Quality Policy

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 country.

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

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

- 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 measure, psychology of road users and transportation economics in relation to different forms of transport.

- To render technical advice and consultancy services to various organisation 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.

- 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.
### Contents

#### Quality Policy
- ii

#### From Director's Desk
- vii

#### Advisory Council (Research Council and Management Council)
- ix

#### Performance Indicators
- xi

### RESEARCH & DEVELOPMENT (R&D) DIVISIONS

<table>
<thead>
<tr>
<th>Division</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geotechnical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Flexible Pavement</td>
<td>18</td>
</tr>
<tr>
<td>Rigid Pavement</td>
<td>29</td>
</tr>
<tr>
<td>Pavement Evaluation</td>
<td>34</td>
</tr>
<tr>
<td>Traffic Engineering and Safety</td>
<td>41</td>
</tr>
<tr>
<td>Transportation Planning and Environment</td>
<td>52</td>
</tr>
<tr>
<td>Bridge Engineering and Structures</td>
<td>65</td>
</tr>
</tbody>
</table>

### R&D MANAGEMENT DIVISIONS

<table>
<thead>
<tr>
<th>Division</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information, Liaison &amp; Training</td>
<td>85</td>
</tr>
<tr>
<td>Planning, Monitoring &amp; Evaluation</td>
<td>105</td>
</tr>
<tr>
<td>Documentation &amp; Library Services</td>
<td>109</td>
</tr>
<tr>
<td>Computer Centre &amp; Networking</td>
<td>111</td>
</tr>
<tr>
<td>Maintenance</td>
<td>113</td>
</tr>
<tr>
<td>Mechanical and Transport</td>
<td>116</td>
</tr>
<tr>
<td>Quality Management</td>
<td>118</td>
</tr>
<tr>
<td>Rajbhasha (Rajbhasha)</td>
<td>120</td>
</tr>
<tr>
<td>Administration</td>
<td>134</td>
</tr>
</tbody>
</table>

### GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Information</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important Days Celebrations</td>
<td>137</td>
</tr>
<tr>
<td>Workshops / Conferences / Meetings Organised</td>
<td>146</td>
</tr>
<tr>
<td>Honours &amp; Awards Received</td>
<td>152</td>
</tr>
<tr>
<td>Invited Lectures / Talks Delivered / Meetings Attended (Outside CRRI)</td>
<td>154</td>
</tr>
<tr>
<td>New Facilities and Equipment Procured</td>
<td>159</td>
</tr>
</tbody>
</table>
### Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deputation Abroad</td>
<td>161</td>
</tr>
<tr>
<td>Thesis/Dissertation Supervision</td>
<td>163</td>
</tr>
<tr>
<td>Visitors</td>
<td>171</td>
</tr>
<tr>
<td>Membership of Staffs in Various Technical Committees</td>
<td>175</td>
</tr>
<tr>
<td>Membership of National and International Organisations</td>
<td>180</td>
</tr>
<tr>
<td>MoUs, Agreements and Patents</td>
<td>182</td>
</tr>
<tr>
<td>Papers in Journals</td>
<td>185</td>
</tr>
<tr>
<td>Papers in Seminars/Conferences</td>
<td>189</td>
</tr>
<tr>
<td>Articles in Books/Magazines</td>
<td>194</td>
</tr>
<tr>
<td>CSIR-CRRI in Media</td>
<td>197</td>
</tr>
<tr>
<td>Participation in Conferences/Seminars/Workshops</td>
<td>200</td>
</tr>
<tr>
<td>Participation in Training Programs/Short Term Courses (Outside CRRI)</td>
<td>206</td>
</tr>
<tr>
<td>Staff News (Retirements, Transfer &amp; New Joinings)</td>
<td>209</td>
</tr>
<tr>
<td>Manpower Positions (as on 31.03.2020)</td>
<td>213</td>
</tr>
</tbody>
</table>
I am pleased to present here 2019-2020 CSIR-Central Road Research Institute, New Delhi Annual Report which summarizes the major activities and achievements of the institute. The institute focused on capacity building and development of human resources in the area of highway engineering to undertake and execute roads and runway projects through technical and consultancy services to various user organizations in India and abroad.

CSIR-CRRI made significant contributions to knowledge generation as evidenced from research papers and patents. During the year, our scientists published 92 papers in renowned journals and conference proceedings and 19 articles in Books and Magazines apart from filing various patents in India and abroad. During this fiscal year, two patents were filed and one was granted. Besides this, ten agreements and MoUs were signed and eight Technologies transferred with government and private agencies during the year for executing the various projects of national importance.

Over the course of the year, we have successfully completed a large number of consultancy assignments and made external cash flow of Rs. 32.79 crore, which is the highest cash flow in the history of our Institute.

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

CSIR-CRRI hosted a number of events during the year. These include National Hindi Workshop on “Development of Basic Infrastructure Development and Challenges of 21st century” and Workshop on “Geotechnical Engineering Practice - Case studies”. Also, this year Audit of CSIR-CRRI as per IS/ISO 9001: 2015 requirements was conducted by the auditors of BIS, certification agency. The auditors were satisfied with the current system / procedure followed in CSIR-CRRI and approved the extension of ISO 9001 certificate to CSIR-CRRI, which is also a testimony to the quality standard maintained by the institute.

Past fiscal year has again touch great heights for Vision Forward and the people we serve. CSIR-CRRI conducted thirty seven regular, customized, International training programs and specialized
certification courses in the area of roads and road transportation. Customized training programs were organised for the engineers of PWD Agratala, Govt. of Agratala; SIRD, Govt. of Tamilnadu; NIRDA, Govt. of India; officers of Air Head Quarter, New Delhi; Border Roads Organisation, New Delhi, National Disaster Managment Authority, New Delhi; and NRAP-MRRD, Kabul, Afghanistan. These were attended by 943 participants from within the country and 52 from other developing countries.

We undertake significant international engagement and work closely with international organisations. It is my pleasure to share that many distinguished Scientists both from India and abroad visited our Institute, delivered lectures, and held discussions with Scientists of the Institute during the year.

Council of Scientific and Industrial Research (CSIR), was launched a student-scientist connect programme 'JIGYASA' in collaboration with Kendriya Vidyalaya Sangathans (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 KVs. In last fiscal year, around 781 students alongwith 55 teachers from KVs and other civil engineering colleges have enthusiastically participated in this interactive workshop/orientation 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.

Students of B. Tech/M. Tech from civil engineering colleges, NITs and IITs have a dream to work for their dissertation in CSIR-CRRI. During the period under report, three students are registered for doctoral degree, thirty nine students have completed M. Tech/B. Tech thesis while eight students were awarded summer internship. Thirty eight new technical staffs have joined the institute during this year, which is a milestone in the history of the Institute.

I 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 extend my gratitude to our external experts who guided in our pursuit for excellence. Team CSIR-CRRI acknowledges the enduring support extended by one and all for the growth of the Institute.

Looking ahead to the 2020-2021 financial year, despite current pandemic, I am confident that our dedicated and expert team will continue to demonstrate the excellence and work towards the goal of #CSIR fights Covid19. Our goal remains to be closer to our customers, society and their needs - even in the age of distance.

Jai Hind

Prof. (Dr.) Satish Chandra
Director
The Research Council of the Institute is as follows.

**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. (Retd.) Suresh Sharma  
AVSM, Engineer-in-Chief,  
IHQ of Ministry of Defense (Army),  
Kashmir House, Rajaji Marg,  
New Delhi, 110011

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

Dr. I. K. Pateriya  
Director (Projects),  
National Rural Infrastructure Development Agency,  
5th Floor, NBCC Tower, Bhikaji Cama Place,  
New Delhi 110066

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

**Director General Nominee**
Prof. 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

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

For the period upto December 31, 2019

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

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

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. 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
Sh. Anjum Sharma
Controller of Administration
CSIR-Central Road Research Institute,
New Delhi, 110025

From January 01, 2020 onwards

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

Members
Dr. Avanish Kumar Srivastava
Director,
CSIR- Advanced Materials and Processes Research
Institute, Bhopal, 462026

Sh. J. K. Goyal
Senior Principal Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. A. Mohan Rao
Senior Principal Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. Mukti Advani
Principal Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Sh. Durga Prasad Golla
Scientist,
CSIR-Central Road Research Institute,
New Delhi, 110025

Dr. C. Kamraj
Sr. Technical Officer (3),
CSIR-Central Road Research Institute,
New Delhi, 110025

Sh. P. V. Pradeep Kumar
Chief Scientist & Head, PME,
CSIR-Central Road Research Institute,
New Delhi, 110025

Sh. Avanish Kumar
Finance & Accounts Officer,
CSIR-Central Road Research Institute,
New Delhi, 110025

Member-Secretary
Sh. Anjum Sharma
Controller of Administration
CSIR-Central Road Research Institute,
New Delhi, 110025
**Performance Indicators**

### Papers Published in 2019-20

![Pie Chart]

- **Papers in Journals**: 19
- **Papers in Conferences**: 35
- **Articles in Books & Magazines**: 57

### Staff Strength in 2018-2019

![Pie Chart]

- **Scientist (Group-IV)**: 28%
- **Technical (Group-III)**: 24%
- **Technical (Group I&II)**: 21%
- **Administrative Staff**: 27%
Performance Indicators

Projects Undertaken in 2019-2020

External Cash Flow (Rs. Millions) in 2019-2020
Research & Development

- Geotechnical Engineering
- Flexible Pavement
- Rigid Pavement
- Pavement Evaluation
- Traffic Engineering and Safety
- Transportation Planning and Environment
- Bridge Engineering and Structures
Geotechnical Engineering
**RESEARCH PROJECTS**

**Impact of Changing Climatic Pattern in a part of Uttarakhand with Specific Reference to Landslides**

Funding Agency: G B PANT National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD)

Duration of the project: March 2017 to June 2020

Broad Objectives: The objective of the final year work is to deliver customized training module and awareness guidelines against landslide disaster scenario impacted by climate change specific to Garhwal region, Uttarakhand.

The major activities in the last two years were focused on the behaviour of various controlling parameters of landslide and their correlation with rainfall and temperature variability’s. Following the previous year studies final results and strategies prepared in brief are:

i. **Correlation of various parameters with landslide under changing climate pattern to calculate the risk involved:**

The results of each factor defining possible areas which are highly influenced due to climate change and as future threat of landslide are as follows:

<table>
<thead>
<tr>
<th>Type of landslide most observed</th>
<th>Rock cum debris slide and Debris flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithological zones</td>
<td>Garhwal group, Jaunsar group and Central Crystallines sequence</td>
</tr>
<tr>
<td>Lithology</td>
<td>Phyllites, Schist, Gneiss and Quartzites</td>
</tr>
<tr>
<td>Geomorphology</td>
<td>Structural Hills highly dissected areas</td>
</tr>
<tr>
<td>Distance from Drainages</td>
<td>50-100m proximity to drainage areas</td>
</tr>
<tr>
<td>Land Use-Land Classification</td>
<td>Agricultural lands and near water bodies</td>
</tr>
<tr>
<td>Proximity from Road</td>
<td>Within 50m</td>
</tr>
<tr>
<td>Aspect</td>
<td>Southern slopes</td>
</tr>
<tr>
<td>Slope</td>
<td>&gt;40%</td>
</tr>
<tr>
<td>Proximity from Thrust boundary</td>
<td>1-2km radi</td>
</tr>
<tr>
<td>Elevation</td>
<td>1200 to 2000 meter above mean sea level</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>Areas under moderate to severe Soil erosion</td>
</tr>
<tr>
<td>Average annual Temperature</td>
<td>Areas with 25° to 14° C</td>
</tr>
<tr>
<td>Average annual Rainfall</td>
<td>Areas with 1200 to 1750 mm</td>
</tr>
<tr>
<td>Profile Curvature</td>
<td>Concave</td>
</tr>
</tbody>
</table>

As a result, the landslide climate hazard profile map is developed based on the results of all thematic factors dividing Garhwal it into five categories from very low to very high hazard zones by categorizing the total estimated hazard through weight of overlay heuristic approach.

ii. **Module on management strategies, awareness & preparedness on the landslides impacted by the Climate change in Garhwal region:**

Clear guidelines on community preparedness in all the three cases i.e. before, during, and after landslide are specified. The landslide factors and climate correlation helps establish the priorities of the actions on the module for as per the Garhwal region. The prepared landslide climate hazard zones will help stakeholders to focus on different areas with different approach as per the risk involved. Module elaborates the capacity building of locals through education of the present situation of landslides and climate change and harnessing their local strategies, knowledge and skills in the right direction. A holistic approach for natural hazards and climate change impact is emphasized to work on for various stakeholders. To cope with ongoing environmental changes due to climate...
change adaptation strategies are recommended as the key measure. Community based landslide mitigation techniques viz. improvement in land use patterns, constructing effective drainage system, soil bio-engineering methods, and vegetation methods are also provided. The structure of training module suggested is presented in Fig. 1.

*Fig. 1 : The work flow of the guidelines prepared for management, awareness & preparedness on the landslides impacted by the Climate change in Garhwal region*

**Geotechnical Engineering**

**Research & Development**

**Ground Improvement of Sub-Soil below existing Structures using Steel Fibre Reinforced Grouting**

Funding Agency: CSIR-CRRI

Duration of the project: October 2016 to October 2019

Broad Objectives:

(a) Develop a ground improvement technology using steel fiber reinforced grouting based on model studies.

(b) Performance evaluation of fiber reinforced grouted columns for total and differential settlements

This research was undertaken to develop a new ground improvement technology for existing structures, showing distress due to excessive ground settlement or to improve the ground bearing capacity for more imposed loads than expected. Silty sand with different degree of compaction was selected as the soil for treatment based on the practicality for conducting large scale physical modelling and literature studies. Index properties of the selected soil as well as shear and compressibility tests were conducted on silty sand with varying relative compaction. Relative compaction varying from 78% to 86% of MDD was considered for the research. For the grout mix, crimped steel fibres with a diameter of 0.45mm and length 12.5mm was used for the testing. Other components include sand and cement. Bentonite was also added to lower the permeability of the mix. BASF accelerators was also used to lower the setting time of mix. Compressive strength, workability, density and setting times of different trial mixes were determined. Final mix proportion was considered based on the optimum value of compressive strength. Flexural strength tests were also carried out for the finalized mixes.

The physical modeling (Fig. 2) of the small-scale tank has been done as per scaling laws (Muir wood 2004). The boundary effects have been considered as per Li et al. (2011), and Sarkar et al. (2012). Acrylic soil tank of size 1.00m x 1.00m x 0.75m, loading frame of 10T capacity, instrumentation (including load cells, LVDTs and data acquisition system) and hydraulic loading jacks were procured. The angle of inclination of the columns were chosen based on the literature studies related to underpinning piles. It was concluded to do model tests on angles varying from 0° to 45°, based on literature studies. To ascertain the compaction effort required to achieve different soil densities, trial compaction tests were conducted in the model test tank. The physical model tests were conducted for different cases of grout column installed manually with cutting shoe and steel tubes. Major Parameters considered for the study are soil relative compaction, saturation, angle of inclination of the column, number of columns, curing period and loading cases. Twenty-four set of physical model tests were successfully conducted. The optimum degree of inclination, curing time as well group effect of the columns for the silty soil, under various saturation and loading cases was established with the study. The failure pattern (Fig. 3), degree of improvement of soil based on density and load bearing characteristics were observed with the study (Fig. 4), which would otherwise in no case including full scale field study or numerical modelling can be established.
Validation of the physical modelling test results was done with the literature (Orense, 2008 and Rao et al. 2019). It was observed that as the relative compaction of soil increases, the load bearing capacity of soil increases, and settlement was decreased. Density of the soil was improved by 3% to 11% with different grouting patterns. The increase in bearing capacity due to grout column is higher for denser soil compared loose one. It was also observed that the increase in bearing capacity is higher for grout column installed at an inclination of 22°, irrespective of the degree of compaction.

**Study of the Nature of Ground Waves and Protection of Important Structures against Vibration**

Funding Agency: CSIR-CRRI

Duration of the project: September 2018 to September 2021

Broad Objectives:

(a) To solve the road/runway construction problem in problematic areas subject to dynamic loads.

(b) To compare the flow of surface waves on the open ground and through piles in a row before an important structures to be isolated against vibration.

The availability of limited space for growing number of technical activities has made this old technique of “Vibration Isolation” very relevant. The infill materials have been characterized in terms of Absorption and Impedance-contrast to enable them to function properly.

The nature of the ground waves is studied in the absence of the trench (Original ground), in the presence of trench and in the presence of suitable infill materials. It has been observed that there is attenuation in the wave energy with distance following an exponential decay law in the absence of the trench. In the presence of the trench, Surface and Ground waves interfere and the variation of amplitude becomes cyclic (Fig. 5). Further, in the presence of infill material, waves are guided inside the ground.

The property of Impedance-contrast and ability to liquefy in a confined state has been emphasized as a
measure of efficiency against vibration. The product of Bulk density ($\rho_b$) and Shear wave velocity ($V_s$) represent the momentum of the oncoming waves which will be neutralized by the Infill material before it reaches the structure.

Regarding the various materials which are to be used in the trenches include Bentonite slurry, Silica gel and some lightweight and porous materials like Rubber Powder and Sawdust. Materials having lower value of Impedance Contrast with respect to soil or having the liquefiable tendency are considered to be efficient. Materials in saturated conditions are desirable as the presence of fluid reduces the Shear Modulus and therefore, Shear wave velocity.

For viewing the material performance, accelerometers are placed on both sides of the rectangular trench. The mechanism of both the processes of Isolation can be expressed in the following manner mentioned below.

**Active Isolation:** Energy dissipation takes place through reflection of the Surface waves and Body waves coming from inside the ground. Huge disturbance is created near the source. Herein, the advantage of using Infill material comes in. The Infill materials absorb the wave energy and act as a Base Isolator when placed below the vibrating machine.

**Passive Isolation:** In this type of Isolation, structure to be protected is located at a larger distance from the source. The depth of the trench is kept more to receive the Body and Surface waves. Body waves proceed to the spot where pressure-difference is created by excavation and come upwards through the porous material. The wave energy can be subjected to liquefaction in this spot.

### CONSULTANCY PROJECTS

**Investigation, Design and Remedial Measures for Protection of Slopes at Bailey Bridge, Pumabai Valley**

Funding Agency: Central Public Works Department (CPWD), Border Fencing Zone, New Delhi

Duration of the project: September 2019 to January 2020

Broad Objective: Arrest rockfall and stabilize the slope by providing remedial/protection measures at the proposed abutments of Bailey bridge on either side

Study area comes under the Higher Himalaya region, which is facing slope stability and rockfall problems at different places. CPWD officials observed rockfall problem at chainage .0km (Fig. 6), where Bailey suspension bridge is proposed to be constructed. The main objective is to arrest rock fall and stabilise the slopes by providing Remedial measures at the proposed abutments of Bailey bridge on either side (Fig. 7).

