The CSIR – Central Road Research Institute (CRRI) endeavors towards Continual Professional Excellence in the area of Roads and Road Transport including Bridges and Structures. The Institute is committed to accomplish Industrial as well as Societal Research and Development Programmes, Consultancy Services and HRD Programmes meeting diverse technical needs of the profession globally.

Prof. Satish Chandra
Director
CSIR-CRRI
The scientific & technical objectives of CSIR-CRRI are:

- To develop specifications and manuals for construction of low cost roads for different regions of the country.

- To carry out applied research for investigation, construction and maintenance of different type of roads and runways including studies on related materials such as aggregates, bitumen, cement, etc. with a view to improve economy and achieve greater serviceability.

- To develop appropriate indigenous tools, machines, equipments and instruments for adapting technologies as related to highway engineering and relevant to the country.

- To carry out research and development activities in all aspects of roads under varying climatic and traffic conditions.

- To carry out research and development in all aspects of road traffic and transportation engineering, including study of accidents, development of road safety measures, psychology of road users and transportation economics in relation to different forms of transport.

- To render technical advice and consultancy services to various organisations in roads and related fields to avoid import of foreign expertise.

- To train engineers through refresher courses, workshops and training programmes for wider application of indigenously developed technologies/tools.

- To create and establish all the needed infrastructure, both equipment and expertise, in the various facets of highway and transportation engineering for investigation, planning, design, construction and maintenance as well as to achieve judicious solutions for special problems.

- To collaborate with other institution for R&D studies concerning roads, road transportation and related practices particularly on regional problems.

- Publication of scientific and technical findings in journals, symposia, conferences, etc. devoted to research and development in related areas of highway engineering.

- Generation of intellectual property and its commercialization through technology transfer.
Organisational Chart

CSIR-CRRI
ORGANISATIONAL STRUCTURE

R&D Areas

R&D Support

Management Council

Prof.(Dr.) Satish Chandra Director

Research Council

Bridge Engineering & Structures (BES)
Sh. S. S. Gahanwar
Geotechnical Engineering (GTE)
Sh. U. K. Guru Vittal
Flexible Pavement (FP)
Sh. Manoj Kumar Shukla
Pavement Evaluation (PED)
Sh. Sunil Jain
Rigid Pavement (RP)
Sh. Binod Kumar
Traffic Engineering & Safety (TES)
Dr. Neelima Chakraborty
Transportation Planning (TP)
Dr. Errampalli Madhu
Environmental Science (ES)
Dr. Anuradha Shukla

HRD & Project Management
Dr. B.K. Durai, Advisor to DRRI (R&D & Business Development)
Sh. P.V. Pradeep Kumar, Head, Project Monitoring & Evaluation (PME)
Sh. T.K. Amla, Head, Information, Liaison & Training (ILT) up to July 2017
Dr. Neelam J Gupta, Head, Information, Liaison & Training (ILT) from August 2017

Estate Services
Sh. A. K. Jain, Head, Civil Section

R&D Support Service
Sh. R.S. Bharadwaj, Head, Technical Services Division (TSD) up to July 2017
Dr. Niral Sharma, Head, Technical Services Division (TSD) from August 2017
Dr. R. N. Dutta, Head, Computer Centre Networking (CCN)

Knowledge Resource Centre
Ms. Pawan Chhabra, Head, Documentation & Library Services (DLS) up to May 2017
Dr. Neera Aggarwal, Head, Documentation & Library Services (DLS) from June 2017

Quality Management
Sh. R.S. Bharadwaj, MR up to Feb. 2018
Sh. A. K. Jain, MR from March 2018

AcSIR-CRRI
Dr. Kanaga Durai, Advisor R&D, BD
Dr. Ch. Ravi Sekhar, In-Charge Academic

Maharani Bagh Staff Quarters (MBSQ) & Horticulture
Dr. Rajeev Goel, Coordinator, MBSQ & Horticulture
Sh. A. K. Tripathi, Head, MBSQ Maintenance
Sh. Ashok Kumar, Incharge Horticulture

Administration
Sh. O. Omman Panicker, Sr. Controller of Administration up to Nov 2017
Sh. Anjum Sharma, Controller of Administration from Dec 2017
Sh. Padam Singh, Sr. Controller of Finance & Account
Sh. Tarig Badar, Controller of Store & Purchase
Sh. Kaushal Kishore, Store & Purchase Officer
Sh. Awanish Kumar, Finance & Account Officer
Sh. Fasih Ahmed Siddiqui, Manager, Guest House
Sh. Braham Prakash, Manager, Canteen
Ms. Priti Sachdeva, Receptionist
Sh. Dharam Singh, Caretaker

Rajbhasha
Sh. Sanjay Choudhary, Rajbhasha Adhikari
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We can look back for another exciting year of 2017-18 for effective technology transfer and building a close linkage with user organizations. The Institute handled a large number of consultancy assignments and earned sizeable cash resource.

I am delighted to present here the Annual Report 2017-18 of CSIR-Central Road Research Institute, New Delhi which summarizes the major activities and achievements of the institute during the last fiscal year. The institute provided technical and consultancy services to various user organizations in India and abroad for capacity building of human resources in the area of highway engineering to undertake and execute roads and runways projects.

We made significant contributions to knowledge generation as evidenced from research papers and patents. This year our scientists filed nine patents. One patent on "New design for box insertion through highly unstable Cohesion less Soil by Stabilisation of Vertical cut slopes" was granted this year. The licensing agreements were signed with many Industries for transfer of technologies. For example, New process for preparation of harder grade bitumen (VG40 and VG50) for formation of asphalt surfacing for roads and airfields was licensed to four industries namely M/S A R Thermosets Pvt Ltd., Kanpur; M/S Juno Bitumix Pvt. Ltd., Noida; M/S Jalnidhi Bitumen Specialties Private Ltd., Kolkata and M/S Tikki Tar Industries Pvt Ltd., Vadodara. Similarly, "Car driving simulator with Driver Diagnostic and Training Method" developed under 12th Five Year Plan Project was patented with M/S Faros Simulation System Pvt. Ltd. The license for manufacturing the "PATCHFILL-The Pothole Repairing Machine" was given to M/S Pioneer Industries, Solan; M/S Pioneer Industries, Solan (H.P) and M/S Jalnidhi Bitumen Specialties Private Limited, Kolkata. Various agreements and MoUs were signed with government and private agencies during the year for executing the various projects of national importance.

Many of our Scientists received National and international recognitions, served as expert members on important committees and contributed in the preparation of Standards/Codes of Practices/Manuals/Guidelines/Specializations (IRC/BIS/MoRTH).

We proudly hosted number of events this year. The National Dissemination Workshops on Development and Application of Technologies for Sustainable Transportation (SUSTRANS); Indian Highway Capacity Manual (Indo-HCM); Establishing a Research Network on Vehicular Emission Reduction
(EARNOVER-2017) and Estimation of Fuel Consumption during Idling of Vehicles at Bhikaji Cama
Intersection and Savings after Employing Suitable Mitigation Measures.

Council of Scientific and Industrial Research (CSIR), has launched a student-scientist connect
programme 'JIGYASA' in collaboration with Kendriya Vidyalaya Sangathan (KVS). The objective of
JIGYASA is extending the classroom learning and focusing on a well planned research laboratory
based learning. This shall not only initiate scientific interaction between present scientific fraternities
and the upcoming generation but also imbibe curiosity and scientific vision in children. As a part of
the JIGYASA programme, the Institute has organized an interactive workshop/Outreach programme for
students of Kendriya Vidyalayas. In last financial year, around 70 to 80 students alongwith 20 teachers
from KVS have enthusiastically participated in this workshop/outreach programme. Scientists of the
Institute have interacted with the students and resolved the queries they raised about the research
activities being pursued in this Institute.

This past fiscal year was one of great accomplishments for Vision Forward and the people we serve.
CSIR-CRRI conducted numerous training programs in the areas of road and road transport. In addition,
an International Training course on Dissemination of Highway Development and Management software
(HDM-IV) was also organized. It was attended by participants from within the country and from other
developing countries. Short term tailor made training programs were also organised for the Engineers
of Departments of Roads, Nepal; Urban Administration and Development Department, Chhattisgarh;-
Madhya Pradesh Rural Road Development Authority; Rural Works Department, Government of Bihar;
Rural Engineering Department, Uttar Pradesh; Transport Department, Government of Rajasthan;
Officers of Air Head Quarter, New Delhi and Public Works Department, New Delhi.

A large number of distinguished Scientists both from India and abroad visited our Institute, delivered
lectures, and held discussions with Scientists of the Institute during the year.

As part of motivating and encouraging young talent in the field of civil engineering, the Institute also
awarded summer internships/dissertations to fifty five B. Tech/M. Tech students. During the period
under report, seventeen students have registered for doctoral degree and thirty five students have
completed M. Tech/B. Tech theses. Ten new scientists have joined the institute during this year.

Team CSIR-CRRI acknowledges with immense gratitude the enduring support extended by Dr. Girish
Sahni, Director General & Secretary DSIR, in the growth of the Institute by giving us his able guidance
and advice. I also express my gratitude towards The Ministry of Science and Technology, CSIR
Headquarter and our Research & Management Councils for the wholehearted support received from
them. I am indeed thankful to our external experts also who guided us in our pursuit for excellence.

CSIR-CRRI has taken enormous strides during the year 2017-18 and we look forward to the institute
emerging as the highest performing CSIR laboratory.

Prof. (Dr.) Satish Chandra
Director
Research Publications 2017-18

- 51 Peer Reviewed Journals
- 62 Conferences
- 28 SCI Journals
- 7 Hindi Publications

Staff Strength: 2017-2018

- 31% Administrative Staff
- 30% Scientist (Group-IV)
- 21% Technical (Group-I-II)
- 18% Technical (Group-III)
Research & Development

- Geotechnical Engineering
- Flexible Pavement
- Rigid Pavement
- Pavement Evaluation
- Bridge Engineering and Structures
- Traffic Engineering and Safety
- Transportation Planning
- Environment Science
Geotechnical Engineering
Varanasi Municipal Solid Waste for Road Construction

Sponsored by : National Highway Authority of India (NHAI)

A detailed study was carried out to investigate the possibility of utilizing the Municipal Solid Waste (MSW) collected from Varanasi, UP as an embankment fill material. About 150 tons of Municipal Solid Waste was collected from Ramana MSW dumping site/Karsada plant and was segregated into different sizes in the existing compost plant at Karsada, Varanasi (Fig. 1). The different fractions (Fig.2) were studied for their suitability for use in embankment construction. A segregation methodology was proposed in the study. The segregated MSW is then characterized for its geotechnical characteristics (Fig. 3). Settlement analysis was also carried out to investigate its feasibility for embankment construction. It was concluded about 55% of Municipal Solid Wastes of 1 and 2 year old MSW can be effectively used in embankment construction. Also MSW is a non hazardous material as concentration of heavy metals is within the permissible limit as per HWM rules. Typical design cross-section (Fig.4) was arrived at for 3m height MSW embankment based on detailed stability analysis.
Development and evaluation of “Soil Nailing Technique” for stabilisation of soil slope for the construction of underpass intersection below Road traffic (Sponsored by CSIR)

The rapid growth in population, industries and infrastructure development in country has led to shortage of land space in the metropolitan cities and also resulted in the tremendous increase in traffic volume and congestion on roads. Many a time, the scope of further widening and flyovers are not feasible in city due to many constraints as shown in Fig. 5. Underpass is the only viable solution in such situations. Construction of an underpass involves in addition to huge money, man power and time, a special construction skill. But, underpass becomes unfeasible due to instability of soil and other site constraints; therefore, idea of construction of underpass below the existing road in live loading condition is generally dropped. Now there is a need of advance technology using which, the safe and economical underpass can be constructed by any means without any interruption to the live traffic.

The construction of underpass is generally taken up by cut and cover method as shown in Fig. 6 which usually takes many months to complete. Also, the construction of underpass with this method requires traffic diversion which results traffic jam for longer period on that city road.

Fig. 4 : Typical proposed Cross section of 3 m High MSW embankment

Fig. 5 : Traffic jam and Fly over is not possible

Fig. 6 : Underpass is only viable solution
In order to accelerate the construction, precast segments are gaining popularity for the construction of multi level flyovers and buildings. Similarly, Precast Boxes can be pushed to create underpasses below the existing live traffic conditions by using jack pushing techniques. The stability of slopes, safety and time are the major concerns of these underground structures. However, many of above stated apprehensions are considerably reduced by adopting the pre-cast box segments for construction of underpasses by jack pushing. One issue, which still requires our attention, is stabilization of soil at the box face during box pushing operation. Many times, it has been observed that the front soil slope of box suddenly collapsed and many casualties have been reported during box pushing operation as shown in Fig.7(a,b).

This problem was focused in CSIR-Central Road Research institute, New Delhi and a new methodology has been developed for box pushing with the help of "SOIL NAILING TECHNIQUE" which was used for stabilizing the sandy soils during box pushing operation. The further advancement in the research and the feasibility of the same technique is being searched out for construction of underpass intersection below the live traffic conditions. The project is under progress in laboratory, and the methodology has been established for construction of the intersection without disturbing the traffic (Fig.8). This methodology/technology would be very useful where sufficient space for construction of underpass is not available.

Fig. 7: Laborers’ buried during box pushing operation.
Fig. 8: Underpass Model Study Setup in Laboratory
Design of Ground Improvement Measures for Multi Model Logistics Park (MMLP) at Paradip Port

Sponsored by : IRCON Infrastructure & Services Limited

A total area of 21 acres is proposed to be developed for container terminal above soft clayey strata. The width of loading/unloading area is 47m and approach road is 25m respectively. The filling height varies from 1.5 to 2.5m. Since the fill to be constructed is over a soft clayey soil, it may result in excessive settlement and failures if constructed without any ground improvement measures. Accordingly, the site was inspected and fill samples were collected for the detailed laboratory investigations. A typical bore-log data and standard penetration number profile are shown in the Fig. 9.

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Depth in Mtr</th>
<th>Thickness of Soil Strata in Mtr</th>
<th>Graphical Representation of Soil Strata</th>
<th>Thickness of Soil Strata in Mtr</th>
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<tr>
<td>1</td>
<td>0.5MT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.5MT</td>
<td>3.0</td>
<td>Inorganic Clays of High Plasticity</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.0MT</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>4.5MT</td>
<td>1.5</td>
<td>Inorganic Clays of Medium Plasticity</td>
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<tr>
<td>5</td>
<td>6.0MT</td>
<td>1.5</td>
<td>Silty Sands</td>
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<td>7.5MT</td>
<td>1.5</td>
<td>Inorganic Clays of Medium Plasticity</td>
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<tr>
<td>7</td>
<td>9.0MT</td>
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<tr>
<td>8</td>
<td>10.5MT</td>
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<td>Poorly Graded Sands</td>
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<tr>
<td>9</td>
<td>12.0MT</td>
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<td>13.5MT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>15.0MT</td>
<td>1.5</td>
<td>CLAYEEM SAND OF LOW PLASTICITY</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 9: SPT-N profile and the details of a typical Bore log data

Based on the subsoil and laboratory investigation reports, suitable ground improvement measures have been designed and proposed for the construction of fill on soft soil. The degree of consolidation with and without Prefabricated Vertical Drains (PVD) is shown in Fig.10. Some of the conclusions from the study have been summarized below.
Fig. 10: Graph showing degree of consolidation with and without PVD

1. Dredged sea sand as well as in-situ water has very high chloride content. Thus dredged sand is not recommended to put near the pavement layers or near any concrete or steel structures. However it can be put for the lower layers of filling and for any working platform.

2. Phosphogypsum is a fine grained which can also be used as fill material.

3. Different ground improvement measures have been recommended before the construction of road over soft subsoil namely, a) Prefabricated Vertical Drains (PVD); b) Stone Columns. The selection of ground improvement method out of the above two was left to the client for due considerations of cost economics.

Feasibility Study of Foundry Sand Waste Materials for Road Construction

Sponsored by: M/s the Institute of Indian Foundrymen, Kolkata

Foundry sand is an industrial waste material generated from the foundry industries spread all over the country. The total annual production of this waste sand is about 3 million tons in India. It is natural sand which is used as a molding material in the ferrous and nonferrous metal casting industries. This sand is typically recycled and reused through many production cycles. After several cycles, it becomes unsuitable for the industry and piled up as a waste material, called the foundry sand. Literature review revealed that foundry sand may be used as an embankment, sub grade, sub base and as a structural fill. Other studies showed that the foundry sand may be also used as a partial replacement for natural sand in concrete.

The present project was taken up with an objective to study the potential of foundry sand as a road construction material in India. Foundry sand was investigated for physical, chemical and geotechnical characteristics. Different geotechnical characteristics that were studied viz. grain size analysis, Atterberg limit test, free swelling index test, specific gravity test, Proctor compaction test, CBR test, unconfined compressive strength test, consolidation test, permeability test and direct shear test. Design and stability analysis of foundry sand embankment was also carried out under different water saturation conditions with seismic factor. The present study...
also investigates the potential use of foundry sand in Dry Lean Concrete (DLC) and Pavement Quality Concrete (PQC) as a partial replacement of fine natural aggregate. Accordingly, foundry sand samples were collected from 10 different industries located in different parts of India i.e. Ahmedabad, Bhiwadi, Chennai, Coimbatore, Vellore, Jaipur and Kolkata. Typical fine and coarse foundry sands are shown in the Fig.11.

Brief summary of the conclusions are given below:

1. Foundry sand mainly contains unburnt carbon, oxides and silica with traces of other compounds. It has sand size particles and is non plastic in nature. Majority of the foundry sand samples do not swell after increase in moisture content. But, some of the samples have high value of FSI (> 50 %) due to presence of higher clay content.

2. Specific gravity of foundry sand was observed to be less than conventional soil. This may be due to different mineral composition in the samples. Loss on Ignition of foundry sand varied in the range of 1 to 10 %.

3. The compaction curves of foundry sand are flat in nature, indicating in-sensitiveness of dry density with moisture content. This is an added advantage during field construction. Failure envelope developed during direct shear test is shown in the Fig.12. Foundry sand has good angle of internal friction.

4. It is inferred that some of the foundry sand samples may be used in the construction of embankment and as a partial replacement of fine aggregate in the concrete mixes.

Construction and Field Evaluation of Phosphogypsum Road

Sponsored by : M/S. Paradeep Phosphate Limited, Orissa

Phosphogypsum is a waste material generated as a byproduct during manufacturing of phosphoric acid. CSIR-Central Road Research Institute submitted a laboratory feasibility report on the use of phosphogypsum waste material for the construction of embankment, sub grade and granular sub base layers. Based on developed technical specifications, experimental test track was laid at the campus of Paradeep phosphate Ltd., Paradeep, Orissa. Phosphogypsum was used as an embankment, sub grade and granular subbase material in the construction of road. The proposed cross sections were designed and checked for safety by carrying out stability analysis. Based on the observation made during the construction of experimental test track, method statement was developed which discusses the methodology to be followed for the use of this material for actual construction. Quality control data in the form of degree of compaction, modulus and field CBR of different layers of compacted phosphogypsum were also determined using different equipments viz. DCPT, Plate load test etc. The pictorial view of experimental road is shown in the Fig. 13. Brief conclusions are given below.
(1) Degree of compaction of phosphogypsum and soil layers was observed to be as per MORTH specifications.

(2) It was observed that settlement of phosphogypsum embankment and subgrade layers are less as compared to sand embankment and subgrade layers. It was also observed that modulus of elasticity of phosphogypsum material is more than sand. From the dynamic cone penetrometer test results, the average value of in-situ CBR of phosphogypsum layer is higher than that of a sand layer.

(3) Based on the experimental test track construction, it was observed that phosphogypsum waste material has potential for use in the construction of embankment, subgrade and granular sub base layers of the road works.

Evaluation of Zydex (TERRASIL & ZYCOBOND) Nanotechnology with Cement in Soil Stabilisation

Sponsored by: Zydex Industries, Vadodara, Gujrat

Terrasil and Zycobond are available in liquid form for the purpose of soil stabilisation. TERRASIL is a water soluble product. ZYCOBOND is a nano sized acrylic co-polymer dispersion in water. To evaluate the Zydex nanotechnology (Terrasil and Zycobond) for soil stabilization, four different types of soils viz. Bhopal (Madhya Pradesh) soil, Karnataka soil, Kerala soil and Jammu (J&K) soil were used for the present study. The test procedure and dosages of stabilizer are as per client protocol. The broad conclusions based on laboratory tests carried out on four types of soils and stabilised with Terrasil + 3% Cement + Zycobond are given below:

- Treatment of soil samples by using terrasil + 3% cement + zycobond, increased CBR values drastically as compared to untreated soils. The increase in CBR value is more for coarse gained soils as compared to fine grained soils.

- Kerala and Jammu soil samples, treated by terrasil + 3% cement + zycobond, satisfied the durability test (brushing loss after wetting and drying) criteria also (Fig. 14). The test procedures adopted were modified with regard to method of application of stabiliser and curing periods as per Zydex protocols.

- Further it is also recommended that actual field trials should be carried out and performance of test roads should be monitored till completion of at least two monsoon seasons for validating the laboratory findings.
Evaluation of Connection Strength between Tenax HDPE Geogrids & T-Clip for Modular Concrete Blocks (T-Block)

Sponsored by : H.M.B.S Textiles Private Limited, Delhi

The T-clip connectors used for the study are shown in Fig. 15. TT045, TT060, TT090, TT120 and TT160 geogrids were used as reinforcement material for the present study. The summary of the geogrid properties as provided by manufacturer is given in Table-1. The connection strength between geogrids and T-clip for modular concrete blocks was performed at different applied normal stresses. The connection strength versus geogrid displacement recorded at the back of the concrete units for TT045 geogrid at 22 kPa normal stress is shown in Fig. 16. It was observed from testing that under low normal stresses the modular precast concrete blocks exhibits significant dilatant behavior compared to higher normal stress. This behaviour was also documented for connection strength tests between geosynthetic reinforcement and modular concrete blocks (ASTM D 6638 – 01, 2001).

Table-1: Properties of Geogrid reinforcement used in the current study

<table>
<thead>
<tr>
<th>Properties</th>
<th>TT045</th>
<th>TT060</th>
<th>TT090</th>
<th>TT120</th>
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<tbody>
<tr>
<td>Aperture Size (mm)</td>
<td>MD</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>TD</td>
<td>13/20</td>
<td>13/20</td>
<td>13/20</td>
<td>13/20</td>
</tr>
<tr>
<td>Peak tensile strength, T_{ult} (kN/m)</td>
<td>45</td>
<td>60</td>
<td>90</td>
<td>120</td>
<td>160</td>
</tr>
<tr>
<td>Junction Strength (kN/m)</td>
<td>36</td>
<td>50</td>
<td>80</td>
<td>110</td>
<td>130</td>
</tr>
<tr>
<td>Long Term Design Strength (kN/m)</td>
<td>21.2</td>
<td>28.3</td>
<td>42.4</td>
<td>56.5</td>
<td>75.4</td>
</tr>
</tbody>
</table>

Fig. 15 : T-clip connectors

Fig. 16 : Connection strength versus displacement curve of TT045 geogrid
Flexible Pavement
1. Research Projects

**Development of Cementitious Material/Grout for use in Cement Grout Bituminous Mix (CGBM)**

**Sponsored by: M/s International Combustion**

The grout supplied by M/S International Combustion Limited was tested in the laboratory for its suitability in CGBM. Flowability and compressive strength were tested on the supplied grout. Based on the results, we requested M/S International Combustion Limited to modify the grout material so that it can achieve flowability at lower water contents with desired compressive strength. The client supplied modified grout sample which was retested for its properties at different water contents. The test results of 1st and 2nd modified sample are given below respectively (Fig. 17). The grout was designed on the basis of the compressive strength and flowability of the grout. Flowability of grout is defined as the time taken for one litre volume of grout to flow from the cone through the circular bottom exit of 10 mm diameter. Consistency of grout material is shown in Fig. 18. A Marsh cone apparatus is used to check the flow ability of the grout. Marsh flow cone apparatus is shown in Fig 18. Compressive strength of the grout was determined on cubes after 7 days of curing.

**Development of Technology for Use of Fly Ash as an Alternate Material in Pavement Construction through Accelerated Pavement Testing**

This Project, sponsored by Department of Science and Technology, MoST (Govt. of India) envisages that pavements serving traffic for the Indian rural road and low volume roads are the best bet for exploring of a technology of maximised utilisation of fly ash waste, with the following objectives:

- Experimental design of test pavement using selected fly ash waste in sub-base/base and construction of test strips within CRRI.
- Semi-field performance evaluation of pavement constructed using these materials using APTF.
- Development of design guidelines on their optimal usage.

**Outcome of the Project: Optimised usage of fly ash waste in different layers of pavement Design Specifications**

With due deliberations with the experts, six different (one conventional and five alternate) design specifications were proposed in the final design matrix to be studied and accordingly test strips were constructed.
In order to assess the performance evaluation of stabilised layer at base and sub-base level in the pavement with different traffic levels, different tests were carried out. Initially, the materials and mix properties were determined as per standard set of procedures Fig. 19. The dynamic cone penetration test was done at sub-base level Fig. 20. Thereafter, the falling weight deflection (FWD) test was carried at base level on the cement aggregate-fly ash mixture Fig. 21. Finally, the Benkelman Beam deflection test was done on the bituminous surface to evaluate the characteristic deflection of the newly constructed pavement.

The related work carried out under the scope of the research study has shown that with certain precaution, flyash can be practically used even with aggregates and cement to produce the required mixtures for sub-base and base of a pavement. While the field performance evaluation based observations are yet to follow, it can be stated that the laboratory designs and construction of the so designed test pavements can be viable under proper guidelines/specifications. The sections, further, will be evaluated at appropriate intervals for performance evaluation using FWD, BBD, DCP, Forensic investigation, etc.

**Development of specification of WMA for Indian conditions**

**Sponsored by**: Department of Science & Technology (DST), Govt. of India, New Delhi

The study is carried out in two parts in collaboration of IIT Roorkee; Part-1 is the Characterization of Warm Asphalt Binders and part-2 is the Characterization of Warm Asphalt Mixes.

To explain how the asphalt binder contributes to the rutting behavior of the pavement, Zero Shear Viscosity (ZSV) was studied. Frequency sweep tests were conducted to determine Zero Shear Viscosity of warm mix binder and bitumen-filler-mastic. Conventional rutting parameter $G^*/\sin \phi$ is also determined over a temperature range to evaluate Failure temperature of warm mix binder and bitumen filler mastic. Various other properties like temperature susceptibility, aging index, short term and long term aging, creep stiffness and m-value of...
Research & Development

Flexible Pavement

Warm asphalt binders were also evaluated. Fourier Transform Infrared Spectroscopy was performed to find the aging characteristics of warm mix asphalt binders.

Indirect tensile strengths (ITS), tensile strength ratio (TSR), moisture induced sensitivity test, resilient modulus, dynamic creep, fatigue strength and rutting depths of WMA mixtures were found and compared with that of HMA mixtures. The effects of aging of warm asphalt mixes were evaluated by artificially aging the mixture samples in the oven at 85ºC for 120 hours. The aged samples were then tested for all the performance properties.

It was observed that the warm asphalt mixes have better TSR values than the control hot mix asphalt. Warm asphalt mixes showed better resilient modulus values than the control hot mix asphalt. Un-aged control HMA mixes showed more permanent accumulated strains than WMA mixes. The results showed that un-aged warm asphalt mixes will have more resistance to permanent deformation than the hot asphalt mixes. Whereas in the case of aged samples, the WMA mixes showed almost similar extent of permanent accumulated strain as in the control HMA mixes. Wheel rutting test results indicated that the warm asphalt mixes had significantly lower rutting depths than the control hot asphalt mixes. The results of four point bending beam test at different strain levels showed that the addition of warm mix additives improved the fatigue life of warm asphalt mixes.

**Feasibility Study on Utilization of Ferro Chrome Slag in Road Making.**

**Sponsered by : TATA Steel Ltd**

Many road development programmes have posed enormous demand on good quality natural stone aggregates. Besides road construction, maintenance of the vast road networks also consumes large amount of quarried aggregates every year. Rapidly depleting deposits of good quality aggregates and ever increasing demand, emanating from infrastructure construction activities has resulted in unsustainable quarrying and usage pattern of natural aggregates in many areas of our country. Recent interventions from the Government, like ban on quarrying of natural aggregates at several places and incentives for utilization of industrial wastes in construction activities have spurred several initiatives for exploring alternative materials for road construction activities. CSIR-Central Road Research Institute (CRRI) has always been in the forefront to take up studies on various industrial wastes for their possible usage in road construction. In this endeavor, recently laboratory evaluation of ferro chrome slag, waste from ferro alloy industry of TATA Steel has been successfully completed showing the feasibility of use of ferro chrome slag in various forms in different pavement layers. Further field implementation within the TATA Steel Campus and performance evaluation is planned to gain knowledge and experience long term performance of this material.

**Evaluation of PME Rejuvenator of LN Petrochem Pvt Ltd**

**Sponsered by : L N Petro Chem Private Limited**

In the past, unmodified bitumen were able to cope with the traffic volumes on runways but due to increase in traffic and adverse climate conditions, preventive maintenance on runways is needed. Nowadays, the burden placed upon has arrived at a critical stage in many developed and developing countries where the increased volume in heavy air traffic coupled with an appreciable increase in allowable axle weights for aircrafts has lead to a dramatic increase in the level of stress exerted on Flexible pavements. Due to sharp increase of stresses exerted most of the runways experience distress and deteriorate before it can achieve the designed service life. Polymer modified emulsion based rejuvenor is used for rejuvenating the runways as preventive maintenance. Laboratory evaluation in terms of aging and moisture resistance of this product is going on. Also a trial was done within CRRI campus to evaluate the effect of climate on skid resistance and permeability on pavement surface. Some photographs during the trial work are given below :(Fig. -22, 23, 24)
Construction of Experimental Road Stretch Using Chrome Shaving as Reinforcement in Dense Graded Cold Bituminous Concrete

Sponsored by

The coarse and fine aggregates used in this study were crushed blue granite stone from Nallampakkam (Near Vandalore) crusher unit which normally used to cold bituminous mixes in south Chennai area. Ordinary Portland cement was used as filler to achieve higher cohesion and indirect tensile strength (ITS) compared to hydrated lime. Cationic slow setting bitumen emulsion (CSS-2) meeting IS: 8887 was used to prepare all CBC samples. Chrome shaving (CS) was used as reinforcement in the cold mix. 50 mm thick CBC as per MORTH specification grading was selected for this study. The mix design of CBC was based on Asphalt Institute Manual Series No.14 (MS-14). A trial section was constructed for the first time in India at an internal road in CSIR-Central Leather Research Institute, Adyar, Chennai campus. This experimental road plays a vital role connecting Kendriya Vidyalaya school and CLRI staff quarters, Adyar, Chennai. The road stretch was thoroughly cleaned and a base layer of 50 mm thick dense bituminous macadam (DBM) was laid. Over the DBM 40 mm dense graded cold bituminous concrete layer using chrome shavings as reinforcement was proposed. The feeder system for addition of fibers and cement was mixed together, trial and error methods were adopted to feed the additives (Fig. 25). The DC motor was adjusted, by controlling the rpm so as to deliver the additive at the rate of 5 percent by the weight of mix. Cold feed mixes were collected to verify the distribution of fiber in the aggregate skeleton. Special arrangement was made to feed the liquid emulsion through pipe in to the bulk (emulsion loaded in the truck) to the mixing plant. The cold mix was transported from the mixing plant by truck and the mix was discharged to the paver. The required compacted thickness was electronically controlled by the paver finisher. The mat was compacted by tandem roller followed by vibratory roller.
Verification of Bituminous Surfacing Specifications of AAI for required Modifications to enhance the Friction Coefficient

Sponsored by: Airport Authority of India

Runway skid resistance is the most important parameter in reducing traffic accidents especially in wet conditions. The understanding of the friction coefficient and skid resistance is very valuable information for safety enhancement of runways. Thus, it is important to find frictional properties of the runway surface. One of the primary safety criterions for asphalt pavements is tire-pavement interaction, and this is directly related to surface texture characteristics, which contributes to skid resistance and surface drainage. The main objective of this study to carry out desirable modifications in aggregate grading, etc. to fulfill volumetric properties in mix design and frictional requirements. A trial section was laid in Bhopal and Imphal runways with modified gradations and evaluated the skid resistance of laid trial sections by using Surface Friction Tester (SFT) (Fig.26, 27).
2. Consultancy projects

Study to investigate causes of Distress/Rutting on Some Roads and to suggest Remedial Measures under Greater Mohali Area Development Authority.

Sponsored by: Greater Mohali Area Development Authority (GMADA)

The project roads pass through the city of Mohali. The entire project roads are constructed as flexible pavements. Chief Engineer of GMADA requested CSIR-Central Road Research Institute (CRRI), New Delhi to undertake the investigations for determining the probable causes of development of distresses/defects such as rutting and cracking on affected road sections and to suggest needed remedial/rehabilitation measures for rectification of these defects. On the later confirmation by GMADA of the institute’s offer, the detailed investigations were done for the affected Roads in Mohali which included field investigation and evaluations, viz., assessment of current pavement surface condition, test pits observation, measurement of pavement's structural thickness, Benkelman Beam deflection measurements, traffic volume and axle load (Fig. 28, 29, 30).

In addition, samples of different materials/mixes used for construction of road in various layers of the pavement structure were also retrieved from the test pits and coring for determining their properties in the laboratory.

CRRI submitted the report in Oct. 2017 for implementation in field.

Design and Development of Instrumentation Plan for the Proposed Creation of Automotive & Weapon System Test Track at CVRDE (DRDO), Chennai - Phase 1: Inputs for DPR

Sponsored by: DRDO-CVRDE, Chennai

Presently, CVRDE is engaged with the design, development and testing of tracked combat vehicles and specialised tracked vehicles. CVRDE also carries out extensive testing of the military vehicles for their dynamic behaviour and performance Fig. 31. For this reason, it gets test tracks designed and built in its establishment for the specific requirements and then tests the designated vehicles over the tracks. Different types of pavement structures are used in these test tracks built as per design considerations. The institute’s involvement is in formulating the detailed design specifications for the proposed upgradation of their existing test track for testing the AFVs.
There was no much documented record available on the earlier design and specifications of the facilities of the existing test track, in order to assess the structures vis-a-vis their performance from the old observations of CVRDE. It was learnt from the concerned officials that for making the designs etc. in the proposed upgradation activities, a design consultant has been in place and the institute’s role is well defined to review the design specifications with reference to structural components of the test track’s design.

**Investigations for Design of New Pavement Section for Connectivity Road and Rehabilitation of Various Distressed Road Network in Deendayal (Kandla) Port Area**

**Sponsored by : Kandla Port Trust**

A variety of field investigations were done under the project primarily to determine the structural adequacy/capacity of the existing pavement and to find out the types, extent and severity of distress/defects so as to suggest remedial measures needed to arrest the progression of distress towards improving the condition of the road sections under study. The following field activities/surveys were undertaken with a view to assess the current condition of pavement.

