is used in partial replacement of natural sand. Due to increase in the water demand, higher water content is required for achieving the desired workability.
- It increases the water-cement ratio of mix which in turn influences both compressive and flexural strength of concrete. Compressive strength increases upto 20% replacement and drops down with 30% replacement.
- Flexural strength also increases upto 20% replacement and drops down with 30% replacement.
- Abrasion resistance increases at 20% replacement and decreases after 20% replacement.
- Compressive strength of dry lean concrete increases with 10% replacement and decreases with 20% replacement.
- Jarosite can be used in cement concrete only in small amount, say 20 to 25 percent of fine aggregate after some modifications in the mix so that workability and strength of mix are not compromised.

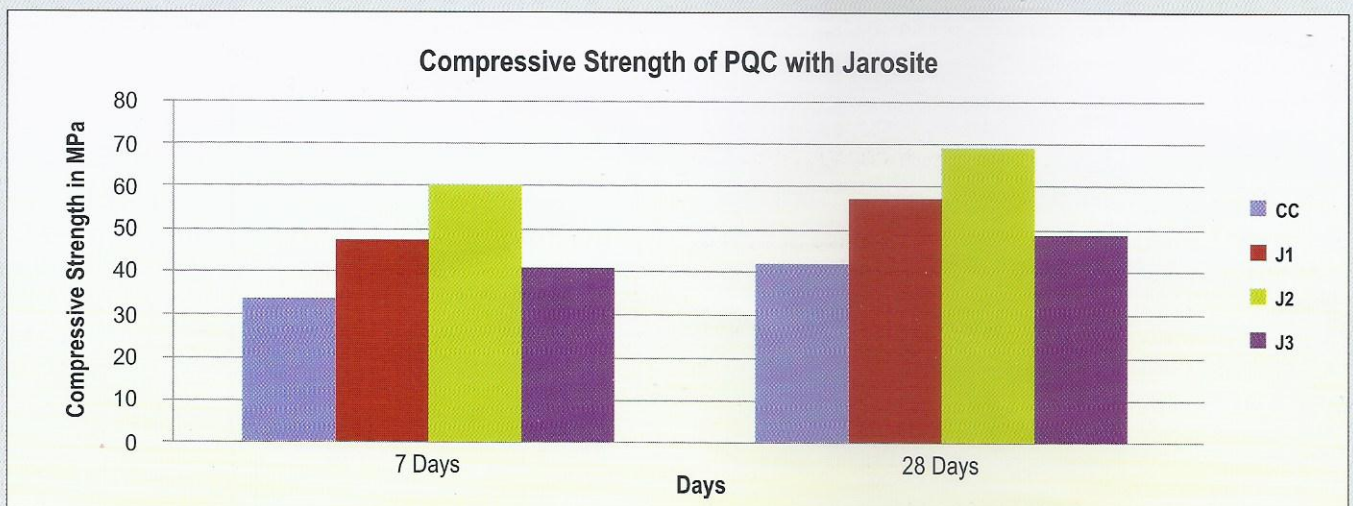


Figure 8. Variation of Compressive Strength with Jarosite Content

## Noise Mapping Study of Thiruvananthapuram Corporation

The noise levels in the core area of Thiruvananthapuram have increased manifold in the past decade especially during festival season.

Kerala State Pollution Control Board is embarking on an exercise to map noise level across the entire corporation area for which Pollution Control Board sponsored a study to Central Road Research Institute, New Delhi. Till now, such analyses have usually been limited to certain sectors or a particular stretch of road. This is perhaps for the first time that noise mapping would be done on such a large scale in a city in the country.

The Noise Mapping Study includes monitoring of various noise parameters, traffic parameters and noise prediction for twenty years. The traffic and noise

monitoring has been carried out for 19 sections of different corridors in Thiruvananthapuram city. Figure 9 shows the noise and traffic monitoring station in Thiruvananthapuram city.



Figure 9 : Noise and Traffic Monitoring Station in Thiruvananthapuram City

### WORKSHOPS / MAJOR EVENTS

## Round Table Meeting on Engineering Interventions in Landslide Risk Reduction

The Forum of Indian National Academy of Engineering (INAE) on Engineering Interventions for Disaster Mitigation joined hands with CSIR-Central Road Research Institute and with many other individual experts and institutions to organize a roundtable meeting on 11th May 2015 on engineering interventions in landslide risk reduction.

It was jointly organized by the Indian National Academy of Engineering (INAE), the premier body of India's most distinguished engineers, engineering-scientists and technologists, and the CSIR- Central Road Research Institute (CRRI), India's national laboratory – the first institution in the country to start, promote and sustain landslide research since the early 1960s.