A detailed field investigation, which includes geological as well as geotechnical investigation were carried out using the contour map on 1:500 scale with 1m contour interval, provided by the CPWD. Geological structural data, sample and other information were collected from the field. Stereographic analysis was used with the help
of geological structural data to find out mode of failures. Laboratory tests on soil and rock samples were carried out to engineering properties of field samples.

Slope stability analysis for both uphill as well as downhill side of Sobla and Hardeval sides were carried out. Considering the geological and environmental conditions and importance of the Bailey bridge, remedial measures were suggested for both uphill and downhill sides of Sobla as well as Hardeval sides. Remedial measures viz. scaling & slope dressing, rhomboidal wire rope panel, continuous threaded anchor, random rubble buttress wall and toe drain on Sobla side. Similarly, scaling & slope dressing is also suggested for Hardeval side along with other remedial measures such as drapery system and random rubble butteress wall.

**Design, Supervision and Pavement performance evaluation of road constructed by using phosphogypsum**

Funding Agency: Paradeep Phosphate Limited, Bhubneshwar, Orissa.

Duration of the project: May 2016 to May 2020

Broad Objectives:

(a) Evaluation of physical, chemical and geotechnical properties of phosphogypsum waste material. Providing construction supervision guidance to quality control team during construction.

(b) Pavement performance monitoring for two years.

Phosphogypsum is a waste material generated as a by-product during manufacturing of phosphoric acid. Laboratory investigation was carried out to examine the feasibility of phosphogypsum waste material
in the construction of embankment, sub grade and granular sub base layers. After that, an experimental test road was constructed using phosphogypsum at Paradeep, Orissa. Five sections were constructed of 100 m length each viz. phosphogypsum used in embankment (with or without soil cover), subgrade, granular sub base layers and one control section using conventional material. Two sets of pavement performance monitoring of the experimental road was completed in 2019. The performance study was carried out by (i) visual inspection (ii) measuring rebound deflection using Benkelman beam and (iii) measuring surface roughness using dipstick. The progress of performance study using Benkelman beam is shown in the Fig. 10. Third set of performance study is due in the year 2020. However some of the important interim conclusions are given below.

1. Overall condition of the phosphogypsum sections is similar to conventional section as observed by visual condition survey. There was no visual crack, pothole, ravelling, bleeding and rutting observed along the completed experimental test track even after two years of construction.

2. Phosphogypsum sections have less rebound deflection as compared to conventional section. This indicates that modulus of elasticity is higher in the phosphogypsum section. Hence, it is concluded that phosphogypsum section have less settlement as compared to soil section and structurally more strong.

3. There is insignificant variation in roughness value with time from the first pavement performance study to the second performance study in both phosphogypsum as well as control sections.

Performance study of a mix of jarofix-zinc slag as a retained fill in reinforced retaining wall

Funding Agency: Hindustan Zinc Limited, Chittorgarh (Rajasthan)

Duration of the project: September 2019 to August 2022

Broad Objectives:

(a) Development of design specifications for utilization of mix of jarofix-zinc slag as a retained fill in the construction of reinforced retaining wall.

(b) Development of construction methodology using mix of jarofix and zinc slag.

(c) Pavement Performance study of the mix of jarofix-zinc slag as a retained fill of reinforced retaining wall.

Six laning of Chittor to Udaipur section of NH-76 from chianage km 214+870 to km 308+370 in the state of Rajasthan (length 93+500 km) on DBFOT (Toll) under NHDP Phase-V (package-III) is in progress. In this section, six approaches of flyover are constructed using a mix of jarofix and zinc slag waste as backfill materials. The ratio of slag and jarofix is decided by about 70:30 % (by weight) after trying different Jarofix - slag ratio considering the density as well as shear strength parameters. Mixing methodology of slag and jarofix has been developed after several trials. In the first trial, slag layer was laid over jarofix layer and mixing was carried out by grader. In the second trial, jarofix was laid over slag and mixing was carried out. In the third trial, jarofix was stacked in a yard near by the site and slag was stacked over it. After that, combined jarofix and slag was loaded into the truck and transported to site. Combined material is stacked along the proposed road as shown in the Fig. 11. It was observed that during the loading of materials in the truck from the stock yard, unloading of the materials at the site, and spreading of the same along the proposed alignment, materials got mixed properly. Third trial methodology was observed to be economical and fast. Considering this, whole mixing of material and construction were carried out by this method. During the construction, quality control
and supervision were carried out as per standard procedure. Arrangement was also made at the site for leachate collection under the retained fill (mix of jarofix-slag) as shown in the Fig. 12. During the construction, quality control and supervision were carried out as per standard procedure. Performance and leachate test will be carried out for two years. Brief conclusion of the study is given below.

1. Stacking of slag over jarofix, bringing the material at the site and laying the material along the proposed approach road is economical method for mixing of jarofix and slag.

2. Leachate collection system will give more confidence to user agency about the nature of toxicity characteristics of waste materials in actual environmental condition.

Duration of the project: September 2019 to July 2021

Broad Objectives:

(a) Development of design specifications for utilization of zinc tailing in embankment, sub grade, granular sub base, WMM, cement stabilized sub base and base layers of road as per MORTH and MORD specifications.

(b) Development of design specifications for utilization of zinc tailing in cement concrete layers of road as per MORTH and MORD specifications.

During the mining and metallurgical process, different kind of wastes is generated. One of them is zinc tailing waste material which is generated during preparation of concentrated zinc ores. To investigate the feasibility of zinc tailing for its bulk utilization in road construction, tailing was collected from pond at Hindustan zinc limited, Zawar, Rajasthan, India.

Consequently, a laboratory study was undertaken to investigate the feasibility of using tailing in the construction of embankment, subgrade, sub-base, base and wearing courses for both bituminous and concrete pavements. Project is going on. However, preliminary laboratory investigation on this material is completed viz. physical and geotechnical characterisation. Design and stability analysis of tailing embankment under different water saturation conditions along with settlement analysis is also completed. Brief summary is given below.

1. Tailing material is found to be in moist condition and having natural moisture content of about 12%. There is no organic content in the tailing material. Specific gravity of tailing is observed to be slightly higher than the conventional soil. Fineness modulus of the samples is very low as compared to natural sand and was found to be about 0.23.

2. Tailing is essentially a fine grained material and contents 30% sand, 55% silt and 15% clay size particles. The result indicated that tailing is a non plastic material. It is observed that tailing material is having non swelling characteristics.

Feasibility Study of Zinc Tailing in Road Construction

Funding Agency: Hindustan Zinc Limited, Udaipur (Rajasthan)
Tailing material is cohesionless and having high value of angle of internal friction (€) i.e. 34°.

3. Factor of safety of tailing embankment is more than 1.25 which indicates that it is safe as per IRC-75 (2015). It was also observed that FoS is higher in partial saturated condition in comparison to sudden draw down condition similar to soil.

**Laboratory Evaluation of ‘Alkali Bypass Dust’ (Soil Stabiliser) from Tata Chemicals for Usage in Road Work**

Funding Agency: M/s Tata Chemicals Limited Mithapur, District - Devbhoomi Dwarka, Gujarat

Duration of the project: July 2019 to February 2020

Broad Objectives:

(a) Assessment of strength (in terms of Unconfined Compressive Strength, California Bearing Ratio) and durability characteristics of Alkali bypass dust and local soil admixed with Alkali bypass dust in different proportions.

(b) To assess the efficacy of soil stabilised with Alkali bypass dust in different proportions and Alkali bypass dust alone in road construction based on laboratory test results.

M/s Tata Chemicals, located at Mithapur, near Okha in Gujarat, is the world’s second largest producer of soda ash (Fig. 13). ‘Alkali bypass dust’ is a by-product material in powder form (Fig. 14), generated from the soda ash plant. Alkali Bypass dust is predominantly silt sized and non plastic. To utilise the inherent self-hardening property of Alkali bypass dust when it comes in contact with water, local soil was stabilised using Alkali bypass dust in different proportions. Engineering tests including California Bearing Ratio (CBR) test, Unconfined compressive strength (UCS) test and Durability test were conducted on alkali bypass dust and soil mixture. Since, alkali bypass dust is a self hardening material, UCS test and durability tests were carried out on cylindrical specimens made by using alkali bypass dust alone (100% alkali bypass dust samples), after curing them in humid conditions for different time periods.

Laboratory evaluation showed that, even though addition of Alkali bypass dust to local soil improves its UCS strength, stabilisation does not lead to adequate strength development of local soil for its use in stabilised sub-base or base course of road pavement. Alkali bypass dust (100%), after adding moisture and compacting it, has high CBR value. Its 7 days UCS was found to be about 1.52 MPa, when it was compacted to 98% of maximum dry density (MDD) as per modified Proctor test. Compacted UCS samples of alkali bypass dust satisfied durability test criteria as per IRC SP: 89. Based on the laboratory test results, it was suggested that alkali bypass dust (100%) compacted to 98% of modified proctor test MDD, and cured for 15 days, can be tried in rural roads as a bound sub-base material, for stabilisation of subgrade soil and for shoulder construction. Alkali bypass dust can be used as embankment fill material. Since curing of individual layers of embankment fill may not be feasible, core of the embankment can be constructed using alkali bypass dust and embankment side slopes can be protected using good earth cover (in a manner similar to fly ash embankments). Further it was also emphasized that separate study is required to ensure that using alkali bypass dust in road works is environmentally safe. Before going for wide scale usage, test track study (minimum suggested length: 250 m) and its performance monitoring for two years was also suggested.

![Fig. 13: Alkali Bypass Dust Dumped Near the Plant](image)
Investigation Based Recommendation for Improvement of Goverdhan Parikrama Road

Funding Agency: Uttar Pradesh Braj Teerth Vikas Parishad, Mathura

Duration of the project: January 2019 to August 2019

Broad Objectives: Development of "Goverdhan Parikrama" to make it more foot friendly to pilgrims

A road has been constructed all around Goverdhan Parvat to facilitate Goverdhan Parikrama by the devotees. This road is black topped for a major length, with few stretches of cement concrete pavement. Towards Parvat (mountain) side of the road, an earthen footpath has been constructed. Pilgrims cover the distance of 21 km around the Parvat by walking mainly on this earthen footpath. Most of the pilgrims walk barefoot on earthen footpath, which is made of a mixture of local soil and Yamuna river sand. Several pieces of small “Kankar” stones (local gravel) are mixed with soil in the footpath, making it difficult for pilgrims to walk. Footpath surface is regularly broomed to remove gravel pieces, but some of them still remain. Hence, there is a need to provide suitable surfacing to footpath to make it comfortable for barefoot walking.

Studies were taken up to prepare “Mud Concrete Blocks (local soil + Cement Blocks)” at CRRI. Initially local soil in the footpath was collected and subjected to various tests in the laboratory to determine its engineering properties. Optimum percentage of cement required to prepare such blocks was determined through unconfined compressive strength tests and durability tests specified for cement stabilised soil. The compressive strength developed for different percentages of cement at 7 and 28 days are given in Table 1.

<table>
<thead>
<tr>
<th>Curing Time Period</th>
<th>Unconfined Compressive Strength in MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Soil + 15% Cement</td>
</tr>
<tr>
<td>7 days</td>
<td>5.4</td>
</tr>
<tr>
<td>28 days</td>
<td>7.6</td>
</tr>
</tbody>
</table>

Since, mud concrete blocks having 20 and 25 per cent cement had less than 20 per cent material loss in durability test, further tests were carried out on these mud concrete blocks. Mud concrete blocks were prepared by mixing and compacting moist soil and cement mixture. These blocks were cured in wet sand for 28 days. After the curing period, these blocks were subjected to surface frictional property test using British Pendulum Tester and abrasion resistance test using 'revolving disks type abrasion resistance tester'. Mud concrete blocks having both 20 per cent and 25 per cent cement performed satisfactorily in these two tests. Hence, using mud concrete blocks having 20 per cent cement was suggested for a trail stretch construction.

Design and Supervision of Suitable Methodology for Minimizing Upheaval of Carriageway during Box Jacking for Construction of Underpass on NH-8 near Mahipalpur, Delhi

Funding Agency: M/s Gawar Construction Ltd.

Duration of the project: December 2018 to September 2019

Broad Objectives: To Design and suggest suitable construction methodology (soil Nailing) for minimizing upheaval of carriageway during box jacking

The Executive Engineer (Civil), Project Division-3, New Delhi Project Zone the work of has proposed to construct underpass across the Delhi-Gurgaon Road (NH-8) for direct entry of traffic from Vasant Kunj to Aero city and Indira Gandhi International Air port (Fig. 15). At the same time, the underpass will also facilitate to decongest the traffic of Mahipalpur intersection on Delhi-Gurgaon Road. The Executive Engineer had awarded the work of...
said underpass to M/s GAWAR Construction Ltd. The project work of “Design and Supervision of Suitable Methodology for Minimizing Upheaval of Carriageway during Box Jacking for Construction of Underpass” on NH-8 near Mahipalpur, Delhi was entrusted to CSIR-CRRI.

The client had observed differential settlement in the alignment of Aerocity-Vasant Kunj as well as about 40-50 cm upheaval on existing NH-8 after jacking of four box segments across NH-8. Thereafter, the problem was referred to CSIR-CRRI when the upheaval affected the live traffic movement on Delhi-Gurgaon expressway. The box jacking operations were taken up towards Aerocity side. The geotechnical investigation report also indicated that the quartzite rock mass exits at different depth (slanting) in both ends of proposed underpass. The thickness of rock mass was increasing with the length of box jacking, it means more frictional forces were encountered while jacking of box. The frictional forces got increased because of irregular rock cutting.

After the site visit of CSIR-CRRI team, it was observed the box jacking operations were taken up through soil and rocky formation (Fig. 16). On the basis of the scope of the project, the up heaving of the existing NH-8 was controlled by modifying the construction methodology. The frictional forces were reduced considerably by providing groove all along the cutting shield. The shoulder soil was protected by soil nailing with gunny bags. The extra lane was created for smooth running of left lane traffic.

**Design & Guidance during Implementation of Soil Nailing for the Stabilization of Embankment for Construction of Rail Underpasses, Pragati Maiden, New Delhi**

Funding Agency: Larsen and Toubro (L&T) Pvt. Ltd. (Through Delhi PWD and Indian Railways)

Duration of the project: February 2019 to March 2020

Broad Objective: Design of suitable construction methodology for stabilising the rail embankments & overburden during construction of underpass through box jacking technique.

The work of Pragati Maiden redevelopment plan (Fig. 17) project involves construction of rail underpasses by box jacking below the rail tracks (New Delhi-H. Nizamuddin and Ghazibad-H. Nizamuddin). The underpass once commissioned will help decongesting the traffic of Mahatma
Gandhi Marg (Ring Road) to Bhairon Marg and Mathura Road to Bhairon Marg which is connecting the Road opposite to Pragati Maidan.

The work of designing the scheme of strengthening the soil embankment and box face using 'soil nailing' (above and inside the box) as well as providing the guidance during execution of soil nailing for construction rail underpasses (Pragati Maidan and UP-5) was awarded to CSIR-CRRI. The team investigated the site and worked out with an appropriate design of soil nailing for strengthening the overburden soil as well as box face below the rail tracks. The rail embankment towards millennium side is composed of filled material which includes the waste material (Municipal solid waste, mostly garbage) in loose condition with considerable moisture in it. However, the sub soil was consisted of poorly graded fine sand. The inner dimension of each segment of RCC precast boxes is 10m x 12.10m x 5.545 m (LxBxH) with box thickness of 1.20 m. The maximum outer dimension of the boxes are 14.50 m x 7.9450 m with overburden height of 6.16m towards millennium side.

The construction methodology of soil nailing is being guided during its implementation at site. The overburden and box face soil towards the millennium side were completely stabilized by soil nailing prior to box jacking operation and soil nailing is to be taken up towards the UP-5 side. The said project is still under construction as shown in Fig. 18 & 19.

**Design of Road Remediation and erosion protection works for the reconstruction of flood damaged Shangumugham beach road, Thiruvananthapuram**

Funding Agency: Public Works Department, Kerala
Duration of the project: December 2019 to December 2020

Broad Objectives: To suggest road remediation and erosion protection measures for the reconstruction of flood damaged Shangumugam beach road, Thiruvananthapuram.

The storms that battered the west coast during the monsoon of 2018 and 2019 eroded the shorelines of Shangumugam Thiruvananthapuram and damaged the beach road. The road is a two-lane undivided
road. At present, one lane is washed away along with
toe protecting Gabion wall due to coastal erosion of
a length of 260 m (approx.).

The subsoil majorly comprises of 78% sand and
22% silt. It is classified as silty sand and observed
to be medium dense as SPT (N) values are more
than 20 except at 3m depth. The insitu moisture
content is reported in the range of 13 to 21%, which
indicates that the subsoil is in submerged condition.
The angle of friction angle is reported as 18° upto
3m depth, while 37° for 3-15m depth. From this, it
can be inferred that the soil is in loose condition
for a depth of 3m and medium dense for rest of the
depth. This may be due to the scouring and further
refilling of top 3m soil by wave action. This is also
supported by the SPT in this range of depth. Water
table was observed at 0.6m below the ground level.
The existing road level is 1m above the ground level
considered for subsoil investigation.

Heavy rain fall and storm surge resulted in shifting
of shoreline thus eroding/scouring of beach soil.
This caused the failure of gabion wall and eventually
road. The road embankment is subjected to tidal
wave action addition to the pavement and traffic
loadings. Depending on the location of the proposed
structure with respect to shoreline, any coastal
structure can be designed as seaward or landward
structure. The proposed road embankment is
designed as a landward structure. There is shallow
water depth near the Shangumugam beach. Since
the road embankment under consideration lies in
the shallow water depth, non-breaking wave forces
were considered for the analysis. The calculated
total force and moment caused due to wave impact
is considerably less compared to other surcharge
forces acting on the road embankment.

Design of remedial measures (Fig. 20) is provided
which comprising diaphragm wall, soil anchor and
rubble mound. Structural design of diaphragm wall
as well as design of pavement was also carried out for
the reconstruction of damaged road. Construction
methodology for the execution of remedial measures
was also provided.

