Scientists of CRRI got engaged in two important areas of pavements during early 1960s. These were Quality control during construction and investigation of premature failure of pavements. A mobile laboratory equipped with necessary equipments and apparatus was made at the institute level for field testing of materials during construction. This mobile lab was used in several projects in Delhi and other neighboring states.

This was the period when research on use of alternate materials and new materials in road construction was given a great emphasis at the national level. To meet the challenges of testing of these unconventional materials in different layers of a pavement, a heavy duty test bed facility was created in CRRI for testing of semi-field pavement sections. This facility was capable of testing a pavement section (flexible or rigid) in different test positions of a test area measuring 15 m in length and 6 m in width. Initially, it was designed and fabricated for applying a static load of 40 Tonne on the pavement section. Later alternating machine for tests with repetitive loading was also added to study the behavior under repetitive loading.
pavements for rationalizing the design concepts. An all India study was conducted at a number of locations in the country on especially constructed concrete slabs of different thicknesses to capture the maximum temperature differentials. The study continued for a number of years and results of these study helped formulation of IRC design guidelines on concrete pavements published in 1974.

The institute started Refresher Courses for senior and junior highway engineers in 1962, with a view to disseminate the results of research and the latest knowledge among the highway professionals in the country. Separate courses were launched for senior and junior highway engineers as per their requirements. This activity of training the manpower has now become integral part of the institute’s mandate.

R&D HIGHLIGHTS

**Evaluation of Selected NDMC Roads and Needed Remedial Measures**

New Delhi Municipal Council (NDMC) awarded the work for detailed evaluation of 36 roads falling under its jurisdiction. The field work for suggesting maintenance and rehabilitation measures is in progress. Few photographs of field studies conducted on roads are shown below.

![Roughometer-III used for the Study](image1)

**Structural and Functional Evaluation on Jetpur - Gondal - Rajkot Road Section of NH-27**

The Institute has recently conducted structural and functional evaluation on Jetpur - Gondal - Rajkot Road section of NH-27, from Km. 117+600 to Km. 184+700 under the project sponsored by West Gujarat Expressway Limited. The evaluation data will be used for deciding the Maintenance and Rehabilitation strategies.

![Functional and Structural Evaluation of NH-27](image2)
Improvement/Widening of Udaipur-Sabroom Section of NH-44, Tripura under SARDP-NE Phase ‘A’ - Cementitious Sub-base and Base-course

Indian road assets have been growing at fast pace which require huge natural resources. Especially for North East Sector, roads are the nucleus of economic development and play important mode of travel in the hilly areas as other modes are either too expensive or difficult to construct. To keep the seamless balance, new construction methodology could be adopted for which the Indian Roads Congress (IRC) has already published the pavement design guidelines (IRC: 37-2012) which incorporates many options to optimize the new pavement design. Looking into it, this project for improvement / widening to two lane with paved shoulder of Udaipur - Sabroom section of NH- 44 in the state of Tripura is ongoing wherein M/s Oriental Structural Engineers Pvt. Ltd. (OSEPL) is the builder and National Highways and Infrastructure Development Corporation Limited (NHIDCL) is the client. Under this project cemented sub-base consisting of brick aggregates and use of foamed bitumen / bitumen emulsion treated RAP / aggregate as base layer over cemented sub-base is being constructed. CSIR-CRRI is looking as consultant for NHIDCL for the new construction method. The project is in progress.

Construction Stage Road Safety Audit of Sambalpur - Rourkela Section of SH-10: 4th Visit (Km 4/900 to Km 167/900)

Sponsored by Odisha Public Works Department (OWD), Government of Odisha,

Odisha Public Works Department (OWD), Government of Odisha, sponsored the study to CSIR-CRRI to conduct the Road Safety Audit (RSA) starting from the Design Stage RSA followed by periodical RSA during Construction Phase culminating with the Pre- Opening Stage RSA during the four laning of Sambalpur - Rourkela section of SH-10 from Km 4.900 to Km 167.900 in the state of Odisha. This study was rightly initiated by OWD aimed at reducing the road crashes on the Sambalpur - Rourkela Section of SH-10 as well as identification of shortcomings / inadequacies with a view to improve / enhance the safety of all types of road users so as to suggest appropriate safety measures during the ongoing construction phase leading to Commercial Opening Operations (COD) phase of the Project Corridor and beyond. Accordingly, CSIR-CRRI study team visited in the month of June 2017 and critically studied the Sambalpur - Rourkela Section of SH-10 through the conduct of exhaustive RSA during the ongoing construction stage and identified the existing deficiencies on the study stretch conforming to IRC: SP-88 (2010) titled, "Manual on Road Safety Audit".