- Assessment of pavement surface condition based on visual observations Fig. 32
- Test pit observations Fig. 33.
- Coring of bituminous mixes and Cement Concrete(CC) slab
- Structural evaluation of flexible pavement by Benkelman beam deflection measurements
- Traffic volume survey
- Axle loads survey
Based on the physical properties, evaluation results, analysis of data/information and engineering inferences, pavement rehabilitation requirements for the affected study roadway network are worked out. There is an immediate need to rectify the defects and make up the deficiencies for the optimised service of the roads in the port area. Keeping in view the surface condition of the existing pavement structure, traffic loads and damaging factors which are figuring significantly on the study road network, the corrective and rehabilitation measures would also differ from the normal/conventional treatments. Since both the surfaced and unsurfaced areas are severely distressed at many locations, the entire affected movement area is considered to be in poor engineering condition, which needs immediate attention. The needed corrective two fold measures; removal/milling of distressed bituminous layers followed by major rehabilitation required structural thickness, have been suggested. Recommendations are made towards the improvement of the structural and functional performance of the flexible layers of the pavement.

Pavement Design using appropriate recycling option for Madhavpur section (46.54 kms) of up gradation work of Gadu-Porbandar section of NH-8E, Gujarat

Sponsored by : M/s Kalthia Infra Projects Private Limited

The detailed evaluation of different road building materials was carried out, covering the subgrade soil, granular sub-base (GSB), granular base course (Wet Mix Macadam) and bituminous course. The analysis of data was done to determine the structural requirement of the pavement crust based on the current subgrade materials strength and the projected load-frequency of operations by the vehicles. Methodology adopted for computation for structural composition is based on IRC 37-2012. On the basis of available average bituminous layer thicknesses, it was observed that the extent of milling of bituminous layer is possible up to 100mm. VG 30 bitumen was used for foaming and BSM design.

On the basis of site inspection and tests on milled RAP material, cold in situ recycling is recommended for reconstruction of the pavement by retaining/reshaping the granular layers above subgrade as required. It was recommended that for the given site for cold in-situ recycling using foam bitumen the optimum foamed binder content shall be taken as 2.25%. Optimum foaming characteristics were achieved at temperature of 180°C and foaming water content of 6%. Gradations to be taken were also recommended. This combination for foaming was selected for the VG-30 asphalt binder in mix design. 1% cement OPC 43 grade was added to improve the stability and better dispersion of foamed bitumen in fine particles of the mix. IITPave software was used to carry out the pavement design as per IRC 37:2012.

Validation of Executed Pavement Work vis-a-vis Pavement Design of Six Roads under Municipal Corporation of Greater Mumbai

Sponsored by: Relcon Infra projects Limited

In order to provide improved transportation links in Greater Mumbai, Municipal Corporation of Greater Mumbai (MCGM) has proposed to strengthen/widen city & Sub-urban roads for ease of movement of traffic and based on recommendations of design consultants MCGM invited tenders. Some of the works were awarded and accordingly executed by M/s. Relcon Infraprojects Ltd. Mumbai. M/s. Relcon wanted to ascertain the sufficiency/likely effect on performance of roads as per crust observed by MCGM vis a vis drawing provided with tender documents. M/s. Relcon accordingly referred 6 roads from Western and Eastern Sub-urbs on sample basis to CRRI. M/s. Relcon made a request to CRRI for checking the observed crust of Pavements vis a vis drawing issued with the tender or during execution by MCGM and to give opinion about sufficiency or otherwise of the roads with respect to performance during designed life span.

As per analysis in respect of design of crust required as per IRC–37– 2001/2012 for various parameters such as traffic density, CBR value, Vehicle Damage Factor etc., it is noted that crust thicknesses considered by the Design Consultant/instructed by MCGM in execution drawings are on higher side. Hence due to some deviation in thickness of
Granular layers observed and reported by MCGM and said information submitted by M/s.Relcon to CRRI, there will not be any effect on Service life of 10 years for the assumed CBR value and traffic volume considered in the design and considered by design consultants appointed by MCGM for these roads subject to condition that proper attention is given to routine and periodical maintenance of roads.

As regards CC Pavement, PQC layer thickness is same as per design and generally as per IRC – 58. However except one consultant, no one has carried out design as per IRC-58 and hence, not much comments can be offered but as PQC layer is of adequate thickness, therefore roads will provide required serviceability.

Investigation to study causes of distress/rooting for flexible pavements from Khageria to Purnea Section of NH-31 and to suggest suitable remedial measures

Sponsored by : Khageria Purnea Highway Project Ltd.

Field studies were carried out and suitable remedial measures were provided. Keeping in view the structural and surface condition of the existing pavement, traffic loads and damaging factors which are playing significantly on the road stretch, the corrective and rehabilitation measures have been worked out. These are given in the following sub-sections.

Short Term Measures (till the time major rehabilitation is carried out)
- All existing surface defects like cracks, potholes, depressions/undulations/deformations, etc. shall be properly treated/filled up. (Fig. 34,35)
- Proper sealing of cracks and filling up of undulations/depressions, wherever and whenever required, depending on the extent and severity of distress must be continued, as soon as they occur, on urgent/priority basis to minimise further progression of deterioration.
- Stipulated routine and periodic maintenance to be carried out at regular intervals.

Recommendations on Rehabilitation (Long Term measures)
The requirement of the flexible overlay to be provided for improving the structural adequacy of the existing pavement has been worked out for 5 years design life, with the specification options as given below Table -2.

Table-2 : Overlay thickness requirement for design life of 5 years (Design Traffic = 27 msa)

<table>
<thead>
<tr>
<th>Rehabilitation Strategy</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>Option 2</td>
</tr>
<tr>
<td>50 BC + 75 DBM</td>
<td>50 SMA + 75 DBM</td>
</tr>
</tbody>
</table>

Note : BC: Bituminous Concrete, DBM: Dense Bituminous Macadam & SMA: Stone Matrix Asphalt

At the end of fifth year, the road stretch is recommended to be re-evaluated for any further structural and functional improvement requirements.
Laboratory Studies of Highly Modified Asphalt (HiMA-using Kraton SBS Polymer) and Bituminous mixes containing HiMA vis a vis VG-30 Bitumen

Sponsored by: Kraton Polymer International Limited

Highly Modified Asphalt or HiMA is a new SBS polymer technology developed by Kraton Corporation for asphalt paving. The SBS polymer loading is more than twice that of ordinary modified asphalt, yet mixes are readily workable and easy to lay in the field. The high polymer loading makes the asphalt more like an asphalt-modified rubber than rubber-modified asphalt so it has many times the fatigue and deformation resistance of ordinary modified asphalt.

The objective of the study is to evaluate the basic and rheological properties of VG 30 and HiMA. Softening point, elastic recovery, penetration, viscosity test are determined in the laboratory. HiMA has higher softening point greater than 83°C; however, viscosity is less than 3 Pa.s at 135°C. Due to higher softening point of HiMA, mix produced from HiMA will have greater temperature resistivity in the field. Besides routine testing, advanced testing on Dynamic Shear Rheometer was also carried out to define various rheological parameters. Fail temperature, complex modulus, non-recoverable creep compliance and average recovery was determined in the laboratory.

The rutting behavior of the HiMA was characterized using advanced test like Multiple Stress Creep Recovery (MSCR). The stress sensitivity of the bitumen is obtained through MSCR test by conducting test at different stress levels. The response is measured in term of elastic recovery and non-recoverable creep compliance. Finally bitumen is ranked for different traffic loading conditions. MSCR test is first time adopted to evaluate the modified binder in comparison to conventional bitumen.

The fatigue failure is another failure which needs to be addressed while characterizing the bitumen. The superpave fatigue parameter i.e. $G^\sin\delta$ is used for evaluating the HiMA. To capture the behavior beyond the linear viscoelastic range, linear amplitude sweep test was adopted and finally fatigue characterization is defined.

Marshall Method of mix design was adopted to obtain optimum bitumen content for HiMA and VG-30 bitumen. There is increase in Marshall Stability on using HiMA in comparison to VG30 grade bitumen. After obtaining optimum bitumen content, various performance testing was done on bituminous mixes. Dynamic modulus test was carried out on Asphalt Mix Performance Tester (AMPT) available in CRRI Fig.-36.
Field Evaluation of Test Section having Steel Slag as aggregate

Sponsored by : Tata Steel Limited

Road construction activities consume large amount of crushed natural aggregate in comparison to other areas of civil engineering construction. Large quantities of natural materials, gravel, rocks and sand are built into kilometers of newly-built roads or in reconstruction of decrepit roads. At the same time, the sustainable development concept requires a more efficient management of waste materials and preservation of environment.

Steel Slag is the major by product of steel making processes i.e. from the conversion of iron to steel in the basic oxygen furnace. In sponsored laboratory study by TATA Steel, it was found that Steel slag is having potential to replace natural aggregate in road construction provided used properly. To further establish, TATA Steel has sponsored research study on construction of trail section using steel slag and subsequently its performance evaluation. The test section of Bituminous Concrete (BC) overlay of 50 mm thickness with BOF/LD slag as aggregate was done on distressed bituminous Dimna- Mango road in Jan. 2015 by JUSCO, an extended arm of TATA Steel. Second test section was laid on Ranchi-Rargaon-Jamshedpur section of NH-33. In this test section processed LD slag Aggregates has been utilized as replacement of natural aggregate in granular sub-base. It is proposed to construct upcoming bituminous layers using steel slag aggregates. Control section with natural aggregate are also constructed for comparative performance evaluation.

Periodic performance evaluation of both test section is under progress by CRRI. The interim findings of the periodic performance evaluation, carried out by CRRI team in Nov. 2015, of steel slag test section was made and submitted to TATA Steel. Steel slag test section has no sign of early pavement distress and riding quality of steel slag section commensurate well with riding quality of control section of natural aggregate. From BBD Testing it was obtained that characteristic surface deflection in steel slag test section is less than the control section of natural aggregate. High layer stiffness of steel slag test

Fatigue beam testing and rutting tests on large size wheel tracker are being carried out to further check the performance of HiMA and finally technical report will be prepared.
section reduces load induce deflection in the pavement. Following Fig. 37, 38, 39, 40 present different test section along with performance evaluation.

The subsequent periodic performance evaluation report of the steel slag test section will bring out the major finding of the study.
Rigid Pavement
Review of the Design of Roads in Additional Complex for Supreme Court of India

The Government of India has assigned the construction work of additional office complex for Supreme Court of India (SCI) adjoining to Pragati Maidan, New Delhi, to the CPWD. Preliminary design of the campus roads/pavements was prepared by the Architectural Consultant appointed by CPWD. Due to some complexities involved such as sub-grade over a deep filled up area after construction of basements, road on deck slab and road over filled up-ground and partly on non-tower slab, the CPWD requested the CSIR-Central Road Research Institute (CRRI), New Delhi to review the road design and submit the final design of the roads in additional complex for Supreme Court of India, Pragati Maidan, New Delhi. The major objectives of the work included:

- The review and redesign of the roads in light of the complexities for the construction of concrete road over deep filled up sub-grade, on RCC deck slab, partly on filled up soil and non-tower slab.
- Suggestion of a practical, effective and efficient methodology for ground improvement on filled-up soil (if required) on which proposed roads are to be constructed.

The copy of proposed designed roads and SPT report carried out on filled up soil were provided to CSIR - CRRI by CPWD during site visit for these roads. Fig. 41-44 show the site conditions.
The sub-soil investigation report revealed that the sub-soil stratum up to a depth of about 14 meters is in loose condition as reflected by low SPT values recorded for this stratum. Therefore, CPWD was advised to use a deep vibratory method of in-situ deep treatment of soil such as vibro compaction technique. The CPWD was further advised to submit the report of SPT conducted on the soil after adopting deep soil compaction technique for the site. After ground improvement the CPWD carried out SPT tests and submitted the report to CSIR-CRRI. The comparison of observed SPT values before and after ground improvement against depth at different borehole locations indicated improved condition of soil strata from loose to medium densified after adopting the suggested technique for ground improvement. Finally, 200 mm thick PQC slab of dimensions 3500 x 3000 with no dowel bars for over deck slab and friction slab was suggested. For filled up soil, additionally a DLC or PCC of 100 mm thick besides an expansion joint matching the expansion joint of building was suggested.

Investigation of Distresses and Suggestion for Repair and Rehabilitation of Rigid Pavement from Kawardha to Simga Section of NH-12A in Chhattisgarh

The work of rehabilitation and up-gradation of National Highway NH-12A from design Ch. 245.375 to Ch. 316.468 (Kawardhha to Simga Section) to two-lanes with paved shoulders in the State of Chhattisgarh under NHDP – IV through Engineering, Procurement & Construction (EPC) basis was taken up by Ministry of Road Transport & Highways, Govt. of India, New Delhi. The EPC contractor designed and constructed the 71.03 km long concrete road from May 2015 to March 2017. In all 29482 concrete slabs were constructed. The Chief Engineer, NHZ, requested Central Road Research Institute (CRRI) to assess the causes of distresses/cracks due to which nearly 3551 concrete slabs has been affected within one year after opening the road to traffic and suggest remedial measures for repair and rehabilitation of newly constructed concrete pavement. Field investigations were carried out to assess the extent and the causes of various types of distress developed in the pavement. On the basis of field investigations of the distressed concrete pavement, following conclusions and recommendations were made:

- The average equivalent cube compressive strength as determined by testing of cores was found to be 45.25 MPa, which is acceptable for characteristic compressive strength of 40MPa.
- Longitudinal cracking was observed in 3130 concrete slabs (Fig. 45). This crack was found to have developed due to fatigue of concrete because of excessive curling and loading stresses. The crack developed only after opening the road to traffic. The crack is also expected to develop further in other concrete slabs. The reason for this crack is that longitudinal saw cut made between shoulder and lane could not develop the anticipated crack under it. Cross-stitching was suggested for repairing this crack.
- Transverse cracking was observed in 357 concrete slabs. The reason for this crack was found to be delayed saw cut. These cracks were working cracks since they were working like normal transverse joints facilitating expansion and contraction of slabs. Grooving and sealing with Silicon sealant was recommended for these transverse cracks.
- Multiple plastic shrinkage cracks were observed on 1534 panels (Fig. 46). These cracks were only surface cracks and not expected to affect the structural and functional capability of the pavement. Gravity sealing with neat epoxy was recommended for these cracks.

Fig. 45: Longitudinal Crack
Research & Development

Mitigation Measures for Foreign Object Debris (FOD) on Rigid Pavement at VSI Airport Port Blair

Rigid pavement in the apron area of the VSI airport at Port Blair was constructed in the year 2010. The approximate area of rigid apron is 45000 m². The disintegration of rigid apron surface has been observed for the last 3-4 years. The disintegrated aggregates from the concrete surface of the apron are creating the problem of Foreign Object Debris (FOD) which can be disastrous in the event the FODs are sucked in by the engine of the aircraft. Airport Authority of India (AAI) sought the advice of CSIR-Central Road Research Institute, New Delhi to ascertain the reasons for aggregate disintegration from the surface of rigid apron and also to suggest the remedial measures so that the disintegration of aggregates can be fully arrested for safe aircraft operations. Following conclusions were drawn about the condition of existing pavement, reason of FOD and remedial measures:

- The surface of concrete pavement in the entire area of apron was badly abraded and disintegrated generating lot of FODs. The reason of FOD generation was poor strength of existing concrete (Fig. 46,47).

- No structural cracking was observed in the concrete slabs indicating that the existing concrete pavement is structurally in good condition.

- A bonded/unbonded overlay of M40 Grade concrete was recommended as a permanent solution for completely arresting the generation of FOD from the pavement surface. The thickness of the bonded overlay was suggested as 250 mm.

- As a temporary measure for 2-3 years or till the time a bonded/ unbonded overlay is placed, epoxy resin – sand mortar in an average thickness of 10 mm was suggested over the entire area or the area where the movement of aircraft takes place.
Investigation and Suggestion for Remedial Measures for Distresses in Cement Concrete Pavement in Firozabad (U. P.)

Public Works Department (PWD), Firozabad, U.P., has constructed a cement concrete road in Makkhanpur city portion. The cement concrete road is 1.8 km long and 3.7 m wide with 1.5 m wide shoulder on each side paved with interconnected cement concrete blocks. The work was done in 2016-17. The road developed distresses and cracks after opening it to the traffic. Executive Engineer, Provincial Division PWD, Firozabad, requested the Central Road Research Institute to suggest remedial measures for the distressed road. Field investigations led to following conclusions:

- The surface of concrete road in the most of the area was badly abraded and disintegrated due to abrasion caused by vehicles running on the road (Fig. 49).
- It was recommended that any commercially available polymer modified cementitious material be used for restoring the adequate abrasion resistance at the surface and for arresting the dislodging of aggregates from the surface of the road (Fig. 50).
- All the transverse joints should be sealed with some bituminous sealant or any other sealant as per the conditions of the contractual agreement.

Fig. 49 : Abraded Road Surface

Fig. 50 : Polymer Treated Surface
Pavement Evaluation
Research Projects

Self-Healing Technology of Bituminous Pavements with Induction Energy

Sponsored by : CSIR-CRRI

The Bituminous material is a self-healing material. When it is subjected to a rest period, bituminous material has the potential to restore its stiffness and strength by closing the micro cracks that occur when the pavement is subjected to traffic loads. It requires adequate amount of rest time to undergo the complete process which is presently insufficient. To enhance the property of self-healing of the flexible pavements, a number of approaches for self-healing techniques are under research stage. Inductive heating is the most progressive self-healing technology for bitumen pavements reported, till date.

The induction process operates by sending an alternating current (AC) through the coil and generating an alternating electromagnetic field. When the conductive bitumen specimen is placed under the coil, the electromagnetic field induces currents flowing along the conductive loops formed by the steel fibers. It generates heat and bitumen viscous property reduces and micro cracks are refilled with binder making once again a homogeneous material.

The Present stage of research is the dosage of steel fibers is optimized; various parameters like temperature gradient, rest period, multiple healing capacity, change in mechanical properties with increase in dosage of steel fibers etc. were studied. It was observed that this technology has huge scope in pavement preservation. The strength recovery after the healing is observed to be very good and this technology can be easily translated in to the field. The performance studies of healed bituminous mixes are going on (Fig. 51). Further study is in progress.

Water Harvesting using Porous Flexible Pavements

Sponsored by : CSIR-CRRI

The overall work plan adopted for the study has been divided into two modules based on the in house capability (Fig. 52).

- Module one consists of methodology for developing the optimum porous bituminous mix and guidelines as final pavement design for porous flexible pavements as per the Indian conditions.
- Module two consists of developing a complete mechanism for rainwater harvesting system using porous flexible pavements, construction of test track using developed mix, analysis of results and benefit cost analysis for the developed pavements.

Physical properties of aggregate and bitumen were determined by conducting the required tests. Four internationally followed gradations for porous pavements; a porous bituminous mix for Indian standards was developed. A detailed study is going on to understand porous system’s critical design. Further studies include construction considerations, potential challenges and limited applications.
Consultancy projects

Use of Brick Aggregates for Base and Sub-Base Course Treated with Foam Bitumen and also with RAP in Base Course

Sponsored by: National Highways and Infrastructure Development Corporation Limited (NHIDCL)

The project consists of two lane improvement/widening with paved shoulder of Udaipur-Sabroom section of NH-8 in the state of Tripura. Since the use of brick aggregates in cemented sub-base and foam bitumen treated base are not commonly used in the country and very little performance observations of such pavements are available, CSIR-CRRI’s association in the mix design, pavement design and use of brick aggregates in sub-base helped the Authority Engineers & Contractor for appropriate transfer of technology on ground, especially for the North East areas.

Due to paucity of good quality aggregates, over burnt brick aggregates could be used in cement treated sub-base or use with foam bitumen treated Reclaimed asphalt pavement (RAP)/brick aggregate as base layer. Since bricks are readily available or can be manufactured in kilns near job sites therefore it can be replaced with the expensive natural aggregates which are getting depleted in a faster rate. Even IRC-37:2012 permits brick metals which are crushed in the form of brick aggregates and can be used in roads for sub-base and base course layers. It has also been found that a good number of bricks are severely over burnt due to uncontrolled distribution of temperature in the kiln and are dark red in color, severely distorted and swollen. These bricks are considered to be totally waste material but could be used as coarse aggregates in road construction projects based on the routine laboratory tests. It was found that over burnt brick aggregates are much stronger, less water absorptive and denser in general. Therefore, many manufacturers are encouraged to produce such high strength bricks with adequate quality control measures.

On the other hand, Foam Bituminous Mixture (FMB) is a mixture of road construction aggregates (which may be brick aggregates/fresh aggregates/RAP) and foam bitumen. The foam bitumen or expanded
bitumen is produced by a process in which water is injected into the hot bitumen, resulting in spontaneous foaming. The physical properties of the bitumen are temporarily altered when the injected water, on contact with the hot bitumen, is turned into vapour which is trapped in thousands of tiny bitumen bubbles. However the foam dissipates in less than a minute and the bitumen resumes its original properties. In order to produce foam bitumen, the bitumen has to be incorporated into the aggregates while still in its foam state. The philosophy of it is that the foaming increases the surface area of the bitumen and considerably reduces its viscosity, making it well suited for mixing with cold and moist aggregates. It can be used with a variety of materials, ranging from conventional high-quality graded materials and recycled pavement materials to marginal materials such as those having a high plasticity index. Therefore, the combination of Foam bitumen with brick aggregates/RAP within the cold climate and even during wet weather conditions (damp state) shall be a fruitful alternate construction technology in the present stage of non-availability of natural aggregates and limited use of Hot Bituminous Mixtures (HMA) as shown in (Fig. 53,54,55,56).

Consultancy services for Pavement Investigations, Ground Improvement and Design of Approach Road to Railway Goods Platform at Verna Yard, Goa

Sponsored by: Konkan Railway Corporation

Konkan Railway Corporation Ltd (KRCL) constructed an approach road to a Good’s platform at Verna Yard in Goa. This approach road is about 1.7 km long and was constructed on a flexible formation which is about 1.5 to 3.5m above the original ground level at various locations. The west side of the approach road is paddy field, which is separated from the road by a 2.0m wide nalla, in which water flows throughout the year. On the east side of the approach road there is a kutcha drain in which water flows only
during monsoon. The top soil layer of the formation which is approximately about 2.5m depth consists of lateritic soil and gravel. The layer beneath the lateritic soil generally consists of silty-clayey soil underlain by thick fat clay layer.

To assess the condition of flexible pavement, site assessment survey was made wherein the approach road in the beginning of the stretch was in poor to fair condition but towards the yard area the road condition continuously deteriorated. In some portions, the bituminous surface was completely worn out and the aggregate layer was exposed. It has resulted in development of potholes and ruts, which subsequently lead to undulations on the road surface. The presence of fine and plastic material in the base course layer further lead to fast deterioration of the road. At some locations, water pounding along the road side was also observed. The Cross-drainage structures provided at site were inadequate and not very effective.

In view of above a detailed investigations was carried out as specified in the objectives and looking into the cohesiveness of soil obtained through the results obtained from the agency appointed by Konkan Railway Corporation Ltd. for sub-soil investigation, three types of pavement design were suggested which are (i) Road pavement with stabilized sub-base and stabilized base with bituminous base course and bituminous wearing course (ii) Road pavement with granular sub-base and granular base with bituminous base course and bituminous wearing course and (iii) Cement Concrete Road. It was concluded that the condition of existing pavement is poor and there was a need for a major rehabilitation. Though, three options were envisaged but the suitability of concrete pavement is meeting the existing site requirements in comparison to flexible pavement for both i.e. approach road and Verna yard area, as first option. The reason being is that the movement of heavy goods vehicles, machineries and spillage of oil during loading and unloading period. However, to reduce the construction cost as well as ease of construction, flexible pavement rehabilitation with geo composite may also be suitable for approach road as second option as shown in (Fig. 57).
Assessment of Riding Quality of Agra Lucknow Access Controlled Expressway Using Laser Profilometer

Sponsored by: M/s Afcons Infrastructure Pvt. Limited, M/s PNC Infratech Limited, M/s NCC Limited and M/s L&T Pvt. Limited

Under this pavement evaluation activity, the Institute has undertaken roughness evaluation study using Laser Profilometer of newly constructed 6-lane Agra Lucknow access controlled expressway in the State of Uttar Pradesh. It is the longest expressway in India. The expressway reduced the distance between the cities of Agra and Lucknow in the Indian State of Uttar Pradesh. (Fig. 58, 59).

International roughness index evaluation report for the entire expressway was submitted to the respective clients.

Geotechnical Investigations and Pavement Design for Basabani Khamadi Road in District of Shimla, Himachal Pradesh

Sponsored by: Public Works Department, Himachal Pradesh

During field investigation, it was observed that the existing road generally consists of 2 layers of WBM and a thin premix carpet. It was further observed during test pits excavation that the pavement layer was founded on the existing formation of the soft disintegrated rock bed. This rock can be categorized as schist with medium to large flat sheet like groins in a preferred orientation (nearby grains are roughly parallel). It was found to have more than 50% platy and elongated minerals. It majorly contains micas & others minerals like biotite or muscovite. Since schist is foliated, the individual grains split off easily into flakes or slabs. Immediately below the schist, some fine grained days & muds were also observed in thin consolidated layers. After the field investigations and analysis of lab results, the recommendations for design of pavement crust and shoulder crust was given for throughout the length of project. The recommended cross section of the pavement crust is given as in Fig. 60. Further the recommendation for longitudinal and cross drainage system is also given to the client.
Demonstration and quality audit for using new technology for recycling of pavement materials for widening and strengthening Sikandra- Jhinjhak -Resulabad road (MDR 47) in Kanpur Dehat District

Sponsored by : Public Works Department, Uttar Pradesh

During the site visit detailed interaction with Netherlands experts has been made regarding construction machinery deployed and construction methodology adopted at site. The scope of works include supervision for laying, spreading and compaction of existing granular materials by adding cement and admixture (Geocrete) using self-propelled cement spreader which works with microprocessor based technology and spread materials at controlled spray rate. The aggregates were pulverized/stabilized using four wheeled driven recycler having working depth upto 50 CM with variable depth control system. The pulverized mix, spreaded cement and additives have been compacted with 20 Ton roller to achieve design compressive strength. Further suggestions were given for development of site laboratory. The construction supervision has been provided for different specifications for soil aggregate stabilised layer, Wet Mix Macadam, Dense Bituminous Macadam and Bituminous Concrete. The site work is shown in Fig. 61 & Fig. 62.

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 PWD Roads

Sponsored by : Works Department, Odisha

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

Fig. 60 : Typical View of Heavy Snowfall in Project Area during March 2017

Fig. 61 : Site work

Fig. 62 : Site Work
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. The field work using automated road survey system was started in the month of Jan, 2018. The field work is under progress as shown in Fig. 62 & Fig. 63.

- Visual assessment of pavement surface condition Fig. 63.
- Classified traffic volume studies on selected roads Fig. 64.
- Roughness measurements using Roughometer III Fig. 65.

Based on the levels of total surface distress and roughness, needed remedial measures covering both modern technologies like micro-surfacing, stone matrix asphalt and conventional hot bituminous mixes have been suggested for improvement of these roads.

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

**Sponsored by:** New Delhi Municipal Council

The project was taken up at the request of Executive Engineer (RIP), NDMC, New Delhi for evaluation of selected roads (36 Nos.) in NDMC area towards suggesting improvement measures needed to achieve high service standards and good quality roads.

In order to arrive at the improvement measures, the following field studies had been conducted:
Structural and Functional Evaluation of Jetpur - Gondal - Rajkot Road (NH - 27), from Km. 117+600 to Km. 184+700

Sponsored by: West Gujarat Expressway Limited, Rajkot, Gujarat

The road section under this study was located in the Rajkot district of Gujarat State, which is an industrial district of Gujarat. With the objective to evaluate the existing condition of road stretch from Km. 117.600 to Km. 184.700 in terms of its structural strength through Benkelman beam deflection test and functional evaluation through roughness measurements using fifth wheel Bump Integrator the field work was executed in the month of September 2017 as shown in Fig. 67 Fig. 68.

The characteristic deflection data and roughness index data was reported for the study road section.
Bridge Engineering and Structures
Research Projects

Technological Solutions for Enabling Smart Infrastructure: Integrating Piezoelectric Energy Harvesting and Structural Health Monitoring in a Smart City.

Sponsored by: Department of Science and Technology (DST)

Work Done- Piezo-electric Energy Harvesting

Piezoelectric energy harvester (PEH) was surface bonded on the road (Fig. 71), and moving vehicular load was applied over it to explore its energy harvesting potential. Effect of different road surfaces, vehicular speeds and vehicular loads including car, loaded truck have been explored. Different size of piezo patches as PEH have also been explored. Increasing speed and weight of vehicle increases the piezoelectric energy generation. Higher stiffness of the road surface increases piezoelectric energy. Larger area of the piezo patch also results in more piezoelectric energy generation. Energy generated by PEH for speed of 40 km/h under different vehicular loads is shown in Fig. 72.

Study of Flexural Behaviour of RC Beams Strengthened using CFRP Strand Sheet under Static and Cyclic Loading (OLP-0586)

Sponsored by: CSIR-CRRI

Scope of Work:

During the experimental work for both the phases, the parameters to be studied are as follows:
Research & Development

Bridge Engineering and Structures

- Strains in specimens at mid span (Top and Bottom along the location depth of specimens) and at identified locations on the CFRP Strand sheet
- Study of crack pattern;
- Failure modes under ultimate load conditions;
- Deformation of specimens at mid span during the loading condition.

CFRP can be used in the form of fabric, laminates and rods either in Externally Plate Bonded (EPB) and Near Surface Mounted (NSM) techniques. As far as static load behaviour of retrofitted reinforced concrete structures is concerned, various code of practice from different countries have reported various provisions for using CFRP strips, fabric and rods, but still fatigue behaviour has not been covered so far. Subsequently, with the development of new geometric shape in the form of Strand sheets, CFRP can be used to enhance the flexural capacity and have the following advantage over laminates, fabric and rods.

- No primer coating for surface smoothening
- No pin hole filling is needed as selective adhesive paste works as primer and surface smoothening hence reduces the execution period leading to low construction cost.
- No need of resin impregnation.

To know the structural performance of CFRP Strand Sheet, the proposed experimental programme includes testing of two Reference Beams and two strengthened RCC beam with CFRP Strand Sheet for both static and cyclic loading.

In Phase I, Static test of Reference and Strengthened Beams were completed and detailed data processing is under process. As an initial finding, it is observed that the strand sheet having same mechanical properties can be used for flexural strengthening of distressed reinforced concrete structures at par with CFRP strips, fabric and rods.

The Fig. 73, 74 and 75 shows the fixing of strain gauges, testing of reference and strengthened specimen during the experimental program respectively.
Investigations on outer carriageway of grade separator at polytechnic crossing, Lucknow during and after its strengthening.

Sponsored by: PWD

Introduction

Grade-separator, connecting Sitapur on one side and Faizabad on the other side was constructed at Polytechnic crossing in Lucknow city and opened to traffic in March 2009. This Grade separator has a curved alignment in plan and has two carriageways namely ‘Inner Carriageway’ (Sitapur to Faizabad) and ‘Outer Carriageway’ (Faizabad to Sitapur). Each carriageway has four spans of single cell box-girder shape and simply supported over a pair of pot bearings on each support. The span length of box girder on Outer and Inner carriageway is about 35.5m and 31.3m respectively. Each box girder is prestressed with 18 numbers of prestressing tendons. There is provision for the future prestressing also inside all the box girders. Aerial view of the Grade separator is shown in Fig. -76.

National Highway Circle, Public Works Department, Lucknow (PWD) approached CSIR-CRRI for suggesting remedial measures for the distresses observed in deck slab (i.e. caving of concrete as shown in Fig. -77) of one of the span of Outer carriageway of the Grade separator. PWD informed that due to this distress, plying of traffic has been stopped over Outer carriageway. Subsequently, PWD also requested CSIR-CRRI to inspect all the spans of the grade separator and suggest suitable strengthening measures, if required.
Objectives and Methodology

The objectives of the study were to assess the present condition of the grade separator and to suggest suitable strengthening measures. To achieve the above objectives, following methodology was adopted:

- Detailed visual inspection of the grade separator
- Review of structural analysis, design and drawings of superstructure of Outer and Inner carriageways
- Study of available records/past inspection reports/past repairs/strengthening reports, if any
- Non-destructive testing of the various structural members
- Extraction and testing of concrete cores
- Analytical studies for load testing of superstructure
- Load testing of superstructure
- Vibration studies of superstructure
- Suggestions of strengthening measures
- Random checking of strengthening work during execution

Results of Study

- Based on visual inspection, following distresses were observed in the Grade Separator:
  - Caving of concrete from deck of span P1-P2 (Outer carriageway)
  - Minor cracks in almost all the box-girders
  - Transverse crack in span P2-P3 (outer carriageway) in the vicinity of end diaphragm near Pier P2
  - Multiple cracks in pier caps of Pier P2 and Pier P3 on Outer Carriageway
  - Honeycombing in concrete at various locations
  - Mismatch of joints between two lifts of concreting in the webs
  - Lack of surface finishes of concrete at several locations of box-girders, blister blocks, bearing pedestals, piers/abutments and pier/abutment caps.
  - Partially filled expansion joints
  - Level difference on road surfaces across the expansion joints
  - Damaged/dislodged neoprene seal in most of the expansion joints
  - Undulations in road surface
  - Peripheral cracks around bearing plates in some of the blister blocks
  - Uncapped/improper surface finishes of end anchorage of prestressing cables
  - Inadequate height of crash barrier near footpath
  - Presence of projected nipples, used for grouting in the past

Past records related to construction, inspection, repairs/strengthening could not be made available by PWD to CSIR-CRRI.

Under Non-destructive testing, Schmidt rebound hammer test, Ultrasonic Pulse velocity test, Carbonation test and Rebar locator test were conducted on randomly selected locations of few selected spans. Concrete cores were also extracted from the randomly selected locations in webs and deck slabs. From Schmidt rebound hammer test, it can be concluded that the in-situ cube equivalent compressive strength of concrete is about M40 grade in the webs of both the carriageway i.e., outer and inner carriageway of tested span. The deck slab of both the carriageways also exhibited in-situ cube equivalent compressive strength of concrete about M40 grade except outer carriageway where some local honeycombing was observed. Results of UPV test reveals that the in-situ concrete quality of both the webs of both carriageways falls in the category of “Good” quality concrete in diaphragm also falls in the category of “Good” quality of concrete. The deck slab falls in the category of “Good” to “Medium” quality concrete. Core test results reveal that concrete in the deck slab and webs of the grade separator is not up to the mark.