![Fig. 20: Cross-section details of the suggested remedial measures](image)

**Feasibility study of local soil/rockfill/boulder as a fill material in Runway extension area, Jabalpur Airport**

Funding Agency: Airports Authority of India

Duration of the project: April 2019 to October 2019

**Broad Objectives:**

(a) Determining feasibility of local soil/rock fill/
boulders, for using it as fill material in the
runway extension area

(b) Determining feasibility of local soil/rock fill/boulders mixed with some percentage of
stone dust/Murrom as a fill material in the
Runway extension area

Airports Authority of India (AAI) has in recent
times awarded the work of extension of Runway
(762 m), construction of Apron and Taxiway and
other associated works at Jabalpur Airport. The
work involves cutting and filling of earth in a
range of height from 0 to 30 m within existing AAI
premises, providing and laying flexible pavement
(bituminous surface) in extended portion of runway
and shoulders. The major work involved in this
task is filling of earth and construction of flexible
pavement over it.

As the runway extension of 762 m involves lot of
filling (6 m average height), AAI had proposed to
fill this runway extension area and other areas with
copra soil (highly weathered basalt) up to a depth
of 4 m and thereafter top 2 m with moorum. Since
AB - 320 type aircraft is proposed to be operated
on this runway, AAI was concerned about achieving
minimum CBR value of 8% with copra soil as a fill
material. In this regard, AAI requested CSIR - Central
Road Research Institute (CRRI) to advice on the use of local soil/rockfill/boulder as a fill material in runway extension area, Jabalpur Airport.

CSIR-CRRI team has carried out visual observations on proposed runway extension area. Some trail pits were also got made by AAI at airport premises to find out the depth of black cotton soil and estimate feasibility of suitable fill material (boulders) for runway extension area.

Different compositions tried through test tracks laid for determining feasibility of local soil/boulders (resulting from excavations at different locations in airport area) and the local soil/boulders (resulting from excavations at different locations in airport area) mixed with some percentage of stone dust/Moorum as a fill material in the runway extension area. Field demonstration and construction of test tracks are shown in Fig. 21. Field tests were also carried out to determine strength properties of the fill materials used for test strip construction.

Based on the field investigations and observations from test tracks laid on runway extension area through field plate load test, in-situ density tests the following conclusions are drawn

- Combinations of compositions of boulders, moorum and stone dust have provided encouraging results for adopting in the embankment fill stage of construction of extended runway
- It may be thus strongly inferred that the boulder (70%) + stone dust (30%) mix is a practically viable solution for fill process in the given circumstances/scenario.
Fill material selection for use in New Apron and Stability of earth at the site of retaining wall, VSI Airport, Portblair

Funding Agency: Airports Authority of India

Duration of the project: March 2019 to January 2020

Broad Objectives:

(a) To assess the suitability and efficacy of locally available materials for its use as fill material in New apron
(b) To advice on stability of earth at the site of retaining wall

During field visit of CRRI team, it was observed that excavated portion of sub-soil adjacent to partially constructed retaining wall had failed by slippage/slumping and the failure of slope extended even up to ITF ground portion (Fig. 22). Huge cracks were observed on failed ground/slope towards ITF ground side and ITF ground area (beyond temporary boundary wall). Huge cracks on excavated portion/slope were also observed towards contractor office side (Fig. 23).

Eight bore holes (150 mm dia) were made up to a depth of 10m. After thorough evaluation of the sub-soil investigation report, laboratory tests and design, the following conclusions were drawn.

Local soils are basically expansive soils and exert high free swell index and high swelling pressure. Hence local soil is not suitable as a fill material in new apron area.

The geotechnical properties of stone dust and moorum indicated that both these materials are suitable as a fill material in new apron area.

The proposed excavated portion of the soil slope is steep and the angle varies from 530 to 610. The steeper slopes excavated for foundation of retaining wall are prone to sliding and require treatment. Soil nailing technique has been designed and suggested to stabilize the steep cut slopes for construction of retaining wall.
Flexible Pavement
**RESEARCH PROJECTS**

**Sustainable Road Pavements in High Altitude Regions Using Geosynthetics**


Duration of the project: May 2018 to May 2021

Broad Objectives: Development of design guidelines for construction of roads in high altitude areas using locally available materials and geosynthetics. CSIR-CRRI has proposed this project targeted towards improving performance of pavement layers built using local marginal materials, which are confined in geosynthetics. CSIR-CRRI team collected three different locally available marginal materials, viz., landslide material, tunneling muck and local soil from the proposed trial site. The Indigenously developed repeated load apparatus is being used to study the effect of Geosynthetic confinements provided in pavement layers (at Laboratory scale). Repeated Load Test conducted to compute the Traffic Benefit Ratio (TBR) from laboratory experiment data for the case of Soil material with reinforcement (Geocell) and without reinforcement (URC). Traffic Benefit Ratio (TBR) of the number of load applications necessary to reach a specific failure state in a geosynthetc-reinforced pavement to the number of load applications required to reach the same failure state in an unreinforced section (same rut depth). Locally available materials may be having lower strength due to lack of interlocking between particles, weaker particles, etc. Such deficiencies can be overcome through confinement provided by geosynthetics. This study aims of evaluate and quantify the improvement in load carrying capacity of local materials by using geosynthetics. Test Sections have been laid in two Himalayan states (Fig 24 & 25) – Himachal Pradesh and Arunachal Pradesh (additional sections are also being planned at different locations). Performance monitoring of these Field laid trial sections is underway with subsequent passage of monsoon cycles.

![Laying of Subbase with Geocell](image1)

![Finished Subbase Layer](image2)

![Laying of Geogrid on Subgrade](image3)

![Test Section with Geocell placed on Subgrade](image4)

![Test Section with Geogrid placed on Subgrade](image5)
Development of Rejuvenating Agent for use in recycling of asphalt pavement

Funding Agency: CSIR
Duration of the project: September 2018 to March 2020

Broad Objectives:
(a) Evaluation and development of indigenous rejuvenating agent from waste material
(b) Increment of the use of RAP percentage in hot mix asphalt recycling from 30% up to 60% using the developed rejuvenating agent.

The present flexible pavement industry faces two major issues. These two major issues are the increasing demand for ecofriendly asphalt mixtures and the costs of raw materials. The use of reclaimed asphalt pavement will be an essential attempt to reduce the costs of aggregates and bitumen in the final mixture. On the other hand, the main challenge for implementing RAP (Reclaimed Asphalt Pavement) is to overcome quality issues. RAP doesn’t perform like a fresh pavement since it is an aged material and needs to be improved. This puts forward the requirement for extra practices like using of rejuvenating agents. Since bitumen loses its oily constituents when it ages, the use of oil-containing additives can be effective. Six different waste oils such as waste engine oil, waste vegetable oil, waste sugarcane oil, polongo oil have been collected and evaluated to check its suitability as rejuvenating agent (Fig.26). An indigenous process to optimize the use of waste material as rejuvenating agent has been developed and also samples using 100% RAP material has been prepared using the collected optimized waste material as rejuvenating agent.

Cold Mix technology for high volume roads

Funding Agency: CSIR
Duration of the project: September 2018 to March 2020

Broad Objectives:
(a) Development of cold mix technology for high end bituminous layers by modifying bitumen emulsion and aggregate gradation and its laboratory evaluation.
(b) Dissemination of developed technology through seminar/workshop with all stakeholders of road construction agencies.

Cold mix has been utilized in various forms in various regions for a number of years. It is however, still used with concerns for specific environments and type of roads. It is still not possible to use it in all situations due to the suspected low structural competence of the material. Also no proper research and specification has been developed for use of cold mix in dense and superior specifications. Hence, evaluation of structural layers using bitumen emulsion and also grading requirement need to be further established. Thus, there is an immediate need to further improve the performance to cover a wider range of applications in varied environment and traffic conditions. In the present study, with addition of cement and lime as filler with fine tuning of aggregate gradation, samples were prepared. With addition of higher percentage of cement, improves the early strength parameter and also results in higher resilient modulus. Result shows that 2% cement with optimized grading of aggregate can be considered for urban road construction using bitumen emulsion.

Development and Testing of Prototype Pothole Repair Machine

Funding Agency: CRRI and M/s JCB India Ltd.
Duration of the project: December 2018 to December 2020

Broad Objective: Development and Testing of Prototype Pothole Repair Machine

One of the most common problems with roads is the structure failure on the road surface due to moisture on the road and traffic passing over the affected area.
that result in formation of potholes. The potholes are very dangerous as it causes fatal road accidents and risking people lives. The potholes are usually repaired manually by pouring the repairing material into the potholes and then compacting the repairing material with a hand held roller rammer or a roller machine. Such method is time consuming and quality of work is sometimes low. CSIR-CRRI has developed laboratory model of pothole repair machine which further needs to be upgraded. Hence, CRRI has collaborated with M/s JCB India Limited and developed a prototype machine on Backhoe platform comprising a compaction assembly (plate compactor), a sweeper, an emulsion reservoir, a compressor unit and multiple air tanks and a bitumen mixing assembly. The demonstration was done at Pune and the repaired pothole was monitored for six months. The large scale demonstration has also been conducted at CRRI campus in presence of field engineers of different government departments (Fig.27). Now, the machine is ready to launch in market for wider application.

(c) Laboratory studies on “Incremental Improvement in Process” with respect to bitumen emulsion compatibility with different types of aggregates available in India

(d) Optimization of curing conditions with respect to prevailing climatic conditions

Customized bitumen emulsion for better compatibility and curing condition were developed based upon the rheological properties of bitumen emulsion. Mixing methodology and mix design criteria were established to achieve better mechanical properties. Effect of different types of aggregate on compatibility of bitumen emulsion were assessed. Fig. 28 shows the results of amplitude sweep test on modified bitumen emulsion to understand its storage modulus and loss modulus.

**Development of Half Warm Mix Technology for Construction and Maintenance of Bituminous Surfacing**

Funding Agency: CSIR

Duration of the project: January 2019 to March 2020

Broad Objectives:

(a) Development of customized bitumen emulsion for half warm mix technology

(b) Development of Mixing Methodology and additives to develop improved mechanical strength

(c) Development of Design Guidelines and Specifications for Utilization of Steel Slag in Road Construction

Funding Agency: Ministry of Steel, Govt. of India, M/s TATA Steel Ltd., M/s JSW Steel Ltd., M/s Arcelor Mittal & Nippon Steel Ltd., M/s Rashtriya Ispat Nigam Ltd.

Duration of the project: October 2018 to October 2021

Broad Objectives:

(a) Identification and comparative evaluation of prevailing steel slag aging technologies

(b) Petrographic examination and mechanical characterization of steel slag aggregate for utilization in flexible and rigid pavement

(c) Assessment of mechanical properties of bituminous, cement concrete and granular mixes having processed steel slag as aggregate
(d) Development of road construction guidelines and State of Art Technology for Utilization of steel slag as substitute of natural aggregate in flexible and rigid pavement

(e) Assessment of environmental benefits of uses of steel slag in road construction

(f) Establishment of national level “Centre of Excellence” for steel slag utilization in road construction

Steel slag is one of the major solid waste generated in an integrated steel plant. During production of one-ton steel around 400kg, steel slag is generated as solid waste. Under the present study steel slag processing methodology has been developed to convert the steel slag as road making aggregate. Physical characteristics of processed steel slag have been determined to assess its suitability as road making aggregate. Processed steel slag aggregate supplied by M/s Tata Steel Ltd., M/s Arcellor Mittal & Nippon Steel Ltd., M/s JSW Steel Ltd. and M/s Rashtriya Ispat Nigam Ltd. were tested on physical and mechanical parameters for utilization in embankment, granular layer, bituminous mixes and cement concrete pavement. Table 2 shows the geotechnical properties of steel slag fines evaluated for possible utilization in embankment and subgrade.

<table>
<thead>
<tr>
<th>Test Performed</th>
<th>JSW Steel EAF Steel Slag Dolvi Plant</th>
<th>Tata Steel BOF Steel Slag Bellari Plant</th>
<th>Essar Steel BOF Steel Slag Jamshedpur</th>
<th>EAF Steel Slag Hazira</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel (%)</td>
<td>5.62</td>
<td>7.62</td>
<td>3.20</td>
<td>10.78</td>
</tr>
<tr>
<td>Sand (%)</td>
<td>72.14</td>
<td>75.17</td>
<td>68.50</td>
<td>87.49</td>
</tr>
<tr>
<td>Silt (%)</td>
<td>21.24</td>
<td>17.21</td>
<td>28.30</td>
<td>1.73</td>
</tr>
<tr>
<td>Clay (%)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Coefficient of Uniformity, Cu</td>
<td>69</td>
<td>54</td>
<td>24.18</td>
<td>-</td>
</tr>
<tr>
<td>Coefficient of Curvature, Cc</td>
<td>2.66</td>
<td>3.6</td>
<td>0.72</td>
<td>-</td>
</tr>
<tr>
<td>Liquid Limit (%)</td>
<td>23</td>
<td>32</td>
<td>40</td>
<td>28.3</td>
</tr>
<tr>
<td>Specify Gravity</td>
<td>2.6</td>
<td>2.8</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Free Swelling Index (%)</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Standard Proctor Test</td>
<td>MDD =2.11</td>
<td>MDD = 2.01</td>
<td>MDD = 2.18</td>
<td>MDD =2.2</td>
</tr>
<tr>
<td></td>
<td>OMC =11.43 %</td>
<td>OMC=11.8</td>
<td>OMC =12.51%</td>
<td>OMC =8.6 %</td>
</tr>
<tr>
<td>Modified Proctor Test</td>
<td>MDD =2.16</td>
<td>MDD=2.28</td>
<td>MDD =2.49</td>
<td>MDD =2.4</td>
</tr>
<tr>
<td></td>
<td>OMC = 9.8 %</td>
<td>OMC=10.2 %</td>
<td>OMC =10.9 %</td>
<td>OMC =6 %</td>
</tr>
<tr>
<td>Consolidation</td>
<td>Cv= 0.058</td>
<td>Cv= 0.021</td>
<td>Cv = 0.026</td>
<td>Cv=0.048</td>
</tr>
<tr>
<td>Direct Shear Test</td>
<td>Normal Stress (KN/M²)</td>
<td>Shear Stress (KN/M²)</td>
<td>Normal Stress (KN/M²)</td>
<td>Shear Stress (KN/M²)</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>69.8</td>
<td>50</td>
<td>69.7</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>140.3</td>
<td>100</td>
<td>70.5</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>183</td>
<td>150</td>
<td>121.4</td>
</tr>
<tr>
<td>Cohesion</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Angle of Internal Friction</td>
<td>45 [°]</td>
<td>45</td>
<td>45 [°]</td>
<td>45 [°]</td>
</tr>
<tr>
<td>CBR (%) (Four Days Soaked)</td>
<td>21.3</td>
<td>34.3</td>
<td>95.7</td>
<td>55.3</td>
</tr>
</tbody>
</table>
### CONSULTANCY PROJECTS

**Investigations to study causes of distress/ rutting of flexible pavements of Nandghat – Bhatapara – Balodabazar Road (Package -03) and Balodabazar – Gidhory Road (Package -04) under Chhattisgarh Road Sector Project (ADB Loan-2981-IND) and suggest suitable remedial measures**

**Funding Agency:** C. G. State Road Sector Project, PWD, Raipur  
**Duration of the project:** February 2019 to February 2020  
**Broad Objectives:** The main objective was to carry out investigation to study causes of distress / rutting of flexible pavements and suggest suitable remedial measures for repair and rehabilitation.

The field investigation work was undertaken with a view to assess the quality of pavement layers and to carry out structural evaluation of the pavement, so that reasons of pavement failure could be made out. The following field studies were undertaken to assess the condition in detail.

- Visual Surface Condition Assessment (Fig.29)
- Benkelman Beam deflection measurements
- Test pit observations
- Extraction of pavement material samples including bituminous layers
- Classified traffic volume count for 24 hours, round-the-clock
- Axles load survey using portable weigh pads for 24 hours, round-the-clock, on a practical sample basis.

Based on the laboratory testing of the materials collected from the field, it was observed that the quality of the material used in the various layers was not as per the specifications. It was concluded that the overall quality/properties of the materials and construction/execution of work was inferior in relation to the specified values; thus, making the pavement weak and poor-performing. Overloading by commercial trucks was also one of the reasons for pavement failure. An overlay of 40 mm SMA or BC has been recommended for Package - 03 and an overlay of 50 mm SMA or BC has been recommended for Package - 04.

#### Pavement design and Mix design using cold in place recycling for Beawar Pali Project of L&T IDPL in Rajasthan

**Funding Agency:** M/s Markolines Traffic Controls Pvt. Ltd  
**Duration of the project:** November 2019 to April 2020
Broad Objectives: To provide the pavement design and mix design of BSM (bitumen stabilized material) layer using recycled asphalt pavement (RAP) material and Foam bitumen.

Beawar Pali Pindwara road Project (244.12 km) located in the State of Rajasthan, which is part of the Kandla-Delhi high density freight corridor, is the first Mega Project proposed by National Highways Authority of India (NHAI). Some of the road section has developed heavy distresses/defects and the pavement has deteriorated and has started showing signs of distress/failure (Fig. 30). CRRI undertook the field and laboratory investigations to give suitable pavement design and mix design using cold in situ recycling with foamed bitumen for the rehabilitation of the damaged road section.

Site investigations were carried out to access the extent of damage (Fig. 31 & 32). Materials were collected from various test pits for the purpose of detailed laboratory evaluation. Milled material was brought to CRRI laboratory for evaluation and design purpose. Site collected materials were evaluated, different batches of RAP (recycled asphalt pavement material) mix with foam bitumen were prepared and evaluated in lab.

<table>
<thead>
<tr>
<th>Foam binder content, %</th>
<th>Dry Indirect Tensile Strength, kPa</th>
<th>Wet Indirect Tensile Strength, kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>392</td>
<td>230</td>
</tr>
<tr>
<td>2.25</td>
<td>423</td>
<td>292</td>
</tr>
<tr>
<td>2.5</td>
<td>276</td>
<td>242</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Foam binder content, %</th>
<th>Resilient Modulus at 35°C, MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>1024</td>
</tr>
<tr>
<td>2.25</td>
<td>1105</td>
</tr>
<tr>
<td>2.5</td>
<td>1186</td>
</tr>
</tbody>
</table>

Fig. 30: View of existing road

Fig. 31: Test pit in progress

Fig. 32: Core cutting in progress
On the basis of field and laboratory evaluation it was recommended to recycle the top 100mm existing asphalt layer using foam bitumen technology. It was recommended that for the given site for cold in-situ recycling using foam bitumen (with 80% RAP) the optimum foamed binder content shall be taken as 2.25% with 3.5% optimum moisture content for the RAP mix design. This combination for foaming was selected for the VG-30 asphalt binder in mix design. IITPave software was used to carry out the pavement analysis. Pavement design is carried out as per IRC 37: 2018 for a design life of 5 years and 75 MSA traffic. The BSM (recycled) layer has to be followed with DBM and BC layers as per the design.