From INAE side, Dr. R.K.Bhandari, the Chairman of the INAE Forum for Engineering Interventions in Disaster Mitigation was the main architect of the Round Table Meeting. Also joined by many learned officials from INAE while from CSIR-CRRI, Dr. Gangopadhyay, Director of CSIR-CRRI and Dr. Kishor Kumar, Chief Scientist, CSIR-CRRI and his team coordinated the meeting.

The main objective of the meet was to arrive at a set of actionable recommendations by addressing the present and the future challenges of landslide risk reduction at the highest level of expertise available in the country. The roundtable was designed to be an event with a difference because of the uniqueness of its architect and conduct. Unlike other seminars, workshops and conferences, it had done away with the formal lectures and presentations and focussed entirely on the critical questions which are eluding



practical answers, far too long. The Background to the roundtable meeting with the initial set of seven questions was circulated more than one month in advance of the meeting. This was followed with group discussions, individual consultations, interactions with the industry and e-participation thrown open to all via the INAE home page. The feedback was continuously analyzed for updating the Backgrounder, the draft recommendations and their basis, the last version of which will be submitted to Government of India.

With considerable clarity that has emerged during the pre-roundtable discussion meetings and consultations, it was possible to keep the interactive discussion focused on the draft recommendations, the reasoning behind the recommendations, implementation strategy, and above all, whether the issues flagged are important enough to deserve a national focus. The recommendations on mitigation of landslide disasters in India were presented in a document which are the distilled product of an extensive nation-wide interactive process.

## World Environment Day

The Institute celebrated the World Environment Day on June 5, 2015. Dr. S. Gangopadhyay, Director, CSIR-CRRI planted a tree in CRRI Lawn.



## Anti-Terrorism Day

Anti-Terrorism Day is observed in the country every year on 21st May to wean away the people (specially youth) from terrorism and cult of violence by enlightening the suffering of common people due to commission of such acts and showing how it is prejudicial to the national interest.

A pledge taking ceremony on important feature of the observance of the anti-terrorism day was held on May 21, 2015 which was attended by the staff members of CRRI.

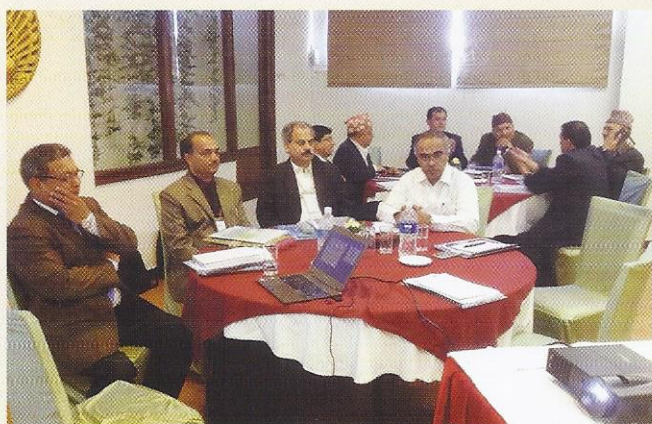
## MEETINGS

### Asian Community Accessibility Project Meeting at Kathmandu

Dr. S. Gangopadhyay, Director, CSIR-CRRI and Sh. T.K. Amla, Chief Scientist attended Regional Coordination meeting for Asian Community Accessibility Project (ASCAP) related activities at Kathmandu, Nepal from April 6-7, 2015. In this regard, a Regional Coordination Committee has been constituted with the following

members to undertake various activities and projects under ASCAP in India:

- Dr. S. Gangopadhyay, Director, CSIR-CRRI, New Delhi
- Dr. Rajesh Bhushan, IAS, JS (RD), MoRD & DG, NRRDA
- Dr. I.K. Pateriya, Technical Director, NRRDA
- Dr. Ashoke Sarkar, Senior Professor & Director, BITS, Pilani Campus, BITS Pilani
- Mr. D.P. Gupta, DG-RD (Retd) MoRT&H
- Mr. T.K. Amla, Chief Scientist & Head, ILT Division CSIR-CRRI
- Dr. B. Kanaga Durai, Chief Scientist & Head, PME Division, CSIR-CRRI
- Mr. U.K. Guru Vittal, Chief Scientist, CSIR-CRRI



## MOUs / AGREEMENTS

CSIR-CRRI entered into Agreements with the following agencies/organizations:

- With Bihar Rural Road Development Agency, Patna, Bihar on Cold Mix Technology for Construction and Maintenance of Roads.
- With Supreme Bitches India Pvt. Ltd. on PATCHFII – an invention of machine for quick, safe and economical repair of potholes.
- With Gemini Power Hydraulics Pvt. Ltd. on SETUCARE – the Mobile Inspection Unit (an electro-mechanical device mounted on truck to



assess the hidden parts of bridges or similar infrastructure for proper inspection).