The bridge superstructure of outer carriageway was analysed using software RM-V10-Advance and STAAD.Pro V8i for obtaining maximum bending
moments due to the movement of IRC vehicles as per design report. Out of the IRC loading namely 2-Lane of IRC class A and IRC class 70R (IRC 6-2014) inclusive of impact factor, it was found that IRC class 70R was the governing load for this span of the grade separator. Typical bending moment diagram and deflection of the span under these loads is shown in the Fig. -78 & 79. From these figures, it is observed that the maximum vertical deflection is 9.85mm at the mid-span. Then location of placement of the loaded trucks was decided to get this maximum bending moment for load test. For this, six numbers of loaded trucks (of about 22 Tons gross vehicle weight) were placed over the span to generate a bending moment 8029 kN.m which was about 99.23% of IRC loading.

To measure the vertical deflections of the span during load testing, dial gauges were installed at predefined locations using CRRI suspended wire technique as shown in Fig. -80 & 81. Movements of the bearings of the test span were also monitored during the load test. Loaded trucks were placed over the span at the predefined locations in several stages over the span (Fig. -82) and deflections were measured. Load test was conducted as per provisions given in IRC-SP-37. Some of the views of load test are given below.
Fig. 81: Dial gauges for measurement of deflection of the superstructure

Fig. 82: Placement of Loaded trucks over the Span
From the static load test of span P2-P3 (Outer carriageway), it can be concluded that bridge span is behaving elastically as the recovery is more than required one as well as the deflection at mid span of box girder was comparable to the theoretical values. Thus, the span meets the deflection criterion of IRC-SP-37. The bearings of the span P2-P3 (Outer carriageway) behaved satisfactorily during load test.

Vibration studies suggest that the bridge is not vulnerable to pedestrians for normal traffic. Hence, from vibration point of view, the bridge is safe.

Suggestions

- Repair of caved-in portion of deck slab by micro-concrete and shattered/honeycombed areas by injecting low viscosity epoxy
- Strengthening of Pier Caps by Jacketing
- Repair of Transverse crack in span P2-P3 (Outer carriageway)
- Strengthening of all box-girders by Injecting Low Viscosity Epoxy
- External prestressing of span P1-P2 of Outer carriageway
- Transverse strengthening of deck slab of all the eight spans using CFRP
- Longitudinal and transverse strengthening of external surfaces of span P1-P2 (Outer carriageway) using CFRP/GFRP
- Laying of Concrete Overlay over Bridge Deck
- Levelling/refixing of Expansion joints
- Raising the Height of Existing Hand rails on footpath side
- Installation of Weigh bridges
- Redesign of Intersection
- Repairs of Internal/External surfaces of the box-girders as well as external surfaces of the Piers/Abutments and their Caps

Keeping the inconvenience of the commuters in view, CSIR-CRRI recommended that PWD may allow light vehicles to ply over the outer carriageway of the grade separator with speed restrictions after completion of the repairs/strengthening work of span P1-P2 and span P2-P3.

Random Checking of Strengthening Work

The strengthening work in Outer carriageway, executed by the PWD, was witnessed randomly by the CRRI during its execution. Photos of the various stages of strengthening are shown in Figs.-83 to 90.
Fig. 84: Typical views of epoxy injection nipples in the box girder of span P1-P2

Fig. 85: Transverse bonding of CFRP wrap on soffit of deck slab

Fig. 86: End anchorage of CFRP wrap to avoid debonding of wrap
Fig. 87: Externally applied CCFRP/GFRP to span P1-P2

Fig. 88: Fixing of new Expansion Joint at Abutment A2 is in Progress

Fig. 89: Fixing of steel reinforcement in span P2-P3 before Concrete overlay
Concrete cores were extracted from the webs of span P1-P2 after the completion of injection grouting work. UPV testing of extracted concrete cores revealed that the homogeneity of in-situ concrete has improved considerably from “Good” quality category to “Excellent” category after injecting low viscosity epoxy.

After completion of strengthening work on Outer carriageway, Load test of span P1-P2 was carried out to check the efficacy of the executed strengthening works. From the static load test, it can be concluded that bridge span is behaving elastically as the recovery is more than required one. Though, the span meets the deflection criterion of IRC-SP-37, need to improve the flexural rigidity of the span was felt as the maximum measured deflections during load test was more than the analytical value. The bearings of span P1-P2 behaved satisfactorily.

The dominant modes of vibration of the span P1-P2 are obtained at different locations of the span. The similar magnitude of vibration frequency at different locations infers that span behaves monolithically. The first flexure frequency and the vertical deflection highlights that the bridge is not vulnerable pedestrians of medium magnitude and is safe in lateral mode too.

The Grade separator was open to light vehicular traffic in November 2017. After the completion of external prestressing work in span P1-P2 and remaining strengthening work of Outer carriageway, outer carriageway of the Grade separator was opened to the heavy traffic also on January 10, 2018.

The strengthening work of four spans of Inner Carriageway is being taken up by PWD and expected to be completely shortly.

**Reliability of Seismic Resilient Bridges on an Urban Mass Rapid Transport Network.**

**Sponsored by : Department of Science and Technology (DST)**

Seismic loads are random and unpredictable thus require tools to analyse structures under these varying loads by careful modelling so as to capture the true behaviour of the structure under different intensities and characteristics of the earthquake loads. One such tool is Pushover (PO) Analysis which is a Nonlinear static analysis (PO/NSP) and is a numerical tool which is used to determine the
displacement and rotation capacity of the structure to ensure desired seismic performance. A structure is subjected to monotonically increasing lateral load until a target displacement is achieved or the structure collapses. The target displacement is the anticipated maximum displacement to be experienced under the design earthquake. The load is increased in steps for obtaining the response parameter (displacement). The result of the NSP is a capacity curve, a curve relating base shear and the lateral displacement at the control node. The capacity curve may also be expressed in the form of spectral acceleration vs. spectral displacement at the control node. A control node is a node used to monitor the target displacement. It should have maximum deflection and should reflect the true behaviour of the structure. The control node in this study has been taken as the centre of mass at the top of the pier.

The fragility function is a probabilistic tool being used to estimate the likely damage to occur during a seismic event. The fragility curves define the probability that the expected global damage, d, of a structure exceeds a predefined damage state, dsi, as a function of a parameter quantifying the severity of the seismic activity. Therefore, for each damage state, the corresponding fragility curve is completely defined by plotting P[d > dsi] vs. drift ratio (dr). For a given damage state (dsi), the fragility curve is well defined by the following lognormal probability density function.

\[
p[-] = F \ln \frac{d - d_{si}}{d_{si}}
\]

Where,

\(dr\) is the drift ratio (seismic hazard parameter), at which the bridge reaches a certain threshold of the damage state, \(d_{si}\),

\(\beta_{eq}\) is equivalent lognormal standard deviation obtained from convolution of demand and capacity deviations.

\(\beta_c\) is Standard deviation of the natural logarithm of the IM of the predefined damage state \(ds_i\),

\(\beta_d\) Standard deviation of the natural logarithm of the demand/seismic hazard,

\(\Phi\) is the standard normal cumulative distribution function.

In this study, the capacities or limit states of various bridge components are assumed to follow a lognormal distribution. Each median have uncertainty associated with it which needs to be defined. This uncertainty is given in the form of a lognormal standard deviation. When enough information is not available for the assessment of the dispersion for each limit state, it is still beneficial to account for some degree of uncertainty. The assignment of this uncertainty can be done in a subjective manner. Estimates of the lognormal standard deviation are made for the three different limit states.

A limit state is a state beyond which the structure is unable to meet the required design performance. Limit states taken under consideration are defined as per FEMA356: 2000 and ATC 40. The limit states are defined as the maximum drift ratio. It is recognized that drift ratio associated with specific limit states may vary significantly for different types of structural systems. The slight damage corresponds to fully operational, immediate occupancy while the moderate damage is characterized by operational condition where damages are controllable and repairable. The collapse prevention level defines the condition of the bridge where damage is severe, near collapse and corresponds to life safety. The drift ratio can be expressed as;

\[
\text{Drift ratio} = \frac{\Delta}{t}
\]

Where \(\Delta\) is the maximum displacement at the pier top and \(t\) is the height of the pier plus pile. Fig. -91 shows the pier of the bridge considered for the study and Fig. -92 Fragility curves obtained by PO.
The reliability indices obtained from Pushover analysis varies from 1.94 to 2.14. These results are based on 50-year return period of the seismic activity. The reliability indices obtained from the two analysis makes it clear that the bridge fulfils the criteria for the serviceability (>1.5). The pier top displacement observed in the present study using PO for a seismic demand of 0.24g (PGA) is 67.00 mm. The reliability indices are 1.94 to 2.14 when Pushover analysis is used (Fig. 93). This study will help in evolving reliable design methodology thus ensuring the performance levels of the bridges and insight of failure of bridges to minimise seismic risk of infrastructures. The study is further advanced to assess the reliability of the transport network consisting of several bridges.

**Evaluation of condition of Ranjit Singh flyover connecting Barakhamba road and Matasundri road, New Delhi**

**Sponsored by**: Municipal Corporation New Delhi

**Detailed Objective and Scope**

- Condition survey of all the spans
- Non-destructive testing of the accessible spans including substructure
- Vibration studies
- Core extraction and testing from selected spans, if necessary
- Recommendations for repair/strengthening of fly over
- Preparation of BOQ, Detailed specification, cost estimate
- Supervision during execution of strengthening works at random intervals (10% of total work)

Various stages of non destructive testing have been show in the Fig. 94 & 95.
Fig. 94: Inspection and Non Destructive Testing of structure
Status: Inspection Report containing observations and conclusions, recommendations for repair and, BOQ, detailed specifications and cost estimate has been submitted to the client.

**Review of Instrumentation scheme, data observed and suggestions for remedial measures of three bridges under Lumding - Silchar B G Rail line in the state of Assam**

**Sponsored by: Funding Agency : M/s RITES Limited**

Objective and Scope: The scope of the project comprises of inspection of three instrumented bridges, study of the instrumentation scheme, data collected and provide suggestions for the additional instrumentation and strengthening measures.

Work Done: A Joint Site visit was carried out by the officials of CSIR-CRRI, NEF Railways, Rites Limited and Geo-Consultant for all the three bridges (Bridge Nos.230,267 and 365)) during January, 2017. During the site visit detailed inspection was carried out of the approaches, bridge components and the installed instruments. Subsequently, the instrumentation scheme adopted for these three bridges and the eighteen months (June 2016-Jan 2018) data collected through instrumentation, i.e., tilt meter, vibrating wire sensors and 3-D displacement measuring instruments were studied. Based on the study, observations on instrumentation scheme, data collected and further data collection required and appropriate sensors and instruments have been suggested for performance monitoring of these bridges. Figs. 96 to 99 shows the general view of bridges.
Instrumentation has been done for the deflection and tilt measurements on abutment/piers as shown in Fig. -100. To measure crack width vibrating wire strain gauge has been installed across the cracks as shown in Fig. -101.

Observations on data collected through instrumentation are given below:

(a) There is no significant change observed in Northing, Easting and vertical settlement of the piers during June, 2016 to Jan, 2018.

(b) There is no tilt observed in the piers during June, 2016 to Jan, 2018.

(c) There are some local deformations observed in the left side slope of embankment (Lumding-Silcher direction) of the bridge no. 267 away from abutment.

(d) There is a change in crack width observed in the order of 0.3mm and 0.2mm on the side walls of the first RCC Box near abutment at bridge no. 365.

(e) Bridge Structure looks to be in good condition.

Investigation of Cracks on the Abutment Cap A2 of Major RUB, IOCL and RFO at Tundla, Agra (UP) of LOT-102 of APC-1 Package Bhaupur - Khurja Section of Eastern Dedicated Freight Corridor

Sponsored by : M/s TATA-AL DESA (JV)

TATA-ALDESA (JV) have been engaged in Design and Construction of Civil, Structures and Track Works for Double Line Railway involving formation of Embankments/Cuttings, Ballast on Formation, Track Works, Bridges, Structures, Building including Testing and Commissioning on Design – Build Lump
Sum basis for Bhaupur – Khurja Section of Eastern Dedicated Freight Corridor – Contract Package Lot 101, 102 and 103 APL-1 Package. As a part of the construction, a major road bridge comprising 2×m composite girders was in progress near Tundla crossing NH 2. It is skew to the direction of rail tracks. Both the abutments as well as pier are of mass concrete and are founded on 1 m diameter piles. At the time of investigations, abutments and pile caps had been completed. Structural configuration of the other two bridges, IOCL and RFO, is similar to the Major RUB.

As per the records of TATA-AL DESA (JV), Abutment Cap for A2 of the major RUB was cast on 30.11.2015. About a week back, it was observed that cracks have formed on the top of the abutment in the direction of movement of traffic, perpendicular to the length of the abutment. The cracks emanate from the corners of the proposed seismic arrestors and extend to the edge of the abutments on either side. Cores were taken at 5 locations along the cracks and it is found that the cracks extend up to 75 – 100 % of the depth of the core taken (35 cm). Similar cracks have been observed in the other two structures, IOCL and RFO.

In view of the above, the scope of the subject work is as follows.

- To investigate the reasons for development of cracks and establish the root cause
- To advise the repair methods and remedial measures to prevent further development and propagation as well as monitoring method.
- To advise on long term effects of these cracks, if any, on serviceability and durability of the structure taking into account the repairs carried out as per the above advice.
- Any other aspects as may come to notice during investigation / review.

Consequent upon thorough scrutiny of the relevant project records, following observations have been made.

1. Concrete Mix Design is OK.
2. As per the provided Test reports, the used construction materials i.e. cement, sand, coarse aggregates, water, concrete admixture conform to the BIS norms.
3. Provided structural design calculations for the Abutment Cap and abutment Walls, the structural design was found o.k. with respect to the norms of IRS Concrete Bridge Code. The quantity of the Secondary reinforcement as per the Clause 15.9.4.2 of the IRS Concrete Bridge Code was found o.k.

As per the provided structural design calculations, the subject Abutment Caps fulfill this criteria as per the IRS Concrete Bridge Code.

Preliminary Site Inspection

A Preliminary Site Inspection was carried out by CSIR-CRRI on 23.08.2016 to assess the actual quantum of work involved. On the basis of Site Inspection, it was decided to carry out the on-site quality evaluation of the constructed structures using NDT techniques namely using Rebound Hammer, Ultrasonic Pulse Velocity and Cover Meter. It was suggested to TATA – ALDESA that the observed cracks’ movement should be monitored regularly using the Glass Tell Tales technique by making proper records. It was also suggested that the installed Glass Tell Tales should be properly protected on account of movements of the site workers on the structures.

Non-Destructive Evaluation of Structures

Schmidt’s Rebound Hammer Test

N-Type Schmidt’s Rebound Hammer capable of imparting impact energy of 2.207 N-m was used to estimate the in-place compressive strength of concrete.

Ultrasonic Pulse Velocity Test using PUNDIT

Portable Ultrasonic Non-destructive Digital Indicating Tester (PUNDIT) was used to know the homogeneity of concrete. IS 13311 (Part 1) deals with the Ultrasonic Pulse Velocity method.

Cover Meter Test

Electromagnetic methods are commonly used to determine the location and cover to reinforcement embedded in concrete. Battery–operated devices commercially available for this purpose are commonly known as Cover meters or profometers. Proceq make profometer was used for subject structures.

Crack Monitoring using Glass Tell Tales

Glass Tell Tales have been used for the monitoring of cracks’ movement.

Non destructive testing and site investigations are shown in Fig. 102 and Fig. 103.
Fig. 102: Non Destructive Testing of structures
Interpretation of Results of NDT Measurements

The range of Rebound Hammer and UPV measurements observed on the subject structures are as follows.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Range of Rebound Hammer Measurements</th>
<th>Range of Indicative Compressive Strength (MPa)</th>
<th>Range of UPV Measurements (Km/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJRUB – A1</td>
<td>46.5 - 55.6</td>
<td>45 – 61</td>
<td>3.5 – (&gt;4.0)</td>
</tr>
<tr>
<td>MJRUB – A2</td>
<td>45 – 56.82</td>
<td>42.4 - 61</td>
<td>3.5 – (&gt;4.0)</td>
</tr>
<tr>
<td>RFO A – 1</td>
<td>48 – 59</td>
<td>48 – 61</td>
<td>3.5 – (&gt;4.0)</td>
</tr>
<tr>
<td>RFO A – 2</td>
<td>51 – 60</td>
<td>53.5 – 61</td>
<td>3.5 – (&gt;4.0)</td>
</tr>
<tr>
<td>IOCL A - 1</td>
<td>44 – 54</td>
<td>40.6 – 59.1</td>
<td>3.5 – (&gt;4.0)</td>
</tr>
<tr>
<td>IOCL A - 2</td>
<td>40.5 - 55</td>
<td>35 - 61</td>
<td>3.5 – (&gt;4.0)</td>
</tr>
</tbody>
</table>

Cause – Effect Analysis for Development of Cracks

The probable reasons for the observed cracks can be attributed to the thermal cracking aspect arising due to the stage construction of the Abutment Walls and Caps having probable deviations from the standard construction practices attributable to the site conditions.

Delay in concreting of various lifts in the stage construction of the abutment walls can produce restraining effect at the layer of old concrete and new concrete due to shrinkage on account of temperature variations due to the generated heat of hydration in green concrete. If the increased temperature of concrete is not addressed by appropriate means, this can further lead to the development of the cracks in the structures.

Rehabilitation Measures

(a) The observed cracks should be sealed properly to safeguard against probable occurrence of corrosion of rebars due to water penetration.

(b) Consequent upon the Site Inspection carried out by the Team of CSIR-CRRI, New Delhi, in September 2016, it was suggested that the Crack Monitoring activity using Glass Tell tales by the TATA – ALDESA (JV) should be continued at least for a period of 2-3 months so as to identify the ‘Active Cracks’, and ‘Passive Cracks’ clearly. The observed cracks have been the non-structural cracks as there is no design deficiency as per the IRS Bridge Code has been found and the loads are still not been applied. As per the regular crack monitoring reports shared by TATA – ALDESA (JV), the observed cracks are now appeared to be in stable condition and no further crack movements have been observed.

(c) Sealing of the observed cracks with a suitable low viscosity epoxy resin through pressure grouting can be adopted.
Traffic Engineering
and Safety
Research Projects

Indian Highway Capacity Manual
Sponsored by: CSIR, New Delhi

The need for an Indian Highway Capacity Manual has been felt for a long time by researchers, policy makers and planners in the country. It was emphasized by the Government of India also in 2012 when the then Planning Commission expressed the immediate need for initiating a comprehensive research study focusing on scientific estimation of the roadway capacity in India in their Eleventh Five Year Plan 2007-12 document. Accordingly, the Council of Scientific and Industrial Research (CSIR) sponsored a research project entitled “Indian Highway Capacity Manual” (referred as ‘Indo-HCM’ Manual) to CSIR - CRRI in 2012 in the form of mission mode project.

The development of Indo-HCM was not an easy task considering the vast size of the country and variety of roads and traffic mix. Therefore, CSIR-CRRI identified seven prominent academic institutes located in different regions in the country to provide technical support for all the Work Packages as well as to assume the role of Regional Coordinators for one or two work packages depending upon their expertise. The seven academic institutions identified are Indian Institute of Technology Roorkee, Indian Institute of Technology Bombay, Mumbai, Indian Institute of Technology, Guwahati, School of Planning and Architecture, New Delhi, Indian Institute of Engineering and Science and Technology, Shibpur, (Howrah), Sardar Vallabhai Patel National Institute of Technology, Surat and Anna University, Chennai. This was the maiden attempt made to network with such a large number of academic institutes on the lines of HCM of USA. This mission mode project led by CSIR-CRRI was completed on time with regular monitoring at different levels to achieve the desired quality which has showcased once again the technical prowess and management expertise of CSIR-CRRI in handling large size projects. Transportation and Highway professionals can now follow the realistic capacity values evolved in this manual while undertaking the projects of evaluation of existing road facility or planning of any new road facility. Each chapter deals with the procedure for the estimation of capacity and Level of Service (LOS) through a series of steps and culminates with typical illustrative examples. It is expected that this document can serve the society as a basic guide for the practicing engineers and decision makers towards capacity augmentation of various types of road and pedestrian facilities in India.

Driver Decision Modelling for Safety Evaluation at the onset of Yellow Light Transition
Sponsored by: CSIR - Central Road Research Institute

In the first stage, work done by the various researchers was studied thoroughly in the context of dilemma zone conflicts at signalized intersection. Six tasks were completed to fulfill the identified objectives:

1. Literature review: study of influencing parameter in Indian context at signalized intersection (Chandra, 1999)
2. Experimental design framework
3. Onsite data collection through video graphic survey
4. Data analysis and study of human learning technique
5. Surrogate measure to minimize the conflicts
6. Cost–Benefit analysis of conflicts and delay caused due to driver's indecisiveness

Five signalized intersections chosen in Delhi catering to varying traffic flow and possessing different intersection characteristics as typically shown in Fig. 104 was selected. At the above candidate intersections, analyzing driver behavior is a complex and tedious process.
When drivers are subjected to yellow signal, their behavior becomes erroneous and subjective to the surrounding circumstances. Present study tries to dissect the different driver’s behavioral phenomena under the composite traffic mix environs prevailing at signalized intersection at the yellow onset. The overall objectives of this research were to develop an efficient and effective system for driver protection in the dynamic dilemma zone and to propose a guideline to decide the dynamic dilemma zone range for different approach speed by analyzing the influencing parameters that affects the dilemma zone distance. In the process of achieving the broad objectives, a noble economic approach is proposed by implementing breakeven analysis to the driver safety. A comprehensive investigation of the influence of vehicle types and other contributing factors to the dilemma zone driver behavior is analyzed by collecting Videography data at five major intersections in Delhi during morning peak hours of traffic flow from 9 am to 1 pm. The candidate intersections have been selected strategically so as to reflect diversity in various parameters such as road geometry, traffic composition and signal characteristics. Results obtained from the above research indicate the presence of strong correlation between dilemma zone parameters. Further, the dilemma zone look-up chart developed as part of this study would be helpful for the traffic planners and decision makers to decide the dynamic dilemma zone range and accordingly help in designing optimal signal strategy for driver safety.

In addition, the economic study i.e. cost - benefit analysis carried out in respect of the dilemma zone gives a balanced approach between driver safety and time value of money. This research recommends formalization of data collection strategy and improvement of evaluation techniques for analyzing dilemma zone issues. As cost -benefit study has been carried out in regards to number of conflicts and additional delay caused for opposing traffic because of clearing off existing vehicle in Dilemma Study (DZ), the study outcome would be useful for the traffic planners and decision makers to revisit the safety aspects in the candidate intersection(s) not only in terms design but also in terms of monetary values as far as human life is concerned. In the end, this study will be useful as a surrogate measure for dilemma zone protection systems as well as for the determination of optimal clearance time.

Devising Novel Methods in Driver Testing and Certification

Sponsored by : CSIR-CRRI

This study focuses on improving safety practices among selected categories of drivers by resorting to scientific screening methods during the licensing process. Driving simulator, Visual acuity tester and Vienna test system have been used as system tools to achieve the study objectives. Simple reaction time, Depth perception, Visual Acuity, Night vision, Glare Recovery test, road sign Test, Hand grip test and Sensorimotor tests have been included to observe the performance of drivers. 162 Drivers performing High Responsibility Driving Tasks i.e. Special Protection Group Drivers (SPG) and Heavy Commercial Vehicle (HMV) drivers have been selected for the above-mentioned tests. The evaluation of the above selected subjects was done by using 5-point Likert scale analysis and the results are given in Table 1. The ongoing study is expected to address different issues of the driver characteristics e.g. risk taking behavior, their tolerance capacity, etc. will be helpful to formulate different behavioral models. Based on the outcome derived in this study and its subsequent implementation, it is hoped that it can help to reduce the incidences of road crash situations and pattern of crashes during long and monotonous driving.

More especially this research will be effective for the commercial drivers who drive on long routes. In
this context, data collected using driving simulator tool and observations from simulated data have been collected. The tests that are being carried out amongst drivers included Reaction Time (RT), Determination Test (DT), Adaptive Tachistoscopic Traffic Perception Test (ATAVT), Cognitrone (COG), INSSV i.e. Intelligence Test, Inventory of Driving related Personality Traits, Glare Recovery and Eye Test i.e. Vision Screening Test.

Driving Task using 5-point Likert scale

<table>
<thead>
<tr>
<th>Performance Rating Parameters</th>
<th>Outstanding (%)</th>
<th>Excellent (%)</th>
<th>Very Good (%)</th>
<th>Good (%)</th>
<th>Reasonably Good (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth perception</td>
<td>11</td>
<td>62</td>
<td>25</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Glare recovery test</td>
<td>25</td>
<td>31</td>
<td>36</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Night Vision Test</td>
<td>5</td>
<td>44</td>
<td>47</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Road Sign Test</td>
<td>9</td>
<td>72</td>
<td>19</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Hand Grip Test</td>
<td>25</td>
<td>23</td>
<td>35</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Driving Rating scale</td>
<td>1</td>
<td>2</td>
<td>53</td>
<td>42</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3: Performance rating of Drivers with High Responsibility

The preliminary results derived from the above ongoing study revealed that only Short Route drivers from the present sample population performed “Good and above” in the above tests while none of the Long Route drivers performed “Good” in the present study. This emphasizes the urgent for the special screening and training facilities among Long Distance Route for the vision related tests.

Consultancy Projects:

Road Safety Audit of 20.00 Km Stretch of Agartala Capital City Road, Tripura

Sponsored by: Public Works Department (R&B), Agartala, Tripura

CSIR-CRRI study team conducted audit of the Lichubagan Tri Junction to Mohanpur Road (refer Fig. 105 and Fig. 106) and identified deficiencies in terms of alignment, cross-sections, shoulders, footpaths, shoulders, facilities, road markings, road signs, night time visibility, roadside furniture, pedestrian facilities, roadside hazards and impact due to emerging land use development. Based on the above, necessary improvements to the road corridor have been suggested. It is highly recommended that the suggested measures shall be implemented as per the recommendations which are expected to help in mitigating the road crashes. Lane markings and median edge markings shall be put coupled with reflective studs which will improve both safety and aesthetic appearance of the Road. Put reflective studs on lane marking and median edges for better visibility as well as aesthetic appearance.

Fig. 105: Typical View of Study Section

Fig. 106: Typical Characteristics of Road Crashes on the Study Corridor
Road Safety Audit and Review of Hoardings Erected in the Bharatpur Town, Rajasthan

Sponsored by: Urban Improvement Trust (UIT) Bharatpur, Rajasthan

The selected road sections for carrying out the safety audit covers majority of the City road network and include eleven roads covering all the major junctions as well as bottlenecks of the city road network and are chosen by UIT based on traffic and safety problems. As part of the project, following traffic surveys besides road safety audit were carried out on the study sections encompassing the part of Road Safety Audit (RSA) assessment of the study corridors as shown in Fig. -107.

- Spot Speed survey
- Speed and Delay Studies

Road surface condition; Shoulders, footpaths; Side slopes, drainage facilities; Traffic Control Device Like Road Signs, Road Markings and Signals; Road lighting; Bridges/Cross Drainage (CD) works; Road Crash Prone Spots/Black spots and Roadside hazards and Facilities for Non-Motorized Traffic (NMT) as shown in Fig. 109.

**RSA observations:** Road safety audit was conducted by CSIR-CRRI team and observations on various safety issues were made. The checklists for RSA covered the following aspects:

- Road surface condition
- Shoulders, footpaths
- Side slopes, drainage facilities
- Traffic Control Device Like Road Signs, Road Markings and Signals
- Road lighting
- Bridges/Cross Drainage (CD) works
- Road Crash Prone Spots/Black spots
- Roadside hazards
- Facilities for Non-Motorized Traffic (NMT)
Recommendations for Safety Improvement

Based on the observed problems and safety issues as above at the crash potential at different locations, the various suggestions are made in order to enhance and ensure safety.

**Action Plan**

To enhance the safety and reduce the potential of road crash on the study corridors of Bharatpur city road network, broad action plans on the following safety issues are recommended and listed in the order of priority besides the specific recommendations made for each of the safety problems in the report as shown in Fig. 110 & Fig. 111.

- Road Surface Condition
- Road Signs
- Safety Measures on Bridges and Culverts
- Visual Aids to Improve the Safety of Road User

Fig. 109: Typical Safety issues at a Black Spot

Fig. 110: Typical Example of Solar Powered Blinkers to caution the road users to reduce speed
Treatment for Safety of Vulnerable Locations and Road Users (Fig. -112)
- End Treatment for Metal Beam Crash Barriers
- Control of Encroachments in Urban Areas
- Other Safety Measures

Assessment of Visual Limitations of Commercial Drivers in Metropolitan Cities in India (Ongoing) Fig. -113

Sponsored by: 2.5 New Vision Generation- Essilor India Pvt Ltd

Objectives
- Development of the evidence based unique database of Uncorrected Refractive Errors (URE) of the Commercial Vehicle Drivers operating in different four metropolitan cities of India to understand the overall visual health.
- Assessment of the need for visual correction
Preliminary Findings

Visual parameters such as color vision, depth perception and contrast sensitivity of drivers influence crash involvement rates in India. In this study Far and Near Both Eye Test for Visual acuity were compared with accidents frequency of the drivers. This study found that out of the 627 sample population of drivers 6% of drivers having both eyes Marginal or Unacceptable Near Visual Acuity were involved in self reported accidents as against 3% of the drivers with Acceptable grade in Visual Acuity. Similarly for Far Both Eye Visual Acuity this study found that 8% of drivers with Marginal or Unacceptable Range of Acuity were involved in road crashes in the recent past as against 3% of the drivers with Acceptable grade in Visual Acuity. As of now, the survey is completed in two cities i.e. Delhi and Bangalore and data is being collected in Pune and Chennai. Study is in progress.

Recommendation:

It has been observed in the study that many drivers are not aware about their present status of their eye vision. So there is a dire need to disseminations of mass campaign for creating consciousness among the drivers to relate their need for visual correction behavioral aspects to increase state of living a healthy life.
Transportation Planning
Research Projects

Impact of Road Condition on Fuel Consumption of Vehicles

Sponsored by: Petroleum Conservation Research Associate (PCRA), Govt. of India

Broad Objectives:

a. Compare fuel consumption of an instrumented test vehicle as a function of condition of pavement surface material (flexible and concrete) at different speed and different type of vehicle (Small, SUV and Truck-loaded, unloaded) through direct field measurements.

b. To establish a procedure in a spreadsheet format to estimate the total fuel savings in a region or over the design life of a project for different pavement type scenarios in terms of their roughness (good, fair, poor) in short term solution and long-term solution for evaluation of investment decision including potential fuel savings and design alternative.

The methodological flow diagram of the study is shown in Fig. 114.

(i) Literature Review: Many researches have been done but there is no benchmarking study on different pavement types on Indian roads OR any proper data and analysis between road categories.

(ii) Experimental Design and Data Collection.
Selection of Road Sections

Five urban street roadway sections (two asphalt and two concrete sections) were selected for fuel consumption studies. The selection criteria included surface material type, surface roughness, longitudinal gradient, and location of the pavement sections. Two sets of concrete pavement versus 3 sets of asphalt pavement sections with similar surface roughness and longitudinal gradient were accordingly selected. Each pair of road sections (one AC and one PCC) was approximately parallel so as to minimize the effect of wind direction and velocity during measurement runs on the two road sections at a given time. The detailed description of each roadway section selected as given in Table-4.

Table-4: Road Section Characteristics

<table>
<thead>
<tr>
<th>Name</th>
<th>Road Surface Type</th>
<th>Road condition</th>
<th>Length</th>
<th>Gradient (maximum Gradient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noida Expressway</td>
<td>Black top/flexible pavement</td>
<td>Less than 2.8 IRI/Good</td>
<td>21.3km</td>
<td>4.6%</td>
</tr>
<tr>
<td>Yamuna Expressway</td>
<td>Concrete road</td>
<td>Less than 2.8 IRI/Good</td>
<td>24.00km</td>
<td>3.8%</td>
</tr>
<tr>
<td>Gurgaon Expresway</td>
<td>Black top/flexible pavement</td>
<td>Less than 2.8 IRI/Good</td>
<td>16.00 km</td>
<td>3.5%</td>
</tr>
<tr>
<td>Flyover</td>
<td>Black top</td>
<td>Less than 2.8 IRI/Good</td>
<td>1.00 km</td>
<td>5.2%</td>
</tr>
<tr>
<td>Faridabad-Ballabghar</td>
<td>Black top/flexible pavement</td>
<td>Greater than 4.0 IRI/Bad</td>
<td>3.00 km</td>
<td>2.3%</td>
</tr>
<tr>
<td>i.  IP Calony</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Chandwali Chowk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Jaat Chowk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITO –ISBT outer section</td>
<td>Concrete road</td>
<td>Greater than 2.8 IRI/Bad</td>
<td>3.00 km</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

Measurements of Fuel Consumption

The experimental design consisted of six levels and three factors (two pavement types, three pavement surface conditions, three vehicle types, one gradient and three speed driving modes), resulting in hundred sixty-four combinations as shown in Table-5. The fuel consumption for different road roughness condition has been measured on three different type of vehicle (Fig. 115).

Three runs were necessary for each factor–level combination in order to obtain statistically meaningful conclusions at 90% level of confidence with a ±10% error. Analysis of Variance (ANOVA) will be utilized as the main statistical tool for hypothesis testing purposes in comparing fuel consumption differences between the two pavement types, three surface conditions, three vehicles and 3 driving speed in AC/non-AC.

Table-5: Matrix of Road Condition & Vehicle Type

<table>
<thead>
<tr>
<th>Description</th>
<th>Types</th>
<th>No. of Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Type</td>
<td>Flexible</td>
<td>Rigid</td>
</tr>
<tr>
<td>Pavement Condition</td>
<td>Good (&lt;5%)</td>
<td>Fair (5-15%)</td>
</tr>
<tr>
<td>(In term of total surface distress)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types of Vehicles</td>
<td>Car</td>
<td>SUV</td>
</tr>
<tr>
<td>Plain Terrain</td>
<td>&lt;2200</td>
<td>2200 to 3000</td>
</tr>
<tr>
<td>(Rouhness Range in mm/km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flyover</td>
<td>One Section</td>
<td>1</td>
</tr>
<tr>
<td>Speed (Kmph)</td>
<td>20 to 30</td>
<td>50 to 60</td>
</tr>
<tr>
<td>Total Numbers of Cells</td>
<td>2<em>3</em>3<em>3</em>1*3</td>
<td>162</td>
</tr>
</tbody>
</table>
(iii) Data Analysis and Results

**Establishing the co-relation between road condition and fuel consumption:**

Data of pavement surface condition for different pavement type viz. asphalt and concrete, length (km), IRI range (m/km), faulting (for concrete roads) has been collected for the test track that represent the road conditions. A model or relation will be developed based on International roughness index and other important parameter as mention above which effect the fuels consumption

### Low-Cost Road Asset Data Collection

**Sponsored by: In-house**

**Broad Objectives:**

- Development of low-cost proto type road asset management system
- Calibration and Validation of system of low-cost proto type road asset management system

**Methodology**

- Literature Review
- Identification of Camera and type of utility vehicles
- Development of Prototype Conceptual diagram
- Data Collection from BRAM
- Data Extraction from BRAM
- Data Validation of BRAM

**Development of Low Cost Data Collection System (BRAM)**

The typical view of developed low-cost proto type road asset management system and its output after trail run is shown in **Fig. 116**.