**Evaluation of NuMIXER® as Rejuvenator for High RAP Mixes**

**Funding Agency:** SRIPATH TECHNOLOGIES LLC, U.S.A

**Duration of the project:** April 2019 to November 2019

**Broad Objective:** The primary objective of this project is to study the NuMIXER® as rejuvenator in laboratory.

M/s Sripath Technologies LLC, NJ, USA has developed rejuvenator named NuMIXER®. As per the information provided by the agency, it is a viscosity reducer/additive for bitumen and used to produce softer grade bitumen intended for used with RAP. For high RAP application, it is important to carry out mix design in laboratory which includes performance testing also. Accordingly, NuMIXER® as rejuvenator for application in high RAP mixes has been studied.

The RAP was characterized for binder content amount using Abson method. It was further characterized using DSR testing and other conventional parameters. Based upon the properties of bitumen recovered and targeted mix design, the asphalt mix design was carried out for different fixed percentage of RAP. According to RAP percentage and rheological properties of the RAP binder the dosage of rejuvenator is defined based upon the following equation given in NCHRP report 452 entitled “Recommended Use of Reclaimed Asphalt Pavement in the Superpave Mix Design Method: Technician’s Manual. Finally RAP hot mix with fixed rejuvenator was evaluated for moisture susceptibility, rutting, fatigue performance in laboratory and compared with mix having no RAP. Following figure and chart present the various test results (Fig.33&34).

![Fig. 33 : Load Set for Hamburg Wheel Tracking Device](image)

![Fig. 34 : Testing of Sample in OT](image)
Investigation for strengthening of Jetpur – Somnath section of NH 8D Highway

Funding Agency: National Highways Authority of India PIU Rajkot

Duration of the project: August 2019 to June 2020

Broad objectives:

(a) Investigating the affected/distress portion of the 16 isolated kms of the road section.

(b) Suggesting remedial measures/rehabilitation design based on the results obtained through investigation.

The project consist of both the field studies and laboratory evaluation of Jetpur – Somnath section of NH-8D (four lane carriageway) i.e. by assessing the pavement surface condition of the road section by visual inspection to assess the failure portion in the road section and the level of distress, test pit evaluation is done in the distressed portion upto the top of the subgrade level to evaluate the subgrade soil, granular sub-base, granular base course. The cores were collected and were evaluated. The traffic survey was conducted and traffic data was calculated along with the axle load survey for VDF. The laboratory evaluation was done for subgrade soil (Grain size analysis, Atterberg Limits, Free Swell Index, Proctor test, CBR test), granular sub base and granular base course (Grain size analysis, Modified proctor test). The cumulative standard axles for the test section in terms of MSA is computed. The condition of the stretch is very critical due to subgrade failure at some locations. Various recommendations and remedial measures were proposed as per the distress portion including full depth reconstruction with replacement of subgrade soil for few kms. Investigation has shown various deficiencies in Road and bridge works for which remedial measures were suggested to repair / rectify them. Some glimpses of the field investigations are shown in Fig.35 to 38.

Fig. 35 : View of Road Section

Fig. 36 : Another View of Road Section

Fig. 37 : Test Pit observations

Fig. 38 : Thickness Measurement at site
Quality Audit for Rehabilitation and Upgradation of ANDAMAN TRUNK ROAD (ATR) NH–4, from Km 181 to Km 206

Funding Agency: National Highways Infrastructure Development Corporation Limited.

Duration of the project: July 2019 to June 2020

The ATR is consist of 330.7 km in length and the stretch from 181 km to 206 km was proposed to be upgraded from 3.5 m carriageway width to 5.5 m carriageway. The scope of work was the design verification and the site visit for the quality audit of the executed work for rehabilitation at the project site. Two visits were made; pre and post monsoon season. The visual assessment of the test section was observed for the whole stretch by visual inspection to observe the distress in terms of ravelling, potholes, and patches along with their severity. The core samples of the cement treated base (CTB) layer was extracted and evaluated using unconfined compressive strength. The present condition of the laid portion was observed and classified into three portions; good surface, average surface, fair surface / poor surface based on potholes upto 50 mm or more than 50 mm depth, surface with low to heavy raveling. Following recommendations are made for rectification of fair/poor distress section in the road.

a. Brooming of CTB surface to remove loose particles
b. Cutting of Potholes into rectangular shape in 100mm depth and putting fresh mix of CTB and curing for seven days.
c. Spreading of SAMI layer.
d. Laying of BC layer including some profile correction

Some glimpses of the pavement condition and field investigations are shown in Fig.39 & 40.

Evaluation of Effect of Modified Wheel Configuration of Electric Bus of ALSTOM on Flexible Pavement

Funding Agency: Alstom India Ltd.

Duration of the project: October 2018 to October 2021

Broad Objectives:

Major objective of the work is to evaluate the effect of modified wheel configuration i.e super single tyre (385/65R22.5) of APTIS electric bus on fatigue and rutting strains in flexible pavement. In order to fix the gross allowable laden vehicle weight from critical strain and deflection point of view in pavement following scope of work is finalized:

1. Collection of wheel configuration, tyre configuration and axle load data from Alstom India
2. Collection of tyre imprint in-terms of contact area, avg. contact pressure, inflation pressure at variable wheel load for different tyre supplier
3. Development of pavement response model through Linear Elastic Analysis Software IIT PAVE and Finite Element Analysis Software ANSYS

4. Determination of Critical Strain and Deflection at variable load and speed corresponding to conventional tyre and super single tyre

5. Analysis of results and determination of gross allowable laden weight with Super Single Tyre

Mechanistic modelling was carried out to assess the changed axle configuration with super single tyre of Aptis Bus on Flexible Pavement. Critical strains i.e. Fatigue and Rutting Strains were determined and compared with critical strains developed under conventional bus with regular dual tyre system in rear axle. Mechanistic analysis was carried out for static and dynamic loading condition using IIT Pave and finite element analysis software ANSYS. Table 3 and 4 shows the critical strains i.e. fatigue and rutting strains under APTIS Bus with Super Single Tyre.

![Fig. 41: Shows the conventional Dual Tyre and Super Single Tyre considered in study](image)

**Table 3: Comparison of Critical Tensile Strain underneath the ALSTOM APTIS Bus with Allowable Tensile Strain determined as per Fatigue Performance Model of IRC: 37:2018**

<table>
<thead>
<tr>
<th>Design CBR &amp; Traffic</th>
<th>Axle</th>
<th>Super Single Wheel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Load on each Wheel, kN</td>
</tr>
<tr>
<td>CBR 5% &amp; 30 MSA</td>
<td>Front Axle</td>
<td>44.49</td>
</tr>
<tr>
<td></td>
<td>Rear Axle</td>
<td></td>
</tr>
<tr>
<td>CBR 5% &amp; 50 MSA</td>
<td>Front Wheel</td>
<td>44.98</td>
</tr>
<tr>
<td></td>
<td>Rear Wheel</td>
<td></td>
</tr>
<tr>
<td>CBR 10% &amp; 30 MSA</td>
<td>Front Axle</td>
<td>43.65</td>
</tr>
<tr>
<td></td>
<td>Rear Axle</td>
<td></td>
</tr>
<tr>
<td>CBR 10% &amp; 50 MSA</td>
<td>Front Wheel</td>
<td>43.10</td>
</tr>
<tr>
<td></td>
<td>Rear Wheel</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4: Comparison of Critical Vertical Strain underneath the ALSTOM APTIS Bus with Allowable Vertical Strain determined as per Rutting Performance Model of IRC:37:2018**

<table>
<thead>
<tr>
<th>Design CBR &amp; Traffic</th>
<th>Axle</th>
<th>Super Single Wheel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Load on each Wheel, kg.</td>
</tr>
<tr>
<td>CBR 5% &amp; 30 MSA</td>
<td>Front Axle</td>
<td>44.49</td>
</tr>
<tr>
<td></td>
<td>Rear Axle</td>
<td></td>
</tr>
<tr>
<td>CBR 5% &amp; 50 MSA</td>
<td>Front Wheel</td>
<td>44.98</td>
</tr>
<tr>
<td></td>
<td>Rear Wheel</td>
<td></td>
</tr>
<tr>
<td>CBR 10% &amp; 30 MSA</td>
<td>Front Axle</td>
<td>43.65</td>
</tr>
<tr>
<td></td>
<td>Rear Axle</td>
<td></td>
</tr>
<tr>
<td>CBR 10% &amp; 50 MSA</td>
<td>Front Wheel</td>
<td>43.10</td>
</tr>
<tr>
<td></td>
<td>Rear Axle</td>
<td></td>
</tr>
</tbody>
</table>
Rigid Pavement
RESEARCH PROJECTS

A Comprehensive Performance study on Hybrid Fiber Reinforced Concrete for the construction of Concrete Pavements

Funding Agency: CSIR-CRRI

Duration of the project: November 2014 to August 2019

Broad Objectives:

(a) To optimize the dosage of synthetic fibers for an improvement up to 20-25% in drying shrinkage as well as the abrasion resistance and the dosage of steel fiber targeting for an increase of 20-25% in flexural strength for developing HyFRC for pavement construction.

(b) To determine the residual flexural strength/post peak behavior of mono and HyFRC for commonly used paving grade concrete.

(c) To explore the possibility of reduction in the thickness of concrete pavement slab for the same loading conditions.

In order to achieve the above stated objectives an extensive experimental programme using micro synthetic polypropylene fibres of different lengths (including one fibrillated fiber), macro steel fibres (hooked and crimped) and hybrid combinations of polypropylene-steel fiber in paving grade concrete mixes (M40 and M60) for the study of influences of the addition of fiber in concrete are carried out. Typical results for the determination of optimum steel fiber dosage for the significant improvement in flexural strength of 60MPa compressive strength is shown in Fig. 42. Similarly, a typical Load-Deflection curves of various fiber reinforced concrete (Control (without fiber), SyFRC (Synthetic fiber reinforced concrete), SFRC (Steel fiber reinforced concrete) and HyFRC (Hybrid fiber reinforced concrete)) is also shown in Fig.43. Study reveals hybrid combination of two fibres is very effective in controlling drying shrinkage and enhancing the abrasion of concrete. The study further reveals that the addition of synthetic fiber reduces the plastic shrinkage of concrete significantly. From this study and other similar studies reported earlier, HyFRC shows a promising future for use in the construction of concrete pavements.

CONSULTANCY PROJECTS

Evaluation of the Suitability of Dalmia Infragreen product (cements) for rigid pavement construction (M40 and M50).

Funding Agency: New Building Solutions, DALMIA CEMENT (BHARAT) LIMITED

Duration of the project: August 2019 to March 2020

Broad Objectives:

(a) To evaluate the properties of Dalmia Infragreen cements (Normal consistency, IST, FST, Strength at various ages).

(b) Testing of materials (i.e. aggregates, water etc.) to be used in design mix for PQC using M40 and M50 grade concrete

(c) Evaluation of test results & suitability for road construction

An extensive laboratory testing work has been done that not only includes the testing of cement and concrete, but also includes effect of change in small
amount of water on normal consistency of cements. Normal consistency of both the Dalmia Infragreen cements products (PSC and PPC) is 25-29% less than normal consistency of OPC. This resulted in a drastic reduction (up to 20-25%) in water requirement per cubic meter of concrete made with Dalmia Infragreen products (PPC & PSC) in comparison with OPC mix. But in spite of low water demand of Dalmia Infragreen products, these products are very sensitive with water content even a slight change in water content have very significant influence on the consistency of cement. Hence, these products require a high degree of supervision before its use in manufacture of concrete. It appears that by using Dalmia Infragreen cements (PPC and PSC), M40 & M50 concrete can be manufactured by using about 15% less amount of cement than the case of OPC. It means that there is possibility to save the OPC cement by using any of these Dalmia Infragreen cements. The results also indicate that 7 days’ strength by using these Dalmia Infragreen cements is similar to 28 days’ strength of concrete mix prepared with OPC as shown in Fig.44. Abrasion resistance of concrete (M40 and M50) Dalmia Infragreen cements (PPC & PSC) is almost similar but it is more than OPC. Drying shrinkage of concrete (M40 and M50) with Dalmia Infragreen cements (PPC & PSC) is similar for both the concrete grades, but it is less than the drying shrinkage shown by OPC cement (Fig.45). The study indicates that Dalmia Infragreen cements (PPC & PSC) may be used in the manufacturing of PQC having properties for paving grade concrete used in India. Both Dalmia Infragreen cements (PPC as well as PSC) perform more or less in similar way. Comparatively, a greener construction of concrete road is possible by using these Dalmia Infragreen cements (PPC & PSC) as the amount of cement needed is much lesser than OPC and these Dalmia Infragreen products are blended cement, having lesser amount of clinkers. It can be further summarized that the Dalmia Infragreen cements appear to be appropriate for on project specific as manufacturing of concrete using these cements require highly qualified and specialized person.

Proof Checking of Design of Cement Road for National Institute of Communication Finance, (NICF), Ghitorni, New Delhi

Funding Agency: CPWD, Delhi

Duration of the project: June 2019 to Aug 2019

Broad Objective: To review and submit revised design of cement concrete road for the campus of NICF Ghitorni, New Delhi.

Government of India has assigned the work of "Setting up Physical Infra Structure for the National Institute of Communication Finance (NICF)” to the CPWD, New Delhi. Preliminary design of the cement concrete road for the campus has been prepared by the Architectural consultant appointed by the CPWD. However, the CPWD has requested the CSIR-Central Road Research Institute (CRRI), New Delhi to review the concrete road designed by their consultant and submit the final revised design for NICF campus vide their email dated 06/05/2019.

The original proposed design of the concrete road was critically reviewed in a wide prospective of this upcoming campus. The revised concrete road design is based on the relevant IRC codes (IRC: 58:2002,
During design, the probable movement of trucks on this road of upcoming campus and gross weight of water tender vehicle including crew, water and equipment weight of fire fighting brigade were kept in mind. Further, this low speed and relatively low truck volume pavement, load transfer through aggregate interlock eliminating use of dowel bars at all transverse joints was suggested. The revised section of the concrete pavement is as shown below (Fig.46):

![Fig. 46: Revised section of the concrete pavement](image)

**Review of Repair Methodology for Cracked PQC Panels at Rewa-Katni-Jabalpur and Jabalpur-Lakhnadon road on NH-7**

Funding Agency: M/s Larson & Toubro Ltd., Jabalpur

Duration of the project: August 2019 to March 2020

Broad Objectives:

(a) To review the repair methodology adopted at site.

(b) To suggest the suitable technique for the repairing of the different types of cracks developed in the rigid pavement slabs.

Four laning of Rewa-Katni-Jabalpur-Lakhnadon Section of NH-7 from Km 311.000 to Km 546.425 in the state of Madhya Pradesh was undertaken on EPC mode under NHDP-IV. The work was awarded to M/s L&T Ltd. Plastic shrinkage cracks and other types of cracks have developed in rigid pavement slabs under Package IV (Rewa-Katni-Jabalpur, from Sleemnabad to Jabalpur) and Package JL (Jabalpur to Lakhnadon) under PIU-Jabalpur, NHAI. The L&T Ltd. requested the CSIR-CRRI, New Delhi to review the repairing methodology adopted at site and suggest appropriate method of repairing of different types of cracks developed in the rigid pavement slabs (Fig. 47 & 48). A site visit was undertaken for visual distress survey. Majority of the panels having cracks were observed to have plastic shrinkage cracks of different severity in both the Packages. These cracks at most of the locations had already been repaired by epoxy filling. Full depth transverse cracks, full depth corner cracks, longitudinal cracks were also observed in some of the slabs. Full depth repair (FDR) for full depth cracks, cross stitching for longitudinal cracks, and epoxy filling was suggested for plastic shrinkage cracks.
Vetting of Rigid Pavement Design for Village road, Main Roads and other Roads and providing specification of Cement Concrete road, Noida

Funding Agency: NOIDA Authority, U.P

Duration of the project: February 2019 to August 2019

Broad Objectives:

(a) To Review and verify the pre-designed crust thickness for village road, main road and other road for Noida

(b) To provide technical specification for cement concrete pavement on which the proposed road is to be constructed

The General Manager (Roads) Noida Authority, Noida requested CSIR-CRRI for providing consultancy services for review and vetting of crust design for cement concrete pavement for different categories of village roads, main roads and other roads in Noida. The road for village and main road consisted of two types 1) Review of Rigid pavement design for new construction and 2) Review of Rigid pavement design over existing pavement. The design was reviewed and the thickness of DLC and PQC for different categories of road were given to the client. The client was also provided with the detailed specifications for construction of cement concrete pavement for village road as well as main roads.
Pavement Evaluation
RESEARCH PROJECTS

Study on Decay in Modulus of Stabilized Layers in Flexible Pavements

Funding Agency: PWD, Uttar Pradesh
Duration of the project: February 2019 to January 2022

Broad Objectives:

(a) Determination of modulus of stabilized layers laid with additives like cement, emulsion and foam bitumen.

(b) Study on decay in modulus of stabilized layers due to loading, time and weather.

The research project consists of finding out decay in modulus of stabilized layers through time series data of three years. To fulfill the objectives, CSIR-CRRI team with UPPWD officials visited few roads having stabilized layers nearby Lucknow in the month of May, 2019. Out of these roads, five roads were identified wherein seven study sections of 500 m each were selected. First time series road related functional and structural data was collected in the month of September, 2019. The details of the identified seven study sections are given below.

1. Lucknow - Sandila Road
   - Change km 246.500 to km 247.000 RHS
     where RHS is Lucknow to Sandila
   - Change km 231.000 to km 230.500 RHS

2. Lucknow Kursi Road Section on Behta to Saiahara Road
   - Change km 2.800 to km 3.300

3. Lucknow Varanasi Road (Talibagh)
   - Change km 10.350 to km 10.850.000 RHS
   - Change km 10.350 to km 10.850.000 LHS

4. Bangarmau abadi portion on Lucknow - Mohan Bangarmau Road
   - Change km 87.300 to km 86.800

5. Dostinagar Byepass Road to Unnao
   - Change km 3.500 to km 4.000

The following field evaluation works were conducted at each identified road section:

- Extraction of full depth cores from stabilized sub-base and base course layers including bituminous cores
- One day classified traffic volume
- One day axle load survey
- One test pit to measure the thickness of pavement layers and collection of road construction materials for detailed evaluation at laboratory
- FWD measurements

The first set of observation has been completed and data analysis is in progress. Some photographs showing testing activities at site are given below (Fig. 49).
Development of Airfield Pavement Management System (APMS)

Funding Agency: Airport Authority of India (AAI)

Duration of the project: April 2019 to September 2022

Broad Objectives: To develop Airfield Pavement Management System (APMS) for 10 airports located at Chennai, Kolkata, Surat, Gaggle, Rajahmundry, Vadodara, Khajuraho, Gaya, Agartala and Imphal cities and provide specific recommendations to AAI for actions required to maintain the airfield pavement network at an acceptable level of service.