This report covers the findings that emerged from the 4th Construction Stage RSA visit conducted on the project corridor during the ongoing construction phase. The study team critically reviewed the existing inadequacies in Work Zone Traffic Management Plans (WTMPs) and Other Safety measures like absence of Object Hazard Markers (OHM), Parapet wall Paintings at CDs / Minor Bridges and major Bridges, Frequent Median Openings, Crash Protection Measures - Requirement and Placement of Metal
Beam Crash Barrier (MCB), Safety Measures at Intersections, Median Gaps and Access roads, Drainage system and Drainage covers, Safety Measures at Toll Plazas, Road signs, Road markings, Road studs, Service roads, Plantations, Safety measures near industrial units like M/s. Bhushan Steel area, Edge drops at Construction Zone areas, Personal Protective Equipment (PPE), Emergency Telephone numbers, Safety Tips to School / residents / inhabitants along the project corridor. It is highly recommended that the suggested measures in this report shall be implemented as per the recommendations which are expected to help in mitigating the road crashes and thus enhance road safety during the ongoing construction and COD. It is highly recommended that the suggested measures in this report shall be implemented as per the recommendations which are expected to help in mitigating the road crashes and thus enhance road safety during the ongoing construction as well as during the Commercial Opening Date (COD) operative stage. It is recommended that chainage compliance report shall be sent to CSIR - CRRI team by M/s. L & T - SRTL well before the CSIR - CRRI team undertakes the COD audit as and when the request of OWD is made. Basically, this RSA study was carried with the basic motto ‘Prevention is better than Cure’ conforming to IRC: SP-88 (2010) titled, "Manual on Road Safety Audit". Considering the above, this RSA study was primarily focussed to decide the priorities for expenditure and the associated costs and benefits of a treatment and its impact on risk on the road users.

Hence the evolved recommendations in this report are intended to show application of principles of RSA and advice to implement best safety practices. These may be used with discretion and judgment and to be complemented by the experience of the concerned OWD site engineer and M/s. SRTL officials. Some of the typical safety concerns observed during the RSA are presented in Figures 1 to 6. For each of the above, action plan has been conceived and presented in the report.

Figure 1: At Km.38/600, U-turn provision recommended; Edge drop on LHS observed

Figure 2: At Km.38/900, No safety measures adopted on the median to cut the glare

Figure 3: At Km.39/100, View in front of M/s. Bhushan Steel Gate No.2, where roundabout is recommended considering the heavy truck traffic from this Gate No.2

Figure 4: At Km.83/600, at some locations, dilapidated signs and redundant signs were observed, The same shall be replaced as per IRC: 67 (2012) and removed to avoid confusion to the road users.

Figure 5: At Km.30/800, At Sharp Curves, Urban Areas, No overtaking signs are needed as per IRC: 67 (2012)

Figure 6: At Km.36/500, Directional destination sign placed as per IRC: 67 (2012), placed only few locations; Recommended to be replicated at all such locations
The research project on "Megacity Logistics: Metrics, Tools and Measures for Sustainability (MEGALOG)" funded by the World Bank Group which is to be carried out this institute in association with TNO, Netherlands and TU Delft, Netherlands. The objective of the project is twofold:

1) Capacity development for R&D in the area of sustainable logistics for cities, in two areas:
   - Metrics for measurement of city logistics sustainability in liveability and logistics efficiency
   - Tools for policy design

2) Development, transfer and application of decision support system specifications for public policies and strategies related to sustainable megacity logistics.

An important goal of the project is to create an impact in practice. An extensive pilot study is carried out for New Delhi with a transferable modelling approach. The city of Delhi i.e. National Capital Territory of Delhi (NCTD) has been selected as study area for this study.