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**Fig. 115**: Fuel consumption and road condition measurement equipment and installation

**Fig. 116**: Typical test bicycle
Calibration Utility

A dialog box called calibrate distance, as shown in Fig. 117 has been used for accurate measurements.

Image Processing Utility

Software interface has been used to process the system generated video files for the measurement of carriageway details. One example of carriageway width measurement from the extracted image from video file is shown in Fig. 118.

Validation of carriageway width from Image processing accuracy level:

The captured images have been validated with the actual field measurements, for the measurement of carriageway details. The validation results were highly accurate (>95%).

Land-use Based Parking Policy: A case study of Delhi

Sponsored by: In-house

Rapid motorization and lack of sufficient space are one of the major factors to influence the mobility and accessibility in a city. As a result, demand for parking facilities is increasing and creating pressure on parking spaces which is leading a serious concern on traffic congestion, accidents, unequal demand and supply ratio and environmental pollution. Fig. 119 shows two photographs of illegal on-street parking on Delhi roads, which leads to congestion on the main carriageway. Parking issues can be controlled by utilizing parking control system for regulating car usage, by utilizing parking fees and fines, by optimizing existing parking capacity before new development, by using public-private partnerships for operations of parking facilities. Before taking any measures for the betterment of conditions, data regarding availability of parking space, extent of its usage and parking demand is essential. Parking statistics basically, includes parking accumulation, parking volume, average parking duration, parking turnover and parking index. Parking surveys have been conducted to collect the above said parking statistics. It includes inventory survey, in-out survey, license plate method and questionnaire survey to collect quantitative and qualitative data. Parking demand and supply models can be developed using these basic statistical parameters for different land uses. It will provide more economical and optimal parking solutions in Delhi city.
Multimodal Travel Demand Model for Evaluation of Sustainable Transport System

Sponsored by: In-house

The coming years are going to witness huge increase in the urban travel demand. Populace in Indian urban areas is relied upon to increment by around 250 million in the following 20 years (McKinsey & Organization 2010), getting huge development urban travel request. It is anticipated that aggregate day by day traveller trips in 87 noteworthy urban focuses in India will dramatically multiply from around 229 million in 2007 to around 482 million in 2031 (MoUD 2008). This urban travel will be highly skewed towards private mode of travel. The share of public transport mode declined in Indian urban communities (20-70% decrease in diverse size urban communities) somewhere around 1994 and 2007. Shares of cycling mode in urban communities have descended from an average of 30 percent in 1994 to under 11 percent in 2007, ascribed to an increment in average trip lengths as after effect of urban sprawl, lacking offices for cycling, and development in private engine vehicle proprietorship.

In wake of above mentioned precarious situation in Indian transport sector we need to resort to multimodal integrated travel demand modelling with incorporation of sustainability as a yardstick for planning and development. Also, in times of diminishing economic and natural resources, using sustainable approaches in transportation will allow us to continue to enhance quality of life and serve the transportation needs of the present without compromising the ability of future generations to meet their needs.

The present study will aim to develop a multimodal integrated travel demand modeling method that will incorporate novel methods of Stochastic User Equilibrium and Dynamic User Equilibrium to bring about true integration in demand and supply side of transport system. An elaborate framework for evaluation of sustainability of the developed travel demand model along using statistical methods will also be carried out. Different transport policies and their impact assessment on the transport network will be done.

Route Choice and frequency optimization under countdown information for bus passengers with strict capacity constraints (OLP 0602)

Sponsored by: In-house

The use of Advanced Traveler Information systems (ATIS) in transit network is gaining importance in developing countries. It has become imperative to understand the behavior of transit riders in the event of ATIS provision. There are several forms of ATIS in operation around the world. Some of the common forms are the presence of countdown signs at transit stops and the provision of web-based route planners. The predominant form of ATIS for transit passengers is the presence of countdown systems at the transit stops. These are systems which provide the arrival time of transit services at the transit stops at a given time step. The number of transit arrivals shown on these display boards ranges from 2 arrivals to 10 arrivals. This system has a wider outreach among various transit users as the information dissemination is at the transit stop level and is provided to all transit users accessing the transit stop.

Several transit assignment studies based on the link additive hyper path approach [1,13] have investigated the line choice of transit passengers in the presence of countdown information. A simulation based approach to assess the line choice of public transport network under information availability has been studied extensively [2, 10, 11]. Reference [3] assessed the effect of information on the path choice of Stockholm metro passengers at network level as well as at individual line level using Bus Mezzo, a simulation software. Reference...
[4] assessed the impact of information in a traffic network with perception updation on the pre-departure and post-travel. It was deduced [11, 12] that the information benefits reduced under congestion. Solving for the seat availability [11] came up with a holistic plan wherein the impact of real time information was assessed in the presence of a seat availability prediction model in a capacity constrained network.

In the work a simulation based learning process model for assessing the line choice of passengers under the influence of countdown information has been developed. The model has been run successfully for a section of Delhi bus transit network. The model has undergone limited calibration as the study is still progressing. The sensitivity results of the model are however encouraging showing the variation in the link flows along the network under varying policy decisions being taken by operator. The period between 2017-2018 involved development of various components of the model and various statistical tests carried out to assess the stationarity of the model. The implementation of the model for a section of Delhi public transport network was carried out followed by the results and discussions.

Traffic Study for Feasibility of Mineral Transportation from Goraburani-Sagasahi Iron Ore Mines, Sundargarh, Odisha

Sponsored by: M/s Essar Steel India Ltd, Odisha

The recent growth in industrialization and mining activities have resulted in increase of motorization and mobility in the mining areas, due to which the freight vehicle population have been increased tremendously in the mining influence areas. Sundargarh is one of the major mineral producing districts of Odisha, which has a population of almost 2.08 million people with population density of 214 inhabitants per square kilometer. There are 82 working mines in this district, out of which 33 mines are iron ore, 21 mines are Limestone and 13 are Manganese Ore. The Koira Tehasil of Sundargarh district is the largest mining circle with a mining capacity of 40 million Tons (MT). The present road infrastructure in the area which serves both freight traffic of mines and the public and private traffic is inadequate. This situation is expected to be worsen in the near future if there is no argumentation in the road network.

Considering current situation of road network M/s Essar Steel India Ltd. have approached CSIR-CRRI New Delhi to conduct feasibility of mineral transportation on the existing road network of Koira Tehsil of Sundargarh District. Accordingly CSIR-CRRI has taken up the traffic study for feasibility of mineral transportation from Goraburani-Sagasahi Iron ore mines, Sundargarh, Odisha. In the present study a total of 54 km length of road network including 4 intersections were considered (Fig. 122) and various traffic surveys such as classified turning movement studies at intersection and speed and delay studies on the corridors were conducted to understand the prevailing traffic problems and assess the capacity of roads with respect to the vehicular traffic plying through intersections in the study road network. Traffic data was analyzed to assess the mode wise traffic composition observed at each intersection on normal working days of the week to arrive at classified intersection in the study road network. Traffic data was analyzed to assess the mode wise traffic composition observed at each intersection in the study road network. Speed and delay survey was conducted on the study road network by using moving car observed method on normal working days. This survey was conducted to quantify delay, journey and running speed on the study corridor. Fig. 120 presents the base and horizon year traffic for the identified intersections in the study area.

This study is focused to estimate the truck traffic by developing a truck demand model for base year (Fig. 121) and horizon year (Fig. 122) for the study road network. These trucks are carrying iron ore from mines to railway sidings and Plants. Fig. 121 presents the estimated horizon Year Truck traffic (2027) due to Goaraburani-Segasahi mines operation in Koira Tehasil, Sundargarh District of Odisha. Performance evaluation of study road network has also been carried out considering the volume to capacity ratio. The V/C ratio was established using the field data for the base year and projected traffic data for the horizon year. This will be useful for
improving the existing road infrastructure facilities as well as proposing new road infrastructure facilities such as widening to enhance capacity of existing roads and provision of bypass to the study area etc. Intersection improvement plans were also proposed taking into account the future traffic, prevailing site conditions and the proposed enhancement of mines. **Fig. 123** presents the schematic representations of recommendations for Widening of the major road corridors on study Road Network.

![Fig. 120: Base and Horizon Year Total Traffic (PCUs)](image1)

**Fig. 120**: Base and Horizon Year Total Traffic (PCUs)

![Fig. 121: Estimated Base Year Truck (2017) traffic due to Mines operation in Koira](image2)

**Fig. 121**: Estimated Base Year Truck (2017) traffic due to Mines operation in Koira

![Fig. 122: Estimated Horizon Year Truck traffic (2027) due to Mines operation in Koira Tehasil, Sundargarh District of Odisha](image3)

**Fig. 122**: Estimated Horizon Year Truck traffic (2027) due to Mines operation in Koira Tehasil, Sundargarh District of Odisha

![Fig. 123: Schematic Representations of Recommendations for Widening of the Major Road Corridors on Study Road Network](image4)

**Fig. 123**: Schematic Representations of Recommendations for Widening of the Major Road Corridors on Study Road Network

**Consultancy Projects**

**Consultancy Services on Developing Thematic GIS Database for Integrated Road Management System for RCD**

Sponsored by: Road Construction Department (RCD), Govt. of Bihar, Visvesaraiya Bhawan Bailey Road, Patna

CRRI considering viewpoint of field engineers and staff at RCD headquarter developed GIS based
Database for 38 district of Bihar states. For each districts, NIC with help of database developed by CRRI developed web environment for people friendly dissemination of massage related to road, bridge, condition and inventory as shown in Fig. 124.

**Megacity Logistics: Metrics, Tools and Measures for Sustainability (MEGALOG)**

**Sponsored by: The World Bank Group, Washington, D.C.**

**Formulation of the Project**

The research project on "Megacity Logistics: Metrics, Tools and Measures for Sustainability (MEGALOG)" funded by the World Bank Group has been carried out by this institute in association with TNO, Netherlands and TU Delft, Netherlands. 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

**Data Collection and Field Surveys**

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**
- **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 Fig. 125.

**Logistics Metrics for Delhi City**

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 Fig. 125. 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 Fig. 125. The overall traffic composition is shown in Fig. 125 and the freight vehicles consist of about 10% at outer cordons as shown in Fig. 126.
The freight traffic composition observed at outer cordons and within the city has been compared and presented in Fig. 127. From the Fig. 128, 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.

It can also be observed from the data analysis that average trip distance of MT is about 228 km and for HT, it is about 112 km, whereas vehicle type LT has about 70 km and smaller vehicles are having a trip distance of about 50 km. All these vehicle types travels about 20-25 km within the city. And it can also be observed that the maximum average distance travelled in a day by these vehicle types is about 200 km. This clearly indicate that these freight vehicles face lot of congestion and other problems to travel more distances in a day experiencing lot of delays and increased operating costs. The weight carried by different freight vehicles has been analysed and it can be observed that MT Vehicles are carrying more than 13 Tonne where as HT vehicle is carrying loads of 5-6 Tonne. The LT is carrying about 2 Tonne and smaller vehicles like GA and GV are carrying less than a Tonne. Further, an analysis has been carried out to assess the share of empty vehicles and the result shows that the 10-20% vehicles are running empty on the road network of Delhi. Further the total weight carried by these freight vehicles on the entire road network of Delhi has been estimated from average distance travelled and weight carried in a day which comes to be about 2.480 Million Metric Tonne (MMT) per day.

Estimation of Total Freight Trips

From the freight travel data collected at outer cordons and selected focal points, Freight Travel Demand Model has been developed adopting Four-Stage traditional modelling approach (Trip Generation, Trip Distribution, Modal Split and Trip Assignment). Freight Trip Production and Attraction Models are accordingly developed adopting multiple linear regression modelling. Freight Trip Distribution has been carried out utilising Gravity model approach. From these models, the total trips have been estimated from all the zones which are in the range of about 500 thousands of freight trips per day in the city of Delhi as shown in Fig. 129(a). The freight modal split has been estimated considering the traffic composition observed at outer cordon and within the city at focal points as shown in Fig. 129(b). Freight Distribution Models have been calibrated using the Distance and Time Skim matrices generated from the coded network of existing roads. The observed Origin Destination (O-D) - Trip matrices have been separately calibrated for each mode. For this purpose, VISUM 11 Software has been utilised and estimated freight O-D matrices for different freight vehicle types. In the present study, the total number of zones taken as 368, out of which 360 are internal zones and 8 are external zones. The size of O-D Matrix would be 368 X 368.
The desire line drawings have been developed in order to see the trend and intensity of trips between origin and destination using VISUM Software and shown in Fig. 130.

The trip assignment has been performed using Urban Strategy Software tool developed TNO. For this, purpose, the developed O-D Matrices for freight traffic has been submitted to TNO. When the assignment of freight trips made on the network, there would be passenger trips already on the network. Hence it is essential to consider all the trips including freight and passenger trips to perform trip assignment.

Forecasting of Freight Trips from Freight Transport Demand Models

The developed freight transport models are utilised to forecast the trips that going to be generated in the City of Delhi for the year 2021. The estimated trips for the year 2021 increased to about 572 thousands with a growth rate of 4% per annum. The traffic loads in terms of vehicle kilometers travelled (VKT) on the road network of Delhi also estimated from the past studies (CRRI, 2009). Utilising this data, the estimated VKT for 2017 and forecasted VKT for the year 2021 are about 240 Millions and 300 Millions respectively. The VKT by freight vehicles are going to be about 10 Million and 13 Millions in 2017 and 2021 respectively which is having a share of about 4% as shown in Fig. 131. The growth of total VKT is increasing with 7% per annum whereas freight vehicles growth is about 8% per annum.

Policy Evaluation with Urban Strategy

The Urban Strategy is the policy analysis and visualization toolset, which has been developed by TNO, The Netherlands. The TNO have been able to use the available data to construct a basic working
model within Urban Strategy and distribute traffic on the basis of that model. The data provided by CSIR-CRRI has been successfully uploaded, and in combination with open-source data from OpenStreetMaps, has been used to conduct an initial traffic assignment, and the results displayed in the 2D and 3D interfaces and the Web interface. The developed system can be utilised as decision support system to evaluate various transport policies by estimating traffic loads and emission loads from vehicular traffic. In the present study, a number of related scenarios have been defined, that affect the emission factors of the traffic circulation as given below:

**Scenario 1 – Elimination of diesel goods vehicles older than 10 years**

**Scenario 2 – Placement of a number of freight hubs in outer areas**

**Scenario 3 – Restriction of heavy trucks from entering a city centre**

**Scenario 4 – Elevated high-density corridor**

**Scenario 5 – Improved connectivity to Railway Stations/Airports**

**Scenario 6 – Fleet conversion to low-pollution vehicles**

In order to evaluate the proposed policies, it is necessary to have base scenario where it shows existing condition with no measures. Accordingly the Urban Strategy has been applied with existing travel demand with no measures and estimated the evaluation parameters. The estimated traffic flows with respect to capacity in the base scenario can be seen for the links with a high probability of congestion (blue coloured links) shown in Fig. 132.

The emissions for base scenario have been calculated for all the road segments per substance per vehicle type. From the analysis, it can be observed that Passenger Car Equivalents (PCE) account for most of the road traffic emissions for all substances. This is due to the fact that the traffic volume of passenger transport is much larger than the other categories. The result also shows that Heavy truck do contribute substantially to the NOx emissions, followed by the light trucks. The contribution of freight transport is limited and the effect of the different scenarios can be seen more clearly when only looking at the freight emission totals as shown in Fig. 11?. From the Fig. 133, it can be seen that removal of diesel vehicles older than 10 years, Scenario 1, shows 4 – 11% decrease in total CO, NOx and PM10 emissions, and negligible difference in Benzene or Hydrocarbon levels. The freight hubs
(Scenario 2) and heavy vehicle restrictions (Scenario 3) may lead to increased overall emissions if there is no change to the emissions profile for the vehicles that replace them. Introduction of a high capacity corridor (Scenario 4) will lead to a slight decrease of emissions. Introduction of electric freight vehicles (Scenario 6) shows promising results for reduction in emissions, dependent on the penetration rate achieved.

Stakeholders Meetings, Short Course and Workshops on MEGALOG

As part of the project, the stakeholders need to be involved in conducting meetings so as to understand and reach the actual ground level problems and difficulties in implementing transport policies related urban freight traffic. Accordingly the first meeting for this purpose has been conducted on May 9th, 2017 at CSIR - CRRI, New Delhi. This meeting was attended by the policy makers, development authorities, practising engineers representing national / state level and local bodies, academia, research institutes and decision makers etc. A total of 34 delegates were attended this 1st meeting and emphasised issues related to freight transport in India and especially in Delhi.

As part of fulfilment of the objective of the project, skill development training in terms of short courses to various stakeholders and operators on sustainable city logistics (SCL) has been organised on December 12th, 2017 at CSIR-CRRI, New Delhi. Prior to that, capacity assessment of existing situation has been done through a proforma of Capacity Assessment and Policy Inventory. Various experts namely Prof. Russell G. Thompson (The University of Melbourne, Australia), Prof. Lorant A. Tavasszy (TU Delft, The Netherlands) and Dr. Hans Quak (TNO, The Netherlands) talked about the Sustainable City Logistics for Policy Making. Dr. Errampalli Madhu, CSIR-CRRI, New Delhi and Mr. Jeroen Borst (TNO, The Netherlands) have presented the metrics of New Delhi freight traffic and policy evaluation tools namely Urban Strategy respectively. Dr. Hans Quak (TNO, The Netherlands) presented Sustainable City Logistics for Freight Operations. Dr. Nilesh Anand (TU-Delft, The Netherlands) has discussed on the Activity Based Modelling in the Freight Transport estimation for an urban area. A total of 36 delegates were attended this short course.

As part of the project, National Dissemination Workshop on Megacity Logistics has been organised
on December 13th, 2017 at CSIR-CRRI, New Delhi to disseminate the findings from the project, approaches to be adopted by different policy makers/stakeholders to achieve sustainability in the area of City Logistics in the city of Delhi. In the workshop, Good Practices and Experiences of City Logistics, Sustainable City Logistics and Capacity Development have been discussed along with the Case Study of Delhi and the Urban Strategy - A tool to evaluate the transport policies and application for the city of Delhi. In addition, the Measures for Sustainability have been presented and ABM application for the city of Delhi has also been discussed. Finally, a way forward to achieve Sustainable City Logistics has been evolved through Panel Discussion chaired by Prof. Satish Chandra, Director, CSIR-CRRI, New Delhi. A total of about 45 delegates were attended this workshop.

**Sustainable City Logistics (SCL)**

The following important points that need to be aimed are emerged out from the meetings and workshop to achieve sustainable city logistics:

- Reduction of negative effects of urban freight transport while maintaining productivity
  - *Encourage to carry out appropriate research*
  - *Systematic planning of facilities*
  - *deployment of Innovative methods*
  - *Advanced Vehicular Technologies*

- Identification of workable urban freight solutions including roadmaps towards these
  - *Adequate database (up to date)*
  - *Evolving appropriate tools*
  - *Encourage to carry out appropriate research (academia, R&D institutes etc.)*
  - *Frequent meetings/discussions among stakeholders (researchers, policy makers, freight operators etc.)*

- Increase of the knowledge base including data collection, models and scenarios
  - *Adopting advanced techniques for data collection*

- *conducting skill development training/short courses to various stakeholders and operators on sustainable city logistics (SCL)*

- *Encourage to use of advanced analytical tools*

- Collaboration with other stakeholders to realize solutions towards sustainability
  - *Formulation of a organizational body with all possible stakeholders*
  - *Members with shared awareness about sustainability*

**Site Impact Assessment due to the Proposed Delhi Metro Rail Corporation (DMRC) Office Complex at Jantar Mantar Area, New Delhi**

**Sponsored by: DMRC, New Delhi**

The following traffic Studies were conducted:

i. Classified Traffic Volume Studies
ii. Parking Studies
iii. Pedestrian Survey
iv. Origin-Destination Studies
v. Speed Studies
vi. Occupancy Survey
vii. Establishment Survey

Based on the above studies, the following key recommendations were given:

- The analysis shows that the proposed office complex at 8, Jantar Mantar road would in itself does not make a substantial addition to the estimated traffic flow in the horizon years 2022 and 2027. Even in the case wherein 1/3rd of the trips originating from the proposed office complex would use private vehicles with single occupancy the contribution to the peak hour PCUs on Ashoka Road and Sansad Marg is minimal. Table-6 gives the estimated share of private vehicle contribution on catchment area of the proposed office complex.
From the above table it is evident that a total of 391 cars and 150 two wheelers, would be generated over the day from the proposed office complex. Based on the above estimated traffic, the required parking space is to accommodate 196 cars and 75 two-wheelers for which DMRC has provided adequate parking space.

Further, the peak traffic expected from the proposed office complex on the Jantar Mantar Road is 142 PCUs which is far below as compared to the actual capacity of the four lane road. Hence the proposed office complex will have very minimal impact in terms of traffic volume, parking and congestion around the catchment area.

Further, the above roads namely Ashoka Road, Jantar Mantar Road and Sansad Marg during the horizon year beyond 2027 will experience congestion due to natural growth of traffic even in the absence of a proposed office complex. This is witnessed on most of the major arterial roads in Delhi during the effective part of the day due to absence of any restraint measures for private vehicle usage. It is hence mentioned that the above proposed office complex by its very existence in the horizon year would not contribute substantially towards the onset of traffic congestion. The congestion will occur naturally with the growth of vehicles in absence of proper policy measures to curb them.

Currently, the percentage distribution of trips from the proposed office building is skewed towards Sansad Marg (50% of the generated trips using Sansad Marg) and Jantar Mantar Road (29% of the generated traffic using Jantar Mantar Road). Therefore, it is recommended that a gate accessing the Ashoka Road be provided by DMRC such that the entry of vehicles into the proposed office complex during the morning hours can be made from Ashoka Road. During the days, when blockage is implemented on Sansad Marg and Jantar Mantar Road, the gate on Ashoka road shall act as both entry and exit points for all the vehicles from the proposed office complex.

A policy revision in line with the objective to develop an office complex needs to be made to ensure a congestion free ride on these roads in future years. Usage of public transport needs to be encouraged along with encouragement of carpooling. The reduction in the number of vehicle traffic generated from the office complex, assuming a higher occupancy than single occupancy indicates the importance of carpooling. The impact of public transport on traffic growth is brought out by assessing the impact of Patel Chowk Metro station on Sansad Marg traffic. It is found that traffic growth rate was +3.06 % as against the 7% on Sansad Marg, in the absence of Patel Chowk metro.

A traffic circulation plan for the traffic generated from the proposed commercial complex shows the ease of integration of the traffic from the proposed complex during the horizon year traffic under various blockage situations.
Environmental Science
Commuters traveling in autorickshaw are exposed to higher concentration of pollutants of black carbon (61.1±34.7 μg/m³) and car commuters (non AC mode) are exposed to high concentrations of CO (7.3±4.5 ppm), particulates (810±462.6 μg/m³) and VOCs (429.9±174.8 μg/m³). Questionnaire survey of commuters showed that 61% of commuters feel that vehicle exhaust is responsible for health related problems such as coughing, irritation in eyes, wheezing and other respiratory discomforts.

Pilot Study for the Development of Surface Enhanced Raman Scattering (SERS) based Sensors for the Detection of Environmental Pollutants (Air/Water/Soil)

Sponsored by: CSIR-CRRI

Theoretical calculation for electric field enhancement factor around various metallic nanostructures has been carried out using Matlab software. Calculation and optimization of various parameters (size, shape, distance) for electric field enhancement factor is complete. Experimental work is in progress.

Impact of road condition on fuel consumption of vehicles

Sponsored by: CSIR-CRRI

Complete fuel consumption studies for various identified test section for speed of 20 km/hr, 50 km/hr and 70 km/hr for Wagon R. Initiated fuel consumption studies on TATA SUMO. Initiated activities for Hiring of TATA TRUCK.
HRD & Project Management

● Planning, Monitoring & Evaluation
● Information, Liaison & Training
PLANNING, MONITORING & EVALUATION
R&D management is the main activity of this division which inter-alia covers Planning, Monitoring & Evaluation of R&D projects, externally funded projects issues concerning Intellectual Property and Business Development, attending to technical queries and technical/performance audits and assistance to Director, Management Council (MC) and Research Council (RC) on the project related matters.

Major activities that PME Division carried out during 2017–18 are as follows:

**PLANNING ACTIVITIES**

Project Planning [Mission Mode/ Fast Track Translational/other R&D Projects]

Organized brainstorming sessions to identify the thrust areas for delivering in mission/faster track mode and the projects of translational in nature. Around 18 theme project proposal were prepared and submitted to CSIR. Coordinated with CRRI team in preparation of mission mode project on Mass Housing. A comprehensive mission mode project titled ‘Green and Climate Resilient Road and Transportation Infrastructure’ prepared and submitted to CSIR. Prepared three proposals on facility creation projects. In addition to this, PME interacts with scientists for submission of R&D proposals to various funding agencies including International collaborations. During the year, In-House R&D project proposals and FTT projects submitted by the scientists are processed & sent to CSIR/Theme Directorate.

Management of various Project Proformae

PME designs, maintains, manages and modifies the proformae pertaining to various project-related activities as per the need arises from time to time in line with ISO requirements/CSIR guidelines.

**CSIR-CRRI Budget**

The budgetary requirement under various head of expenditure was prepared based on the estimates of various R&D projects and demand for R&D equipments and other activities of the institute.

**Scrutiny & Registration of Project Proposals**

Scrutiny and Registration of all externally funded projects and allotment of specific identity in terms of a Project No. is effected at PME, soon after the money for the project is received along with In-Principle approval. Registration and Technical scrutiny of in-house R&D projects is also carried out by the Division.

**Development and Regular Maintenance of Project Database**

PME has developed Project Database which is regularly updated incorporating addition of new projects, and modifications during their implementation stage and finally during their completion. The database includes project title, classification and technical and financial details which help in tracking the technical and financial progress of the projects. PME also maintains the cash inflow of all the projects. The database is highly useful for monitoring and evaluation of the projects.

**Scientists Meet:** Organized scientists’ meetings/brain storming sessions where in every Division has come up with various plans and programmes to achieve the Government of India polices, CSIR-CRRI vision and to reach out common men.

**Theme Directorate activities:** Preparation of Business Plan for CRRI, Road Map, Planning & Monitoring of Mission Mode projects, FTT/FTC projects. Projecting/Technology forecasting for the next 3-5 years of the institute. Information is compiled for Directors’ Conference and theme directors’ meetings. Information provided on parametric achievements of the institute.

**MONITORING ACTIVITIES**

Reporting on performance and the status of various projects was carried out through preparation of Performance Reports from time to time that contains information about the performance of the Institute on various parameters such as projects handled; technologies developed/licensed. These reports are sent to CSIR for their perusal. These reports also help the Institute in reviewing its own performance as a monitoring tool.

PME Division also calls for progress report of all the on-going projects in the Institute. This exercise is meant to monitor and ascertain the status of each of the projects with respect to adherence to time
schedule and other milestones. Any deviation is intimated to the respective project leader and remedial measures are taken to put the project on course. Completed projects, as reported by the respective Project Leaders are processed for closure.

**CSIR-Data Infographics System (C-DIS):** This is to ease in Data Collection and Management, availability of Information, excellence for Data/Information mining and next generation knowledge synthesis system maintained by CSIR. PME has compiled and provided/uploaded various inputs/information to the portal time to time.

**PROJECTS MONITORING**

**Externally funded projects:** Externally funded projects were regularly monitored particularly for their adherence to time schedule, amount dues, if any, documentation, closure etc. through divisional/project review meetings.

**In-house Projects:** Project Identification and Monitoring Committee monitors the progress of the In-house projects. The committee also reviews the progress of the In-house projects periodically. The new projects are taken up if approved by the Committee after the presentation made by the Project Leader. Similarly at the time of completion of a project, a presentation is made by the Project Leader to incorporate suggestions if any made by the committee members.

**External Cash Flow (ECF):** The Institute undertakes projects sponsored by various external agencies such as Ministry of Road Transport & Highways (MORT&H), National Highway Authority of India (NHAI), Department of Science and Technology (DST), National Rural Roads Development Agency, PWD, Industries, Consultants, etc. The details of External Cash Flow i.e., money received from these agencies to carry out specified task was regularly recorded and monitored vis-à-vis target established by the Institute.

**Expenditure Monitoring:** Efforts were made to keep track on the expenditure vis-à-vis budgeting allocations/requirements on the monthly basis so that performance/working of the Institute could be made more effective.

**EVALUATION ACTIVITIES**

**Projects information to Research Council(RC)/Management Council(MC)**

Research Council (RC) is the apex advisory/monitoring body in CSIR-CRRI through which the major R&D activities are monitored and evaluated. Also it gives direction/guidance for future R&D programmes of the institute. During the Year, PME Division has provided various information/data for Agenda, progress reports of R&D projects, Information for Action taken Report, Information for Director’s Presentation and other related logistics for conducting of meeting.

PME is responsible for preparing the up to date projects summary and providing the information on projects that are to be ratified by the Management Councils. In addition, as per ISO, Customer Satisfaction Evaluation and Feedback on completed project was carried out. The result showed that the clients are highly satisfied with the Institute.

Information provided on achievements [5-10 years] and future plan of the institute for evaluation by the Apex Committee of Performance Appraisal Board.

**Technical Queries from within/or outside CRRI and CSIR**

PME handles technical queries pertaining to various projects being. PME is also required to interact with various Directorates of CSIR particularly RPPBD, Mission and DGTC regarding the preparation of Plans/Budget, Management of FTT and MMP(Mission Mode Projects), Audit, ECF queries, RTI, other technical information to Ministries etc. Also interacts with the project clients related to amount dues, schedule, taking satisfaction feedback etc.

**Parliament Questions**

PME also handles parliament questions which are technical in nature. During the year, replies to Parliament questions were prepared after collecting, compiling and collating information from various divisions of the institute.

**Central Public Grievance Redress and Monitoring System (CPGRAMS)**

PME is the nodal division in CRRI to handle Public
Grievances received through pgpportal.gov.in. It examines the cases appropriately and disposes-off them in time through online as well as intimating to the concerned person.

**GeM, PFMS:** Division has facilitated for registering under Govt e-Market place portal (GeM) and coordinated with F&A section, funding agencies, bank, Project Leaders and Research Fellows related to transfer of research grants/fund under PFMS portal.

**Service Tax and GST related Activity**

The Division regularly prepares the statement on the receipts and ensures for the payment by accounts section of Service Tax/GST on monthly basis. PME also prepares and files the returns of Service Tax. The division has successfully executed the task of migration to GST regime in time. Registration with GST portal and formation of Tax Committee has been done to look into all GST issues. SOPs have been prepared for smooth transition/execution in GST regime, G-TDS, preparation of monthly returns i.e. GSTR-1, 3B etc. Coordinated with F&A section, DDO, Stores & Purchase, Civil and all scientists for proper implementation of GST in the institute. Also organized an awareness program on GST in CRRI. Registered with e-Way bill portal of GST.

**Development & Maintenance of PME System**

Designed & Developed web based “Project Management System” by PME division to manage the projects in the Institute effectively with less manpower. Time to time enhancement in the system is also taking place by adding new features. This also increased the transparency in the system. Further, e-PPS (e-Project Proposal System), Expenditure monitoring system, manpower deployment module, Invoice generation module have been developed and integrated to it.

**ERP (HR, Projects, R & D Module) & Salary System:**

The Division has uploaded the details of all ongoing projects in the CSIR ERP site, also entry of Projects amount receipts in the Central Value Register of ERP site. Addition/Deletion of projects members and map their credentials according to the requirement of ERP System. In addition PME staff also assisted to implement the HR module under ERP system in CRRI. In addition to it the division has facilitated administration to make changes in the software to generate the salary as per 7th CPC.

**BUSINESS DEVELOPMENT:**

The division had prepared MoUs and agreements for various projects, Technology Transfer to clients. Technology dissemination and other related activities. The division had facilitated Director and other senior scientists in making presentations / documents from time to time for various forums and industrial meets. Further this division has processed around 40 Bid documents for various projects with different organizations.

**Technology Transferred:**


**Agreements/MoU signed:**


2. Signed an agreement with Ghaziabad Development Authority for a project “Development of Comprehensive Mobility (Traffic and Transportation System) Plan (CMP) for Ghaziabad City” [Feb 3, 2018]

3. Signed an agreement with M/s Nitto-Denko India Pvt. Ltd, Japan to carry out a project “Pilot study on evaluation of Dust Suppressant for control of Road Dust Emissions” jointly with NEERI, Nagapur [Feb 19, 2018] (Fig. 134)

![Fig. 134 : Signed an agreement with M/s Nitto-Denko India Pvt. Ltd, Japan](image-url)
   a. “Sustainable Road Pavements in High Altitude Regions Using Geosynthetics”
   b. “Safe Road connectivity for Tripura State of NER of India”

5. CSIR-CRRI, New Delhi signed Agreement on 27-2-2018 with BITCOL, Mumbai for Process Technology for VG-40 and VG-50 for Harder Grade Bitumen. (Fig. 135)

Fig. 135: CSIR-CRRI, New Delhi signed Agreement with BITCOL, Mumbai

IP/Patent Filed
- High Performance Highly Modified Bitumen and process thereon on 11-10-2017
INFORMATION, LIAISON & TRAINING
Information Liaison & Training division acts as a nodal point between Institute & outside agencies for promotion, utilization and implementation of Institute knowledge base. The main activities of the division includes dissemination of the information, research liaison, development of human resource; and marketing of Institute’s knowledge base. Liaisoning with outside departments and agencies in India and abroad and organizing various training programmes either regular or customized for the highway & transportation professionals.

Training is an important activity of the division & we have trained more than 25,000 engineers so far at CRRI. Several regular refresher/training and development programmes are organized on various aspects of road and road transportation to develop trained manpower for effective implementation of research based technologies in highway projects.

Every year CSIR-CRRI announces regular training courses to meet the demand of road industry. These courses are extremely useful to various stakeholders, consultants, students, researchers and engineers of civil agencies. In addition to these regular training programs, ILT also organizes Tailor-made customized training programmes on request of the client to meet the training requirements of sponsoring organisations. Several organisations such as NRRDA, RITES, Air force Headquarter, Municipal corporations, Indian Oil Corporation Limited (IOCL), Delhi Development Authority (DDA), Department of Development of North East Region (DONER), Government of India, Rural Engineering Services (UP), World Bank, several State PWDs have availed the services of CRRI in this regard.