The work plan includes yearly assessment of each airfield pavement network for three years. It has been proposed that after each observation, database as per APMS requirements will be prepared in PAVER software and report in respect of current maintenance needs shall be provided. The time series data after the completion of the entire study will be useful for development of pavement condition deterioration models, determination of future pavement condition and maintenance strategies and analysing the consequences of different budget scenarios by AAI.

The necessary field work for the evaluation of Chennai and Rajahmundry Airfield Pavement Network i.e. first set of observations was made by CRRI team in the month of November 2019. The field investigations carried out mainly included functional assessment of airfield pavement network using state of art survey tools such as Automated Road Survey System (ARSS). For the development of APMS, Geographic Information System (GIS) based database has been prepared with the integration of georeferenced base map with the Global Positioning System (GPS) tagged Distress data collected using Automated Road Survey System. GIS with Google Maps, Hawkeye Processing Tool Kit, and PAVER software tools have been used for the development work. Inventory and pavement condition database for the Airfield Pavement Network in PAVER software has been prepared for further data analysis and reporting on time to time basis.

CONSULTANCY PROJECTS

Investigation for Feasibility of Reducing Existing Road Level near President House

Funding Agency: CPWD, Central Secretariat Division, New Delhi

Duration of the project: May 2019 to November 2019

Broad Objective: Detailed investigation for feasibility of reducing the existing road level of Rajpath starting from Vijay Chowk to North and South Block, upto
Pavement Evaluation

President House including peripheral roads using GPR.

The scope of the work consists of the following activities (i) identification of total bituminous layers thicknesses of the pavement crust using Ground Penetrating Radar (GPR) (ii) identification of depth and distance from the pavement edges of the existing services which are laid below the road surface using GPR viz. security assets such as under vehicle inspection system (UVIS), sensors, etc. installed in North & South Block (iii) identification of depth and distance from the pavement edges of the utilities buried viz. drainage lines, sewage lines, wires, etc. installed below the pavement crust up to the depth of 4 m or within the pavement layers and (iv) evaluation of road levels (cross slopes) focusing mainly in the front of Rashtrapati Bhavan and Parliament House to stop pounding effect of rain water.

CSIR-CRRI team undertaken the field work in the month of August, 2019 and submitted the report in the month of September, 2019. The final report submitted to CPWD consist of recommendations with detailed Auto CAD drawings of road levels using Total Station Theodolite (TST), utility drawings using GPR and Electromagnetic Locator (EML) and pavement thickness drawing using GPR. Road levels were also obtained using Total Station Theodolite (TST), so that the exact lateral and vertical dimensions of the buried utilities could be located at site. The report also consists of the recommendations for reduction of road levels of the project site in such a way that the existing buried utilities including underground live cables may not get damaged. Typical photos of the site, field activities and outputs are given below (Fig.50).
Broad Objectives: To establish web based road information system and road maintenance management system (RMMS) for the Kerala state PWD roads

A contract agreement was made between Project Director, Kerala State Transport Project, Public Works Department and Director, CSIR-Central Road Research Institute (CRRI), New Delhi with the objective to establish an enhanced and user-friendly web based Road Information System and Road Maintenance Management System of the State PWD Roads and to ensure that PWD is able to effectively plan and prioritize its road improvement and maintenance works and to prepare realistic proposals for budgetary allocations for road maintenance. The major activities of the study includes, training to Kerala PWD officials on RMMS concept, one time road inventory and pavement condition (functional and structural) survey using Modern Survey Techniques viz. Network Survey Vehicle and Falling Weight Deflectometer for 4000 km of State Highways (SH), technical assistance for procurement of web based RMMS software, analysis using Highway Development and Management Tool (HDM-4) for the identified road network. Some of the completed project activities includes:

- Introductory Training on development of RMMS
- Finalisation of technical specification of RMMS
- Road Inventory and Pavement Condition Survey Using Network Survey Vehicle
- Training on field data collection in respect of traffic counts, axle load, pavement crust details

The following photograph shows meeting of CSIR-CRRI Scientists with Honourable Minister for Public Works and Registration, Government of Kerala Shri. G. Sudhakaran ji and Signing of the Contract with Project Director, KSTP, Thiruvananthapuram, Kerala (Fig. 51).

Fig. 51 : Meeting with the PWD Minister and Signing of the Contract

Evaluation and Quality Assessment of Resurfacing Works of Test Track in Hero MotoCorp Ltd. Plant in Gurugram

Funding: M/s Hero MotoCorp Ltd., Gurugram, Haryana

Duration of the project: October 2019 to March 2020

Broad Objectives: To evaluate test track at Gurugram plant of Hero MotoCorp Ltd., and to conduct quality checking of resurfacing work carried out on the test track.
In order to evaluate the existing surface condition of test track, CSIR-CRRI team visited the site and visually assessed the present condition of test track. It was observed that levels of surface distresses are of the order of 30-35%. The major types of distresses developed in the test track are cracking and ravelling. No potholes were seen over the entire surface. Drainage conditions all along and across the paved area were found to be good, in general. Typical views of the existing surface conditions of the test track (i.e. before undertaking re-carpeting work) are given below (Fig. 52).

- In case of fine to medium cracks, the cracks to be filled with a bituminous binder having low viscosity (Slow Setting Grade – I emulsion)
- In order to prevent reflection cracking at the expansion joints of cement concrete slabs, it is recommended to provide glass grid in a width of about 1.5 m on both sides of widened portions of the test track.
- An overlay of 40 mm thick bituminous concrete (BC) should be provided, which will care of the requirements of Hero MotoCorp Ltd. With regards to the usage of the test track.

**Evaluation of Delhi PWD Road (No. 57) for milling and strengthening**

Funding Agency: Public Works Department (PWD), Delhi

Duration of the project: December 2019 to May 2020

Broad Objective: To determine the possibility of lowering down the existing level of carriageway of project road by cold milling process and to recommend suitable overlay thickness.

Road No. 57 is a busy road with heavy commercial vehicular traffic in both travel directions. Classified traffic volume count survey for 24 hours round the clock was conducted. After the traffic analysis, 50 Million Standard Axles (msa) of design traffic loading has been considered for the project.

To assess the structural condition of pavement layers, structural evaluation of the project roads were carried out for which field investigation works were undertaken. The following field studies Visual assessment of pavement surface condition, Test pits observations for layer thickness measurements, (Fig.53) Full depth extraction of cores were undertaken, Traffic Volume count survey and Falling Weight Deflectometer survey to assess the road condition as shown in the figure below (Fig.54).

The samples collected at different locations were brought to CRRI and detailed laboratory test were carried out to determine their gradation, Atterberg’s limit, Maximum Dry Density and CBR etc. FWD data provides the remaining life of the existing project road in terms of MSA for the existing pavement compositions. It will lead for assessing the structural
soundness of the project road for its remaining life.

IITPAVE software was used for finding out the tensile and vertical compressive strains of existing pavement crust of the project roads with respect to remaining life of the project roads. Step by step reduction in bituminous layer thickness were made to find out the tensile and compressive strains within the permissible/allowable strains, so that the remaining pavement crust are capable to withstand the expected traffic loading assumed as 50 MSA. Iteration process was continued till it matches with allowable limit of existing bituminous layer thickness obtained from the test pits data. Through iteration process, target reduction in thickness of bituminous layer has been obtained. Keeping this in view, it is recommended that the overlay of 50 mm DBM and 40 mm BC to be provided on the project road with 120 mm milling of existing bituminous layers. Further it was recommended that an overlay of 40 mm BC on the service lane of the pavement as exiting condition of service road is not found to be in good condition. The mastic asphalt present on the grade separator portion is found to be in very poor condition needs to be milled completely and an overlay of 50 mm BC/SMA is recommended.

Response Type Road Roughness Measuring Systems (RTRRMS), comprising of Fifth Wheel Bump Integrator and Car Axle Mounted Bump Integrator received from various manufacturers and user agencies, were calibrated using 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 from very good to very poor. Calibration certificates were issued to the respective agencies. During this period 45 RTRRMS have been calibrated.
Traffic Engineering and Safety
RESEARCH PROJECT

Characterizing and Accessing the Driver Behaviour for Cognitive, Sensorimotor and Environmental Stressors

Funding Agency: CSIR-CRRI
Duration of the project: November 2017 to December 2019

Broad Objectives:

(a) To study drivers behavioral profiling through socio-demographic parameters & to administer psychometric batteries for analyzing the psychophysical characteristics of drivers.

(b) To design a framework for developing coping strategies while driving in the presence of multiple stressors based on gathered evidence to minimize road traffic accidents.

This study has been conducted to evaluate the reaction time of the drivers under different stimuli conditions. To accomplish the same, the subjects were evaluated using the Vienna System and the indigenously developed Car Driving Simulator by CSIR - CRRI. The present study was conducted mainly on four parts; which has been summarized as below: Part 1: As a first part of the study, the screening of visual traits was conducted by selecting 50 commercial drivers to assess different visual parameters. Part 2: Under this part of the study, the two main tests namely Choice Reaction Time and Determination Tests were administered to evaluate the reaction time for the Visual, Acoustic and Motor stimuli at different speed. Part 3: In this phase different types of music were played for the subjects to assess its impact on their reaction time. The following salient findings were drawn from this study: The number of correct reactions was found to be lowest for the driving session without music for both the age groups. Highest RT was observed without music among all categories of drivers. Poor Vision and increase of age factors were found to be associated with increased reaction time. Overall, it can be inferred that young drivers (up to 30 years) had the strong positive impact due to playing of music on correct reactions. Examples of tests are shown in Fig.55 & 56.

CONSULTANCY PROJECTS

Preparation of Internal Traffic Circulation Plan at Jojobera Cement Plant of Nuvoco Vistas Corporation Limited, Jamshedpur

Funding Agency: M/s. Nuvoco Vistas Corp. Limited, Jamshedpur, Jharkhand State
Duration of the project: June 2019 to December 2019

Broad Objectives:

(a) To study the existing Traffic Circulation Plan (TMP) including assessment of traffic volume, parking characteristics and overall safety of the internal road network as well as estimate the future traffic loads due to proposed expansion of the cement plant.

(b) To prepare appropriate Traffic Management Plan as well as traffic infrastructure improvement / development plan aimed at achieving efficient and safe movement of traffic inside the Cement Plant.
Traffic Engineering and Safety

Jojobera Cement Plant (JCP) has a capacity of 4.6 Million Tons per Annum (MTPA), wherein the production of Portland Slag Cement (PSC) and Portland Pozzolona Cement (PPC) accounts for 3.2 MTPA and 1.4 MTPA respectively. The proposed expansion of cement plant will have impact on the internal road network of the plant would be eminent. To understand its impact, 24-hour Classified Traffic Volume Count (CVC) through videography survey was conducted at selected locations within the plant premises. It is observed that 3026 vehicles are daily entering and exiting the complex gate. In the case of passenger traffic entering / exiting the plant it is dominated by Cycles accounting for 45.4% followed by 41.9% of Two Wheelers, 11.6 percent of cars and 1.13% of bus traffic. Other than the above share of traffic in the PPE Zone of the plant is dominated by goods traffic (95.8%) and at other locations also it is noted that the proportion of two wheelers is dominant to the tune of 50.3%. Further, 32 incoming trains were observed to transport the raw material to Jojobera and Tata Steel whereas 35 trains were found to be outgoing on a normal working day. The peak hour for incoming train is observed from 5:00 to 6:00 am wherein 5 trains were inbound to the plant whereas peak hour for outward movement is observed between 23:15 to 0:15 registering a figure of 5 trains outbound from the plant.

Considering the proposed expansion of plant by M/s. Nuvoco Vistas Corp. Ltd, the traffic needs, potential road safety hazards and safety conditions on the roads inside the plant have been evaluated for the base year and horizon period. Based on the same, appropriate traffic circulation and management plan as well as road infrastructure improvement plan for the plant roads have been evolved keeping in view of the future traffic needs and safety requirements.

Road Safety Audit and Treatment for Identified Black Spots on Varanasi - Shaktinagar (SH-5A): Narayanpur to Hathinala Road Section

Funding Agency: Uttar Pradesh State Highway Authority (UPSHA), Lucknow

Duration of the project: June 2019 to March 2020

Broad Objectives:

(a) Conduct of Road Safety Audit on Varanasi-Shaktinagar Road (SH-5A) starting from Narayanpur i.e. Km 0/000 to Hathinala i.e. Km 113/440 and thus evolve remedial for the measures various safety related deficiencies identified on the project corridor.

(b) Development of action plans for the identified Black Spots and thereby elimination of crash prone locations can be achieved and analysis of road crash scenario supplied by UPSHA and suggesting remedial solutions for crash prone locations.

Considering the rising trends road crash severity on the state highways, it was felt essential by the Uttar Pradesh State Highways Authority (UPSHA) to mitigate the rising road crash trends on the roads falling under their jurisdiction through the conduct of Road Safety Audit (RSA). In this context, Varanasi - Shaktinagar Road (SH-5A) starting from Km. 0.000 (at Narayanpur) of Mirzapur District up to Km 113.440.000 (at Hathinala) was identified by UPSHA for the conduct of Road Safety Audit (RSA) and thereby develop undertake appropriate remedial measures. The detailed RSA findings along with the road safety measures as well as development of action plans for the identified black spots for the identified black spots have been discussed. Based on the above study, needful action can be taken by UPSHA at their end for implementation after the closure meeting. A typical illustration of safety issues identified on the Project Corridor along with suggested measures for the same as well as specific measures for one of the 16 identified crash prone locations are presented in the figures given below for illustrative purposes (Fig. 57 to 64).

Fig. 57 : Missing panels of Cement Concrete Crash Barrier (CCB) on the flyover portion is a safety problem @ Km 21/500 in Varanasi to Hathinala direction
Fig. 58: Embankment is more than 3 m @ Km 28/000 wherein Wire Rope is installed in Varanasi to Hathinala direction; This is a good practice followed by UPSHA needing replication at all such locations.

Fig. 59: Discontinuity in MBCB is a major safety problem @ Km 54/700 in Varanasi to Hathinala direction.

Fig. 60: Level difference between LHS and RHS (about 1.5 m) is a major safety problem @ Km 68/100 needing immediate installation of MBCB on the median portion.

Fig. 61: Absence of Road Studs at median opening is a safety problem during nighttime between Km 45/340 in Hathinala to Varanasi direction; Noted at many locations on the Project Corridor.

Fig. 62: Due to median width of 2.0 m coupled with absence of median plantation leading to glare issues during nighttime between Km 45/340 and 47/740 in Hathinala to Varanasi direction; Noted at many locations on the Project Corridor.

Fig. 63: Absence of Crash Barriers on the Ghat Section passing through Chhato Village; Noted at a few locations on the Project Corridor passing through Ghat Section.

Fig. 64: Good Practice of proper crash protection measures given on the Valley Side of the Ghat Section passing through Chhato Village; Has to be replicated at other locations as well.
Traffic Engineering and Safety

Typical Observations
The observations made from this location consisted of the road alignment passing through hilly area and herein the road alignment has been segregated for both directions of travel and taken through two distinct alignments so as to provide gentle climbing vertical gradient as well as best possible horizontal gradient. The traffic is not forewarned in advance about traffic segregation in advance through the installation of Overhead Gantry Signs. For instance, between Km 69/000 to 72/000, there are three hair pin bends on the Varanasi to Hathinala direction of travel which are not fortified with the above essential requirements.

Typical Recommendations
It is recommended to install advance gantry sign to inform about the segregation of traffic, nose protection measures such as road markings, compulsory left direction traffic sign, road studs and cleaning and leveling of the earthen shoulders so as to prevent edge drops. It is recommended to install Thrie Beam Crash Barrier or Wire Rope on the entire valley section of the Project Corridor passing through hilly terrain. Fig. 65 also presents the other geometric design improvements suggested for the above identified black spot location as well as in terms of other road signs and road markings.

Fig. 65: Suggested Improvements for Black Spot 12 from Km 69/000 to 72/000

Road Safety Audit and Treatment for Identified Black Spots on Bareilly - Almora (SH-37): Izatnagar - Jawaharpur Road Section
Funding Agency: UPSHA, Lucknow
Duration of the project: June 2019 to March 2020

Broad Objectives:
(a) Conduct of Road Safety Audit on Bareilly - Almora Road (SH-37) starting from Izatnagar, i.e. Km 3/500 to Jawaharpur i.e. Km 57/200 and thus evolve remedial for the measures various safety related deficiencies identified on the project corridor.
(b) Development of action plans for the identified Black Spots and thereby elimination of crash prone locations can be achieved and analysis of road crash scenario supplied by UPSHA and suggesting remedial solutions for crash prone locations.

Considering the rising trends road crash severity on the state highways, it was felt essential by the Uttar Pradesh State Highways Authority (UPSHA) to mitigate the rising road crash trends on the roads falling under their jurisdiction through the conduct of Road Safety Audit (RSA). In this context, Bareilly - Almora Road (SH-37) starting from Km. 3.500 (at Izatnagar, Bareilly) of Bareilly District up to Km 54.000 (just after Jawaharpur) was identified by UPSHA to conduct the Road Safety Audit (RSA) and thereby develop undertake appropriate remedial measures. Based on the above study, needful actions can be taken by UPSHA at their end for implementation of RSA findings after the closure meeting. This report covers the RSA findings focused on Operations and Maintenance Stage RSA. The detailed RSA findings along with the road safety measures as well as development of action plans for the identified Black Spots for the identified black spots have been discussed. Road crash data related to information on number of road crashes, fatalities and injuries i.e. Grievous and Simple, location, time, type of vehicles involved, reason of crash etc. occurring on the Project Corridor are furnished by UPSHA for a period of three years. A profile of the road crash data collected for the Project Corridor is presented in Fig.66. It is inferred from Figure that higher number of road crashes occurred in the summer months of May to July 2019 with the month of May accounting for the maximum number road crashes of 11.3 %. Based on the above study, needful action can be taken by UPSHA at their end for implementation after the closure meeting.
Road Safety Audit and Development of Geometric Improvement Plan for Surajkund - Badkal - Gurugram Road Intersection

Funding Agency: TRAX Sports Society, Delhi

Duration of the project: November 2019 to January 2020

Broad Objectives:

(a) Conduct of road safety audit at the candidate intersection for about 200 m on each of the approaches of the intersection

(b) Evolving geometric improvement plan for the candidate intersection based on the physical survey plan which can be directly implemented on the ground.