The initiative will be deployed in three work packages

WP1 – Sustainable city logistics metrics
WP2 – Knowledge transfer between R&D institutes for capacity development,
WP3 – Decision Support Systems

The data collection task has been completed which include the following:

- Outer Cordon Freight Traffic Volume Count Survey @ 10 Locations for 24-hour duration
- Outer Cordon Freight Characteristics Questionnaire Survey @ 10 Locations (collected 8391 Samples)
- Focal Point Freight Traffic Volume Count Survey @ 20 Locations for 24-hour duration
- Focal Point Freight Characteristics Questionnaire Survey @ 20 Locations (collected 10091 Samples)
- Traffic Volume Counts @ 5 Location for 24-hour duration
- Journey Speed Survey for Major Arterial Roads for a length of 413 km
- Road Network and Zone Data of Delhi
  - Shape files of Zones and Road Network
  - Socio-Economic and Land-use Parameters of Zones

The data collection through interviews using predesigned questionnaire at Outer Cordons and Focal Points have been carried out and the glimpses of data collection is shown in the Figure 1. The collected data has been analysed and it was found that about 1.2 million vehicles entering and exiting Delhi in a day and the freight vehicles are about 100 thousand in that as shown in Figure 2. The traffic has increased with an annual growth of about 3% compared to 2009. The passing through freight traffic is about 21% which was 18% in 2009 as shown in Figure 2. The overall traffic composition is shown in Figure 2 and the freight vehicles consist of about 10% at outer cordons as shown in Figure 3.
The freight traffic composition observed at outer cordons and within the city has been compared and presented in Figure 4. From the Figure 4, it can be seen that the share of heavy duty vehicles namely HT and MT is less inside city (about 20%) compared to outer cordons (about 50%) and light duty vehicles are more within the city compared outer cordons. The Age distribution of freight vehicles within the city are given in the Figure 5 along with outer cordons. It was found that the mean age is almost same at outer cordons and within the city varying between 4.5-5.0 years and the share of 10 year old vehicles within the city is ranging from 1 to 6% and 5 to 9% at outer cordons.
New Project: Assessment of Odisha Road Network Using Modern Data Collection Techniques such as Automated Road Survey System and Falling Weight Deflectometer for Asset Management of Odisha P.W.D. Roads

The Works Department of Government of Odisha has developed Odisha Road Asset Management System (ORAMS) for the State Road Network of Odisha. The envisioned system is to facilitate in rationalizing the decision making process in the allocation of resources in road sector in order to make the best use of public funds in preserving the road network at an acceptable level of serviceability.

To fulfill the above objective Works Department, Odisha has awarded the work for collection of Road Inventory, Pavement Condition and Deflection Data using modern tools and technologies like Automated Road Survey System and Falling Weight Deflectometer in the State of Odisha. The field work will be started very soon.

Design and Evaluation of Pavement Quality Concrete mixes Using Ground Granulated Blast Furnace Slag as Partial Replacement of Cement

Ground Granulated Blast Furnace Slag (GGBFS) is a fine material obtained by grinding granulated Blast furnace slag into powder form (Photo 4). Glassy granulated slag is produced by rapid cooling or quenching in water of molten slag generated in the Blast furnace during metallurgical process of iron and steel. Granulated slag is then dried and ground into a fine powder called as GGBFS. The glass content of slag suitable for blending with Ordinary Portland Cement (OPC) generally varies between 90 and 100% and depend on the cooling method and the temperature at which
cooling is performed. Higher the glass content higher is the reactivity of slag.

A laboratory study was performed for the utilization of ground granulated blast furnace slag as partial replacement of ordinary Portland cement in pavement quality concrete mixes so that it can be used for the construction of concrete roads. The lime reactivity of GGBFS was determined as 15.3 MPa. A control mix was designed for M40 Grade concrete with 400 kg/m³ cement and 0.4 water-cement ratio. Mixes containing different amount of grounded slag were then proportioned replacing cement from 10 to 60 %. Samples were prepared and tested for compressive strength, flexural strength, drying shrinkage, and abrasion resistance. Analysis of test data led to the following conclusions:

- Workability of concrete mixes do not change with the use of any amount of GGBFS. Use of suitable plasticiser can take care of the workability of the mix without changing the water requirement.
- Both short term (7 & 28 days) and long term (90 days) compressive as well as flexural strength of concrete is increased when cement is partially replaced by GGBFS up to a level of 40%. When 50 % cement is replaced by GGBFS, the strength of the concrete remains almost same.
- Abrasion resistance of M40 Grade PQC containing different amount of GGBFS was observed to be adequate enough for its use in concrete pavement construction.
- Drying shrinkage of concrete reduces with the increase in GGBFS content. Thus, concrete containing GGBFS is comparatively more suitable than conventional concrete for road construction.