CRRI is registered with the World Bank, Asian Development Bank and African Development Bank to provide consultancy services and to meet the specialized training requirement of the highway and transportation engineering organisations. Our professional linkages with International organisations such as World Roads Association (PIARC), International Road Federation (IRF), Australian Road Research Board (ARRB), and Transport Research Laboratory (TRL), Tanzania National Roads Agency (TRANSROADS) help collaborative research and consultancy services.

### Regular Training Programme

Imparting training to the engineers of the user agencies is an integral part of the research programme of the Institute. During the year, following refresher courses/training programmes for in-service engineers of the user organizations related to roads and road transportation in the Govt. Public & Private Sectors were organized. Through these programmes, the Institute imparted training to the junior, middle and senior level engineers of the user organizations and acquainted them with the latest research based information on various aspects of road and road transportation.

<table>
<thead>
<tr>
<th>TITLE OF THE COURSE</th>
<th>DURATION</th>
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<tbody>
<tr>
<td><strong>A. PAVEMENT ENGINEERING &amp; MATERIALS</strong></td>
<td></td>
</tr>
<tr>
<td>• Design, Construction and Maintenance of Flexible Pavements</td>
<td>21-25 August, 2017</td>
</tr>
<tr>
<td>• Pavement Evaluation Techniques and their applications for Maintenance and Rehabilitation</td>
<td>04-08 Dec., 2017</td>
</tr>
<tr>
<td><strong>B. ROAD DEVELOPMENT PLANNING &amp; MANAGEMENT</strong></td>
<td></td>
</tr>
<tr>
<td>• International Course on Dissemination of HDM-4</td>
<td>11-22 Sep., 2017</td>
</tr>
<tr>
<td>• Geo-Spatial Technology (GIS, GPS, RS etc) for Road and Transportation</td>
<td>05-08 Feb., 2018</td>
</tr>
<tr>
<td><strong>C. GEOTECHNICAL ENGINEERING</strong></td>
<td></td>
</tr>
<tr>
<td>• Geotechnical and Landslide Investigations for Highway Projects</td>
<td>04-08 Sep., 2017</td>
</tr>
</tbody>
</table>
D. BRIDGES & STRUCTURES

- Bridge Diagnostics, Performance Evaluation and Rehabilitation 10-14 July, 2017
- Bridge Design and Construction 30 Oct-03 Nov., 2017

E. TRAFFIC & TRANSPORTATION PLANNING

- Economics & Financial Analysis of Highway & Transportation Projects 19-23 June, 2017
- Traffic Engineering & Road Safety Audit 24-28 July, 2017
- Air and Noise Pollution Measurement and Analysis 13-16 Nov, 2017

Glimpses of Regular Training Program at CSIR-CRRI

Bridge Diagnostics, Performance, Evaluation and Rehabilitation (10-14 July 2017)

Traffic Engineering and Road Safety” (24-28 July 2017)

Geotechnical and Landslide Investigations for Highway Projects (04-08 Sept., 2017)

Bridge Design and Construction (October 30 to November 03, 2017)
Demonstration Activities during the Training Programme

Pavement Evaluation, Techniques and their applications for Maintenance and Rehabilitation

Geo Spatial Technology (GIS, GPS, RS, etc.) for Roads and Transportation
Customised Training Programme

Besides the regular training programmes, the Institute conducted customer oriented programmes to meet the specific training requirements of the user agencies. During the year, the Institute conducted the following customer oriented training programmes:

- As per the requirements of National Highway Authority of India (NHAI), fifteen days Certificate Course on “Road Safety and Other Road Safety Related Aspects” was organised by CSIR-CRRI, New Delhi for consultants of Highway Engineers/Traffic Engineers/Transportation Planners. The course covered the theory and practical road safety audits and field visits and practical audit findings presentations. The training programme was inaugurated by Prof. Satish Chandra, Director CSIR-CRRI. The Training programme was attended by 30 participants from 15-30 May, 2017.

- Training Programme on “Construction of Cement Concrete Pavement for Low Volume Traffic Roads” for the Engineers of Rural Engineering Department, Uttar Pradesh was inaugurated by Prof. Satish Chandra, Director CSIR-CRRI. The Training programme was attended by 24 participants from 5-8 June, 2017.

- Training Programme on “Design, Construction & Maintenance for Flexible Pavements, Quality Control and Quality Assurance for Road and Bridges” for the Engineers of Rural Engineering Department, Uttar Pradesh was inaugurated by Prof. Satish Chandra, Director CSIR-CRRI. The Training programme was attended by 24 participants from 12-16 June 2017.

- Training Programme on Construction and Maintenance of Village Roads under PMGSY for the Engineers of RED, UP was conducted at CSIR-CRRI during July 03-06, 2017. It was attended by 21 participants.

- Training Programme on “Design, Construction of Flexible Pavement and Rigid Pavement” for the engineers of Punjab Urban Development Authority (PUDA), Mohali was inaugurated by Sh. T.K. Amla, Chief Scientist, CSIR-CRRI. The Training programme was attended by 40 participants during 15-16 July 2017.

- Training Programme on “Contract Management and Quality Control Aspects” for the Engineers of Rural Engineering Department, Uttar Pradesh was inaugurated by Sh. Sudhir Mathur, Chief Scientist, CSIR-CRRI. The Training programme was attended by 23 participants during 17-21 July 2017.


- CSIR-CRRI organised Five Days Customized Training Programme on “Pavement Evaluation, Techniques and their applications for Maintenance and Rehabilitation” for the Engineers/officers of the Indian Air Force. The training programme inaugurated by Prof. Satish Chandra, Director CSIR-CRRI. Training Programme was attended by 14 participants from January 29 - February 02, 2018.

- Customized Training Programme on “Road Safety Audit and other Road Safety Related Aspects” for the Engineers of Road Construction Department (RCD), Bihar. The training programme was inaugurated by Prof. Satish Chandra, Director CSIR-CRRI. Training Course was attended by 70 officers of RCD, Bihar from 19th -23rd February, 2018 at Patna.
National Highway Authority of India (NHAI), fifteen days Certificate Course on “Road Safety and Other Road Safety Related Aspects” for consultants of Highway Engineers/ Traffic Engineers/ Transportation Planners ts (15-30 May, 2017)

Construction of Cement Concrete Pavement for Low Volume Traffic Roads for the Engineers of Rural Engineering Department, Uttar Pradesh (5-8 June, 2017)

Design, Construction & Maintenance for Flexible Pavements, Quality Control and Quality Assurance for Road and Bridges” for the Engineers of Rural Engineering Department, Uttar Pradesh (12-16 June 2017)
Construction and Maintenance of Village Roads under PMGSY for the Engineers of RED, UP 03-06 July 2017.

Contract Management and Quality Control Aspects* for the Engineers of Rural Engineering Department, Uttar Pradesh (17-21 July 2017)

Road Safety Audit* for the PWD Engineers of Raipur (30-31 August 2017)

Pavement Evaluation, Techniques and their applications for Maintenance and Rehabilitation” for the Engineers/ officers of the Indian Air Force. (January 29 - February 02, 2018)
International Training Programmes

- International Training Programme on Highway Development and Management (HDM-4) was organised from September 11-22, 2017. During the programme hands on Experience on HDM Software was given to the participants for arriving decision making strategies for implementation of Highway Project.

- Training Programme on “Rigid Pavement: Design, Construction & Quality Control Aspects” for the Engineers of Department of Road, Nepal, was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI. The Training programme was attended by ten participants from 24 July – 4 August 2017. A field visit to Agra Expressway was organised during the programme for showing practical aspects of rigid pavements.

Glimpses of International Training Programmes
**Human Resource Development Programme**

Human resource development is a philosophy of management and is purported to upgrade the capabilities and professional skills of the personnel working in an organization to match the changing work demands. To enhance the professional capabilities of scientists and scientific staff for undertaking the R&D work in frontline areas of highway engineering and with the urge to develop technologies which have competitive edge and marketable strength, CRRI has been devoted in human resources development. Realizing the need for skill development and capacity building of the human resources, training programmes were selected. Staff members received specialized training in the areas of their expertise to cope up with the challenging assignments. Every year CRRI send our scientists to attend various training programmes and other specialized courses.

**Publications**

**CSIR-CRRI Annual Report for the Year 2016-2017**

The report is the profile of achievements of the Institute during the year 2016-2017. It also serves as a medium to acquaint the user agencies, clients and the other related organizations in the roads and road transportation research with R&D and other concomitant activities of the Institute. Progress reports of the R&D works and other related activities during the year from the various divisions/sections of the Institute were collected, compiled, edited and brought out as Institute’s Annual Report for the year 2016-17.

**CSIR-CRRI Newsletters** *(April-June, 2017) (July-September, 2017) (October, 2017-March, 2018)*

During the year, three issues of CRRI Newsletters were brought out. The Newsletter contained informations related to R&D activities and other general information related of the Institute.
R&D activities are being promoted through various publications like CSIR-CRRI Annual Report, CRRI Newsletter, leaflets, Training booklet, Sadak Darpan, Compendium, CRRI Profile, CRRI at a glance, CRRI history, etc.

**Other Activities**

**Dissemination of R&D Products**

The Institute’s R&D publications such as its Annual Report, Newsletters and Training Calendars were sent to highway professionals, engineering & academic organizations in the country and abroad. The publications are meant to disseminate R&D based information to the highway engineering profession.

**Technical Queries**

Technical queries concerning the R&D activities and technical know-how of the Institute were attended. Information on various technologies developed by the Institute were sent to a number of organizations dealing with databases, technology transfer and consultancy assignments pertaining to roads and road transportation.

**Press Publicity**

Various local press approached CRRI for information on research & developments and studies carried out by the Institute on roads, flyovers, bridges etc. The needed information was provided to the press for the purpose of awareness and publicity.

Press clipping pertaining to road and road transport in particular and Science and Technology in general were culled out from various National dailies and were brought to the notice of the Director and circulated to staff members for information, if needed. These were also compiled in the form of 2 document.

**Publicity through CRRI Advertisement**

To popularise the Institute’s past R&D achievements and present R&D programmes, capabilities, facilities and expertise, the Institute issued various advertisements at various forums. One such forum was the scientific documents brought out by various organizations on different occasions. The Institute published its various advertisements in the documents brought out by the various organizations on the different occasions.

**Publication of Research Outputs**

Research Papers emanating from the R&D work were processed for publication in various National & International Journals/Conferences through internal review system. Cases pertaining to deputation of CRRI Scientists to attend various Conference/Symposia were processed and attended.

**ISTAG Activities**

The scientists of the Institute were deputed abroad under various collaborative, exchange and bilateral programme of CSIR to participate in various conferences/symposia/seminar/study programmes. This financial year, CRRI has sent five scientists to attend conference & Present Papers.

**Technical Exhibitions**

The Institute participated in the following exhibitions and depicted its expertise, capabilities and R&D achievements.

**World of Concrete 2017**

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 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.

Smart Mobility Expo, 13-15 September 2017

On the request of M/s Virtual Info Systems Pvt. Ltd., Mumbai, CSIR-CRRI participated in the technical exhibition during Smart Mobility Expo: TrafficInfra Tech Expo & Parking Infra Tech Expo held on 13-15 Sept. 2017 at Hitex Exhibition Centre, Hyderabad, organized by M/s Virtual Info Systems Pvt. Ltd., Mumbai. During the technical exhibition CRRI showcased CRRI expertise & capabilities by way of detailed charts/posters and distributed CRRI Expertise/Technology leaflets, brouchers, etc. for the visiting delegates and other outside visitors during the technical Expo.

78th IRC Annual Session on Nov.3-6, 2017 at Bangalore

A technical exhibition was organized to showcase the latest in technology, products, and projects in the road and mobility sectors and CRRI expertise & capabilities during IRC’s 78th Annual Session at Bangalore (Karnataka) from 3-6 Nov. 2017. CRRI delegation attended the annual session at Bangalore.
IRF’s World Road Meeting on “Safe Roads and Smart Mobility: The Engines of Economic Growth” during 14-17 Nov. 2017 organized at New Delhi

A technical exhibition was organized to showcase the latest in technology, products, and projects in the road and mobility sectors and CRRI expertise & capabilities during IRF’s 18th World Road Meeting on “Safe Roads and Smart Mobility: The Engines of Economic Growth” from 14-17 Nov. 2017 at India Expo Centre and Mart, New Delhi. This prestigious Conference provided an outlet for sharing cutting-edge research, practices, and experiences, from across the world and is intended to be a premier knowledge event for discussing important issues facing the road, transport and mobility sectors.

Lucknow Conference on New Technology for Road Construction, 8-9 December 2017

CSIR-CRRI put a stall during Lucknow Conference on New Technology for Road Construction held on 8th & 9th Dec 2017. CRRI delegation attended the conference.

Events

Division also commemorate National Days and celebrates National Science Day on 28th February, National Technology Day on 11th May, CSIR-CRRI Foundation Day on 16th July, CSIR Foundation Day on 26 September, and Independence Day on 15th August, Vigilance Week, Swachchta Pakhwada, organisation of Meetings, Workshops, Conferences etc.

Student's dissertation/Project Work

Division is also facilitating B.Tech & M.Tech students who come for their dissertation work at CSIR-CRRI. Division has devised the guidelines and designed the proforma for the students to apply online through CRRI website twice in a year.

Jigyasa Program

Prime Minister has launched “Jigyasa” programme in July 2017 to connect scientists and students. CSIR has signed MoU with Kendriya Vidyalaya Sangathan (KVS) to inculcate the culture of inquisitiveness on one hand and scientific temper on the other, amongst the school students and their teachers. Division has conducted various interactive workshops under Jigyasa programme to imbibe curiosity and scientific vision in the children. CRRI Scientists have visited various KV’s of Delhi-NCR and Interacted with the students. Students of various Kendriya Vidyalayas from Delhi-NCR and other states have also visited CSIR-CRRI to see the state of art equipments, laboratories and various research activities. This has enabled the students and teachers to practically live the theoretical concepts taught in science by visiting laboratories. The mentorship and encouragement of our scientists to foster scientific temper among students shall give continuity for technological advancement in India.

Visitors

Visits of distinguished professionals and delegates from various organizations related to road and road transportation from India and abroad to CRRI were organized during the year.

Glimpses of Visitors at CSIR-CRRI
Linkages with Professional Bodies

The Institute is represented as the Institutional Member on the various technical, executive and administrative committees and groups of various National and Foreign Organizations. These organizations maintain their databases including R&D activities, organizational heads, etc. of the Member Institutions and regularly seek the updated information. The updated information on CRRI was provided to various organizations and the annual subscriptions were paid to continue the membership.
Civil infrastructure works executed during 2017-18 are as follows:

**COMPLETED WORKS:-**

Name of Work:- Renovation of RP and FP division at CRRI.
Total Expenditure (In lacs) :- 24.63

Name of Work:- Renovation of Dining hall including Toilets, Kitchen etc. of Guest House - I at CRRI.
Total Expenditure (In lacs) :- 26.82

Name of Work:- Renovation of Annex portion of PED along with complete building block at CRRI.
Total Expenditure (In lacs) :- 32.00
Name of Work:- Development of Geological & Geotechnical Specimen Gallery at CRRI.
Total Expenditure (In lacs) :- 1.57

ONGOING WORKS:-
Name of Work:- White wash & Painting (Internal & External) at CRRI.
Awarded Cost (In lacs) :- 16.41

Name of Work:- Renovation of Recreation club with badminton hall, Toilets of Guest House-I and miscellaneous civil works at CRRI.
Awarded Cost (In lacs) :- 32.39
Name of Work:- Renovation of laboratory (Plate load test) of GTE division at CRRI. 
Awarded Cost (In lacs) :- 10.28

Name of Work:- Renovation of Canteen building (1st Floor) and Guest House-I at CRRI. 
Awarded Cost (In lacs) :- 40.43

Name of Work:- Renovation of Guest House - II rooms at CRRI. 
Awarded Cost (In lacs) :- 40.31
R & D Support Services

- Technical Support Division
- Computer Centre & Networking
Technical Support Division
The division is involved in:

- Design & Development of Equipment
- Repair of R&D equipment
- Calibration of Automatic Road Unevenness Recorder (ARUR)
- Maintenance and installation of Electrical equipment and accessories
- Repair and maintenance of Airconditioners and Air conditioning Plants and other temperature control equipment
- Maintenance of Water Purifiers
- Supervision of AMC for EPBX
- Calibration of R&D equipments, etc.
- Handling the transport facility for smooth functioning of the Institute
- Disposal of Nuclear Devices used for R&D activities
- Design and Development Gym Facilities at MBSQ

Calibration of Automatic Road Unevenness Recorder (ARUR):

Automatic Road Unevenness Recorder (ARUR) units, comprising both Car Axle Mounted Bump Integrator and Fifth Wheel Bump Integrators, received from different manufacturers and user agencies, were calibrated using Dipstick, Class-I equipment. Roughness measurements, using Dipstick and the Response Type Roughness Measuring Device, were undertaken on a number of selected test sections having varying roughness levels (excellent to very poor). Calibration equation between the observed roughness and the standard roughness is developed to determine the corrected/calibrated Roughness. Calibration certificates are issued to these agencies.
Calibration of R&D Equipment:

CSIR-CRRI is ISO-9001:2008 certified R&D institution. Calibration of measuring equipments is an essential requirement for taking measurement/test values/test results. The calibration of various R&D equipments such as Proving Rings, Load Cells, Dial Gauges, Weighing Balance, Thermometers, Universal Testing Machines, Compression Testing Machine have been carried out as per the requirement of Geotechnical, PED, Bridges, Flexible and Rigid Pavement Divisions of CSIR-CRRI.

Repair & Maintenance of R&D and other Equipment

- 500 line EPABX MATRIX Exchange
- DRRI Office Siemens Exchange
- 80 Nos. of 500 VA Offline UPS for Computers attended/repaired like NGPBS, Uniline, Samtek and other R & D Equipments like Electronic balances, CVTs
- Benkelman beam
- Automatic Sample mixer
- Compression Machine
- Core Cutting Machine
- CBR Moulds
- UTM

Air Conditioner Repairs and Maintenance

- The division undertakes in-house repair and maintenance of approximately 350 air conditioners of the Institute besides supervising operation and maintenance of Air Conditioning Plant at CRRI office campus.

Transport Section

- Repair, maintenance and insurance of staff cars and other instrumented vehicles are being taken care of.
- Five old vehicles are being processed for condemnation and disposal as per the orders of Hon'ble NGT.
- Hiring of vehicles from CRRI approved external agencies for movement of CRRI staff for official purposes and processing their bills for payment.
Computer Centre & Networking
The main objective and function of CCN Division is to meet the ICT requirements in the domains like Admin, Finance, HR including various R&D related services.

CRRI’s LAN Structure is equipped with a highly secured Unified Thread Management System (UTM) security appliance for a complete enterprise class security solution, with centralized management, logging, reporting and restrict unauthorized network use.

The high performance of this LAN system is maintained with the maximum perimeter protection.

CCN operates the connectivity through a fully networked campus with state-of-the-art IT infrastructure and computing & communication resources and it offers Scientists and Research Scholars the facility of 24x7 uninterrupted, super-fast, reliable and secure Wifi Access having 53 Access Points and LAN Connectivity with 1GBPS NKN to carryout the R&D works in an easier manner.

The present LAN/IT system is supported by Layer 3 Core Switches, Layer 2 Edge Switches, Routers, Firewall, Access Control Server, Net Manager and Wireless Controller for its functionalities and operations.

The centralized Corporate Antivirus Security Solutions is provided with End-Point protection, Web reputation, URL filtering, etc. to all the computing devices in the institutes.

The regular IT Support facilitates the following areas.

- Procurement of IT hardware and Software items.
- Hardware and Software supports of all the IT equipments in CRRI including Servers, PCs, Printers, Laptops and various computer peripherals.
- IT support for Seminars and Video conferencing and webinars.
- CRRI Home page development, maintenance and regular updates with latest news, events, tenders, RTI pro-active disclosure, training programmes and recruitment details, etc.
- Online Library Search (Web OPAC), BIS Searching facility, Transport Database, Links for subscribed E-Journal, Driver Testing Software and Online Payslip Application through CRRI Intranet Services, etc.
- Provides E-Mail facility to all the Staff members in the institute.
- Alignment of CRRI with RTI Online, Handling online RTI applications and submission of quarterly reports, etc.
- Maintenance of Bio-Metric Attendance System (Procurement, Installations and configuration of the BAS Hardware.).
- Conducting Training programmes for increasing IT literacy among Group 1 and 2 Staff.
Knowledge Resource Centre
Documentation & Library Services
Prof. S.R. Mehra library provides information services to the staff of the Institute in the field of traffic, transportation and highway engineering. The library has a collection of over 90,000 publications including books, reference books, periodicals, conference proceedings, technical reports, standards, specifications, microfilms, maps, CD-ROM databases, video cassettes, etc.

**Bibliographic Service**

Literature searches were carried out and bibliographic service was provided on request to researchers of CRRI on topics related to highway engineering and transportation.

**Reference Service**

Specific information provided on more than one hundred reference queries.

**Collection Development**

Publications like books, periodicals, conference proceedings, technical reports, CD-ROM databases, standards, related to roads, transport and related areas, etc. were acquired for updating the library collection.

**Technical Processing**

Publications added to the collection were classified, catalogued, indexed and well maintained for efficient retrieval.

**Access to E-Journals**

Access to full text E-Journals is being provided through Internet from various publishers like American Society of Civil Engineers (ASCE), American Society for Testing and Materials (ASTM) Digital Library, Taylor & Francis, Wiley, Institution of Civil Engineers (ICE, UK), etc.

**Computerisation of Documentation and Library Services**

Database is being developed for the publications received in the library.

**E-CART Bulletin- Current Awareness in Roads & Transport**

A monthly current awareness service containing scanned content page of the current journals received in the library is e-mailed to individual scientists to make them abreast of latest developments in the field of transportation and highway engineering.

**Library Statistics**

Books added during the period

(01.04.2017 -31.03.2018) 156
Total Number of books as on 31.03.2018 56206
Maps 688
Microforms 655
Video cassettes 122
Periodicals (Print) titles received regularly (Foreign +Indian) 45

E-Journals subscribed through NKRC (CSIR-NISCAIR)
- American Society of Civil Engineers (ASCE),
- American Society for Testing and Materials (ASTM) Digital Library,
- Institution of Civil Engineers (ICE, UK), etc.
Quality Management
Quality Management

Quality Management Division is responsible to ensure that IS/ISO 9001:2008 Quality Management System operates effectively and efficiently in the Institute. Besides, adopting higher level of quality standards in the working of the Institute is also the mandate of the division. During the year, the division was engaged in conducting internal quality audits, discussing the findings of the audit in the management review committee meetings, ensuring the Institute’s readiness for the external audits to be conducted by certification agency i.e Bureau of Indian Standards (BIS) for the surveillance audit for higher level of quality standards in the working of the Institute.

Internal Quality Audits (IQA)

The Internal Quality Audits are systematic and independent examination of the system to determine whether the planned arrangements are implemented effectively and are suitable to achieve the objectives. The audit was carried out by trained quality auditors of the Institute with the following objective:

- To determine the conformity or non-conformity of the quality system elements with specified requirements.
- To determine the effectiveness of the implemented quality system in meeting the specified quality objectives.
- To provide the auditee with an opportunity to improve the quality system.
- To meet regulatory requirements.

During the internal audit, two aspects namely the requirement of the quality management system as defined in the Quality Manual and the Quality System Procedures were focused. The non-conformity reports (NCRs) and corrective action reports (CARs) were communicated to the auditees for ensuring the corrective and preventive actions. The action taken by the auditees were verified during the subsequent audit and NC’s were closed.

Internal Quality Audit of the Institute was carried out during 19.06.2017 to 23.06.2017 and on 27.06.2017 & 07.07.2017 to check whether the IS/ISO 9001:2008 QMS is effectively and efficiently in place in the Institute. The audit findings were discussed in the Management Review Meeting.

Management Review Meeting (MRM)

After the internal quality audits, the findings of the audit and its reports were discussed in detail in the Management Review Committee meeting held on 04.12.2017. Besides the findings of the audits, the gray areas related to the functioning of the Institute were also discussed and resolved to ensure that Institute’s work is carried out as per the planned arrangements. The Quality Policies and Quality Objectives were reviewed to make them in line with each other keeping in view the mandate of Institute. The Quality Objectives were reviewed to ensure that they are quantifiable and measureable to meet the QMS requirement.
राजभाषा
Different types of activities were conducted so as to ensure the compliance of the official language policy of the Union Government. Rajbhasha Section continued in its endeavor to promote the official language in day-to-day routine work as well as official work of permanent nature. For this, Official Language Implementation Committee (OLIC) meetings were organized on quarterly basis and follow up actions were taken on the decisions taken in these meetings. Various incentive schemes were implemented in the Institute and employees doing remarkable work in Hindi were given cash incentives as well as certificates of commendation. Hindi Day & Hindi fortnight were celebrated to enhance official language use in day to day work. A large number of staff took participation in different competitions organized during the Hindi Week. Cash prize and certificates were also distributed to the winners.

In accordance with the official language policy of Govt. of India, Rajbhasha section assisted other sections in the translation work of different type of documents. Assistance was offered to various sections and divisions with respect of Hindi correspondence and preparation of technical reports, abstracts, work reports etc. in Hindi. Scientists actively participated and presented their papers in Hindi at different Seminars organised by CSIR Labs as well as other government organisations. Scientists were awarded cash incentives and certificates for the seven papers which were adjudged best in the technical Hindi paper competition organized during the last year.

Rajbhasha Section also helped scientists in preparing lectures/presentations related to their research work in Hindi. Lectures on various subjects
related to R&D work of the Institute were delivered by the scientists in Hindi which was organized on a monthly basis. Two health-related lectures were delivered by padamshri awardee Medical experts. To encourage the staff to do more and more work in Hindi “Hindi workshops” were organized in every quarter of the year. To promote Official Language Policy and to assist employees of the Institute to write and express themselves in Hindi, fifteenth issue of “Sarak Darpan”, the scientific magazine of CRRI was published.

“कंप्यूटर पर वोइस टाइपिंग द्वारा हिंदी में कार्य” विषयक हिन्दी प्रशिक्षण दिनांक 30 मई 2017

कंप्यूटर पर वोइस टाइपिंग के माध्यम से कंप्यूटर पर राजभाषा हिंदी के कार्य को बढ़ाने हेतु संस्थान में दिनांक 30 मई 2017 का हिंदी कार्यशाला—सह—प्रशिक्षण सत्र का आयोजन किया गया। प्रशिक्षण के दौरान संस्थान के कार्मिकों को विस्तार से यह बताया गया कि किस प्रकार कंप्यूटर में कुछ सेटिंग के माध्यम से हिंदी कंप्यूटर टाइपिंग का उपयोग किया जा सकता है। इससे लिए कंप्यूटर में में माइक्रोफोन/इलेक्ट्रॉन का प्रयोग करके कंप्यूटर पर हिंदी में कार्य किया जा सकता है।

हिंदी में स्वास्थ्य संबंधी व्याख्यान दिनांक 19 मई 2017

संस्थान के कार्मिकों में राजभाषा हिंदी के प्रति सकारात्मक बलात्मक का निर्माण करने के लिए प्रतिभामंदिर में हिंदी व्याख्यान का आयोजन किया जाता है। इस श्रृंखला में स्वास्थ्य से संबंधित जागरूकता उत्पन्न करने के लिए दिनांक 19 मई 2017 को संस्थान में प्रो. एस. श्री मनचंदा (पदमश्री) का “स्वस्थ जीवन शैली, बीमारियाँ एवं उनका उपचार” विषय पर हिंदी में व्याख्यान का आयोजन किया गया। अखिल भारतीय आयुर्विज्ञान संस्थान (एस) से सेवानिवृत्त और पदमश्री से सम्मानित डॉ. मनचंदा ने सरल हिंदी में आधुनिक मानव की अंतर्गत जीवन शैली की चर्चा की और बताया कि अपने जीवन में हमें जिन बीमारियों का सामना करना पड़ता है उनसे बचाव और उनके उपचार के बारे में जानकारी प्राप्त करना आवश्यक है। भोजन और जीवन शैली के संतुलन का आश्वासन नियमित योग और व्यायाम के द्वारा जीवन में उत्तम स्वस्थ का लक्ष्य प्राप्त किया जा सकता है।
इस अवसर पर समागम में उपस्थित संस्थान के कर्मियों ने स्वास्थ्य से संबंधित अपनी शंकाएं डॉ. मनचंदा के समक्ष रखीं और उन्होंने विस्तार से इनका समाधान दिया। डॉ. मनचंदा ने अपने व्याख्यान में इस बात को रेखांकित किया कि जीवन शैली को सुस्थित बनाना तथा अवसाद और तनाव से बचाव के लिए शारीरिक, मानसिक एवं आध्यात्मिक उन्नति के लिए प्रकृति सम्मत एवं भारतीय संस्कृति के अनुरूप जीवनचर्या को अपनाना महत्वपूर्ण है।
राजभाषा अनुभाग

संस्थान में दिनांक 19 मई 2017 को आयोजित हिंदी व्याख्यान के कार्यक्रम में सभी अधिकारियों एवं कर्मचारियों को आतंकवाद विरोधी शपथ भी दिलाई गई। दिनांक 21 मई को मनाए जाने वाले आतंकवाद विरोधी दिवस के उपलब्ध में संस्थान के निदेशक महाद्विप्रो. सतीश चंद्र और वरिष्ठ प्रशासन नियंत्रक श्री. ओ. उम्मन पणिकर ने यह शपथ दिलवाई।

हिंदी टेबल कार्यशाला की रिपोर्ट (दिनांक 26 एवं 27 जुलाई 2017)

संस्थान में दिनांक 26 एवं 27 जुलाई 2017 को दो दिवसीय हिंदी टेबल कार्यशाला का आयोजन किया गया। इसके अंतर्गत संस्थान के प्रशासनिक अनुभागों में हिंदी में किए जा रहे कार्य की समीक्षा की गई तथा सरकारी कामकाज में हिंदी के प्रयोग में वृद्धि करने के लिए सुझाव दिए गए। प्रत्येक अनुभाग में सरकारी कामकाज में हिंदी की मात्रा को बढ़ाने तथा कर्मचारियों को हिंदी में काम करने में आने वाली कठिनाइयों के विषय में अनुभाग अधिकारी एवं स्टाफ सदस्यों के साथ प्रत्यक्ष रूप से चर्चा की गई। हिंदी टेबल कार्यशाला में अनुभागों द्वारा भरी जाने वाली तिमाही प्रगति रिपोर्ट में दिए गए अंकों के आधार पर धारा 3(3) के अनुसार एवं पत्ताचार की स्थिति की समीक्षा की गई।

टेबल कार्यशाला में कम्प्यूटर पर हिंदी में कार्य को बढ़ाने के लिए वेबसाइट पर संबंधित काठिनाइयों का समाधान किया गया। इसके लिए राजभाषा विभाग, गृह मंत्रालय की वेबसाइट पर उपलब्ध हिंदी ई-ट्विल के अंतर्गत दी गई सुविधाओं से अवगत कराया गया।

इसमें उपलब्ध गृह वेबसाइट, मशीन अनुवाद और ई—महाशक्ति शक्ति शक्तिविकल के प्रयोग के द्वारा सभी स्टाफ सदस्यों को सरलतापूर्वक अंदाज़े के साथ कार्य हिंदी में करने की विधि प्रदर्शित की गई। इसके अतिरिक्त, राजभाषा विभाग, गृह मंत्रालय के वार्षिक कार्यक्रम 2018-2017 में निर्धारित लक्ष्यों तथा संस्कृति राजभाषा समिति की दूसरी उपसमिति को दिए गए आवश्यकताओं को पूरा करने की दृष्टि से अनुभागों के कार्यियों के अपेक्षित दायित्वों के संबंध में उन्हें विस्तारपूर्वक बताया गया।

टेबल कार्यशाला में अनुभागों को संघ सरकार की राजभाषा नीति, विभिन्न राजभाषा नियमों, अधिनियमों और आदेशों के अनुसार अपेक्षित अनुपालन, रिकार्ड का रखरखाव एवं अन्य साक्षात्कारियों से संबंधित सुझाव भी दिए गए। इसके लिए, सभी संबंधितों से अनुरोध किया गया कि निम्नलिखित / बाराबर प्रयोग आने वाले मानक प्रारूपों को हिंदी में ही लिखें जिसके अनुसार को हिंदी में करने के लिए अनुसार अनुपालन की सहायता ली जा सकती है। कार्यशाला में अधिकारियों एवं कर्मचारियों का अपना मूल काम हिंदी में करने के लिए प्रोत्साहित किया गया। टेबल कार्यशाला के दौरान इस बात पर विशेष रूप से विचार किया गया कि सीएसआईआर मुख्यालय से प्राप्त पत्रों एवं राजभाषा विभाग, गृह मंत्रालय के विशालनिर्देशों के अनुसार प्रशासनिक कार्यों में हिंदी का प्रयोग न स्त-प्रतिष्ठा अपक्षित है।

सीएसआईआर—कंट्रीय सड़क अनुसंधान संस्थान में हिंदी पखवाड़ा 2017 का आयोजन

सीएसआईआर—कंट्रीय सड़क अनुसंधान संस्थान (सीएसआईआर—सीआईआरआईआर) नई दिल्ली में दिनांक
14 सितंबर 2017 को हिंदी दिवस का आयोजन किया गया। इस उपलब्धि में दिनांक 29 सितंबर 2017 तक चलने वाले हिंदी पखवाड़े का उद्घाटन भी किया गया। संस्थान के निदेशक प्रो. सतीश चंद्र ने उद्घाटन समारोह की अयोग्यता की। अपने बयान में उन्होंने हिंदी के प्रचार-प्रसार के लिए गंभीर प्रयास करने पर बल दिया। वरिष्ठ प्रशासनिक नियंत्रक श्री ओ उम्मन पणिकर ने हिंदी दिवस 14 सितंबर के महत्व के बारे में बताया। इस अवसर पर प्रो. हरीश नवल, प्रशिक्षण विभाग के मुख्य अधिकारी के रूप में समारोह की गरीबी बढ़ाई। अपने बयान में उन्होंने देश-विदेश में हिंदी के प्रचार-प्रसार के लिए की गई यात्राओं एवं अभाषण के दौरान प्रचार हुए और अपने अनुभवों को साझा किया। मुख्य अधिकारी ने सरकारी कार्य में हिंदी के महत्व पर बल देते हुए हिंदी को एक दुर्लभ भाषा से इतर सुप्रभाव भाषा बनाने पर बल दिया तथा हिंदी को लोकप्रिय बनाने के लिए अन्य भारतीय भाषाओं में उपलब्ध विशाल शब्द संपदा के उपयोग बढ़ाने की आवश्यकता बताई।