The principle objective of any road owning agency should be to provide safe road infrastructure development as well as enhancing mobility. However, in this regard, the candidate intersection namely, Surajkund - Badkal - Gurugram Road Intersection is having skewed geometries located in the periphery of Faridabad district near Surajkund. This intersection acts as the major connector for the Surajkund to Badkal Road which leads to Delhi on one side as well as connecting with Faridabad on the other side (leading to NH-44 road) and Faridabad - Gurugram Toll Road on the third approach. The vicinity of the intersection is studded with many educational institutions and institutional developments like Aravalli International School and Manav Rachana Group of institutions and Institute of Road Traffic Education (IRTE). Though the signal heads are found at each of the approach arms of the intersection, they are dysfunctional for a long time which is ascertained from the Faridabad police who manage the traffic flow during the morning office peak hours (as well as school opening and closure timings) and evening office peak hour traffic. Further, road signages as well as road markings are largely absent/inadequate at the above intersection which is compounded with skewed road geometrics, improper channelization and poor delineation coupled with poor upkeep of the shoulders as well as discontinuous footpath on each of the approaches (Fig.67 & 68).

Considering the above prevailing traffic scenario and poor geometrics at the candidate intersection, M/s. TRAX Sports Society, New Delhi, (A Member of Global Alliance of NGOs on Road Safety) took an initiative to conduct the road safety audit of the above intersection as well as develop geometric improvement plan for candidate intersection by availing the technical expertise available with CSIR - CRRI. Accordingly, CSIR – CRRI team conducted Road Safety Audit of the candidate intersection and thereafter also developed two distinct geometric design improvement plans in the form of roundabout design conforming to IRC:65 (2017) have been conceived for the candidate intersection. The only difference between Drawing 2 and 3 is the recommendation of paving of the existing soft shoulder portion on the Surajkund approach so as to achieve flaring of the intersection and thus make it a three lane carriageway for the Gurugram to Surajkund approach for a distance of about 100 m. Either one of the design, depending on the availability of resources shall be considered for implementation by Municipal Corporation of Faridabad (MCF).
Evolving Feasible Transportation Route from Ambuja Cement Limited (ACL) Plant to the proposed Nandgaon Ekodi Mines in Chandrapur District of Maharashtra

Funding Agency: M/s. Ambuja Cement Limited, Maratha Unit, PO Upparwahi, Korpana, Chandrapur District, Maharashtra.

Duration of the project: January 2019 to December 2019

Broad Objectives:

(a) To conduct a study on the roadway capacity assessment due to the new proposed mining plant at Nandgaon and Ekodi Mines, Nandgaon and Ekodi of Chandrapur district in Maharashtra

(b) To devise appropriate capacity augmentation measures for meeting the projected traffic demands due to the proposed mining plant
conforming to the relevant Indian Roads Congress (IRC) standards and Indian Highway Capacity Manual (2017).

(c) To evolve best route from Nandgaon Ekodi to ACL for carrying the proposed mines bound traffic.

Ambuja Cements Limited (ACL) is one of the largest cement producing company in India. It is an established norm that for any envisaged capacity augmentation of a mining plant, it is essential to take clearance from environment as well as assess its impact on the traffic plying on the adjoining road network coupled with fixing best route from mining area to the cement plant. In this context, M/s. Ambuja Cements Limited (ACL) had approached CSIR - CRRI to carry out traffic study in the project area considering the proposed mining plant (which is expected to handle maximum capacity of 2.0 MTPA) at Nandgaon and Ekodi villages and explore the need (if any) for capacity augmentation of the connecting roads from plant to mines and thereby suggest best route for transportation route between the proposed mining area and the cement plant. As part of the above study, relevant traffic surveys and road crash data were collected on the study corridor from the Police Station(s) in Gadchandur, Chandrapur district of Maharashtra.

Based on the above primary traffic studies and keeping in view the requirement of providing safe commuting passage for various types of vulnerable road users like motorised two wheelers as well as bicyclists and pedestrians, it is recommended to provide paved shoulders of 1.5 m wide plus 1.0 m earthen shoulder on two lane bidirectional roads. The existing four lane divided road having two staggered intersections of Gadchandur and Manikgarh needs immediate geometric improvement which would help in achieving smoother radii for turning traffic considering the proportion of multi axle trucks would increase after the opening of the proposed mines. Further, it is recommended towards implementation of strict enforcement in terms of prohibition of on street parking and removal of encroachments. These measures should be supplemented with the immediate repair and rehabilitation measures of the existing road from Gadchandur to Nandgaon and Ekodi in the form of pothole repair and overlay.

The existing sort of mini roundabout at Manikgarh intersection is not designed conforming to IRC: 65 (2017) titled, “Guidelines for Roundabout Design”. It is necessary to redesign the roundabout conforming to IRC: 65 (2017) by providing adequate diameter of around 15 m as well as improve the staggered intersections coupled with posting of necessary road signs markings [conforming to IRC:67 (2012) and IRC:35 (2015)] and street lighting. In summary, it is recommended that needful measures shall be done on the above intersections and existing road sections by the relevant stakeholders who would help to enhance the safer commuting environment for the mixed mode traffic witnessed on the above Project Corridor. Based on the analysis conducted, it is inferred that Gadchandur to ACL via proposed road from State Highway to ACL joining behind ACL plant will be the best route amongst three routes due to its advantages like shortest distance, devoid of any interaction with local traffic and environment friendly as there will be no roadside built up area as this being own land of ACL.

Road Safety Audit of Selected State Highways in the State of Bihar

Funding Agency: RCD, Bihar.

Duration of the project: February 2019 to February 2020

Broad Objectives: To conduct Road Safety Audit of selected existing state highways in the state of Bihar and to suggest the action plan to enhance the safety on those roads

The state of Bihar is pegged at the 15th rank in terms of total number of road crashes numbering 9,600 during the year 2018 constituting a share of 2.1 per cent of nationwide statistics. Moreover, the state has occupied 9th position numbering 6054 in terms of number of fatal road crashes considering the pan Indian state level statistics during 2018 which reveals the fact the state has gone from 11th rank registered in 2017 and thereby earning the dubious distinction. The above increase in the number of fatal crash statistics is directly reflected in the severity of road crashes which is 70.1 i.e. number of persons killed per 100 road crashes during the year 2018. It can be inferred that the above figure is about 2.2 times in terms of severity of road crashes.
recorded at national level. This is despite the fact that the overall mobility level in the state is not that high due to smaller length of national highways (NH) pass through the state and only about 3000 Km length of state highways is available in the state. Further, the number of persons killed per lakh population in the road crashes is 9.0 persons killed per 1,00,000 population which has gain gone up from 8.4 registered in 2017.

Considering the above, it was felt essential by the Road Construction Department (RCD), Government of Bihar to mitigate the rising road crash trends through the conduct of Road Safety Audit (RSA) and thereby undertake appropriate remedial measures covering the State Highway (SH) network falling under North Bihar Wing of RCD, spanning a length of 1409.637 Kms. Accordingly, RCD of Bihar had requested to CSIR - CRRI to conduct RSA on the identified state highway road corridors which are experiencing high number of road crashes and thus develop appropriate road safety action plan which can be implemented by the respective circles of RCD immediately. The safety measures undertaken towards enhancement of road safety on the identified road corridors can be periodically reported to the Supreme Court Appointed Committee on Road Safety by RCD Bihar and Transport Department, Government of Bihar which are the nodal organizations. To reduce the road crash proneness on selected State Highways and thus enhance safety, action plans have been developed. A typical illustration of safety issues identified for one of the Project Corridors along with suggested measures are presented in the photos below for illustrative purposes (Fig. 69 to 74).
Road Safety Audit of Selected Road Stretches of Four Different Circles in the Chhattisgarh State

Funding Agency: PWD, Chhattisgarh.

Duration of the project: August 2018 to August 2019

Broad Objectives:

(a) Conduct of Road Safety Audit study on selected roads of State Highways (SHs) and Major District Roads (MDRs) which encompasses Bilaspur Circle 205.5 Km, Ambikapur Circle 110 Km, Raipur Circle 150 Km and Durg Circle about 44 Km

(b) Development of chainage wise action plan for the removal of the safety related deficiencies identified on the above candidate road sections.

The state of Chhattisgarh has been ranked 12th highest in terms of total number of road crashes numbering 13,580 during the year 2017 and thus constituted a share of 2.8 per cent in the entire country. Similarly, the state of Chhattisgarh has registered 53 road crashes per lakh population and 34 road crashes per 10,000 vehicles during the year 2017. This is despite the fact that the road length in the state of Chhattisgarh and the number of registered vehicles in the state is not very high as compared to the other top ranked states in terms of road crashes in the country. Further, the road crash severity index has recorded steady increase during the last three years which is found to be a major cause of concern for the stakeholders like the Chhattisgarh Public Works Department (CPWD) and general road users alike.

Considering the above trend in road crashes in the state, Chhattisgarh had decided to mitigate the rising road crash trends through the conduct of Road Safety Audit (RSA) and thereby undertake appropriate remedial measures covering selected State Highway (SH) and Major District Roads (MDR). In this regard, PWD, Chhattisgarh requested CSIR - CRRI to conduct RSA on the identified road corridors spread over four different circles which are experiencing high number of road crashes so as to develop appropriate road safety action plan which can be implemented by the respective circles of Chhattisgarh immediately. Thus the measures undertaken by Chhattisgarh PWD towards the enhancement of road safety on the identified road corridors can be compiled by PWD Chhattisgarh and Transport Department, Government of Chhattisgarh as the latter is the nodal organization for periodical reporting of safety measures to the Supreme Court Appointed Committee on Road Safety.

Road Safety Audit of Road No. 56, 57 and G. T. Road under Shahdara Road Maintenance Division, Delhi

Funding Agency: PWD, Delhi

Duration of the project: July 2019 to December 2019

Broad Objectives:

(a) Conduct of Road Safety Audit of selected roads falling in PWD CRM Division M-211, Delhi

(b) Development of action plan for the removal of the safety related deficiencies identified on the above candidate road sections.

Public Works Department, Division M-211, Delhi, with due consideration to assess the safety situation had requested CSIR-CRRI to conduct the Road Safety Audit (RSA) on three selected roads i.e. Road No.56, Road No.57, and G.T.Road,. CSIR-CRRI study team critically studied the road stretches by carrying out the RSA at Existing Stage and identified the existing deficiencies in the stretch. The study team critically reviewed the existing inadequacies like Intersection...
design deficiencies, absence of pedestrian facilities, absence of Object Hazard Markers, Road side Hazards, Existing pavement surface conditions, absence of curve delineation, deficiencies in minor junction and access roads, problems in bus stops, absence or non standard signs and markings, absence of NMT facilities, unauthorized parking etc. The appropriate corrective measures for improving the safety are suggested to mitigate the deficiencies.

Testing, Training and Evaluation of Special Protection Group (SPG) Drivers

Funding Agency: SPG, Govt. of India
Duration of the project: July 2019 to December 2020

Broad Objective: To identify the driving characteristics through assessing the cognitive and psychomotor functions of drivers such as reaction time, visual orientation, perception, vigilance and motor coordination by deploying Vienna System, Car Driving Simulator and Keystone View instrumentations.

53 drivers belonging to Special Protection Group (SPG) of the Government of India (GoI) were administered various types of psychomotor ability tests which included the following:

- Car Driving simulation test,
- Action judgment test,
- Simple and complex reaction time test,
- Depth perception test (judgment of height, distance and width),
- night vision and glare test,
- Visual acuity test and
- Driver behaviour rating scale (field testing).

Considering the above mentioned list of tests is to be carried out amongst the subjects, maximum of three drivers on each day were tested. A brief on each test is given:

i) Driving Simulation test: The driving simulator system simulates driving conditions of city, hills, cross country, snow bound terrain, in varying light and climatic condition like rain, fog, snow and dust. The driving level starts from basic from then intermediate and progress to advance level. The driving simulator enables instructor to control sessions during exercise, monitor and continuously assess the progress of trainees individually, selectivity or collectively. Then clutch, brake, accelerator, engine oil, temperature and various other reading are displayed on the monitor. The system continuously records the faults of the drivers. The administrator can create obstacles during the exercise to judge reactions of the drivers in this test.

ii) Reactive capacity (complex reaction time) Test: Reaction time is defined as the time which elapses between the reception of an external stimuli and taking of an appropriate action, in other words, total time taken by the drivers between appearance of the stimuli and reaction over the break. This test is done with Vienna Test system.

iii) Driver Behaviour Rating Scale: This test is administered for the subjects for measuring the attitude of the drivers on the road side infrastructure, pedestrian, road signs and signals, lane discipline and road marking etc.

iv) Glare Recovery test: This test measures how quickly the drivers comes out of the glare effect caused by the head lights of oncoming vehicles.

v) Night vision test: This test measures driver’s ability to see accurately in darkness. This test is being conducted by Keystone unit.

vi) Road sign test: the test has been developed to measures the awareness level of the

vii) Drivers related to different (mandatory, information, warning signs of the road).

viii) Visual Acuity Test: This test measures the sharpness of driver’s vision which is basic requirement for safe driving.

Based on the score achieved by each of the subjects in the above mentioned tests, SPG drivers who have secured an overall ranking of B+ i.e. 7 out of 10 and above i.e. A-, A, A+ have been recommended for the deployment of high responsibility driving tasks and those who secured ranking of B and B- are recommended to be deployed for normal driving duties only.
Transportation Planning and Environment
RESEARCH PROJECTS

Traffic Circulation plans around metro stations and their impact quantification

Funding Agency: Petroleum Conservation Research Association, Ministry of Petroleum and Natural Gas, Government of India

Duration of the project: March 2019 to March 2020

Broad Objectives:

(a) To develop alternate traffic circulation plans around identified metro stations

(b) To quantify and compare impact of alternate traffic circulation plans in terms of traffic delay, level of service, fuel consumption & vehicular emissions using microscopic traffic simulation.

CSIR-CRRI carried out a research study (with funding from PCRA) to explore the subtle changes which can help in improving level of service for all road users without major infrastructural changes as well as without banning any vehicle usage or road user. The study should also propose effective strategies leading to fuel savings as well as its effect on vehicular emissions. On a pilot basis, the present study identified five metro stations ranging in ridership land-use activities around it. Five metro stations considered in present study are: Karol Bagh, Kailash Colony, Laxmi Nagar, Lajpat Nagar and Inderlok. The data analysis of traffic volume for 15 hours (from 7:00 am to 10:00 pm) at these locations revealed that it ranges from about 85,000 vehicles to 1.50 lakh vehicles without any clear peak hour. Traffic composition is dominated by Cars (37%) and Two Wheelers (39%). Share of non-motorised vehicles (cycle rickshaw and cycles) is approximately 6% on major roads. Approximately one third of the space is being used by all feeder modes (cycle rickshaw, e-rickshaw, taxis, and buses) within 100 meter distance from metro stations in all the directions. These feeder modes are directly providing last mile connectivity to metro users. Apart from all these feeder modes, metro commuters reaching to metro stations by walk is in majority i.e. 39% followed by 35% of commuters reaching by rickshaw (cycle rickshaw, e-rickshaw, shared/ unshared auto rickshaw). Further, about 14% are making their last mile trip by private car/ taxi and 2% by two wheelers and remaining 10% by buses. Considering these travel demands around metro stations, alternate traffic circulation plans have been developed using microscopic traffic simulation (VISSIM) and compared with base condition to assess their impact.

Microscopic Traffic Simulation: Existing road and traffic conditions have been studied in detail and simulated in VISSIM with all calibration and validation processes for comparing alternate traffic circulation plans to study the potential improvement options (Fig.75). From the results it has been found that parking related policies can result in speed increase of 2 to 6 km/hr depending on the location and selected policy of on-street parking and/or segregated parking lane for Cycle Rickshaw and E-Rickshaw. Similarly, Bus Stop Location based strategies are expected to increase the speed by 2 to 7 km/hr and segregated Pick-up/Drop off for facilities is able to increase the speed by 2 to 3 km/hr. Signal Redesign considering pedestrians have resulted in change (increase and/or decrease) of speed ranging from -4 km/hr to +2 km /hr. Implementing agencies can choose the scenario suiting to their priority within given options.

In this study, saving in fuel consumption and corresponding emissions for the conceived alternate traffic circulation plans have been estimated and compared with the base case (observed situation) by taking the simulation output for each of the scenario. The results indicated that in almost all the alternative scenarios suggested there was less fuel consumption and corresponding emissions as compared to the base case. However, shifting of on-road parking near the metro stations to some

![Fig. 75 : Vehicular Movements on Minor Road during Simulation](image-url)
alternative site was common alternative scenario (at all five sites) which had marked benefit in terms of reduction fuel consumption and emissions as compared to base case.

From the results it has also been concluded that best scenario can result in total daily savings of petrol of 598 Litres, diesel of 117 Litres and CNG of 779 Kg and total CO2 reduction of 3.9 tonne/day at all five metro stations. Implementing agencies can choose the scenario suiting to their priority within given options. Based on the detailed study carried out at five metro stations i.e. Karol Bagh, Inderlok, Lajpat Nagar, Kailash Colony and Laxmi Nagar, the effective improvement measures need to be addressed while preparing alternate traffic circulation plans have been identified.

**Development of Automatic Vehicle Counting and Classification software using Deep Learning Techniques**

Funding Agency: CSIR-CRRI

Duration of the project: October 2018 to May 2020

Broad Objectives:

(a) To develop programme incorporating deep learning techniques to count and classify the motorized vehicles.

(b) To verify the software with field data and other methods

The main objective of this study is to estimate classified traffic volume counts using You Only Look Once (YOLO) algorithm. Previously used image processing-based techniques have limitations in estimation of traffic counting during traffic congestions. Deep neural network-based YOLO algorithms methods are better approach to estimate traffic volume during heterogeneous traffic conditions. This study introduced YOLO algorithm to automatically count and classify the traffic volume on urban roads. Further, to improve the accuracy in heterogeneous conditions, this study adopted non-maximum suppression algorithm, which removes the redundant boxes on single vehicle detection. This study developed an integrated software programme for vehicle detection, non-maximum suppression and vehicle tracking. To implement the proposed methodology, a case study of urban arterial road corridor in Delhi was considered. From the results it was observed that the non-maximum suppression based YOLO algorithm produce better results during peak and non-peak traffic hours. The developed method can be implemented in real world online data collection system. The study methodology is given in Fig. 76. This study compared the count accuracy by considering the headway parameter. From the results it was observed that if the headway is less than 2 s, the error in vehicle count without NMS is 97 % whereas it is reduced to 9% with NMS. If the headway is more than 2s, vehicle count error without NMS is 44%. This error is reduced to 7% when applying the algorithm with NMS.