The study recommended that GGBFS can be used as partial replacement of OPC up to 50 % without compromising the requirement of short term and long term strength.
प्रचार-प्रसार के लिए कोई गई यात्राएं एवं अध्यापन के दौरान प्राप्त हुए अपने अभ्यासों का प्रमाण किया। मुख्य अभिव्यक्ति ने सरकारी कार्य में हिंदी के महत्व पर बल देते हुए हिंदी को एक दुर्घट भाषा से इस सुगम, सुपारी भाषा बनाने पर बल दिया तथा हिंदी को लोकप्रिय बनाने के लिए अन्य भारतीय भाषाओं में उपलब्ध विशाल शब्द संपदा का उपयोग बढ़ाने की आवश्यकता बताई।

हिंदी पखवाड़े के दौरान संस्थान के कार्यकर्ताओं के लिए विभिन्न हिंदी प्रतियोगिताओं यथा हिंदी स्लोगन प्रतियोगिता, निबंध लेखन, तकनीकी लेख प्रतियोगिता, शृंखला प्रतियोगिता, हिंदी प्रश्नोत्तरी तथा सामाजिक वाचन प्रतियोगिता का आयोजन किया गया। पखवाड़े के अंतर्गत संस्थान के अनुभवों और प्रश्नों के हिंदी कार्य का समकालीन को गई। हिंदी प्रतियोगिताओं में संस्थान के प्रशासनिक एवं तकनीकी वर्ग के विभिन्न श्रेणियों के कर्मचारियों ने बड़ी चुनौतियों भाग लिया। संस्थान के अनुसंधान एवं विकास कार्यों में हिंदी के प्रयोग में वृद्धि के उद्देश्य से ‘ईशन की खपत’ पर सड़क और यातायात की स्थिति का प्रभाव’ विषय पर हिंदी में एक तकनीकी प्रस्तुति कर लिया गया। पखवाड़े के दौरान इसी क्रम में विशिष्ट हिंदी व्यक्ति व्यक्ति को लाभ लिया गया। उन्होंने आवेदनों के जोड़ी में विभिन्न उपयोगी जानकारी दी, जिससे संस्थान के सभी कार्यकर्ता लाभार्जित हुए।

हिंदी पखवाड़े के दौरान संस्थान में हास्यकवि सम्मेलन भी आयोजित किया गया, जिसमें सूचिक जैसे एवं सुधी मनोहर शुक्ला को हास्य कवि के रूप में आमंत्रित किया गया। हास्य कवि सम्मेलन के मिल-परिवार हास्य प्रवाह आयोजित कर ने अपनी कई हास्य कविताएं नवनिर्मित, जिनका संस्थान के कार्यकर्ताओं ने धार्मिक अनुभव उठाया। इस दौरान संस्थान के कार्यकर्ताओं ने अपनी स्वर्णता कविताएं भी प्रस्तुत की।

हिंदी पखवाड़े का समापन एवं पुरस्कार वितरण समारोह दिनांक 29 सितंबर 2017 को आयोजित किया गया। संस्थान के कार्यकर्ताओं को संबोधित करते हुए निदेशक प्रो. सतीश चंद्र ने कहा कि आप जानता हैं वैज्ञानिक उपलब्धियों की जानकारी राजभाषा के माध्यम से पहुँचाया जाना नितांत आवश्यक है और इसके लिए यह जरूरी है कि संस्थान के वैज्ञानिक व तकनीकी लेखन को बढ़ाने के लिए विशेष रूप से प्रयास किए जाएं। इसके साथ-साथ प्रसारण के क्षेत्र में सभी अभिव्यक्तियों द्वारा हिंदी में कार्य को माजा बढ़ाने के लिए और अधिक गंभीर प्रयास करने की भी आवश्यकता है। उन्होंने आशा व्यक्त की कि पखवाड़े के दौरान आयोजित हिंदी प्रतियोगिताओं में कार्यकर्ताओं को उत्साहपूर्व प्रतिभागिता, हिंदी कार्य के वृद्धि के रूप में परिलक्षित होगी।