## EXHIBITIONS

### IRF and Road Australia Regional Conference on Innovation for the future, Sydney, Australia

CSIR-CRRI participated in IRF and Road Australia Joint Regional Conference and Trade Fair from May 4-6, 2015 at Sydney by putting up an Exhibition Stall in the



India Pavilion. Sh. T.K. Amla, Chief Scientist, CRRI chaired a session on Road Safety during the conference. Besides, Dr. B. Kangadurai, Scientist CRRI, also attended the conference.

## VISITORS

A Technical Presentaion on "Studies on Frequency Domain for Characterization of Aggregate Shape and Road Surface" was made by Prof. Animesh Das, of IIT, Kanpur on May 19, 2015. The presentation was attended by CRRI S&T Staff, PGRP Students and Student Trainees from various colleges and universities. Prof. Animesh Das also interacted with students for taking up projects in their respective areas/specialisations.



## TRAINING PROGRAMMES / COURSES CONDUCTED

### A. Regular Training Programmes/Courses

CRRI organized regular training programme on Bridge Distress, Diagnostics, Performance Evaluation and Rehabilitation from June 15-19, 2015. The training programme was attended by Field Engineers, Academicians and Consultants from various organisations.



A view of Training Programme

### B. Customized/Special Training Programmes

CRRI organized customized training programme on Road Design for Flexible and Rigid Pavements for the Engineers of National Rural Access Program (NRAP). Afghanistan sponsored by Ministry of Rural Rehabilitation & Development (MRRD) Kabul, Afghanistan, May 11-16, 2015.



Customized Training Programme

### Awards/Honours

- The paper entitled "Effect of Type of Lead Vehicle on Headway Behaviour in Mixed Traffic" authored by Ravindra Kumar, Purnima Parida, Waffa Saleh, has been adjudged a highly commended paper for the year 2014. The paper was presented in London School of Economics, London, UK in 2013 and subsequently selected for publication in World Journal of Science, Technology and Sustainable Development. The research work covered Northeastern Region of India, (Shillong and Silchar as the case study) under an in-house study. Different types of lead category and their influence on headway were analyzed.
- Dr. R. K. Panigrahi, Senior Scientist has been awarded Certificate of Excellence by India International Friendship Society for his meritorious services, outstanding performance and remarkable role. The award was given away by Dr. Bhisma Narain Singh. Former Governor of Tamil Nadu & Assam at a Seminar on "Economic Growth & National Integration" on Nov 24, 2014 held at New Delhi.
- Dr. Rakesh Kumar, Principal Scientist has been recognized as an external reviewer for the review of American Concrete Institute (ACI) report on the Use of Flyash in Concrete, i.e., ACI 232.2R submitted by ACI Committee 232, USA.

### Welcome on Joining CRR I

Ms. D. Vijaya Lakshmi as Controller of Administration  
w.e.f. June 19, 2015

### Retirements/ Transfers

Following staff members have retired from the service of the Institute during the period. CRR I Welfare Committee organized function to bid all of them a grand farewell:

Sh. Satnam Singh, Sr. Technician (2) – 30-04-2015



Sh. Baldev Talwar, Asst. (G) (Admn.) – 30-04-2015



Ms. Pushpa Jetly, PS (Admn.) – 31-05-2015



Ms. Madhu Bala, Assistant – 30-06-2015



## OBITUARY

With profound grief and sorrow, we inform the sad and sudden demise of our colleague Sh. Tek Chand, Mali who left us for his heavenly abode on June 15, 2015. We deeply mourn the death of Sh. Tek Chand and convey our heartfelt condolences to the bereaved family. We pray to the Almighty that his noble soul be blessed with the eternal peace.

### सम्पादक मंडल

संरक्षक : डा. एस. गंगोपाध्याय, निदेशक  
सम्पादक :

श्री टी. के. आमला, मुख्य वैज्ञानिक एवं प्रमुख, सूचना, सम्पर्क एवं प्रशिक्षण, श्री बी. एम. शर्मा, मुख्य वैज्ञानिक, सलाहकार  
श्रीमती अनिता अरोड़ा, पूर्व तकनीकी अधिकारी, श्री मुकेश कुमार मीणा, वैज्ञानिक  
फोटोग्राफी :  
श्री अशोक कुमार