The developed method and the corresponding software works better provided the input video is collected at a height of at least 2m. The model used here, however, is pre-trained based on vehicles whose designs are more common in Western countries. Thus, vehicle classes like auto rickshaw, scooter, which are fairly common in India, are either not detected or are classified incorrectly. Proper retraining of the YOLO model with new image datasets, which include auto rickshaws and scooters, will make the software more adept at classifying and counting vehicles pertaining to Indian traffic context.
Development of Mass Spring System based on low frequency i.e. 1 Hz frequency

Funding Agency: CSIR-CRRI

Duration of the project: October 2019 to December 2020

Broad Objective: To develop Mass Spring System based on low frequency i.e. 1 Hz frequency

CSIR-CRRI is developing a mass spring system which can control vibration upto 1 Hz. Present global technology options available are the ones that can reduce upto 3 Hz, which most common prevalence of reducing 5Hz & 7Hz. The technology is being developed using viscous dampener with many layer spring system maintaining overall deflection upto less than 5mm, thereby reducing upto 40 VdB of vibrations. Before reaching 1Hz vibration isolation, we had developed 7Hz vibration reduction 26 VdB, 5Hz vibration reduction 32 VdB and 3 Hz solution vibration reduction 35 VdB. The new technology on mechanical isolation of vibrations is expected to be unique achievement as there is no reported success story on the aspect. It will help in achieving reduced vibration levels particularly in building isolation, thermal plant, nuclear plant, heavy equipment, metro and other fast trains. After achieving the goal of 1 Hz vibration isolation system. Typical development of mass spring system under progress as given below (Fig.77).

Safe Road Connectivity for Tripura State of North East Region of India

Funding Agency: National Mission of Himalayan Studies, Ministry of Forest and Environment, Government of India

Duration of the project: May 2018 to March 2021

Broad Objectives:

(a) To develop Self Sufficient Score (3S) for all habitations of Tripura state
(b) To develop Road Connectivity Index (RCI) for all the habitations of Tripura state
(c) To develop Safe Road Index (SRI) for all the roads of Tripura state
(d) To develop Safe Road Connectivity Index (SFCI), a systematic approach for prioritizing road connectivity and safety improvements based on score of RCI and SRI

The major task of this study is to prepare a geo referenced database containing all required information. This includes the road network covering all roads, locations of habitations, schools and health care centers. This is to be attributed by demographic information collected from Census of India. All secondary data are converted to GIS platform and further improved with primary data collected during household surveys conducted in various part of the Tripura state and road geometry updated based on site visits.

This study involves collection of secondary/primary data for Tripura State from various sources. All collected data were presented and discussed with
stakeholder in a meeting held at NIT-Agartala on 12th July 2019 (Fig.78). This meeting was attended by Public Works Department (PMGSY), Rural Road Development Authority, Directorate of School and Higher Education, Tripura, Department of Health Tripura, Police Department, Tripura, Census Office –Tripura and National Disaster Management

This meeting was attended by various stakeholders including Public Works Department (PMGSY), Rural Road Development Authority, Directorate of School and Higher Education, Tripura, Department of Health Tripura, Police Department, Tripura, Census Office –Tripura and National Disaster Management.

For developing various access measuring indices, parameters are identified from the prepared geo database.

- First index developed is Self Sufficient Score (3S) which indicates the level of education and health facilities available within the habitation.

- Second index is ‘Road Connectivity Index’ which measures the level of connectivity of a habitation with other habitations. This is to incorporate the 3S score of all adjacent habitations which can be accessed from subject habitation. For example, a small habitation having a larger habitation (and therefore more schools and health care centers) nearby is considered to be better connected compared to a small habitation having another small habitation nearby.

- Third index is of ‘Safe Road Index’ which assigns values to roads based on their level of traffic safety. This is developed based on sharpness of curve and the altitude of roads.

- The Safe Road Connectivity Index (SRCI) is the concluding index covering all aspects of above three indices. The values of this index are to be utilized for prioritizing the resources.

This is a decision making tool for governing authorities.

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

Funding Agency: CSIR-CRRI

Duration of the project: October 2016 to December 2020

Broad objectives:

(a) To develop inexpensive, sensitive, selective paper based SERS sensors for the detection and quantification of ground-level air pollutants / environmental pollutants.

(b) Development of SERS sensors to monitor the toxic substances in air (benzene, toluene, ethyl benzene, carbon monoxide, polyaromatic hydrocarbons (PAH), water (heavy metals like arsenic, lead, cadmium, etc) and soil (heavy metals).

For optimizing the parameters of sensors, first four sets of nanoparticles were prepared, silver nanoparticles of various sizes (three types) and gold nanoparticles. The formation of silver and gold nanoparticles can be easily identified by their UV-visible absorption spectrum (Fig.79). The localized surface Plasmon resonance (LSPR) of silver nanoparticles is at around 400 nm to 430 nm depending upon the size of nanoparticles. The formation of Gold nanoparticles can be easily identified by their LSPR in the region of 500 to 600 nm. LSPR varies with the size of nanoparticles, so smaller size nanoparticles LSPR will be around 520 nm and for larger nanoparticles (80 to 100 nm) the LSPR is at 580 to 600nm. The broadening in the spectrum peak explains the agglomeration of nanoparticles which can be clearly seen around 600 to 750nm. The color of nanoparticles changes with size, which also explains the sensor characteristic of silver and gold nanoparticles.
Once the nanoparticles were prepared, the Raman reporter methyl blue (MB) was taken to optimize the enhancement parameters for getting sensor. Five sets of experiments were performed, first the Raman of pure MB was taken, and for that 1mM of 20 µl solution was deposited on a glass. For comparing the intensity of enhancement of MB, the MB solution were further mixed with nanoparticles (silver and gold) and deposited on a glass. Silver and gold nanoparticles were mixed with the Raman reporter (Fig. 80) and deposited on a glass and then field enhancement factor of the nanoparticles were compared and the experimental work shows that the silver nanoparticles were more effective in enhancing the Raman signal of Methylene blue. Based on optimized parameters of enhancement, sensors will be formed, further sets of experiment is in progress.

Transport Sustainability Index (TSI) Software for Indian Cities

Funding Agency: CSIR-CRRI

Duration of the project: February 2020 to March 2021

Broad Objectives:

(a) To develop a software for measuring transport sustainability index (TSI) of an area/city/corridor.

(b) To integrate non-motorized module in existing software of public transport sustainability.

(c) To architect and implement a prototype report generation application that summarizes and documents and provides Transport Sustainability Index

There is big gap in research in terms of sustainability of transportation system especially public and non-motorized mode and user-friendly software to assess transport sustainability index. This user-friendly software can be easily and frequently used by the public transportation authority and other stakeholders. There is no such user-friendly software in the country. The proposed software measures transport sustainability of public transport as well as non-motorized transport including social, economic and environment-related aspect.

There are some indices available in reference for Indian cities focusing on different facilities separately. However, normalized sustainability transportation index including all aspect of transport sustainability is not available. Current methods mentioned in literature are complex in nature. Currently there is no a standardized assessment framework model or software to test various policy measures effects on urban areas. Further, every application is site dependent and uses specific set of indicators. The lack of homogeneity in detection, measure, store and monitoring of standardized performance indictors often does not permit to compare different cities contexts.

Conducting Traffic studies and pollution exposure to quantify the health Impact assessment of Delhi Metro Line

Funding Agency: International Institute of Health
Management Research, New Delhi

Duration of the project: February 2019 to June 2020

Broad Objectives:

(a) Exposure data of traffic related air pollution will provide scientific basis for pollution control in local areas.

(b) Assessing the degree of pollutant exposure of public during commutation in different modes of transport

(c) Air quality benefits of metro use.

The Delhi Metro network (DMRC) currently spans 373 km and has 271 stations making it one of the top 10 metro system in terms of coverage. DMRC being a rail system is an environmentally appealing mode of transport. Chapter 5 of the current study evaluated the environment friendliness of DMRC system through various methods; firstly using a questionnaire survey to capture the general perception of the commuters and secondly by evaluating the emission loads for the existing traffic plying on the roads parallel to the DMRC network ‘with’ and ‘without’ metro.

The questionnaire study was carried out at various stations of Magenta Line to assess the perception of commuters with respect to their exposure to pollution. The study resulted in a sample size of 352 commuters. Statistical assessment of the questionnaire data was done through multinomial logit modeling. The multinomial logit model was used to model the relationship between the times of the day a commuter perceived himself to be most exposed to pollution, the socio economic characteristics of the commuter and the trip characteristics. The relationship established through multinomial logit model indicated that only recreational and educational trip purposes were the independent variables which influenced the perception of commuters with respect to the time of the day that they felt most exposed to pollution. This could be due to the fact that commuters going for work based trips do not prioritize exposure to air pollution and it is only during the educational and recreational trips that one sees a change in perception of commuters.

The second evaluation was to assess the emission loads for ‘with metro’ and ‘without metro’ scenarios. In order to evaluate the emission loads for the entire network of Delhi it was decided to carry out the macroscopic simulation process of four stage modeling in VISUM. The base model developed in 2013 for the SUSTRANS (2016) study conducted in CSIR-CRRI was utilized for the current study as well. Certain assumptions with respect to growth rates, the mode choice as well as the trip distribution were made and the four stage modeling was carried out. The traffic flows obtained along the road segments parallel to the existing metro network was used for evaluating the emission loads for ‘with metro’ scenario. The exit passenger flows at each of the metro station was converted to vehicular traffic and added onto the existing traffic along the road segments. These were assumed to be the ‘without metro’ traffic plying on the roads adjacent to the existing metro lines. The current study was unable to quantify judiciously the number of inline passengers who would have been converted to vehicular traffic in absence of metro. The study has however highlighted the process that can be used for assessing the emissions for without metro scenario which includes the in-line passengers as well.

Using only the exit passenger count values the evaluation of ‘with metro’ and ‘without metro’ scenarios resulted in the following emission load differences (Table D).

<table>
<thead>
<tr>
<th>Line</th>
<th>CO</th>
<th>PM</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange Line</td>
<td>0.0001 to 0.0073</td>
<td>1E-08 to 0.0004</td>
<td>0.0004 to 0.46839</td>
</tr>
<tr>
<td>Magenta Line</td>
<td>0.0003 to 0.0328</td>
<td>1E-08 to 0.0021</td>
<td>0.0188 to 1.8794</td>
</tr>
<tr>
<td>Green Line</td>
<td>0.0114 to 0.0322</td>
<td>0.0005 to 0.0172</td>
<td>0.4247 to 15.0075</td>
</tr>
</tbody>
</table>
Trip Pattern and its Implications on Intermediate Public Transport Services in Imphal

Funding Agency: National Mission for Himalayan Studies, Ministry of Forest and Environment, Government of India

Duration of the project: January 2020 to January 2023

Broad Objectives:

(a) The study envisages to arrive at the travel behaviour indicators namely, the index of Intermediate Public Transport (IPT) provision for work and non work based trips of commuters in Imphal.

(b) The study shall estimate the trip frequencies, willingness to pay, current modal split and current trip patterns of commuters in Imphal.

(c) The study shall assess whether the current commuter trips are catered to by the existing IPT services in the city of Imphal.

(d) In case of deficiencies in IPT, the study shall bring out the route modifications of IPT services based on passenger flow movement.

Research on travel behavior of people in cities of developing countries are often focused on limited data collected for large scale transport models. It is also noted that these data are not temporal in nature as it is seldom collected on yearly basis. This is because of the costs involved in such data collection are huge and hence often a micro level data collection indicating the travel characteristics of individuals misses out in large scale planning. This leaves a vacuum in addressing the travel needs of marginalised commuters.

With the focus of providing commuters with unhindered accessibility to perform work based and non-work based trips, the current study would focus on defining the travel based indicators through the development of an index for IPT provision, defining the trip frequency of commuters, identifying the trip chaining activities, willingness of the commuters to pay for a better service and assessing their existing mode choice as well as future mode choice preferences. The existing operational travel options of the commuters would be assessed.

Based on the empirical evidence collected for the supply and demand, a revised routing of the existing services would be provided and policy evaluation towards the provision of IPT services shall be made. The methodology to be adopted for the study is as shown in figure below (Fig. 81).

![Fig. 81 : Study Methodology](image)

CONSULTANCY PROJECTS

Comprehensive Mobility Plan (CMP)-Ahmedabad


Duration of the project: February 2018 to June 2018
Broad Objectives:

(a) To provide long-term vision(s) and strategies plan for development of Ahmedabad city

(b) To prepare the travel demand model for base and horizon year

(c) To propose feasible short term and long-term traffic management measures/plans and transport infrastructure facilities for safe and efficient movement of motorized, non-motorized vehicles and pedestrians

This study is focused to develop comprehensive mobility plan for Ahmedabad city. For this, conducted various traffic surveys includes, classified traffic volume count survey, household survey, Origin-Destination survey, spot speed survey, speed and delay survey, Pedestrian volume count survey, parking survey, freight survey, Public transport passenger survey, and Road Inventory survey. Existing traffic characteristics such as average daily traffic, traffic composition characteristics and peak hour characteristics were estimate for Identified 37 intersections (Fig.82) and 10 mid-block sections. The spot speed character tics such as average travel time, 85th Percentile travel time were estimated (Fig. 83). Passenger travel characteristics includes travel characteristics at outer cordon and travel characteristics of various household were analyzed. Public transport characteristics includes Bus passengers; Intermediate public transport passenger were analyzed. The existing pedestrian facilities were studied and remedial measure were suggested. The parking demand and supply for the study are was estimated. Freight travel characteristics at various outer cordon was investigated. The traffic volume data and travel behavior data was considered to develop travel demand model for base and horizon year. Traffic growth rates were estimated considering the past trends of motor vehicle registered in Ahmedabad city and these were considered for estimating the horizon year traffic. This will useful to improving and strengthening the road infrastructure facilities as well as proposing new infrastructure facilities. Intersection Improvement plans also proposed taking into account the future traffic, prevailing site conditions and proposed city development plans.

Five year accident data (2015-2019) was considered to carry out accident analysis and the main cases of accidents in Ahmedabad city was analyzed. The strategies of various short term and long term plans were prepared to implement the same in the study area.

Road Safety Remedial Measures for Gurugram City Road Network

Funding Agency: SABMILLER India Ltd, Bangalore

Duration of the project: December 2018 to May 2020
Broad Objectives:

(a) To conduct Road Safety Audit and Suggest Road Safety Remedial Measures for Gurugram City Road Network covering 15 Top accident prone locations

(b) Action Plan to implement the Road Safety Remedial Measures

Gurugram is a city located in the state of Haryana which is also part of the National Capital Region (NCR) of India and located about 32 Kilometers southwest of New Delhi. As per the Census-2011, the population of Gurugram is 876,824. Since the city has witnessed rapid urbanization, it has become a leading financial and industrial hub accounting for the third-highest per capita income in the country. Today, Gurugram is housing more than 500 commercial establishments encompassing multinational and registered offices of major corporate giants in the country. Over the last decade, the city has witnessed steady increase in traffic coupled with increase in road crashes due to various reasons. Figure below shows the trend of road crashes, persons killed and injured in Gurugram city (Fig. 84).

Based on the Road Safety Audit conducted at top 15 locations, the RSA recommendations are grouped into the following categories.

- Road signs
- Road markings
- Road studs
- Object Hazard Markers (OHM)
- Pedestrian Facilities
- Placement of Separation Barriers/Dividers
- Safety Tips to School/residents/inhabitants along the corridors
- Safety Measures at Intersections, Median Gaps and Access roads
- Other Important points emerged during the site visit

Considering the above increasing trends in the road crashes and their severity in Gurugram, it has been felt prudent by some of the major Corporate Houses to carry out mitigation measures as part of their Corporate Social Responsibility (CSR) towards achieving enhanced road safety. In this context, a consortium leads by M/s.AB In Bev India (Anheuser-Busch InBev) India formed by various stakeholders towards the "Safer Road for Gurugram Initiative". As a part of this program total 15 top accident prone locations were indentified in Gurugram the remedial measures were suggested, some of the study recommendations were in given in Fig. 85.

Fig. 84 : Trend of road crashes in Gurugram

Fig. 85(a) : Fencing on the median at the Entry of subway is needed to enhance the safety during the night time as well as day time at Signature Tower Intersection

Fig. 85(b) : Remove the redundant signs and place the road signs as per the IRC:67 (2012) at IFFICO Intersection
Impact of traffic on health amongst school children in Delhi

Funding Agency: International Institute of Health Management Research, New Delhi

Duration of the project: August 2019 to December 2020

Broad Objectives:

(a) To estimate the association between local traffic exposure and child health conditions amongst school children

(b) To investigate the policy implications if schools and residential units are located outside the buffer zone around major traffic sites

In accordance with the objective of the project, video graphic classified traffic volume count was carried out at the following junctions and corridors:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Code</th>
<th>Name of the Intersection/ midblock</th>
<th>Duration of Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I-01</td>
<td>Batla House</td>
<td>12 hours</td>
</tr>
<tr>
<td>2</td>
<td>I-02</td>
<td>Holy Family</td>
<td>12 hours</td>
</tr>
<tr>
<td>3</td>
<td>I-03</td>
<td>Jasola Puliya</td>
<td>12 hours</td>
</tr>
<tr>
<td>4</td>
<td>I-04</td>
<td>Madanpur Khadar</td>
<td>12 hours</td>
</tr>
<tr>
<td>5</td>
<td>I-05</td>
<td>Noor Nagar</td>
<td>12 hours</td>
</tr>
<tr>
<td>6</td>
<td>M-01</td>
<td>CRRI</td>
<td>24 hours</td>
</tr>
<tr>
<td>7</td>
<td>M-02</td>
<td>C V Raman Marg</td>
<td>12 hours</td>
</tr>
<tr>
<td>8</td>
<td>M-03</td>
<td>Ashram</td>
<td>24 hours</td>
</tr>
<tr>
<td>9</td>
<td>M-04</td>
<td>Sarita Vihar Flyover</td>
<td>12 hours</td>
</tr>
</tbody>
</table>

Speed and delay survey was carried out using the moving observer method. In this process, a mid-size SUV was used. Along with the above surveys the space mean speed of the traffic stream was also assessed. The air pollution surveys were conducted in parallel at 3 locations in order to assess the ambient air quality. Based on the surveys conducted the ADMS-Urban software was used to assess the dispersion. Fig. 86 shows the dispersion as obtained for CO.