हिंदी पखवाड़े के दौरान संस्थान के कार्यक्रमों के लिए विभिन्न हिंदी प्रतियोगिताओं यथा हिंदी स्लॉनग प्रतियोगिता, निवंद्ध लेख, तकनीकी लेख प्रतियोगिता, शुरुआत प्रतियोगिता, हिंदी प्रश्नपत्र हंसा  तथा समाचार वाचन प्रतियोगिता का आयोजन किया गया। पखवाड़े के अंतर्गत संस्थान के अनुभवों और भाषाओं के हिंदी कार्य की समीक्षा की गई। हिंदी प्रतियोगिताओं में संस्थान के प्रशासनिक एवं तकनीकी वर्ग के विभिन्न श्रेणी के कर्मचारियों ने बड़ बढ़कर भाग लिया। संस्थान के अनुसार एवं विकास कार्यों में हिंदी के प्रयोग में बुद्धि के उद्देश्य से 'ईमान की खपत पर सड़क और यातायात की स्थिति के प्रभाव' विषय के हिंदी में एक तकनीकी प्रस्तुतीकरण भी रखा गया। पखवाड़े के दौरान इसी क्रम में विशिष्ट हिंदी व्याख्यान भी रखा गया जिसमें पद्मश्री से समानित नेत्र विशेषज्ञ डॉ. एस महिपाल सचवाई को आमंत्रित किया गया। उन्होंने और उन्होंने जबूती विभिन्न उपयोगी जानकारी ही, जिससे संस्थान के सभी कार्यकारी लाभान्वित हुए।

हिंदी पखवाड़े के दौरान संस्थान में हायकवि समेलन भी आयोजित किया गया, जिसमें श्री विरान जैन एवं सुश्री मनोजा शुक्ला को हायकविक के रूप में आमंत्रित किया गया। हायकवि कवि समेलनों के विर-परिवर्त हस्ताक्षर आमंत्रित कवियों ने अपनी कई हायकविताएं सुग्राह, जिनका संस्थान के कार्यक्रमों ने भरपूर आनन्द उठाया। इस दौरान संस्थान के कार्यक्रमों ने अपनी स्वर्णित कविताएं भी प्रस्तुत की।

आमंत्रित वार्ता: आंखों की देखभाल संबंधी हिंदी में विशेष व्याख्यान

संस्थान के कार्यक्रमों में राजमात्रा हिंदी के प्रति सकारात्मक बातचीत का निर्माण करने के लिए प्रत्येक तिमाही में हिंदी व्याख्यान का आयोजन किया जाता है। इस बृहत व्याख्यान में स्वर्णित कविताओं का जागरूकता उत्पन्न करने के लिए दिनांक 21 सितंबर 2017 को संस्थान में डॉक्टर महिपाल एस. सचवाई (पदमश्री) का 'आंखों की सुरक्षा, स्वर्णित रोग और उनके उपचार' विषय के हिंदी में व्याख्यान का आयोजन किया गया। अखिल भारतीय आर्थिक व्याख्यान संस्थान से ग्रेजुएट एवं मोडल ग्रेजुएट स्तर की मैदनान्तिक शिक्षा पूर्ण करने वाले डॉ. महिपाल एस. सचवाई ने सरल रूपों में नेत्र विज्ञान से जुड़ी विभिन्न जानकारी दी। उन्होंने आंखों का कायर्थिती के बारे में बताया, साथ ही आंखों से संबंधित स्वर्णित सामान्य समस्याओं की अत्यधिक
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उपयोगितापूर्ण जानकारी भी दी। डॉक्टर महिपाल ने आंखों में जलन, खुजली, पतनों गिराना, पलकों में सींकरी होना इत्यादि की जानकारी देते हुए कंजैकिटवाइटिस की समस्या को भी रेखांकित किया।

डॉ. महिपाल ने अपने व्याख्यान में बताया कि भारतवर्ष में 80% तक आंखों की समस्या स्तायिनिक एवं व्यवसायिक कारणों से उत्पन्न हुई है। उन्होंने मोतियाबिंद – सफेद मोतिया, काला मोतिया, भंगपान, निकट दृष्टि दोष, दीर्घ दृष्टि दोष इत्यादि समस्याओं पर भी प्रकाश डाला। साथ ही, इन सामान्य रोगों के उपचार के बारे में शल्यक्रिया उपचार तथा शल्यक्रिया रहित उपचार की भी जानकारी दी गई। उन्होंने सरल एवं सुविधाजनक माध्यमों से चर्चा हटाने की विधियों को अपने व्याख्यान में रेखांकित किया।

डॉक्टर महिपाल एस. सचदेव ने उपचार के रूप में मददगार विधियों से मोतियाबिंद दूर करने के बारे में बताया जिसमें श्रम एवं धन की बचत होती है तथा जो सुरक्षित, तीव्र एवं अधिक मुद्देजनक है। इस अवसर पर समागम में उपस्थित संस्थान के अनेक कर्मियों ने नेत्र से संबंधित अपनी शाकांडे डॉक्टर महिपाल के समक्ष रखी और उन्होंने विस्तार से इनका समाधान किया।

हिंदी पत्रवादे का समापन एवं पुरस्कार वितरण समारोह दिनांक 29 सितंबर 2017 को आयोजित किया गया।

संस्थान के कर्मियों को संबोधित करते हुए निदेशक प्रो. सतीश चंद्र ने कहा कि आम जनता तक वैज्ञानिक उपलब्धियों की जानकारी राजभाषा के माध्यम से पहुंचाया जाना नितांत आवश्यक है और इसके लिए यह जरूरी है कि संस्थान के वैज्ञानिक एवं तकनीकी लेखन को बढ़ाने के लिए विशेष रूप से प्रयास किए जाएं। इसके साथ-साथ प्रशासन के क्षेत्र में सभी अधिकारियों द्वारा हिंदी में कार्य की मात्रा बढ़ाने के लिए और अधिक गप्पे प्रयास करने की भी आवश्यकता है। उन्होंने आपके बयान की कि पत्रवादे के दौरान आयोजित हिंदी प्रतियोगिताओं में कर्मियों की उत्साहपूर्ण प्रतिभागिता, हिंदी कार्य में वृद्धि के रूप में परिलक्षित होगी।

समारोह में निदेशक प्रोत्साहन पुरस्कार योजना के अंतर्गत उन सभी अधिकारियों को पुरस्कार दिया गया जिन्होंने पिछले वर्ष के दौरान हिंदी में प्रशासनीय कार्य किया था। पत्रवादे के दौरान आयोजित प्रतियोगिताओं में प्रथम, द्वितीय, तृतीय, सातवें पुरस्कार एवं प्रशस्ति प्रमाण-पत्र प्राप्त करने वाले कर्मचारियों को भी प्रमाण-पत्र एवं प्रदान किया प्रोत्साहन राशि का किया गया। मूल रूप से हिंदी में टिप्पणी एवं प्रारूप लेखन करने वाले कर्मियों को सम्मानित करते हुए उन्हें पुरस्कृत किया गया। इस अवसर पर हिंदी अधिकारी, श्री संजय चौधरी ने संस्थान में राजभाषा कार्यान्वयन के संबंध में संशोधन रिपोर्ट स्पष्टत की और समापन समारोह का सफलतापूर्वक संचालन किया।
हिंदी कार्यशाला का आयोजन

संस्थान में दिनांक 5 व 6 दिसंबर 2017 को दो दिवसीय हिंदी कार्यशाला का आयोजन किया गया। इसके अंतर्गत संस्थान के प्रशासनिक अनुभवों तथा अनुसंधान एवं विकास प्रभागों के कार्मिकों के लिए सरकारी कार्यकाल में हिंदी के प्रयोग में वृद्धि करने के लिए व्याख्यान एवं अभ्यास के सात आयोजित किए गए। कार्यशाला के प्रथम दिवस, 5 दिसंबर 2017 को केंद्रीय हिंदी प्रशिक्षण संस्थान से श्रीमती कमलेश बजाज, सहायक निदेशक ने सरकारी कार्यकाल में हिंदी की अन्विष्टता एवं पारिभाषिक शब्दावली पर व्याख्यान दिया। साथ ही उन्होंने वर्णमाला से संबंधित अक्षर ज्ञान तथा सामान्य हिंदी वर्तनी पर प्रशिक्षण देते हुए, हिंदी में प्रयुक्त स्वर, व्यंजन, संयुक्तक्षण, इत्यादि की सामान्य तृंटियों के बारे में बताया। इसके अतिरिक्त, उन्होंने हिंदी के महत्व को बताते हुए हिंदी प्रमुखों और कार्यशालाओं हिंदी शब्दावली के संदर्भ में प्रतिभागियों को अत्यंत उपयोगी जानकारी दी।

कार्यशाला के दूसरे दिन 6 दिसंबर को प्रथम सत्र में कंप्यूटर पर वॉर्डस्क्रिप्ट का प्रशिक्षण दिया गया, जिसमें संस्थान के सभी कर्मचारियों को वाचन के द्वारा हिंदी टाइप-लेखन की जानकारी दी गई। सीसीएम प्रमोग से श्रीमती रीता न्यूनकेरा ने कंप्यूटर के वॉर्डस्क्रिप्ट संचालन की पूर्ण विधि बताई। साथ ही, इस सत्र के दूसरे कार्यक्रम में द्वारा हिंदी में टाइप-लेखन की प्रक्रिया का क्रमानुसार व्यवहारिक ज्ञान भी दिया गया एवं समय और श्रम की बचत करने एवं टाइप-लेखन करने के लिए सुझाव दिए गए। इस सत्र में वॉर्डस्क्रिप्ट के संबंधित प्रतिभागियों का कहना-कहना का समाधान किया
राजभाषा अनुभाग

gaya, जिसके लिए उन्हें राजभाषा विभाग, गृह मंत्रालय की वेबसाइट पर उपलब्ध हिंदी ई-दूल्स के अंतर्गत दी गई सुविधाओं से भी अवगत कराया गया।

कार्यशाला में इंटरनेट पर उपलब्ध गूगल वोइस टाइपिंग एवं मशीन अनुवाद के साथ—साथ वैज्ञानिक एवं तकनीकी शब्दकोश आयोग के शब्दकोश तथा ई—महाशब्दकोश शब्दकोश के प्रयोग के द्वारा सभी स्टाफ सदस्यों को सरलतापूर्वक अधिक से अधिक कार्य हिंदी में करने की विधि प्रदर्शित की गई। इसके द्वितीय सत्र में अनुभागों एवं प्रभागों के द्वारा भरी जाने वाली हिंदी तिमाही प्रगति रिपोर्ट में भरते समय आने वाली समस्याओं का समाधान बताया गया। प्रगति रिपोर्ट संबंधी प्रतिमागणियाँ की कठिनाइयों पर चर्चा के दौरान राजभाषा अनुभाग के स्टाफ सदस्यों ने उन्हें आंकों के रखरखाव के लिए रजिस्टर बनाने की महत्व बढ़ाई गई। विषय में उनसे यह सुनिश्चित करने के लिए कहा गया कि तिमाही प्रगति रिपोर्ट में तथ्यपरक आंकें ही भरे जाएं एवं अनुभागों एवं प्रभागों में धारा 3(3) के अनुसार को सुनिश्चित किया जाए।

हिंदी में तकनीकी प्रस्तुतीकरण

संस्थान के कार्यालयों में राजभाषा हिंदी के प्रति सकारात्मक बातकरण का निर्माण करने के लिए प्रत्येक तिमाही में राजभाषा अनुभाग के द्वारा तकनीकी व्याख्यान/ प्रस्तुतीकरण का आयोजन किया जाता है। इस श्रृंखला अंतर्गत संस्थान के टीईएस प्रभाग से श्रीमती कामिनी गुप्ता ने दिनांक 14/12/2017 को “चढ़क सुखा उपाय: बायोफीडब्लू थरेपी” पर तकनीकी व्याख्यान दिया जो ‘वाहन चालकों में तनाव को कम करने हेतु बायो फीडब्लू का प्रयोग’ विषय पर था। उन्होंने बताया कि भारत में चालकों के बीच तनाव को कम करने और सुरक्षित वाहन चलाने के लिए बायोफीडब्लू थरेपी का प्रयोग किया जा सकता है। इसके बाद प्रदर्शन प्रारंभ करने के लिए बाइब्लो को आराम देने के लिए यह अध्ययन किया गया, साथ ही, वे अपने इलाक़े में प्रदर्शन को बृद्धि देकर कॉम को देख सकते हैं। बायोफीडब्लू के प्रयोग के माध्यम से थरेपी से पहले और बाद में चालक के निर्णय समय का तुलनात्मक अध्ययन किया गया। शुभ्री से होता है यह परिक्षण विद्या टेस्ट परीक्षण भी कहलाता है जो एक्सपीट्रा द्वारा
किया जाता है और स्कोर किया जाता है। वियना टेस्ट सिस्टम और बायोफीडबैक थेरेपी से डी.टी. टेस्ट का प्रशासन करने के लिए विशेष सुरक्षा समूह (एसपीजी) से 40 ड्राइवरों का चयन किया गया।

तकनीकी प्रस्तुतिकरण के माध्यम से यह स्पष्ट समझा जा सकता है कि आज के युग में तकनीकी उन्नति के साथ चालकों में तनाव भी बढ़ रहा है। इसलिए बायोफीडबैक थेरेपी का उपयोग अधिक होना चाहिए जो न केवल चालकों को तनाव-मुक्त होने में सहायता करेगा अपितु रड्ड के सुरक्षित वाहन चालन में भी उपयोगी होगा। उपयोग की यह पद्धति सक्रिय रूप से तनाव को दूर करने और काम में एकाग्रता क्षमता को बढ़ाती है। इस प्रस्तुतिकरण के द्वारा संस्थान के कार्यालय में आरएंडी कार्यों में हिंदी का प्रयोग बढ़ाने को लेकर सकारात्मक वातावरण का निर्माण हुआ तथा साथ ही इस कार्य पूरा करने के लिए सभी कार्यकर्ताओं से साफ आदेश दिए गए।
हिंदी व्याख्यान का आयोजन
निदेशक, केंद्रीय सड़क अनुसंधान संस्थान द्वारा संस्थान में हिंदी व्याख्यान/प्रस्तुतीकरण की श्रंखला के अंतर्गत संस्थान के श्री एस.एस. गहरवार, प्रभागीय प्रमुख, बीईएस ने दिनांक 13 फरवरी 2018 को संस्थान के समस्त कर्मचारियों एवं अधिकारियों को शारीरिक भाषा के महत्व पर अपने अमूल्य विचारों का प्रस्तुतीकरण किया।
Administration
CSIR-CRRI Research activities are fully supported by dedicated staffs in the administration. It has different arms to assist its day-to-day functioning such as DRRI Secretariat, Controller of Administration, Personal Cell, Vigilance, Establishment-I, Establishment-II, Accounts and Purchase departments. They maintain personal files, service books and Annual Confidential Report folders of around 250 staff members. They deals with allotment of staff quarters & scientist apartments, matters pertaining to estates, leaves, deputation/foreign services, pension, medical reimbursement etc. They deal with parliamentary questions and other related matters. These departments are also dealing with all administrative matters including their appointment, promotion, transfer, posting, deputation, disciplinary issues, apart from other service matter that may come up from time to time.
Memorable Events
Memorable Events

संस्थान की राजभाषा कार्यान्वयन समिति की तिमाही बैठक 11 अप्रैल 2017

सीएसआईआर—सीआरआरआई राजभाषा कार्यान्वयन समिति की तिमाही बैठक में संस्थान की पिछली तिमाही की बैठक की कार्यवाही और निर्णयों पर कार्यवाही पर विचार एवं तिमाही प्रगति रिपोर्ट पर विचार किया गया और संसदीय राजभाषा समिति की दूसरी उपसमिति को दिये गए आवेदनों पर विचार किया गया। राजभाषा विभाग, गृह मंत्रालय के वर्षिक कार्यक्रम 2016–17 के निर्धारित लक्ष्यों के आधार पर संस्थान की राजभाषा प्रगति पर भी विचार किया गया।

Nature Awareness Talk Followed By Nature Walk

Dr O P Sharma, IFS, Director Ecology Environment & Remote Sensing, J&K delivered a talk on nature awareness followed by nature walk. It was organised inside the CRRI campus, acquainting us with eco stories of plants around the campus. The staff members attended this Nature Awareness event on 3rd May 2017.
National Technology Day Celebration

11th May is observed as National technology Day each year all over India to commemorate the technological breakthrough made by India. The Institute celebrated National Technology Day on Friday, 11th May, 2017. On this occasion, Shri R.C. Agarwal, Head (ILT), gave a brief background of National Technology Day Celebration. While Prof. (Dr.) Satish Chandra, Director, CSIR-CRRI introduced the Chief Guest and delivered the welcome address. IPS Shri Ajay Kashyap, Spl. Commissioner of Police, Delhi, graced the occasion as the Chief Guest and delivered a lecture on “Use Information Technology for Traffic Management in Delhi”.

निर्मल एकादशी छबील

dinaParticipants were honored. The event was concluded with a moment of silence to honor the memory of Shri Arjuna Devji, followed by a delicious feast of sweets and prasad offered to the guests.

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समन्वय महिला क्लब द्वारा पेयेंटिंग लेखन का आयोजन
सीएसआईआर—सीआरआरआई में समन्वय महिला क्लब के सौजन्य से 20 अप्रैल 2017 को संस्थान के सभी अधिकारियों एवं कर्मचारियों एवं उनके परिजनों को बच्चों के पालन पोषण के विषय पर सुशील संतोष जावा (सत्या साई चार्ल्स विकास) ने अपने द्वारा दिये व्याख्यान के अंतर्गत उनको बताया गया की आप लोग हमारे बच्चों के लिए दिशानिर्देशों का अपने जीवन में प्रयोग करके एक अच्छे अभिवादक के रूप में अपने बच्चों का सही पालन पोषण कर सकते हैं। और उनका जीवन सफल बना सकते हैं।
World Environmental Day Celebration

On the 5th June, occasion of World Environment Day 2017, Tree Plantation was done by Prof. (Dr.) Satish Chandra Director CSIR-CRRI at CRRI Campus and the quiz competition on Environment Awareness was organised by Dr. Anuradha Shukla, Head Environment Science division, CSIR-CRRI.
International Yoga Day Celebration

CSIR-CRRI celebrated International Yoga Day in its premise on 21 June 2017. Yoga exercise session for the Institute’s staff was conducted by Dr. Neelam J. Gupta, Principal Scientist. More than 75 staff member attended the Yoga session. The session consisted of short warm-up period that focuses on relaxation, centring and breath. This was followed by Surya Namashkar to build heat and get the heart rate moving and finally, Pranayam for focusing on breathing and relaxation.

Prof. Satish Chandra, Director, CSIR-CRRI and Mrs. Sunita Chandra graced the occasion by their presence.

"Yoga is skill in action. The skill is to see, how to keep your spirit uplifted, your energy high and accomplish the task in hand. This comes only by Yoga. Yoga should not be limited or misunderstood as just some exercise. It is a holistic development, expression & connection of human life."

~ Gurudev Sri Sri Ravi Shankar

CSIR-CRRI Foundation Day Celebration

CSIR-CRRI Foundation Day was celebrated on July 14, 2017. On this occasion, Prof. Seyed Mohammad Reza Khalili, Research Counsellor, Embassy of I.R. Iran to India, New Delhi was the Chief Guest. Prof. Seyed Mohammad Reza Khalili addressed the scientist 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 have performed in this cultural program.
Independence Day Celebration

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 Celebration

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.
Memorable Events
Vigilance Awareness Week

Vigilance Awareness Week was observed at CSIR-CRRI from 31st October to 5th November 2017. On October 31, a pledge was administered by the Director, CSIR-CRRI to the staff members of CRRI for maintaining integrity and continues to strive to bring about transparency in all spheres of life. Banners and posters were displayed at prime locations in the premise of the Institute.

Swachhta Pakhwada

Institute observed "Swachhta Pakhwada" from 1st to 15th November 2017 to propagate the message of clean India. It culminated with a pledge for cleanliness and hygiene. Institute initiated following activities towards Clean India during Swachhta Pakhwada:

- Cleanliness drive was organized across all the divisions of CRRI with active participation of employees.
- Records management work including weeding out of old files is being undertaken on a priority basis.
- Lots of old records were stored in almirahs in the open passage/corridor of the institute. The same has been taken out and now the corridors/passages are absolutely clean without any obstruction.
- Efforts are being made to dispose off obsolete machinery, equipments, scrap etc.
- In order to give a good ambience to the environment of the Institute, continuous efforts have been made under Swachha Bharat Mission for proper upkeep of the lawns. We have initiated the practice of planting flowers in every season.
- The internal roads within the CRRI campus have been repaired and presently they are in excellent conditions.
- Bottlenecks in disposal of sewage have also been removed so that they do not pose any health hazard.
- For the purpose of providing safe drinking water to the employees and guests who visit CRRI, an action plan was devised and is underway.
- The toilets that were built around three decades ago are being renovated & refurnished in tune with present requirements of the Institute.
- In order to segregate bio-degradable and non bio-degradable garbage, blue and green dustbins have been installed in Maharani Bag Headquarters.
Accordingly the efforts, in pursuance of directives of CSIR letter no. 5-1(17)/2008-PD dated 26.10.2017, have borne fruit as can be evidenced in the following picture album.

**Constitution Day**

Pledge of the preamble of Indian Constitution to commemorate the birth anniversary of Dr. B.R. Ambedkar as “Constitution Day” was taken by all staff members on 27-11-2017.
CSIR-CRRI Recreation Club activities

The badminton hall of the Institute (near Main Store) has been renovated recently. The badminton hall was inaugurated by Prof. Satish Chandra, Director CSIR-CRRI and President, CRRI Recreation Club. Director also distributed prizes to the winners and runner-ups of various sports activities on 22nd Nov. 2017 organised by CSIR-CRRI Recreation Club on the occasion of CSIR-CRRI Foundation Day.

Outbound Team Building Program

As part of HRD training of CSIR-CRRI staff members, CSIR-CRRI organised Half Day “Outbound Team Building” Training Programme especially for the staff members of CSIR-CRRI on 22 Dec. 2017 at CSIR-CRRI Lawn, conducted by M/s SkillMile Solutions Pvt. Ltd., Gurgaon. Seventy Five staff members attended the programme. Various activities were performed and games were played to build the team spirit and highlight the benefits of working in team.
New Year Celebration

A get-together was organised on the occasion of New Year Day at CSIR-CRRI on 2nd January 2018. Prof. Satish Chandra, Director CSIR-CRRI, in his address highlighted the achievements of the Institute during the preceding year (2017) and expressed the hope the scientists and technologists will do more R&D work in the coming year and motivated the CRRI family to meet new challenges. Prof. Satish Chandra extended best wishes to all the staff members and their families.
CSIR - CRRI Research Council Meeting

Director General, CSIR constituted the CSIR-CRRI Research Council (RC) for a period of three years from Aug. 2017 to Aug. 2020.

The newly constituted Research Council met on 30th and 31st October 2017. All Chief Scientists, Heads of Divisions and Project Leaders attended the meeting. Presentations on Fast Track Translational (FTT), 12th Five Year plan projects, Major Lab and Sponsored Projects were made by the Scientists. RC also met all the scientists and discussed the R&D related issues.
JIGYASA Programme at CSIR-CRRI

CSIR-CRRI is a constituent establishment of Council & Scientific & Industrial Research (CSIR). CSIR launched a student-scientists connect programme called JIGYASA. The focus of this programme connected students and scientists so as to extend student’s classroom learning with that of a very well planned research laboratory based learning programme. It not only initiated scientific interaction between present scientific fraternities and the upcoming generation but also imbibed curiosity and scientific vision in children.

Information, Liaison and Training Division (ILT), CSIR-CRRI has organized the JIGYASA programme for Kendriya Vidyalayas. Various KV schools from Delhi- NCR region participated in Jigyasa programme. Around 300 students alongwith 15 teachers participated in the programme. Interactive sessions were organised to explain the R&D activities /scientific work to the students and teachers.

K V, AFS, Arjangarh on 29-11-2017

K V, Kamla Nehru Nagar, Ghaziabad,  30-11-2017

KV, No-2, Faridabad on 1-12-2017
Workshops/Conferences & Meetings Organised
Workshops/Conferences & Meetings Organised

**Workshop on Cold Mix Technology**

- A 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 on 21st sep.2017.

**Meeting on SIG F5 Transport Noise and Vibration Control**

This is a new Special Interest Group which has been established recently in WCTRS. This group held its first meeting in CSIR-Central Road Research Institute, New Delhi. This was followed by the 2nd Conference on Transport Noise and Abatement Measures (CTNAM – 2018) held on 15 -16 February 2018. This conference was supported by the World Conference on Transport Research Society (WCTRS) and the European Noise Barrier Federation (ENBF).

The program began with the welcome address of Prof Satish Chandra, Director CRRI, followed by the keynote speech of Giovanni Brero, President ENBF and the second keynote speech by Prof Yoshitsugu Hayashi, President WCTRS. A total of 6 sessions were conducted in the program. In all approximately 200 delegates attended the conference included several industry partners.

**Workshop on “Vigilance & Purchase Procedure in CSIR”**

A workshop on vigilance and purchase procedure was held in CSIR-CRRI on 26-27 February, 2018. The workshop commenced with a welcome address by Dr. Neelam J. Gupta, Head, Information Liaison & Training (ILT) subsequent to which Prof. Satish Chandra, Director, CRRI shared his thought regarding the significance and necessity of holding such workshop so that the Scientific Community is made well aware about the various nuances of vigilance particularly preventive vigilance as well as tendering processes in order to prevent lapses that occur leading to vigilance cases and irregularities in purchases due to lack of knowledge of rules and procedures.

The workshop started with a talk on overview of vigilance by Shri Anjum Sharma, Controller of Administration. This was followed by detailed lectures and presentations by the Resources Person Shri Y.K.Sharma, Former Sr. Dy. Secretary, CSIR or
vigilance and disciplinary concepts, CCS(Conduct) Rules, Inquiry Procedure, etc. These presentations continued throughout the day on 26th February, 2018.

On 27th February, 2018, the Resource Person, Shri Brijesh Sharma, CoSP, IGIB gave lectures and presentations on purchase procedure and indent specifications, tendering evaluation and tendering process followed by advice on how to prevent irregularities in purchases.

The above two days workshop was well received by the Scientists, Technical Officers and Staff of CRRI and appreciated by them.

The workshop concluded with a Vote of Thanks given by Shri Padam Singh, Sr. CoFA on behalf of the host.
Honours & Awards Received
Prof. Satish Chandra, Director CSIR-CRRI received Excellence in Academics Award-2017 on Engineer's day by Institution of Engineers(I), Roorkee local chapter on Sep. 15, 2017.

Best Hindi Scientific Work Awards 2017 under Director Promotion Award Scheme to Dr. Ravindra Kumar and Dr. Mukti Advani.

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

Dr. Rajeev Goel received Outstanding Concrete Technologist of Western UP Award for Year 2017, given by ICI, Delhi chapter.

Prof. Satish Chandra, Director, CSIR-CRRI and four scientists were felicitated by honourable CM of Uttar Pradesh during Conference on New Technology for Road Construction held on 8th & 9th Dec 2017 at Lucknow.
Honours & Awards Received

- ‘Skoch order of merit’ (2017) for carrying out a project titled ‘Jarofix solid waste material from zinc industry for road construction’, considered as top-80 technology projects in India.

- 10th Viswakarma Award (2018) for carrying out a project titled ‘Jarofix waste material from zinc industry for road construction’.

- Dr. A.K. Sinha received 10th Viswakarma Award in the category of Scientist from Construction Industry Development Council (CIDC), New Delhi.

- Dr. P.S. Prasad received 10th Viswakarma Award in the category of Scientist from Construction Industry Development Council (CIDC), New Delhi.

- Received Medal and Scroll of Commendation (Dr A K SINHA) 10th CIDC Vishwakarma Achievement Award 2018 under Scientist category

- Received Medal and Scroll of Commendation 10th CIDC Vishwakarma Achievement Award 2018 under best construction project category entitled “Design, Construction and Performance study of jarofix experimental road, Chittorgarh”
Invited Lectures/Talks Delivered
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.

Dr Vasant G Havanagi, Senior Principal Scientist delivered a lecture on Utilization of Aged Municipal Solid Waste in Road Embankment in Workshop on ‘Landfills and Waste-to-Resources’, on 19 April 2017.

Dr. Errampalli Madhu, Principal Scientist delivered a lecture on Role of ITS in Enhancing Road Safety for Indian Conditions in Conference organised by SAFE (a SIAM initiative) at Bhubaneswar, Odisha. On 20th April 2017.

Dr. Rina Singh, Senior Scientist Presented an invited talk on ‘Hybridized Plasmon modes and Electric Field Enhancement around Plasmonic Nanostructures/Nanoshells: A Systematic Investigation for SERS sensing’ at an International Conference in Small Science (ICSS), San Sebastian, Spain. 9 to 13th May 2017.


Dr.Mukti Advani Principal Scientist delivered a lecture on Non motorized transport planning and design guidelines in Certificate course for Road Safety Engineers and Auditors - Invitation for lecture(s) at IAHE, Noida on 12th July 2017.

Dr. Lakshmy P, Chief Scientist, as a Invited Speaker, talk on “Pre-stressing Techniques Bridge Bearings and Expansion Joints ”in Training of Engineers at L&T Leadership Development Academy on 19th July, 2017.


Dr. Ambika Behl, Sr. Scientist Presented a invited talk on Cold in Place Recycling: Green Roads in 3rd International Conference ROADTECH Sustainable Roads and Highways on 27 August 2017

Dr. Mukti Advani Principal Scientist delivered a lecture on Road Safety in and around Schools through Engineering, Education and Awareness in Kadi Sarva Vishwavidyalaya Gandhinagar on 27th August 2017.

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.


Key note by Dr. Rakesh Kumar, Pr. Scientist at International Conference on Innovations in Concrete for Infrastructure Challenges Nagpur, (INFRACON 2017), organized by ICI Centre of Nagpur, India October 6-7, 2017.


Shri A.Saurikhia Principal Scientist delivered a lecture on New Technologies in the Road Sector at Noida Institute of Engineering & Technology (NIET), Greater Noida on 14th Oct. 2017.


Shri Kanwar Singh Principal Scientist delivered a lecture on Stabilisation of soil by soil nailing during box jacking for the Construction of underpass below live traffic condition in IRC Session at Bengaluru on 3-6th Nov., 2017.


Shri Sampath Kumar Pasupunuri, Scientist delivered a lecture on Self-healing pavements: A revolution in pavement materials during 18th IRF World Road Meeting Conference on 16th Nov., 2017.

K. Sitaramanjaneyulu, Sr. Pr. Scientist delivered a lecture on Development of pavement maintenance management system for high speed road corridors using state-of-art technologies in 18th IRF World Road Meeting Conference on 17th Nov., 2017.

Dr. Kishor Kumar, Chief Scientist delivered a lecture on Highway Slope Management- Key to Disaster Resilient Highway Infrastructure in National Workshop on "Disaster Resilient Infrastructure in the Himalayas: Opportunities and Challenges” on 21st and 22nd November 2017 at Dehradun organized by "Uttarakhand State Disaster Management Authority (USDMA) on 21st Nov. 2017.


Dr. Mukti Advani Principal Scientist delivered a lecture on Basics of Transportation Planning and Road Safety in As a part of JIGYASA. Kendriya Vidyalaya, Air Force Station, New Delhi on 29th November 2017.

Dr. Mukti Advani Principal Scientist delivered a lecture on Basics of Transportation Planning and Road
Invited Lectures/Talks Delivered

Safety in As a part of JIGYASA. Kendriya Vidyalaya, Kamla Nehru Nagar New Delhi on 30th November 2017.

- Dr. Mukti Advani Principal Scientist delivered a lecture on Basics of Transportation Planning and Road Safety in As a part of JIGYASA. Kendriya Vidyalaya, Faridabad on 1st December 2017.

- Shri Manoj Kumar Shukla, Pr. Scientist & Dr. Siksha Swaroopa Kar, Scientist delivered a lecture on Cold Mix Technology and its Applications in Workshop Organised by HPPWD on 4th December, 2017.

- Dr. Lakshmy P, Chief Scientist as a guest speaker, talk on “CSIR-CRRI Technologies for Urban Infrastructure” in Round Table, New Delhi on 4th December 2017.

- Shri Binod Kumar, Presented a paper on “Utilization of Ground Granulated Blast Furnace Slag in Pavement quality Concrete Mixes”, Proceeding of 15th International Seminar on Cement, Concrete and Building Materials, 5-8 December, New Delhi.


- Dr. Lakshmy P, Chief Scientist delivered a presentation on “Long Term Performance Monitoring of Second Thane Creek Bridge” in International Seminar on Repair, Rehabilitation and Retrofitting of Bridges & Structures, at Jaipur on 16th December 2017.

- Dr. Ch. Ravi Sekhar Principal Scientist delivered a lecture on General Assembly of the BRT Centre of Excellence in General Assembly for reviewing the BRT Projects, in the World Resources Institute (WRI) offices - 10 G Street NE Suite 800, Washington DC on 10th Jan 2018.

- Dr. Kishor Kumar, Chief Scientist delivered a lecture on Sharing of Experiences and Best Practices on Proactive Planning Addressing Road Infrastructure in Training programme on "Mainstreaming Disaster Management in Infrastructure Sector" organized for SAARC countries held by SAARC Disaster Management Centre Gujarat at Gandhinagar on 11th Jan.2018.

- Dr. Lakshmy P, Chief Scientist as a speaker, talk on “Advancing Use of Recycled Material in Road Sector”, in one day workshop on C&D Waste Management at Mumbai, organized by IL&FS & SINTEF on 2nd February 2018.

- Dr. Ambika Behl, Sr. Scientist Presented a invited talk on Plastic/Polymer Modified Bitumen and Its Feasibility in All India Bitumen Conference on 8th Feb 2018

- Shri S.S. Gaharwar, Sr. Pr. Scientist, as a Invited Speaker, talk on “Health Monitoring of Bridges”in Aryabhatta Institute of Technology (ABIT),New Delhi on 16th February, 2018

- Dr. Rajeev Goel, Sr. Pr. Scientist delivered a lecture on “Assessment of Load Carrying capacity of Baily Bridge in Koteshwar, Uttarakhand ” in Structural and Geotechnical Engineering (ACSGE-2018), Organised by Birla Institute of Technology & Science, Pilani on 26-28 February 2018.

- Dr. Lakshmy P, Chief Scientist as a keynote speaker talk on “Recent Advances in Materials for Sustainable Bridges” in International Conference on Advances in Construction Materials and Structures, at IIT Roorkee on 8th March 2018.