संस्थान के निदेशक प्रोत्साहन पुरस्कार योजना के अंतर्गत उन सभी अभिव्यक्तियों को पुरस्कार दिया गया जिन्होंने पिछले वर्ष के दौरान हिंदी में प्रशस्तीकृत कार्य किया था। पखवाड़े के दौरान आयोजित प्रतियोगिताओं में प्रमाण, द्वितीय, तीसरी, सातवें पुरस्कार प्रमाण-पत्र प्रदान करने वाले कर्मचारियों को भी प्रमाण-पत्र एवं प्रदान किया गया। मूल रूप से हिंदी में रिपोर्ट एवं प्राप्त लेखन करने वाले कार्यकर्ताओं को समानार्थित करते हुए उन्हें पुरस्कृत किया गया। इस अवसर पर हिंदी अभिव्यक्ति, श्री संजय जौहरी ने संस्थान में राजभाषा कार्य-न्याय के संबंध में स्थिति रिपोर्ट प्रस्तुत की और समापन समारोह का सफलतापूर्वक संचालन किया।
CSIR-CRRI Foundation Day Celebrations

CSIR-CRRI Foundation Day was celebrated on July 14, 2017. On this occasion, Prof. Seyed Mohammad Reza Khalili, research counselor,
Embassy of I.R. Iran to India, New Delhi was the Chief Guest. Prof. Seyed Mohammad Reza Khalili addressed the scientists through his Foundation
Day lecture and stressed for innovative research to fulfill the needs of the society. Various sports activities were conducted by CRRI recreation club on the occasion of foundation day. CRRI staff members participated enthusiastically.

A cultural program was organised by “Samanvay Club” on the occasion of CRRI foundation day. Staff members and their wards performed in this cultural program.

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**Independence Day**

On the occasion of 70th Independence day, Prof. Satish Chandra, Director, CSIR-CRRI hoisted the National Flag on August 15, 2017. The function was attended by the staff members and also their family members. Devotional and patriotic songs were recited on this occasion by the CRRI staff and wards of CRRI staff members.
CSIR Foundation Day was celebrated on September 27, 2017. On this occasion, Dr. Ram Boojh Yadav, Programme Specialist Environment & Natural Heritage, UNESCO, New Delhi was the Chief Guest. The function was attended by the Scientists, employees and ex-colleagues of CSIR-CRRI. Prof. Satish Chandra, Director, CSIR-CRRI addressed the gathering and highlighted the progress and journey made by CSIR-CRRI over the years. Various prizes were given away by Dr. Ram Boojh Yadav to the winners of various competitions organized by CSIR-CRRI for the children of CSIR-CRRI’s employees. CSIR-CRRI employees who had completed 25 years of service in CSIR and all those who had retired during September 2016 to August 2017 were also honoured and mementoes were presented to them by the Director.
Workshop and Exhibition on Concrete and Structures-2017 held at Pragati Maidan on 10th August 2017 wherein suppliers from the commercial concrete and construction industry in India had visited and showcased their products and technologies. The exhibition served as an excellent platform for industry suppliers to showcase innovative products, state-of-the-art technologies, latest tools and equipment used in the industry.

Mr. Holger Dietrich, Development Engineer, HILTI Entwicklungsgesellschaft, Munich (Germany), Ms. Kamalika Paul, Manager, Codes, HILTI, India, Pvt. Ltd. and Mr. Prabhat Sathe, HILTI, India, Pvt. Ltd., visited CSIR – CRRI, New Delhi on 01st Sep 2017.

Prof Satish Chandra, Director CSIR-CRII received excellence in academics award-2017 on Engineer’s day Sep. 15, 2017. The award is conferred by the Institution of Engineering (i), Roorkee Local Chapter.

Best Hindi Scientific Work Awards 2017 under Director Promotion Award Scheme to Dr. Ravindra Kumar and Dr. Mukti Advani.
Dr. Rajeev Goel received Outstanding Concrete Technologist of Western UP Award for the Year 2017.

The Cold Mix technology developed by CSIR-CRRI was chosen for the CSIR Technology Awards 2017 under the category “Physical and Engineering Sciences”. The award was given on September 26th, 2017 at Vigyan Bhavan, New Delhi by the Honourable President of India Shri Ram Nath Kovind ji.

Endowment Fund

Mrs. Roychoudhary donated an amount of Rs. 6.00 lacs to CSIR-CRRI in the memory of her husband, late Dr. P. Roy choudhary, Founder Head, BES Division to establish the Endowment Fund to start a Lecture Series on Annual Basis at CRRI.
LECTURE DELIVERED

- Professor Satish Chandra, Director, CSIR- CRRI delivered key note address on “Mainstreaming of new Technologies for Road Construction” in 3rd International Conference on Roadtech – Sustainable Roads and Highways, New Delhi on August 29, 2017.


- Dr. Mukti Advani delivered a lecture on NMT planning and design guidelines, for certificate course for Road Safety Engineers and Auditors at Indian Academy of Highway Engineers, Noida.

- Dr. Ravindra Kumar delivered a lecture on GIS application and Road Planning-Smart Transportation in Smart City, Hindustan College of Science & Technology at Madhav Institute of Technology, Gwalior.

NEW FACILITIES ADDED

- Crèche and Day care centre “Anchal” was inaugurated by Mrs. Sunita Chandra on 14th July 2017 at CSIR-CRRI. This crèche would facilitate the wards of CRRI staff to stay in CRRI crèche during working hours.
TRAINING PROGRAMS

Training Programme on “Construction and Maintenance of Village Roads under PMGSY” for the Engineers of RED, UP (July 03-06, 2017)


Training Programme on “Bridge Diagnostics, Performance, Evaluation and Rehabilitation” (July 10 - 14, 2017)

Training Programme on “Contract Management and Quality Control Aspects” for the Engineers of Rural Engineering Department, Uttar Pradesh (July 17-21, 2017)

Training Programme on “Road Safety Audit” for the PWD Engineers of Raipur at Raipur, Chhattisgarh (August 30-31, 2017)

Training Programme on “Geotechnical and Landslide Investigations for Highway Projects” (Sept. 04 - 08, 2017)

One day workshop on cold mix technology under Green Road Mission is organized by CRRI and BITCHEM at Jammu for J&k rural road development authority and PWD J&K (21 Sept. 2017).

Training Programme on “International Course on Dissemination of HDM-4” (Sep. 11-22, 2017)
Following staff members retired from service of the Institute during the period.

Shri T.K. Amla, Chief Scientist, on 31-07-2017

Shri Ram Lal, Lab. Asstt. On 31-07-2017

Shri Bijender Kumar, Lab. Asstt on 31-07-2017

Mrs. Prema Prasad, Sr. Technician (2) on 31-08-2017

Brij Mohan Singh Negi, Chowkidar on 31-08-2017

Shri Sushil Kumar, Technical Officer on 30-09-2017

Shri Ram Pal, Pr. Tech. Officer on 30-09-2017
CRRI IN NEWS

Road to Metro stations riddled with obstacles

NDTV Delhi: Delhi Metro stations are great assets for people trying to reach them.

A study carried out by CSIR-Central Road Research Institute clearly established this, boosting the view that accessibility to public transport is the key to sustainable urban living.

65% of Delhi’s urban population uses some form of public transport, with public buses being the most popular mode. However, the city’s road network is overused, leading to congestion, which affects the efficiency of public transport systems.

Moreover, the city’s lack of adequate pedestrian facilities and inadequate public transport infrastructure further contribute to the problem. The lack of proper pedestrian facilities and inadequate public transport infrastructure further contribute to the problem.

Traffic jams and congestion are common in Delhi, affecting the city’s economic and social development. The traffic congestion in the city is a major cause of air pollution, loss of productivity, and increased travel time.

The report suggests that the city needs to revamp its public transport system and improve pedestrian facilities to reduce congestion and improve the overall quality of life in the city.

Published by:
Prof. Satish Chandra, Director, CSIR-CRRI, New Delhi

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Dr. Neelam J Gupta, Principal Scientist & Head (ILT); Sh. R.C. Agarwal, Pr. Technical Officer (ILT); Sh. R. C. Pardesi, Technical Officer (Retd.)