- Dr. Errampalli Madhu, Principal Scientist delivered a lecture on Sustainability Approach with respect to Public Transportation for Smart Cities - A Case Study of Delhi City in Workshop on " Bus Transport
Planning, Scheduling and Optimisation” Organised by Anna University, Chennai on 8th March 2018.

- Dr. Errampalli Madhu, Principal Scientist delivered a lecture on Sustainability Approach for Smart Cities in Workshop on “Sustainable Mobility in Delhi NCR & Beyond: How to Achieve more from Efforts?” Organised by CSIR-NEERI on 13th March 2018.


- Shri Binod Kumar, Pr. Scientist, Lecture in one day Workshop on Rural Concrete Roads, Washed Manufactured Sand and Water Repellent, 14th March, 2018, Lucknow.
New Facilities Developed/Procured
• Portable Retro-Reflectometer
• Tobii Eye Tracker
• SARA Analyser
• Gas Analyzer
• Sigma Plot and Sigma Scan
• Universal tank for conducting model tests for stabilisation of slopes using ‘Soil Nailing’
• Designed and fabricated (2017) “Connection Strength Test Apparatus to evaluate connection strength between geosynthetic and modular concrete blocks”
• Impedance Analyser
• Field Portable Concrete/Rebar Corrosion Analyzer
• Concrete Carbonation Test Chamber Cap-400Ltr.
• Up gradation of 10t capacity over head crane in heavy testing Laboratory in BES Division.
• Electrically Operated Rotating Drum Type Concrete Mixer 0.1-0.15 cum capacity.
• NISA Software upgrade (version-19)
• Induction Machine for heating of bituminous mixtures.
• Asphalt Permeameter for permeability testing of asphalt mixes
Participation in Training Programs/Short Term Courses (Outside CRRI)
## Participation in Training Programs/Short Term Courses (Outside CRRI)

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<td>Programme on Effective Implementation of RTI Act and Record Management</td>
<td>HRDC, Ghaziabad</td>
<td>6-7 April 2017,</td>
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<td></td>
<td>Sh. A K Sagar</td>
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<td>Sh. P C Meshram</td>
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<td>Sh. Rajesh Rana</td>
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<td>3</td>
<td>Sh. D V Singh</td>
<td>Professional Training Program to Fight Dengue and Chikunguniya</td>
<td>New Delhi</td>
<td>16-17 August 2017,</td>
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<td></td>
<td>Sh. Sunil Grover</td>
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<td>Sh. Muniraj Meena</td>
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<td>Sh. Tara Chand</td>
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<td>Sh. Panjik Bhatt</td>
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<td>4</td>
<td>Sh. Surendra Kumar Verma</td>
<td>Earthquake Resistance Design of Building</td>
<td>New Delhi</td>
<td>26 August-14 October 2017</td>
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<td>5</td>
<td>Smt. Nidhi Agarwal</td>
<td>Programme on Work Life Balance for Women Scientists and Officers</td>
<td>HRDC, Ghaziabad</td>
<td>6-8 September 2017</td>
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<td>Smt. Reeta Kukreja</td>
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<td>6</td>
<td>Abhishek Mittal</td>
<td>Users Awareness Workshop on “ScienceDirect, SCOPUS and Mendeley (Reference Management Tool)”</td>
<td>IIT Delhi</td>
<td>01st September, 2017</td>
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<td>7</td>
<td>Abhishek Mittal</td>
<td>AIMIL Customer Interaction Program on “Importance of Quality Control Equipment in Infrastructure Development”</td>
<td>Delhi</td>
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<td>8</td>
<td>Sh. Avanish Kumar</td>
<td>Executive Development Program on Public Procurement</td>
<td>Alwar</td>
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<td>Sh. Sumer Singh</td>
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<td>Sh. Virendra Kumar Dussya</td>
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<td>9</td>
<td>Parvathi G. S.</td>
<td>Short Course on Geotechnical Modeling using GeoStudio</td>
<td>IIT Delhi</td>
<td>18th - 20th December 2017</td>
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<td>10</td>
<td>Dr. Ravindra Kumar</td>
<td>AICTE Sponsored Faculty Development Programme on &quot;Deep Learning in Big Data Analytics”</td>
<td>Department of Computer Science &amp; Engineering, Swami Keshvanand Institute of Technology, Management &amp; Gramothan, Jaipur</td>
<td>6-17 November, 2017</td>
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Deputation Abroad
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<tr>
<th>Name of Scientist &amp; Designation</th>
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<td>Dr. Rina Singh</td>
<td>San Sebastian SPAIN</td>
<td>09.05.2017</td>
<td>13.05.2017</td>
<td>To Present keynote lecture</td>
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<td>Sh. Satish Pandey</td>
<td>ITALY</td>
<td>10.06.2017</td>
<td>18.06.2017</td>
<td>World Conference on Pavement &amp; Asset Management</td>
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<td>Prof. Satish Chandra</td>
<td>Rome, ITALY</td>
<td>05.09.2017</td>
<td>07.09.2017</td>
<td>23rd International Conference on Urban Transport and Environment</td>
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<td>Dr. E. Madhu</td>
<td>NETHERLANDS</td>
<td>02.10.2017</td>
<td>07.10.2017</td>
<td>To present the project Findings and Revise the Project funded by World Bank</td>
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<td>Dr. Ravi Sekhar</td>
<td>Washington D.C. (USA)</td>
<td>07.01.2018</td>
<td>11.01.2018</td>
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Thesis/Dissertations Supervision
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<th>S.No.</th>
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<th>Institute</th>
<th>Title of Project/Thesis</th>
<th>Supervisors</th>
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<td>1</td>
<td>Mr. Satbir Singh Puwar</td>
<td>AcSIR</td>
<td>Evaluation of Road Safety Interventions and Impact on Road Crashes on Indian Roads</td>
<td>Dr. A. Mohan Rao, Dr. S. Velmurugan</td>
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<td>2</td>
<td>Ms Manisha Gaur</td>
<td>AcSIR-CRRI</td>
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<td>Dr. Anuradha Shukla</td>
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<td>3</td>
<td>Vijay Bahadur Yadav</td>
<td>Indira Gandhi Delhi Technical University &amp; ESD, CSIR- CRRI</td>
<td>Development of nano composite material for the removal of trace metals from waste water</td>
<td>Dr. Ranu Gadi,</td>
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<td>4</td>
<td>Khushboo Arora</td>
<td>AcSIR</td>
<td>Studies on High Performance Warm Mixes Containing Modified Bitumen</td>
<td>Dr. Ambika Behl</td>
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<td>5</td>
<td>Dr. Siksha Swaroopa Kar (Completed)</td>
<td>AcSIR (CSIR-CRRI)</td>
<td>Investigation of Foaming Characteristics of Bituminous Binders and Recycled Mixtures</td>
<td>Dr. Devesh Tiwari, Dr. P. K. Jain and Prof. A. K. Swamy, (IIT, Delhi)</td>
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<td>6</td>
<td>Dr. Sanjay Deori (Completed)</td>
<td>IIT, Guwahati</td>
<td>Deterioration Modelling of Flexible Pavements with Modified Bitumen in Wearing Course</td>
<td>Dr. Rajan Choudhary, Associate Professor (IIT, Guwahati) and Dr. Devesh Tiwari</td>
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<td>7</td>
<td>Shri Gagandeep Singh</td>
<td>AcSIR (CSIR-CRRI)</td>
<td>Investigation of Fatigue Endurance Limit in Bituminous Mixes Containing Modified Bitumen</td>
<td>Dr. Devesh Tiwari, Dr. P. K. Jain and Prof. A. K. Swamy, Assistant Professor (IIT, Delhi)</td>
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<td>8</td>
<td>Shri Shahbaz Khan</td>
<td>AcSIR (CSIR-CRRI)</td>
<td>Performance Evaluation of Inverted Pavement with Cement Fly Ash Base Layer</td>
<td>Dr. Devesh Tiwari, Mr. M. N. Nagabhushana and Prof. Dharamveer Singh (IIT Bombay)</td>
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<td>S.No.</td>
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<td>Thesis Title</td>
<td>Supervisor (s)</td>
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<td>9</td>
<td>Mr. Fadamoro Oluwafemi Festus</td>
<td>AcSIR- The World Academy of</td>
<td>Performance Evaluation of Foam Bitumen Stabilization Using Warm RAP Material</td>
<td>Dr. Devesh Tiwari &amp; Dr. Siksha Swaroopa Kar</td>
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<td></td>
<td>(Ongoing)</td>
<td>Sciences (TWAS) Fellowship</td>
<td>and Aggregates</td>
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<td>Programme</td>
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<td>10</td>
<td>Ms. Lincy Varghese</td>
<td>AcSIR-CRRI</td>
<td>Characterization of Engineering Properties of High Volume Flyash Concrete</td>
<td>Dr. V.V.L. Kanta Rao, Dr. Lakshmy P</td>
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<td>Containing Colloidal Nano Silica.</td>
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<td>11</td>
<td>Mr. Dinesh Kumar</td>
<td>AcSIR-CRRI</td>
<td>A study on Structural Properties of Self Compacting Concrete made with</td>
<td>Dr. V.V.L. Kanta Rao, Dr. Lakshmy P</td>
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<td>Recycled Concrete Aggregate</td>
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<td>12</td>
<td>Ms. Beenu Raj</td>
<td>AcSIR-CIMFER</td>
<td>Studies on Polyester Terephthalate wastes and their Conversion to Polyester</td>
<td>Dr. V.V.L. Kanta Rao</td>
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<td></td>
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<td>based Products for application in mining and road construction</td>
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<td>Ajay Singh Patel</td>
<td>Gautam Buddha University, Near Yamuna Expressway, Greater Noida</td>
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<td>Dr. Mukti Advani</td>
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<td>Aravind Kumar Tigari</td>
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<td>10</td>
<td>Kabilan M</td>
<td>College of Engineering, Anna University, Chennai</td>
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<td>Dr. Velumurgan S</td>
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<td>Ms. Saranya Sasi</td>
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| 30    | Ms. Bhamini B           | Rajiv Gandhi     | Surrogate Safety | Dr. A. Mohan Rao  
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| 31    | Ms. Neethu T. P         | Rajiv Gandhi     | Development of Crash | Dr. A. Mohan Rao  
|       |                         | Institute of Technology, Government Engineering College Kottayam, Kerala | Occurrence Model for Urban Mid-Block | Dr. S. Velmurugan |
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|       |                         | University, Greater Noida | Vibration Analysis, June 2017 | Dr. Shilpa Pal (Professor, Gautam Buddha University) |
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<p>|       |                         | University, Greater Noida | the Properties of Structural Concrete produced from Recycled Aggregates | Dr. Shilpa Pal (Professor, Gautam Buddha University) |
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Visitors
Prof. Mohammad Reza Khalili, Scientific & Research Counsellor, Embassy of the Islamic Republic of Iran visited BES Division of CSIR-CRRI on 03rd July 2017.

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 at CSIR –CRRI, New Delhi on 01st Sep 2017.

Mr Coady Cameron, CEO, Founder, TotalPave, Canada met Director CRRI and PED Scientists related to evaluation of their TotalPave Mobile based App in India.

Presentation by A2Z Infraservices Ltd. on Magic Bricks (Cement Concrete Blocks using Municipal Waste) on 6th December, 2017.

Japanese deligation from Hiroshima University, Prof. Fujiwara and Prof. Chikaraishi (urban transportation and town planning) along with some Hiroshima University students visited CSIR-CRRI to explore the possibilities of collaboration in the area of “urban transportation and town planning” on 9 March 2018.

Mr. Christian Lanng Nielsen, CEO and Mr. Stephen Wormald, Director, DYNATEST Denmark Visited CRRI on 01.03.2018 and discussed with Prof. (Dr.) Satish Chandra, Director CSIR-CRRI on creation of calibration facilities for Falling Weight Deflectometer at CRRI.

Mr. Yasuhito Ohwaki, Chairman, Mr. Ashish Sharma, Manager and Mrs. Jhalak Gupta, Assistant Manager, Japanese establishment in India - Nitto Denko India Private Limited, Dr. S.K. Goyal, Sr. Pr. Scienitst, Head CSIR-NEERI, Delhi Zonal Centre visited CRRI on 19.02.2018 to sign a tri-party agreement between Nitto Denko India Pvt Limited, CSIR-NEERI and CSIR-CRRI for a project entitled “Pilot Study on Evaluation of Road Dust Suppressant for Control of Road Dust Emissions”

Prof. Russell G. Thompson, (The University of Melbourne, Australia), Prof. Lorant A. Tavasszy (TU Delft, The Netherlands), Dr. Hans Quak (TNO, The Netherlands), Mr. Jeroen Borst (TNO, The Netherlands), Dr. Nilesh Anand (TU-Delft, The Netherlands) visited for discussion on World Bank funded project on MEGALOG.
Membership of Staff in Various Technical Committees
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<th>Position held</th>
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<td>Member</td>
<td>Indian Roads Congress (IRC), H-6 &quot;Road Maintenance and Asset Management Committee&quot;</td>
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<td>2</td>
<td>Shri K. Sitaramanjaneyulu</td>
<td>Member Secretary</td>
<td>Indian Roads Congress (IRC), H-2 &quot;Flexible Pavement Committee&quot;</td>
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<td>3</td>
<td>Dr. Devesh Tiwari</td>
<td>Invitee Member</td>
<td>H-8 (Urban Roads, Streets &amp; Transport) Committee (2015-17), Indian Roads Congress (IRC)</td>
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<td>Dr. Devesh Tiwari</td>
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<td>Committee for Accreditation of New/ Alternate Materials/ Technologies for the Year 2015-2017</td>
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<td>5</td>
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<td>Member</td>
<td>Indian Roads Congress (IRC), H-3 &quot;Rigid Pavement Committee&quot;</td>
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<td>Shri M.N. Nagabhushana</td>
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<td>Dr Anuradha Shukla</td>
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<td>Technical Committee on Reduction of Carbon Footprint in Road Construction and Environment (G-3), Indian Roads Congress (IRC)</td>
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<td>Shri. Sudhir Mathur</td>
<td>Member of The Sub Group</td>
<td>Prepared the IRC: SP: 89 (Part II) – 2018: Guidelines for the design of stabilized pavements.</td>
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<td>IRC H8 Committee</td>
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<td>HRB Identification, Monitoring &amp; Research Application Committee of IRC</td>
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<td>H-4 committee on Embankment, Ground improvement and Drainage</td>
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<td>Dr. Lakshmy P.</td>
<td>Member</td>
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<td>Dr. Lakshmy P. Dr. R. K. Garg Shri D.C. Sharma</td>
<td>Chairman</td>
<td>IRC’s G-4 Committee: Mechanization &amp; Instrumentation</td>
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<td>Shri U.K. Guru Vittal Dr Vasant G Havanagi</td>
<td>Member Member Secretary</td>
<td>H 4 Committee on 'Embankment, Ground Improvement &amp; Drainage'</td>
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<td>Member Secretary Co-convener</td>
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<td>Satish Pandey</td>
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<td>IRC</td>
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<td>Dr. Ambika Behl</td>
<td>Member</td>
<td>H9 Committee</td>
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<td>30</td>
<td>Manoj Kumar Shukla</td>
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<td>Manoj Kumar Shukla</td>
<td>Member</td>
<td>Pilot Project Committee of IRC</td>
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<td>S.No.</td>
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<td>Prof. Satish Chandra</td>
<td>Chairman</td>
<td>PCD-6 Committee on Tor and Bitumen</td>
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<td>2</td>
<td>Dr. Anuradha Shukla</td>
<td>Chairperson</td>
<td>Solid Waste Management Sectional Committee CHD-33, Bureau of Indian Standards (BIS) Govt. of India.</td>
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<td>3</td>
<td>Shri K. Sitaramanjaneyulu</td>
<td>Member</td>
<td>Bureau of Indian Standards (BIS), CED-6 &quot;Stone Sectional Committee&quot;</td>
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<td>4</td>
<td>Dr. Devesh Tiwari</td>
<td>Member</td>
<td>Bureau of Indian Standards (BIS) committee on Aggregates from other than Natural Sources, CED 2/P3'</td>
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<td>5</td>
<td>R.K. Panigrahi</td>
<td>Alternate Member</td>
<td>Rock Mechanics Sectional Committee, CED 48 of Bureau of Indian Standards (BIS).</td>
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<td>6</td>
<td>Dr. Pankaj Gupta</td>
<td>Member</td>
<td>Bureau of Indian Standards (BIS) - Hill Area Development Engineering Sectional Committee CED 56</td>
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<td>7</td>
<td>Dr. Pankaj Gupta</td>
<td>Member</td>
<td>Bureau of Indian Standards (BIS) - Rock Mechanics Sectional Committee, CED 48</td>
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<td>8</td>
<td>Dr. Pankaj Gupta</td>
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<td>PMC</td>
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<td>9</td>
<td>Dr. Pankaj Gupta</td>
<td>Convener</td>
<td>Subcommittee of CED 56, Bureau of Indian Standards (BIS) - Revision of IS 14680 i.e. Landslide control</td>
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<tr>
<td>10</td>
<td>Parvathi G. S.</td>
<td>Member of working group for the preparation of guidelines for IS 14458: Part- 6</td>
<td>Hill Area Development Engineering Sectional Committee</td>
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<td>11</td>
<td>Dr. Rakesh Kumar</td>
<td>Member</td>
<td>Bureau of Indian Standards (BIS) ISO/TC 71 &amp; ISO/TC 74; BIS Committee on Cement and Concrete Sectional Committee of Civil Engineering Division Council CED 2/P1 and CED 5, CED51.</td>
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<td>12</td>
<td>Dr. Jakkula Nataraju</td>
<td>Member</td>
<td>BIS Intelligent Transport Systems Sectional Committee, TED-28</td>
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<td>13</td>
<td>Shri M.N. Nagabhushana</td>
<td>Member</td>
<td>PCD 6 BIS</td>
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<td>14</td>
<td>Dr. Ambika Behl</td>
<td>Member</td>
<td>PCD 6 BIS</td>
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<tr>
<td>15</td>
<td>Dr. Rajeev Kumar Garg</td>
<td>Member</td>
<td>BIS’s CED: 38 Committee Special Structural Committee</td>
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<td></td>
<td>Dr. Lakshmy P</td>
<td>Alternate Member</td>
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<td>16</td>
<td>Dr. Rajeev Goel</td>
<td>Alternate Member</td>
<td>BIS’s CED 46:P8 Plain Reinforced and Prestressed Concrete</td>
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<td>17</td>
<td>Dr. Lakshmy P</td>
<td>Member</td>
<td>Drafting Group of IS-1893 (Part-3)</td>
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<td>18</td>
<td>Dr. S.S. Gaharwar</td>
<td>Alternate Member</td>
<td>BIS’s CED:54 Committee Concrete Reinforcement Sectional Committee</td>
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<td>19</td>
<td>Dr. Pankaj Gupta</td>
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#### GB Pant Institute of Himalayan Environment and Sustainable Development

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<td>Dr. Kishor Kumar</td>
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<tr>
<td>16</td>
<td>Shri K. Sitaramanjaneyulu</td>
<td>Member</td>
<td>Bhagalpur College of Engineering, Bhagalpur , Board of Governors</td>
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#### Sri Guru Ram Rai University (SGRR) Dehradun

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<td>Advisor</td>
<td>Sustainable Smart Cities India</td>
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#### NIT, Tirucharappalli

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#### MORTH, New Delhi

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<td>1</td>
<td>Dr. Devesh Tiwari</td>
<td>Member</td>
<td>Standing Committee constituted by MORTH on 'Introduction of new technology/ alternative design in the projects on EPC/BOT basis'</td>
</tr>
<tr>
<td>2</td>
<td>Dr. Lakshmy P</td>
<td>Member</td>
<td>Committee for Empanelment of Bearing and Expansion Joint Manufacturers and Suppliers, MORTH, New Delhi</td>
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#### Indian Association of Structural Engineers ,New Delhi

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<td>Dr. Rajeev Goel</td>
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<td><strong>National Council for Cement and Building Materials (NCCBM)</strong></td>
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<td>Dr. Rakesh Kumar</td>
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<td><strong>IIT Indore</strong></td>
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<td>1</td>
<td>Dr. Rakesh Kumar</td>
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<td><strong>Delhi Traffic Police (DTP)</strong></td>
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<td>1</td>
<td>Dr. Neelima Chakrabarty</td>
<td>Board Member &amp; Coordinator</td>
<td>Navchetna Club by Delhi Traffic Police.</td>
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<tr>
<td>2</td>
<td>Dr. S. Velmurugan</td>
<td>Expert Member</td>
<td>Technical Committee of Delhi Traffic Police (DTP) for finalizing the technical specifications and functional requirements of the new Intelligent Transport System (ITS) installations being procured by DTP.</td>
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<td><strong>Samarthyam (National Centre for Barrier Free Design)</strong></td>
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<td>Samarthyam (National Centre for Barrier Free Design) for finalizing the technical reports and other major functional requirements</td>
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<td>Shri Subhash Chand</td>
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<td><strong>National Association of Psychological Science (NAPS)</strong></td>
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<td><strong>Ministry of Environment, Forests and Climate Change, Government of India</strong></td>
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<td>1</td>
<td>Dr. Anuradha Shukla</td>
<td>Member</td>
<td>Expert Appraisal Committee (EAC) for Projects related to Infrastructure Development, Coastal Regulation Zone, Building/Construction and Miscellaneous projects. Ministry of Environment, Forests and Climate Change, Government of India</td>
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<td>1</td>
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<td><strong>Institute of Steel Development and Growth, Kolkatta</strong></td>
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<td>Dr. Lakshmy P.</td>
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<td>Project Review Committee (PRC) Institute of Steel Development and Growth, Kolkatta</td>
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<td><strong>Indian Concrete Institute, Western UP Center, Ghaziabad</strong></td>
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<td>Vice President Secretary</td>
<td>Executive Committee of Indian Concrete Institute, Western UP Center, Ghaziabad</td>
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<td><strong>National Institute of Ocean Technology, Chennai</strong></td>
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<td><strong>National Rural Roads Development Authority (NRRDA)</strong></td>
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<td>Dr. Lakshmy P.</td>
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<td>Expert group for suggesting measures for cost reduction in Rural Roads (NRRDA)</td>
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<td>Manoj Kumar Shukla</td>
<td>Member</td>
<td>Advisory Group of NRRDA &amp; TERI</td>
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<td>Dr. S.S. Gaharwar</td>
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<td>Appellate Committee to consider State’s Appeal in respect of PMGSY Works Notified as having Defects of Non-rectifiable Nature (NRRDA)</td>
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<td><strong>International Journal of Construction Materials &amp; Structures (IJCMS)</strong></td>
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<td>1</td>
<td>Dr. Lakshmy P</td>
<td>Member</td>
<td>Editorial Board, International Journal of Construction Materials &amp; Structures (IJCMS), ISSN 2321-2231 Editorial Board</td>
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<td><strong>Pune Municipal Corporation (PMC)</strong></td>
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<td>Dr. Lakshmy P</td>
<td>Member</td>
<td>STAC Committee, Pune Municipal Corporation (Bridge Expert)</td>
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<td><strong>TIFAC</strong></td>
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<td>Dr. Devesh Tiwari</td>
<td>Invitee Member</td>
<td>TIFAC – Assigned for “Technology Needs Assessment” (TNA)” and Assigned by MOEF&amp;CC</td>
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</table>
Membership of National and International Organisations
• Australian Road Research Board (ARRB).
• Indian Institute of Bridge Engineers (IIBS), New Delhi.
• Indian Association of Special Libraries and Information Centers, Kakugachi, Kolkata.
• Transportation Research Board of the National Academy of Science, National Research Council, 2101, Constitution Avenue, Washington DC, USA.
• Indian Geotechnical Society, C/o Central Soil and Material Research Station, Olof Palme Marg, Hauz Khas, New Delhi.
• Indian Road Congress, Jamnagar House, Shahjahan Road, New Delhi.
• Government of Indian Librarians Association (GILA (Regd.) C/o Planning Commission, Library, Yojna Bhawan, Sansad Marg, New Delhi.
• Society for Information Science, NISCAIR Building, Hillside Road, New Delhi.
• Indian Group of Geotextiles, Central Board of Irrigation & Power, Malcha Marg, Chanakyapuri, New Delhi.
• Associate Membership of Current Science Association, Bangalore.
• International Road Federation (IRF) India Chapter.
Marketable Products and Services
Intellectual Property (Patents)

Intellectual Property (Patents filed in India)

- A Device Useful For Evaluation Of Road Conditions (Filing No.- 0325DEL2004)
- Utilisation Of Waste Plastic Bags For Modification Of Bitumen (Pat no. 246060)
- New Design For Box Insertion Through Highly Unstable Cohesion less Soil By Stabilisation Of Vertical Cut Slopes (Filing No.- 0136DEL2012)
- Vehicle Mounted Automatic Controlled Mobile Bridge Inspection Device (Filing No.- 2984 DEL 2012)
- Upgraded Device For Road Condition Evaluation (Filing No.- 201611003957)
- Use Of Thermocool(Expanded Polystyrene) Waste In Hot Bituminous Mixes For Road Construction (Filing No.- 1258 DEL2014)
- Utilisation Of Pvc Pipe Waste In Modifying Bitumen For Paving Applications (Filing No.- 1368DEL2014)
- Design And Development Of Pothole Repair Machine (Filing No.- 0821 DEL 2014)
- Electro Mechanical Field Density Gauge (Filing No.- 1632DEL2014)
- New Process For Preparation Of Harder Grade Bitumen (Vg40 And Vg50) For Formation f Asphalt Surfacing For Roads And Airfields (Filing No.- 2837DEL2015)
- Car Driving Simulator With Driver Diagnostic And Training Method (Filing No.- 201611040851.00)
- Process For Laying Roads Using Cold-Mix Technology(Filing No.- 201611039241A)
- Carbon Based Mixture For Improved Performance Of Flexible Pavements As One Of Bitumen Additives Or Fillers And Methods Of Preparation Thereof (Filing No.- 201611008235.00)

Intellectual Property (Patents filed Abroad)

- New Design For Box Insertion Through Highly Unstable Cohesion less Soil By Stabilisation Of Vertical Cut Slopes, (International Patent In 4-Four Countries)

Services Offered

Contract Research
- Collaborative Projects
- Sponsored Projects

Consultancy Services

Testing & Calibration

Training Programs
Papers Published in SCI Journals
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<td>4</td>
<td>Effect of warm mix additives on creep and recovery response of conventional and polymer modified asphalt binders</td>
<td>Rajiv Kumar, N Saboo, P Kumar and S Chandra</td>
<td>Construction and Building Materials 138, 352-362</td>
<td>3.169</td>
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<td>Modeling Travel time of car with varying demand on an urban midblock section,</td>
<td>Anish Kumar Bharti, Ch. Ravi Sekhar &amp; Satish Chandra</td>
<td>Journal of Intelligent Transportation Systems Technology, Planning, and Operations Vol.22(2) (Published Online)</td>
<td>1.769</td>
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<td>13</td>
<td>Comparative evaluation of bus rapid transit routes using super efficiency data envelopment analysis</td>
<td>A Kathuria, M Parida and Ch. Ravi Sekhar</td>
<td>Journal of Current Science, Vol.113 No.8</td>
<td>0.990</td>
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<td>14</td>
<td>Estimating capacity of hybrid bus rapid transit corridor.</td>
<td>H Singh, A Kathuria, Ch Ravi Sekhar and M Parida</td>
<td>Journal of Current Science, Vol.113 No.8</td>
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<td>Route performance evaluation of a closed bus rapid transit system using GPS data</td>
<td>Ankit Kathuria, M Parida, Ch. Ravi Sekhar</td>
<td>Journal of Current Science Vol.112, No.8, 1642-1652</td>
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<td>Influence of signal countdown timer on efficiency and safety at signalized intersections</td>
<td>Sabyasachi Biswas, Indarjit Ghosh and Satish Chandra</td>
<td>Canadian Journal of Civil Engineering 44 (4), 308-318</td>
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<td>Influence of operating speed on capacity urban arterial midblock sections</td>
<td>Ashish Dhamaniya and Satish Chandra</td>
<td>International Journal of Civil Engineering, 15(7), 1053 – 1062, DOI: 10.1007/s40999-017-0206-7.</td>
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<td>Delay at Signalised Intersections under Mixed Traffic Conditions</td>
<td>Arpita Saha, Satish Chandra and Indrajit Ghosh</td>
<td>Journal of Transportation Engineering, ASCE, Part A: Systems 143 (8), 04017041</td>
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<td>3</td>
<td>Ageing Characteristics of warm mix binders</td>
<td>Ambika Behl and Satish Chandra</td>
<td>Journal of Materials in Civil Engineering ASCE, 29 (10), 04017155</td>
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<td>5</td>
<td>Effect of on-street parking in urban context – A critical review</td>
<td>Biswas, Subhadip, Chandra, Satish and Indrajit Ghosh (2017),</td>
<td>Transportation in Developing Economies, 3(1), 10, doi. org/10.1007/s40890-017-0040-2.</td>
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<td>4</td>
<td>हिंदी में वैज्ञानिक एवं तकनीकी लेखन</td>
<td>डॉ. नीरज शर्मा, रजनी ध्यानी</td>
<td>सड़क दर्पण, अंक 15, दिसम्बर 2017, पृष्ठ 17-23</td>
</tr>
<tr>
<td>5</td>
<td>सिविल इंजीनियरी अनुप्रयोगों के लिए नैनो तकनीक की संभावनाएं</td>
<td>रीता सिंह, नेहा चौधरी, अनुराधा शुक्ला</td>
<td>सड़क दर्पण अंक 15, दिसम्बर 2017, पृष्ठ 33-42</td>
</tr>
<tr>
<td>6</td>
<td>इंजीनियरी सामग्री के यात्रिकों गुणों का परीक्षण—प्रथम अवलोकन</td>
<td>राजेश राणा, एस.चे. शर्मा, सुशील कुमार, एस.एस. गहरवार</td>
<td>सड़क दर्पण अंक −14, जून–2017, प्र.-3</td>
</tr>
<tr>
<td>7</td>
<td>अधिनायकी परीक्षण दुर्बार पाईल नीव की अखंडता का आंकलन</td>
<td>सुरेंद्र कुमार वर्मा, एस.एस. गहरवार</td>
<td>सड़क दर्पण अंक −14, जून–2017, प्र.-34</td>
</tr>
</tbody>
</table>
Participation in Conferences/Seminars/Workshops
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the staff</th>
<th>Name of the Conference</th>
<th>Venue</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. V.V.L. Kanta Rao</td>
<td>One-day Seminar on “Durability and Service Life Design of Concrete Structures”</td>
<td>NCCBM, Ballabghar</td>
<td>07-Apr-17</td>
</tr>
<tr>
<td>2</td>
<td>Parvathi G. S.</td>
<td>Geoenvironment 2017 Workshop on Landfills and Waste to Resources</td>
<td>IIT Delhi</td>
<td>19-Apr-17</td>
</tr>
<tr>
<td>3</td>
<td>Dr. E. Madhu,</td>
<td>&quot;Vision towards Safer Roads: Technology, Education &amp; Enforcement&quot; Organised by SAFE (a SIAM initiative) in association with Ministry of Road Transport &amp; Highways and Transport Department, Government of Odisha</td>
<td>Bhubaneswar, Odisha</td>
<td>20-Apr-17</td>
</tr>
<tr>
<td>4</td>
<td>Nos. of Scientist and Technical staff of BES Division</td>
<td>One-day workshop on Advances in Corrosion of steel in Concrete Structures – Science, Prevention, and Repair</td>
<td>CSIR-CRRI</td>
<td>24-Apr-17</td>
</tr>
<tr>
<td>5</td>
<td>C. KAMARAJ</td>
<td>4th Conference on Transportation Systems Engineering and Management CTSEM 2017</td>
<td>Division of Transportation Engineering, Anna University, Chennai.</td>
<td>12-13 May 2017</td>
</tr>
<tr>
<td>6</td>
<td>Dr. SS Gaharwar Dr. VVLK Rao Dr. Rajeev Goel Sh. G K Sahu Sh. Binod Kumar Dr. S K Sharma Sh. A k Dhal</td>
<td>Workshop on Issues and Solutions in Concrete Structures</td>
<td>ABESIT College, Ghaziabad</td>
<td>03-Jun-17</td>
</tr>
<tr>
<td>8</td>
<td>Dr. S S Gaharwar Dr. Rajeev Goel Sh. G K Sahu Dr. S K Sharma Dr. Rajeev Garg</td>
<td>Workshop on World of Concrete and Structures 2017</td>
<td>New Delhi</td>
<td>10-12 Aug 2017</td>
</tr>
<tr>
<td>S. No.</td>
<td>Name of the staff</td>
<td>Name of the Conference</td>
<td>Venue</td>
<td>Date</td>
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</tr>
<tr>
<td>9</td>
<td>Dr. Ambika Behl</td>
<td>ASSOCHAM 3rd International Conference on ROADTECH Sustainable Roads and Highways</td>
<td>Delhi, India</td>
<td>27-Aug-17</td>
</tr>
<tr>
<td>10</td>
<td>Dr. Ambika Behl, Dr. Siksha Swaroopa Kar</td>
<td>RELIM International Conference on Advances in Construction Materials And Systems</td>
<td>Chennai India</td>
<td>3-8 Sept 2017</td>
</tr>
<tr>
<td>11</td>
<td>Dr. V.V.L. Kanta Rao</td>
<td>71st RILEM Annual Week &amp; International Conference on Advances in Construction Materials System (ICAMS 2017) and, RILEM workshops</td>
<td>IIT Chennai</td>
<td>4-8 Sept 2017</td>
</tr>
<tr>
<td>12</td>
<td>Binod Kumar Lalita Janpangi</td>
<td>Workshop on Impact Method for Concrete Homogeneity</td>
<td>New Delhi</td>
<td>21-Sep-17</td>
</tr>
<tr>
<td>13</td>
<td>Dr. Lakshmy P</td>
<td>Smart Mobility Summit</td>
<td>New Delhi</td>
<td>04-Oct-17</td>
</tr>
<tr>
<td>14</td>
<td>Dr. Ravindra Kumar, Dr. P S Prasad</td>
<td>Planning and Design of Urban Roads and Streets</td>
<td>India Habitat Centre, New Delhi</td>
<td>7-8 Oct 2017</td>
</tr>
<tr>
<td>15</td>
<td>Dr. Kishore Kumar, Dr. P S Prasad</td>
<td>International Conference on Engineering Geological Solutions for Sustainable Development</td>
<td>Eros Hotel, New Delhi</td>
<td>7-8 Oct 2017</td>
</tr>
<tr>
<td>16</td>
<td>Dr. Neelima Chakraborty, Dr. S Velumurugan, Dr. S Padma, Subhash Chand A. Mohan Rao, Ramesh Chand Manjhi, Kamini Gupta</td>
<td>Workshop on Planning &amp; Design of Urban Roads and Streets</td>
<td>New Delhi</td>
<td>7-8 Oct 2017</td>
</tr>
<tr>
<td>S. No.</td>
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<tr>
<td>18</td>
<td>R K Panigrahi</td>
<td>Conference on INDOROCK 2017-7th Indian Rock Conference</td>
<td>New Delhi</td>
<td>25-27 Oct 2017</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>Interactive and Visual Approaches to Data Mining</td>
<td>Kolkata</td>
<td>30 Oct -3 Nov 2017</td>
</tr>
<tr>
<td>20</td>
<td>Sampath Kumar</td>
<td>78th IRC Annual Session</td>
<td>Bengaluru</td>
<td>3–6 Nov 2017</td>
</tr>
<tr>
<td>21</td>
<td>Manoj Kumar Shukla</td>
<td>Presented a discussion paper on Design of Flexible Pavements with stabilized Base and Bituminous Mixes in IRC Annual Session</td>
<td>IRC Annual Session Bangalore</td>
<td>07-Nov-17</td>
</tr>
<tr>
<td>22</td>
<td>Dr. Errampalli Madhu</td>
<td>18th World Road Meeting (WRM) Organised by International Road federation (IRF).</td>
<td>Noida, NCR</td>
<td>14-15 Nov 2017</td>
</tr>
<tr>
<td>23</td>
<td>M.N. Nagabhushana</td>
<td>Cross Roads IRF World Road Meeting 2017, , Delhi</td>
<td>India Expo Mart Ltd. Greater Noida</td>
<td>14-17 Nov 2017</td>
</tr>
<tr>
<td>24</td>
<td>K. Sitaramanjaneyulu, Dr. Devesh Tiwari, Sunil Jain, Pradeep Kumar, Sampath Kumar, Dr. Ambika Behl, Manoj Kr. Shukla</td>
<td>18th IRF World Road Meeting 2017</td>
<td>Expo Mart, Greater Noida, India</td>
<td>14-17 Nov. 2017</td>
</tr>
<tr>
<td>25</td>
<td>Dr. Errampalli Madhu</td>
<td>Challenges and Solutions defining the new mobility paradigm Organised by BMW Group</td>
<td>New Delhi</td>
<td>17-Nov-17</td>
</tr>
<tr>
<td>26</td>
<td>Dr. Ravindra Kumar</td>
<td>Smart Mobility Conference</td>
<td>FICCI Federation House, New Delhi</td>
<td>20-Nov-17</td>
</tr>
<tr>
<td>28</td>
<td>Dr. Ambika Behl, Manoj Kumar Shukla</td>
<td>Conference on New Technology in Road construction</td>
<td>LUCKNOW</td>
<td>8-9 Dec 2017</td>
</tr>
<tr>
<td>29</td>
<td>Dr Vasant G Havanagi</td>
<td>New technology for Road construction</td>
<td></td>
<td>9-10 Dec 2017</td>
</tr>
<tr>
<td>S. No.</td>
<td>Name of the staff</td>
<td>Name of the Conference</td>
<td>Venue</td>
<td>Date</td>
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<tr>
<td>30</td>
<td>Dr. RK Garg</td>
<td>Conference and workshop on Urbanization Challenges in Emerging Economies</td>
<td>IIT Delhi</td>
<td>12-14 Dec 2017</td>
</tr>
<tr>
<td>31</td>
<td>Parvathi G S</td>
<td>National Dissemination Workshop on &quot;Megacity Logistics: Metrics, Tools and Measures for Sustainability (MEGALOG)&quot;</td>
<td>CSIR-CRRI</td>
<td>13-Dec-17</td>
</tr>
<tr>
<td>32</td>
<td>Dr. Pankaj Gupta</td>
<td>ESRI India users conference 2017 and exhibition</td>
<td>Leela Ambience Conventional Hotel, New Delhi</td>
<td>13-14 Dec 2017</td>
</tr>
<tr>
<td>33</td>
<td>Dr. Lakshmy P, Dr. V V L Kanta Rao</td>
<td>International Seminar on Repair, Rehabilitation and Retrofitting of Bridges and Structures</td>
<td>ITC Rajputana Jaipur</td>
<td>15-16 Dec 2017</td>
</tr>
<tr>
<td>34</td>
<td>Dr. Mukti Advani, Dr. Ambika Behl, Siksha Swaroopa Kar</td>
<td>4th Conference of Transportation Research Group of India (CTRG 2017)</td>
<td>IIT Bombay, Mumbai</td>
<td>17-20 Dec 2017</td>
</tr>
<tr>
<td>35</td>
<td>Dr. S Padma</td>
<td>10th International Conference on “Communication Systems &amp; Networks (COMSNETS), 2018”</td>
<td>Bangalore</td>
<td>03-Jan-18</td>
</tr>
<tr>
<td>36</td>
<td>Dr. Ch Ravi Sekhar</td>
<td>Transportation Research Board</td>
<td>Washington DC</td>
<td>7-11 Jan 2018</td>
</tr>
<tr>
<td>37</td>
<td>Dr. Devesh Tiwari</td>
<td>Invited as speaker and also conducted a session in the Seminar on 'Sustainable Development of Road Infrastructure', Organized by Roads and Buildings Department, Government of Gujrat</td>
<td>Hotel Narayani Heights, Gandhinagar</td>
<td>18-20 Jan 2018</td>
</tr>
<tr>
<td>38</td>
<td>Alok Ranjan</td>
<td>Design and construction of pavements using geosynthetics</td>
<td>CBIP, Malcha Marg, Chanakyapuri, New Delhi</td>
<td>30-31 Jan 2018</td>
</tr>
<tr>
<td>39</td>
<td>Dr. Lakshmy P</td>
<td>One day Workshop on C&amp;D waste Management</td>
<td>Mumbai</td>
<td>02-Feb-18</td>
</tr>
<tr>
<td>40</td>
<td>Dr. Ambika Behl</td>
<td>All India Bitumen Conference</td>
<td>Mumbai</td>
<td>08-Feb-18</td>
</tr>
<tr>
<td>41</td>
<td>Minal</td>
<td>2nd Conference on Transport Noise &amp; Abatement Measures CTNAM 2018</td>
<td>New Delhi</td>
<td>15-16 Feb 2018</td>
</tr>
<tr>
<td>S. No.</td>
<td>Name of the staff</td>
<td>Name of the Conference</td>
<td>Venue</td>
<td>Date</td>
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<tr>
<td>42</td>
<td>Dr. Ravindra Kumar</td>
<td>Clean Air for Delhi Campaign Workshop On Vehicular Pollution And Traffic Management</td>
<td>Indira Paryavaran Bhawan, Aliganj, New Delhi</td>
<td>17-Feb-18</td>
</tr>
<tr>
<td>43</td>
<td>Dr. Pankaj Gupta</td>
<td>National Dissemination Workshop on &quot;Megacity Logistics: Metrics, Tools and Measures for Sustainability</td>
<td>CSIR-CRRI</td>
<td>26-27 Feb 2018</td>
</tr>
<tr>
<td>44</td>
<td>Dr. Lakshmy P</td>
<td>International conference on Advances in Construction Materials and Structures</td>
<td>IIT, Roorkee</td>
<td>08-Mar-18</td>
</tr>
<tr>
<td>45</td>
<td>Dr. E Madhu</td>
<td>Workshop on &quot; Bus Transport Planning, Scheduling and Optimisation&quot; Organised by Anna University, Chennai</td>
<td>Chennai</td>
<td>08-Mar-18</td>
</tr>
<tr>
<td>46</td>
<td>Dr. E Madhu</td>
<td>Workshop on &quot;Sustainable Mobility in Delhi NCR &amp; Beyond: How to Achieve more from Efforts?&quot; Organised by CSIR-NEERI</td>
<td>New Delhi</td>
<td>13-Mar-18</td>
</tr>
<tr>
<td>47</td>
<td>Dr. Ravindra Kumar</td>
<td>Sigma Plot and Sigma Scan</td>
<td>CRRI</td>
<td>13-Mar-18</td>
</tr>
</tbody>
</table>
Retirements,
Joinings & Promotions
Following staff members have retired from services of the Institute during the period. CRRI Welfare Committee organized function to bid all of them a grand farewell:

Shri Suresh Chandra, Sr. Tech. Officer  
On 28-04-2017

Mrs. Pawan Chabra, Sr. Pr. Scientist  
On 30-05-2017

Mrs. P. Pramdavalli, Sr. Pr. Scientist  
On 30-06-2017

Shri Tek Chand Thappa, Work Assistant  
On 30-06-2017

Shri U.S. Rao, Sr. Scientist  
On 30-06-2017 (VRS)

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

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

Shri Bijender Kumar, Lab. Assistant  
On 31-07-2017

Shri Brij Mohan Singh Negi, Chowkidar  
On 31-07-2017

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

Shri Susheel Kumar, Technical Officer  
On 31-09-2017

Shri Ram Pal, Pr. Tech. Officer  
On 31-09-2017

Shri Phool Chandra, Section Officer  
On 31-10-2017

Shri Md. Irshad, Technical Officer  
On 31-10-2017

Shri V. Murugesan, Tech. Officer  
On 31-10-2017 (VRS)
### NEW JOININGS IN CRRI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name</th>
<th>Date of Joining</th>
<th>Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shri Sachin Kumar</td>
<td>14-03-2018</td>
<td>E-II Section</td>
</tr>
<tr>
<td>2</td>
<td>Shri Umesh Kumar</td>
<td>15-03-2018</td>
<td>Personal Cell</td>
</tr>
<tr>
<td>3</td>
<td>Shri Niranjan Kumar Srivastava</td>
<td>15-03-2018</td>
<td>E-II Section</td>
</tr>
<tr>
<td>4</td>
<td>Shri Sunit Pal</td>
<td>16-03-2018</td>
<td>E-II Section</td>
</tr>
<tr>
<td>5</td>
<td>Deepa Rawat</td>
<td>16-03-2018</td>
<td>Account Section</td>
</tr>
<tr>
<td>6</td>
<td>Shri Parul Jain</td>
<td>20-03-2018</td>
<td>E-I Section</td>
</tr>
<tr>
<td>7</td>
<td>Shri Kartik Acharya</td>
<td>22-03-2018</td>
<td>Store &amp; Purchase</td>
</tr>
<tr>
<td>8</td>
<td>Shri Sanjai Singh</td>
<td>26-03-2018</td>
<td>Vigilance Cell</td>
</tr>
</tbody>
</table>
With profound grief and sorrow, we inform the sad and sudden demise of our esteemed colleague Sh. Kaushal Kishore, Store and Purchase Officer, who left us for his heavenly abode on December 30, 2017. We deeply mourn the death of Sh. Kaushal Kishore and convey our heartfelt condolences to the bereaved family. We pray to the Almighty that may his noble soul rest in peace and be blessed with the eternal peace.

With profound grief and sorrow, we inform the sad and sudden demise of our esteemed colleague Sh. Harish Kumar, Senior Technician (2), who left us for his heavenly abode on March 23, 2018. We deeply mourn the death of Sh. Harish Kumar and convey our heartfelt condolences to the bereaved family. We pray to the Almighty that may his noble soul rest in peace and be blessed with the eternal peace.
Human Resource
**Director**  
Prof. Satish Chandra, B.E. (Civil),  
M.E.(Transportation Engg.)(Hons), Ph.D.

**R&D Areas**  
**Bridge Engineering & Structures (BES)**  
**Head**  
Sh. S. S. Gaharwar, B.E. (Civil), M.E. (Structures)

**Scientists/Technical Officers**  
Dr. P. Lakshmy, B.E. (Civil), M.E., Ph.D.  
Dr. R. K. Garg, B. Tech. (Civil), M.Tech, Ph.D.  
Sh. D. C. Sharma, B.E. (Electrical Engg.), M.Tech  
(Computer Science & Technology)  
Sh. G. K. Sahu, B.E. (Civil), M.E. (Structures)  
Dr. Rajeev Goel, B.E. (Civil), M.E. (Structural Engg.), Ph.D.  
Dr. Suraj Prakash, B.E. (Civil), M.E. (Earthquake Engg.), Ph.D. (On Deputation)  
Dr. V.V.L. Kanta Rao., M.Sc., Ph.D.  
Sh. J. K. Goyal, B.E. (Civil), M.E.(Structures) (On Deputation)  
Sh. U. S. Rao, B. Tech. (Civil), M.Tech. (Structures)  
Sh. A. K. Dhall, B. Tech. (Civil), M.Tech(Structural Engg.)  
Sh. Durgaprasad Golla, B. Tech. (Civil), M. Tech. (Structures)  
Dr. Naveet Kaur, B.E. (Civil), M. Tech. (Structures) Ph.D.  
Dr. S. K. Sharma, M.E. (Structures) Ph.D.  
Sh. Sushil Kumar, B.Sc., Diploma. in Civil Engg., AMIE Sh. Narendra Kumar, M. Sc.  
Sh. Yogender Kumar Singh, Diploma in Electronics  
Sh. Pradeep Kumar, M.E. (Structure Engg.)  
Sh. Rajesh Rana, Diploma in Production & Industrial Management, B.Tech. in Mechanical Engg.(AMIE)  
Sh. Kumar Shashi Bhushan, Diploma in Civil Engg. B.Tech. in Civil Engg.(AMIE), M.E. (Structures)  
Sh. Mahipal Singh Rana, ITI

**S&T and Supporting Staff**  
Sh. Surendra Kumar Verma, Diploma in Civil Engg., BE (Civil)  
Sh. Vijay Kumar, ITI, Diploma in Civil Engg  
Sh. Rajveer Singh, Non-Matric  
Indu Rani, B.A.  
Sunil Dutt, Non Matric,  
Sh. Ram Lakhan, Non-Matric

**Geotechnical Engineering (GTE)**  
**Head**  
Sh. U. K. Guru Vittal, M.E. (Highway)

**Scientists/Technical Officer**  
Sh. Sudhir Mathur, M.Tech (SM & FE)  
Dr. Kishore Kumar, M.Sc. (Geology), Ph.D. (Landslide)  
Dr. Vasant.G. Havanagi, M.Tech, Ph.D. (Highway & Geotech Engg.)  
Dr. Pankaj Gupta, M. Tech, (Engg. Geology) Ph.D (Landslide)  
Sh. R. K. Panigrahi, M.Sc. (Applied Geology)  
Sh. Ambrish Saurikhia, M.Sc. (Env.& Water Resources Engg.)  
Sh. Kanwar Singh, M.Tech. (Geotechnical Engg.)  
Dr. P.S. Prasad, M.E. (Geotechnical Engg.), Ph.D.  
Sh. Alok Ranjan, M.Tech. (Engg. Geology)  
Sh. Anil Kumar Sinha, M.Tech. (Geotech. Engg.)  
Dr. P. Pramada Valli, M.Sc. (Applied Geology), Ph.D. (Applied Maths)  
Sh. Vinoth M., ME (Soil Mechanics & Foundation Engg.)  
Sh. Vinoth M., ME (Soil Mechanics & Foundation Engg.)  
Sh. V. K. Kanaujia, M.Tech. (Geotechnical Engg.)

**S&T and Supporting Staff**  
Ms. Prema Prasad, M.A.  
Sh. V. Murugesan, SSLC
Human Resource

Ms. Rekha, I.T.I., B.A.
Sh. Jamdar Mehto, Non-Matric
Sh. Surender Kumar, Non-Matric
Sh. Sunil Chander Saha, Matric (Retired)

Flexible Pavement (FP)
Head
Sh. Manoj Kumar Shukla, M.Tech. (Highway Engg.)

Scientists/Technical Officers
Dr. Sangita, M.Sc., Ph.D. (Polymer Chemistry)
Sh. M.N. Nagabhushana, M.Sc. (Highway Engg.)
Sh. Abhishek Mittal, M.Tech(Transportation Engg.)
Sh. Satish Pandey, M.Tech (Transportation Engg.)
Dr. Ambika Behl, M.Tech, Ph.D.
Dr. Siksha Swaroopa Kar, M.Tech, Ph.D
Sh. Gagandeep Singh, M.Tech
Dr. Gottumukkala Bharat, M.Tech, Ph.D.
Ms. Shanta Kumar, B.Sc., L.L.B.
Sh. Shankh Dass, B.E. (Civil)
Dr. C. Kamaraj, M.E. Ph.D.
Sh. Madan Pal Singh, B.Sc.
Sh. K.K. Gola, Diploma in Mechanical Engg., PG Diploma in R/AC

S&T and Supporting Staff
Sh. PR Singh, B.Sc.
Sh. Pratap Singh, Matric, ITI
Sh. Subhash, Cert. in Draftsman
Ms. Neha Dhiman, ITI
Sh. Mahinder Prasad Singh, Non-Matric
Sh. Ram Lal, Non-Matric

Pavement Evaluation (PED)
Head
Sh. Sunil Jain, M.E. (Transportation Engg.)

Scientists/Technical Officers
Sh. K. Sitaram Anjaneyulu, M.E. (Highway Engg.)
Sh. Sudesh Kumar, M.Sc. (Chemistry)

Rigid Pavement (RP)
Head
Sh. Binod Kumar, M.E. (Hill Area Development Engg.)

Scientists/Technical Officers
Sh. J.B. Sen Gupta, M.Sc (Applied Chemistry)
Dr. Rakesh Kumar, M.Tech, Ph.D. (Civil Engg)
Ms. Lalita Jangpangi, B.Sc. (Engg.), M.E. (Instrumentation & Control)
Sh. Dinesh V. Ganvir, M.E. (Highways & Transportation)
Sh. Romeil Sagwal, M.Tech
Sh. Ravi Shankar S, M.Tech
Sh. Pankaj Goel, M.Tech (Const. Engg. & Management)
Human Resource

S&T and Supporting Staff
Sh. Ashok Pant, Hr. Sec.
Ms. Aashia, I.T.I.
Sh. Manoj Kumar Singh, B.E. (Civil)
Sh. Balvir Singh, Non Matric

Traffic Engineering & Safety (TES)
Head
Dr. Neelima Chakraborty, M.A., (Psycho.), P.G. Dip. (Environmental Psycho.), Ph.D.

Scientists/Technical Officers
Dr. S. Velmurugan, M.E., Ph.D. (Transportation Engg.)
Sh. Subhash Chand, M.E. (Highways)
Dr. A. Mohan Rao, M.Tech. (Transportation Engg.), Ph.D
Dr. J. Natraju, M.E.(Highways), Ph.D.
Sh. Ashutosh Arun, M.Tech
Sh. Ramesh Ch. Majhi, M.Tech
Sh. S. Kannan, M.Sc
Ms. Kamini Gupta, M.Tech. (Transportation Planning)

S&T and Supporting Staff
Sh. Rajan Verma, Diploma in Civil Engg.
Sh. S.K. Biswas, Draftsman
Sh. Satyabir Singh, SSC, ITI (Printing)
Sh. Aniket Ranjan, ITI.
Ms. Krishna Verma, BA
Ms. Sushma Bhel, Intermediate
Sh. Narender Kumar, Matric
Sh. Jaglal Mehto, Non-Matric
Ms. Raj Bala, Non-Matric

Transportation Planning (TP)
Head
Dr. Errampalli Madhu, M.Tech (Transportation Engg.), Ph. D.

Scientists/Technical Officers
Dr. Purnima Parida, M.A. (Economics), M.Tech., Ph.D.
Dr. Kirti Bhandari, M.Sc. (Environmental Engg.), Ph.D.
Dr. Ravinder Kumar, ME (Transportation Engg.), Ph.D.
Dr. K. Ravinder, M. Tech. (Transportation Engg.) Ph.D.
Dr. Nasim Akhtar, M.Tech. (Environmental Engg.), Ph.D.
Dr. Ch. Ravi Sekhar, M.E. (Transportation Engg.), Ph.D.
Ms. Farhat Azad, M.Tech
Dr. S. Padma, M.Tech., Ph. D.
Dr. Mukti Advani, M.E. (Transportation Engg.), Ph.D.
Ms. Minal, M.Tech (Transportation Engg.)
Dr. Pritikana Das, M.Tech. (Transportation Engg.), Ph.D.
Dr. H. Lokeshwor Singh, B.Sc (Instrumentation)
M.Sc. (Electronics), Ph.D.(IT)
Sh. Satish Kumar, Diploma in Electronics & Communication Engg.

S&T and Supporting Staff
Sh. Jagdish Singh, Intermediate
Mr. Sanjay Kumar, M.A. (Pub. Admn.), B.Lib. (Science)
Ms. Shakuntla Devi, Non-Matric

Environmental Science (ES)
Head
Dr. Anuradha Shukla, M.Sc., M.Tech., PG. Diploma in Ecology & Environment Science, Ph.D.

Scientists/Technical Officers
Dr. Niraj Sharma, M.Tech. (Environmental Engg.), Ph.D.
Dr. Sippy K. Chauhan, M.Sc., Ph.D. (Chemistry)
Dr. Rina Singh, M. Tech. (Material Science), Ph.D (Nanotechnology, Physics)
S&T and Supporting Staff
Ms. Sarita Sethi, M.A. (Sociology)
Sh. Daya Ram, B.A.
Ms. Neha Chaudhary, Diploma in PHEE,(Civil)
Degree in Civil,PG Diploma in Env.Impact Assessment & Monitoring
Sh. Sunil Kumar, Graduate
Sh. Brij Mohan Singh, Matric

R&D Support
HRD & Project Management (HRP)

PME
Head
Sh. P.V. Pradeep Kumar, M.E. (Mech.), M.B.A.

Scientists/Technical Officers
Advisor R&D, BD
Dr. B. Kanaga Durai, M.A. (Eco), M.R.P. (Regional Planning) Ph. D.
Sh. Ravinder Deekonda, Diploma in Computer Engg., BCA, MCA
Ms. Nidhi, M.Sc. (Chemistry)

S&T and Supporting Staff
Sh. Anshul Saxena, M.Tech (IT)
Sh. Dinesh Prakash, Non-Matric
Ms. Santosh, Non-matric

Information, Liaison & Training (ILT)
Head
Dr. Neelam J Gupta, M.Sc, M.Phil (Computer Application), Ph.D. (Numerical Analysis)

Scientists/Technical Officers
Sh. M. K. Meena, B. Tech (Civil), M.Tech. (Environmental Science & Engg.)
Sh. R.C. Agarwal, B.E. (Mechanical Engg.)
Ms. Sarita Rastogi, Diploma in Commercial Art
Ms. Kamla Masih, Diploma in Electronics, M.C.A

S&T and Supporting Staff
Sh. Vijay Kumar Kaushal, MCA, MBA
Sh. Amin Ali Khan, M.A. (Political Science)
Sh. Rajbir Singh, B.A.
Ms. Sumitra Bai, Non-Matric

Estate Services (ESS)

Civil Section
Head
Sh. A. K. Jain, M.E. (Transportation Engg.) Hons.

Scientists & Technical Officers
Sh. A.K. Sabharwal, B.E.(Civil), M.B.A. (Marketing)
Sh. V.K. Tyagi, Dip. in Civil Engg.
Sh. Mukesh Kumar, M.Tech. (Construction Engg. & Management)

S&T and Supporting Staff
Sh. Vaibhav Varshney, Diploma in Civil Engg.
Sh. Pankaj Bhatt, Diploma in Civil Engg.
Sh. Harish Kumar, ITI (Plumbing)
Sh. Asif Hussain Choudhary, B.Com.
Sh. Bhanwar Singh, Non-Matric
Sh. Kailash Kumar, Matric
Sh. Gautam Pandey, Non-Matric
Sh. Mohan Lal, Non Matric

R&D Support Services

Technical Services Division
Head
Sh. R.S. Bharadwaj, M.Sc., M.Phil (Science Communication & Journalism) (upto July 2017)
Dr. Niraj Sharma, M.Tech. (Environmental Engg.), Ph.D. (from August 17)
Scientists/Technical Officers
Sh. Y.C. Tiwari, M.Sc. (Physics)
Sh. Subodh Kumar, M.S, M.B.A.
Sh. N.K. Sharma, Diploma in Mechanical Engg., B.Tech. (Mechanical)
Ms. Renu Chadha, M.Sc. (Botany)
Sh. P.C. Meshram, M.Tech. (Digital Communication Engg.)
Sh. Mohd. Irshad, Diploma in Draftsmanship (Mech.)
Sh. Ashok Kumar Arora, M.A., Dip. in Auto Engg.

S&T and Supporting Staff
Sh. K.J.S. Kapoor, B.Com, I.T.I
Sh. Devbinder Kumar, I.T.I (Motor Mech.)
Sh. Lakhbinder Singh, H.Sc., I.T.I. (Motor Mech.)
Sh. Kishan Swroop, ITI (Electrical/Wireman Course)
Sh. Om Prakash, I.T.I. (Fitting)
Sh. S.K. Dhirag, B.Com., Steno
Sh. Sant Ram, B.A.

Computer Centre & Networking (CCN)
Head
Dr. R. N. Dutta, M.Sc. (Operational Research), Ph.D.

Scientists/Technical Officer
Sh. Vivek Dubey, M.C.A., PGDBM (Finance & Marketing)
Sh. S. Mariappan, M.C.A.
Ms. Reeta Kukreja, M.Sc. (IT), M.B.A.
Sh. Manpreet Singh, M.E. (Electronics & Communication Engg.)
Ms. Preeti Sinha, B.C.A.

Knowledge Resource Centre

Documentation & Library Services (DLS)
Head
Dr. Neera Aggarwal, M.A., B.LI. Sc., Ph. D (from June 2017)

Scientists/Technical Officers
Ms. Mitali Mohapatra, DLISc., PDLSc., MLSc., PGDLAN

S&T and Supporting Staff
Ms. Ching Lydia, B.Sc., MLISc.
Sh. Om Kumar, B.A., I.T.I.
Sh. Dev Dutt Sharma, Matric

Quality Management
Sh. R.S. Bharadwaj, M.Sc., M.Phil (Science Communication & Journalism) up to 28th Feb. 2018
Sh. A. K. Jain, M.E. (Transportation Engg.) Hons. from 1st March 2018

AcSIR-CRRI

Advisor R&D, BD
Dr. Kanaga Durai, M.A. (Eco), M.R.P. (Regional Planning) Ph. D
Dr. Ch. Ravi Sekhar, M.E. (Transportation Engg.), Ph.D. (I/C Academic)

Maharani Bagh Staff Quarters (MBSQ) & Horticulture
Coordinating Officer
Dr. Rajeev Goel, M.E.(Structural Engineering), Ph.D.
Sh. A. K. Tripathi, Dip. in Civil Engg. (Head, Maintenance)
Sh. Ashok Kumar, M.Sc. (In-Charge, Horticulture)

**Scientists & Technical Officers**
Sh. Sunil Grover, B.E. (Civil)
Sh. D.V. Singh, M.Sc.
Sh. Muni Raj Meena, B. Tech (Electrical)
Sh. Tara Chand, Dip. in Civil Engg.

**S&T and Supporting Staff**
Sh. Prem Chand, Non-Matric
Sh. Raja Lal Manjhi, Non-Matric
Sh. Raj Pal Singh Gautam, Non-Matric

**Directorate**
Sh. Daleep Mutreja , B.Com
Sh. Kartar Singh, Matric
Ms. Sunita Saini, HSc

**Administration**

**Sr. Controller of Administration**
Sh. O.Omman Panicker, MBA (Retired on 30th Nov. 2017)

**Controller of Administration**
Sh. Anjum Sharma, BA, DBA, PGD Eco, & Env. (Joined on 1-12-2017)

Sh. Vijay Kumar, H.Sc.
Sh. Yoginder Mehto, Non-Matric
Sh. Suresh Prasad Thakur, Matric
Sh. Karam Singh, Matric
Sh. Ravi Kumar, Non-Matric
Sh. Om Prakash, Non-Matric
Sh. Ram Singh, Non-Matric
Sh. Dharam Singh, Matric (Caretaker)
Ms. Priti Sachdeva, B.A. (Hons.) & Diploma in Secretarial Practices (Receptionist)

**Establishment-I**

**Section Officer**
Sh. Sudhanshu Kumar, M.A.(Pub. Admn.) (upto 14th Jan 2018)
Ms. Santosh Khuttan, B.A. (from 15th Jan 2018)

Sh. Chander Kant, MA
Ms. Satinder Kaur, B.A.
Sh. Rajeev Chopra, Sr. Sec.
Sh. Manoj Kumar, Non-Matric
Ms. Parul Jain, B.Com (P)
Sh. Sri Ram Mahto, Matric

**Establishment-II**

**Section Officer**
Sh. Sanjeev Shankar, BE(Civil), LLB

Ms. K.B. Verghese, Sr.Sec.
Sh. Anil Kumar, B.A.
Sh. V.K. Bhambota, Matric
Sh. Ramesh Badola, Hr.Sec.
Sh. Sumit Paul, B.Com., M.Com., M.Ed, MBA,
Sh. Niranjan Kumar Srivastav, B.A.
Sh. Sachin Kumar, M.Com.
Sh. Rakesh Kumar, Intermediate
Sh. Dinesh Kumar, Non-Matric
Sh. Desh Raj, Matric
Sh. Bhawesh Paswan, Matric

**Personnel Cell**

**Section Officer**
Ms. Vandana D. Singh, M.A.

Sh. Rajan Tirkey, B.A. (Hons.)
Ms. Parveen Bhatia, B.A., Certificate in Lib. Science
Sh. Umesh Kumar, BCA
Ms. Karuna Saini, M.A. (Economics)
Sh. Dharam Pal, Non-Matric  
Sh. Murari Lal Meena, B.A.

Vigilance Cell  
Section Officer  
Sh. Sudhanshu Kumar, M.A.(Pub. Admn.)

Sh. Sam Kurian, SSLC.  
Sh. Meesam Zaidi, MA  
Sh. Sanjai Singh, B.A., PGDCA  
Sh. Satish Kumar, B.A.

RTI Cell  
Sh. Bhajan Singh, B.A.

Finance & Account Section  
Sr CoFA  
Sh. Padam Singh, B.Com, PGDMP
F&AO  
Sh. Avanish Kumar, B.Sc., LLB

Sh. Phool Chandra, M.A.  
Sh. Bishan Dass Sharma, B.A.  
Ms. Neelam Malik, Matric  
Sh. Vikas Negi, B.A.  
Ms. Deepa Rawat, M.Com.(Pro)  
Sh. Jagdish Singh Negi, Matric  
Sh. Shiv Narayan, Non-Matric

Store & Purchase Section  
Sr. SPO  
Sh. Tariq Badar, B.Sc., MVS(Computer Operations & Application)
SPO  
Sh. Kaushal Kishore, B.A., LLB
Section Officer  
Sh. Sumer Singh Chhachhia, B.A  
Ms. Veena Verma, B.A.

Sh. K. Bairagi, Sr.Sec.  
Sh. C.M. Kukreti, HSc  
Sh. Virender Kumar Dussyya, B.A., PGDAPP  
Ms. Rachna Kumari, BA  
Sh. Vijender Kumar, Matric  
Sh. Kartik, B.Sc  
Sh. Bijender Kumar  
Sh. Gore Lal Paswan, Matric  
Ms. Sumitra Devi, Non Matric

Rajbhasha Unit  
Hindi Officer  

Ms. Anupama Sharma, MA, PG Dip. in Translation  
Sh. Tek Chand Thapa, B.A.

Guest House (Wing I & II)  
Manager  
Sh. Fasih Ahmed Siddiqui, B.Com., One Year Diploma in Hotel, Reception, & Book Keeping, 3yrs Diploma in Hotel Management, Catering & Nutrition

Sh. Rajbir Singh, Non-Matric  
Sh. Keshav Ram Acharya, Non-Matric  
Sh. Rajesh Bariya, Non-Matric  
Sh. Chet Narayan, Non-Matric  
Sh. Rajpath Singh, Non-Matric  
Sh. Ramsai Balmiki, Non-Matric

Canteen  
Manager  
Sh. Braham Prakash, Matric

Ms. Kamlesh Kumari, MA  
Sh. Balbir Singh, Non-Matric  
Sh. Rajinder Singh, Non-Matric
Advisory Council
2017-2018
Research Council

Chairman
Prof. Tarun Kant
Institute Chair Professor,
Department of Civil Engineering,
IIT Bombay, Powai,
Mumbai 400076

External Members
Prof. Ranganathan Sundaravadivelu
Professor.
Department of Ocean Engineering,
IIT Madras, Chennai, 600036

Lt. Gen. Suresh Sharma
AVSM, Engineer-in-Chief,
IHQ of Ministry of Defense (Army), (Retd.)
H-701, Shishpal Vihar
Gurgaon, 122109

Dr. A.K. Gupta
(former Engineer-in-Chief, UP PWD)
Member, UP PSC, Allahabad
2/475, Vinamra Khand, Gomti Nagar,
Lucknow, 226010

Dr. R.K. Pandey
Member (Projects),
National Highway Authority of India,
G-5&6, Sector-10, Dwarka,
New Delhi, 110075

Dr. I. K. Pateriya
Flat No. 29, Triveni Apartments,
A-6, Block, Paschim Vihar East
Opposite to DDA Sports Complex
Delhi, 110063

Dr. R. K. Bhandari
(former Director, CSIR-CBRI)
302, Kamadgiri Tower,
Kaushambi, Ghaziabad, 201012

Director General Nominee
Dr. Santosh Kapuria
Director,
CSIR- Structural Engineering Research Centre,
Taramani, Chennai, 600113

Sister Laboratory
Dr. N. Gopalakrishnan
Director,
CSIR- Central Building Research Institute,
Roorkee, 247667

Director
Prof. Satish Chandra
Director,
CSIR-Central Road Research Institute,
New Delhi, 110025

Permanent Invitee
Dr. Sudeep Kumar
Head, Planning and Performance Division,
Council of Scientific & Industrial Research,
Anusandhan Bhavan, 2, Rafi Marg,
New Delhi, 110001

Member Secretary
Sh. K. Sitaramanjaneyulu
Chief Scientist,
Pavement Evaluation Division,
CSIR-Central Road Research Institute,
New Delhi, 110025
Management Council

Chairman
Prof. Satish Chandra
Director,
CSIR-Central Road Research Institute,
New Delhi, 110025

Members
Sh. G.K. Sahu
Senior Principal Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. Ch. Ravisekhar
Principal Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. A.K. Sinha
Senior Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. S. Padma
Senior Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Smt. Kamini Gupta
Sr. Technical Officer,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. N. Gopalakrishnan
Director,
CSIR- Central Building Research Institute,
Roorkee, 247667

Dr. B. K. Durai
Chief Scientist and
Business Development Officer,
CSIR-Central Road Research Institute,
New Delhi, 110025

Controller of Finance & Accounts/
Finance & Accounts Officer
CSIR-Central Road Research Institute,
New Delhi, 110025

Member-Secretary
Controller of Administration/
Administrative Officer
CSIR-Central Road Research Institute,
New Delhi, 110025