A questionnaire survey has been carried out to assess the perceptions of parents of the school children with regard to their knowledge on air quality and if they feel that the air quality impacts the health of their school going kids. The questionnaire was conducted through telephonic contact and has resulted in over 300 samples. The data shall be statistically evaluated to arrive at the quantified assessment of the school children perceptions.

Estimation of Fuel Losses and Assessment of Air Quality at Selected Traffic Intersection(s) in Delhi

Funding Agency: Central Pollution Control Board (CPCB), Ministry of Environment Forests and Climate

Duration of the project: November 2018 to August 2020

Broad Objectives:

(a) Measurement of kerb-side air quality and study of traffic related attributes (e.g., traffic volume, traffic composition, vintage etc.) at selected intersection(s) in Delhi

(b) To find relationship between vehicular traffic and observed air pollution levels

(c) Estimation of fuel losses and corresponding emissions from motor vehicles, idling at the selected signalised intersection(s) using fuel-based IPCC/USEPA emission factors

(d) Correlation between estimated emissions due to idling of motor vehicles and observed air quality at the selected signalised intersection(s)
(e) Performance evaluation of CAL3QHC traffic intersection model (using CO as indicator pollutant)

(f) To suggest various mitigation measures and quantification of impact of these measures in terms of reduction of fuel losses and improvement in air quality at these selected signalised intersection(s).

The direct effect of idling of motor vehicles at various traffic intersections is fuel losses (i.e., wastage of fuel), resulting in significant increase in air pollution levels there and ultimately converting these traffic intersections into urban “hot spots”. At these “hot spots”, air pollution levels generally exceed the stipulated air quality standards, prescribed by various regulatory agencies. The situation becomes much more serious during the winter months due to unfavourable meteorological conditions.

Three signalised intersections viz., ITO, Lodhi Road near IMD office and Mathura Road in front of CRRI Main gate were selected for the present study. As part of the study various surveys including (videography) Traffic volume count (48 hours Continuously Weekend and Weekday) for idling and non-idling vehicles, fuel station survey (for determining age profile of vehicles), road geometry survey were carried out for summer and winter seasons. Simultaneously, ambient air quality and on-site meteorological data at the CPCB monitoring stations situated at these traffic intersections were also collected. Idling fuel consumption for different categories of vehicles were taken from earlier studies carried out by CRRI. The study also involve using fuel-based IPCC emission factors which converts quantity of different types of fuels into direct GHGs (viz., CH4, CO2, N2O) and Indirect GHGs (viz., CO, NO2, Volatile Organic Compounds: VOCs) based on the Nat Calorific Value (NCV) of the respective fuel(s).

The methodology adopted for the present study is presented in the following flow chart given below (Fig.87).

Various surveys (viz., traffic volume, fuel station, signal timing) as well as secondary data related to air quality and meteorological data have already been completed/colllected and have been compiled. The draft final report is being prepared and likely to be submitted by August, 2020 to the CPCB.

---

**Noise and Vibration Study for Pune Metro Rail Project**

Funding Agency: Maharashtra Metro Rail Corporation Limited, Mumbai, Maharashtra

Duration of the project: February 2018 to August 2019

Broad Objective: To conduct Noise and Vibration Study for Pune Metro Rail Project for Phase-I and suggest the remedial measures.

Primary data collection involved photography and videography along the entire corridor along with household survey to estimate the total number of people affected. Noise and vibration data was also collected in buildings along the corridor. Secondary data was collected from the various reports for geotechnical data and the Detailed Project Report (DPR) provided by the general consultants for the project. Package wise drawings for the sections were also provided. After the initial data collection, data analysis was carried out to estimate the vibration at the tunnel floor and ground level during train operation as well as during the construction phases. Based on the estimates arrived at, suitable remedial measures were elaborated.

Recommendation during construction: TBM speed should preferably be low, if crossing below buildings. Late Night working of TBM operation...
may be avoided to ensure minimum discomfort to people in the overlying buildings. Heavy vehicle on road side should be diverted, if TBM operation is below the road side. During TBM operation VdB values should be 99 VdB to 106 VdB at 1m distance in inside tunnel.

Recommendation during operation of metro train:
During train operation biggest problem is curve & tunnel level difference. Speed of train should not go more than 60km/h. The maximum position speed should be between 45km/h to 55km/h.

Noise Control System during Drilling for Station:
Noise level during drilling of rock will be approx 87-90 dB (A), and frequency will be around 5k Hz. After installation of flexible noise barrier till 10m height total reduction will be 20-23 dB (A).
Bridge Engineering and Structures
RESEARCH PROJECTS

Experimental Investigations of “Hybrid Composite Beam (HCB) System”

Funding Agency: CSIR-CRRI

Duration of the project: July 2018 to July 2020

Broad Objectives: The objective is to develop and investigate an innovative light weight composite beam system, whether it could be implemented in a commercial application, as a viable alternate to the conventional girders, whether the proposed beam is competitive with prestressed concrete beams with respect to structural performance and cost performance.

The HCB is a new type of beam that combines concrete, steel, and Fiber-reinforced polymer in an efficient form a concrete arch tied at the bottom with steel strand is encased inside of a polymer box. The compression reinforcement consists of self-consolidating concrete (SCC) that is poured in a classical arch shape. The tension reinforcement consists of galvanized high strength (HS) steel tendons anchored at each end within the end blocks. The profile of the compression reinforcement is designed to resist the compression and shear forces resulting from vertical loads applied to the beam in much the same manner as an arch structure. The beams have a great advantage in that they are much lighter than similar sized concrete and steel beams. Because of the lack of experience with HCB design and the limited studies in the past, a research is warranted to investigate the behavior of the HCB bridge system.

In India, the new Code IRC 112 has been introduced, which is a unified code for design of all types of concrete bridges, using plain concrete, reinforced concrete, and prestressed concrete. The Code covers mainly the design guidelines for conventional type of superstructure and clearly mentions it cannot be used for hybrid composite beams, which requires special literature and knowledge or experimental data for the design and understanding of behaviour of HCB.

A model HCB and a conventional beam was casted in the laboratory with a scale of 1 in 15 with same concrete grade, same height and same length with difference in shape of the beam as shown in Fig.90. Deflections and strains at critical locations were measured in order to determine the behaviour of the HCB and also compared the experimental results with the HCB analytical model made in STAAD (refer Fig.91).

Fig. 90 : Testing of HCB and Conventional Beam
The scaled model of individual beam in the laboratory has been studied from which, strain data, strain profiles were extracted for each beam to evaluate the accuracy of the transformed section. The test data served as the basis for the design of full scale HCB bridge model to be casted in laboratory of Bridge Division. Design of two beam system of HCB with 8m span and 0.65m height with 0.2m deck height (Fig.92) is done manually using the strain data extracted from laboratory testing of individual HCB and checked with STAAD analysis. This two beam system of HCB will be casted in laboratory for behavioural study when it is integrated with two beams, cross beams and deck slab configured in a zero degree skew.

Development of customized RPAV (Drone) for smart application in the field of remote inspection and monitoring of bridges

Funding Agency: Collaborative Research project of CSIR-CRRI and M/s Matrix Geo Solution

Duration of the project: April 2018 to March 2021

Broad Objectives: To develop a customized RPAV (Drone) for smart application in the field of remote inspection and monitoring of bridges

With the advancement in high-resolution cameras and digitalization technology, it is proposed to develop an eco-friendly digital device to measure the physical dimensions and investigate the surface distress conditions of bridges. The same will then be scientifically simulated for comparing the results obtained using the physically and those using the developed digital device. Further advancement will be done for its smarter application for detecting the surfaces distress / defects and existing condition survey. CSIR-CRRI, which is having long working experience, scientific knowledge and analytical skills in the bridge monitoring, joined hands with the M/s Matrix Geo Solution, which excels in the drone technology for the development of RPAV-BMS. In view of above it is aimed to develop of customized RPAV-BMS (Drone), which will be a handy and smart device for quick and accurate bridge monitoring and inspection. This device will be useful for creating geometry map of the structures using their photographic views. This device will be extremely useful in the remote and creek areas, which are tough to access otherwise.

A bridge on Western Peripheral Expressway, Padheni, Haryana was chosen for the study. It was a skew RCC bridge with five spans. In the stage 1, high resolution geo-referenced aerial images of the bridge structure were captured using the RPAV (as shown in Fig.93 and Fig.94). In the Stage 2, the 3D Reality Model of Bridge was generated in the Bentley software using the Stereo Photogrammetry Processing technology. Various dimensions of the bridge can be measured in this model. In the Stage 3, data analysis was done in which the actual measurements of the bridge were measured on the site and compared with those obtained from the 3D model. Maximum error of 10% was observed when
the actual measurements were compared with those obtained from the 3D model. Thus, achieving its set objectives successfully finishes the Phase II of the project (Phase I already finished). The Phase III involves forensic investigations which require attaching sensors and its data acquisition system in order to estimate the concrete strength and homogeneity. Fig. 95 shows the customized RPAV along with the sensor which is being calibrated as a part of Phase III of this project.

**Structural Safety Audit of Seventeen Flyovers in Delhi through Detailed Inspection**

Sponsoring Agency: Public Works Department, Govt of NCT Delhi

Duration of the project: April 2019 to March 2020

Broad Objective: To carry out Structural Safety Audit of seventeen flyovers through detailed visual inspection and to suggest further course of action

The work of structural safety audit of seventeen flyovers in Delhi through Detailed Inspection and suggestion of further course of action was entrusted by Public Works Department, Government of NCT, Delhi to CSIR-CRRI.
During the visual inspection, all the accessible structural as well as non-structural components of flyover such as road over the flyover, drainage spouts, railings/crash barriers, electricity poles, expansion joints, superstructure, bearings, bearing pedestals, pier caps, piers, area below the flyovers, green belt, etc. were checked (Fig 96 to 98).

Some of the observations about these flyovers, based on this detailed inspection, are as given below:

- Damaged Crash Barrier, Cracks in concrete, spalling of concrete and exposed steel reinforcement at few locations.
- Hitting of superstructure / pier caps/ etc by vehicles
- Honeycombing of concrete at few locations
- Laying of bituminous wearing coat over expansion joint at few locations
- Restriction of movement of the some of the expansion joints due to filling of debris in the expansion gap of the joints.
- Damaged expansion joints at few locations
- Blocked/damaged drainage spouts and insufficient length of down pipe of drainage spouts at many locations
- Settlement of approaches to the bridges at few locations
- Absence of seismic restrainers in some of the flyovers
- Corroded steel prestressing cables of PSC T-girders around the uncapped ends of cables
- Distressed/ tilted elastomeric bearings at few locations
- Corrosion and missing nut bolts in some of the POT-PTFE bearings
- Seepage from drainage spouts/ expansion joints at few locations
- Vegetation growth over pier caps/ RE wall panels/retaining walls at few locations
- Accumulation of bituminous material at Road surface at few locations.
- Accumulation of debris around bearings / bearing pedestals / pier caps at most of the locations

Suitable remedial measures for improvement of condition of these flyovers were suggested.
Determination of in-situ early strength of rapid setting concrete using piezo sensors

Funding Agency: CSIR-CRRI

Duration of the project: July 2018 to June 2019

Broad Objectives:

(a) To monitor early strength gain of concrete using piezo sensors and investigate the effect of temperature and humidity on the concrete strength gain

(b) To develop a correlation between concrete strength gain and EMI signature acquired by piezo sensor

This research aims to estimate the in-situ concrete strength using the embedded Resin Jacketed Piezo (RJP) sensors. The proposed mathematical models and are based on sufficiently large samples are developed using the EMI signatures of the RJP sensors. For all the RJPs, the peak conductance values reduced drastically till Day 1, followed by gradual reduction till Day 4 and finally negligible change till Day 28 as shown in Fig.99. The peak frequency values were also varying in similar manner but with an increasing trend. In order to have sufficiently scattered concrete strength values, ten different concrete mixes (18 cubes each with three of them instrumented with RJP sensors) were casted. Three cubes (each) without RJP sensors were uniaxially compressed to determine the compressive strength at the ages of 18 hours, 1, 2, 3, 4 and 7 days after casting. The UPV and the RH readings were also captured for the mentioned days for comparison with the EMI results captured using the RJP sensors.

Based upon the average values of the compressive strength of 180 concrete cubes and corresponding peak conductance shift, peak frequency shift and their combined effect, three correlation models were developed and validated in laboratory for two sets (with different concrete grade) as shown in Fig.100(a-c). After the age of 2 days for both the sets, a good correlation was obtained between the measured and the estimated compressive strength using the three developed RJP based models with an error less than 10% (Figure 2d). Further, the developed RJP based models were extended to the site conditions by providing corrections for the temperature and humidity. A combined model to estimate the compressive strength of concrete based upon the RH number and the UPV is also developed and validated in this study. A clear improvement in the correlation was observed for the developed model in comparison to the traditional RH number-based charts (provided by the manufacturer) and existing available models, which establishes the former’s efficacy. However, this developed model based on RH and UPV values was less competent as compared to the developed RJP based model due to inconsistency in former’s results. It is believed that in addition to the existing site practices, the outcome of this study will pave in better decision making for the formwork removal in the casting yards which will help them increase their production rate.
Fig. 99: Conductance signature with increasing days

Fig. 100: Proposed model for estimating concrete strength based on (a) peak conductance shift, (b) peak frequency shift and (c) combined effect of peak conductance and peak frequency shift (d) Correlation between the measured and predicted strength using piezo based models
**Research & Development**

**Bridge Engineering and Structures**

**To study the corrosion of various reinforcement bar materials / structural steel including anti-corrosive coatings, concrete treated with surface coating under different environment exposure conditions**

Funding Agency: Ministry of Road Transport and Highways, Govt. of India, New Delhi

Duration of the project: September 2018 to August 2021

Broad objectives:

(a) To study the effectiveness and comparison of various types of protective coating on reinforcement bar embedded in normal concrete and also to study the corrosion behaviour of normal TMT bar in high performance concrete.

(b) To assess the relative performance of concrete specimen treated with water repellent coatings/admixtures, and embedded with TMT bars.

(c) To investigate the corrosion behaviour of structural steel specimen, coated with most widely used protective systems (one metallic and one polymeric as recommended in relevant Indian specification/codes).

(d) The performance of the coating shall be studied in different environment conditions such as normal atmospheric, saline and polluted environment.

(e) The study will explore the possibility of correlating results from the laboratory accelerated exposure conditions to the real time performance of the structures, taking help from the available National and International literature.

Different types of reinforcement bars namely TMT bars, Hot Dip – Galvanized (HDG) bars (Fig. 101), Fusion Bonded Epoxy Coated Reinforcement (FBECR) Bars (Fig. 102), Corrosion Resistant Steel (CRS) reinforcement bars, Zinc-Aluminium coated bars, and Stainless-Steel bars (Fig. 103) have been procured. Mild Steel Structural Steel (C-section) specimen were purchased from open market and got them zinc coated in a hot-dip galvanization facility (Fig. 104). The steel bars were tested for their ultimate tensile strength (UTS) and elongation in a Universal Testing Machine (UTM). Rebar cages were got fabricated using the steel bars procured (Fig. 105). Concrete specimen of different shapes and dimensions were cast using ready mixed concrete of grades M35 (conventional), M35 (conventional) with water proofing compound, and M40 (HPC) (Fig. 106 to 108). A total of 14 types of concrete castings were carried out including RCC beams and rebar embedded slabs and cubes, and plain concrete cubes and cylinders, and a total of about 400 specimens were cast.
Preliminary Test Results and Interim conclusions

Literature study revealed that Zinc-Aluminium coating is not used for reinforcement bars in concrete structures. They are used only for steel structures. Fusion bonded epoxy coated reinforcement bars are widely used in India in concrete structures especially in marine environment. Stainless steel reinforcing bars are not being used due to cost implications. It was noticed that corrosion resistant steel (CRS) bars were developing rust coating when left open in atmosphere. They are mostly in use in coastal states. However, the extent of its use couldn’t be obtained.

The UTS of steel bars varied between 560 to 750 MPa, and elongation of bars varied between 17 to 44 %. The slump of concretes procured at different times varied between 120-180 mm. The 28-day compressive strengths of concrete specimens were in general above 35 MPa and the elastic modulus of concrete was above 30 GPa. Addition of waterproofing admixture resulted in increase in compressive strength of concrete. The average thickness of zinc coating on structural steel members was about 90 microns.

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

Funding Agency: Department of Science and Technology, New Delhi

Duration of the project: March 2016 to February 2021
Broad Objective: To develop methodology/process and products as relevant for structural health monitoring with and without energy harvesting using piezoelectric material.

An experimental and statistical investigation to monitor residual pre-stressing force in the prestressed reinforced concrete (RC) bridge using piezo patches through the EMI technique is done. Lead Zirconate Titanate (PZT) sensors were bonded on the commercial load cells and their EMI signatures were captured in the laboratory using an impedance analyser (E4980AL, Keysight). Prediction models were developed and validated in the laboratory for three piezo-based load cells. The calibrated piezo-based load cells were installed on a five-span continuous post-tensioned RC bridge estimate its pre-stressing force. EMI signatures were captured once the full load was applied on the post-tensioned cables and then after 24 hours of loading. Using the developed prediction models and the root mean square deviation (RMSD) values of the piezo-based load cells, the residual load in the post-tensioned cable was predicted and found to match with that measured by the commercial load cell as observed from the Fig.109. This established the feasibility of using piezo-based load cells as an alternative to the commercially available expensive load cells for the prediction of residual pre-stressing force during the increasing age of a prestressed concrete bridge.

Work Done on Piezo-electric Energy Harvesting

Aim is to trap the ambient vibrations in the bridges due to traffic movement and converting it to useful energy using piezoelectric patches. Piezoelectric energy harvester (PEH) was surface bonded on the road 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 sizes of piezo patches in the 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.110. Further work is being done to improve the design of the PEH and energy storing circuitry.

**CONSULTANCY PROJECTS**

**Structural Safety Audit of Structures of 4-Lane Connectivity to ICTT Vallarpadam Road (Ch. Km. 0.000 to Ch. Km. 17.121) Section of NH-966A in the State of Kerala”**

Funding Agency: National Highways Authority of India

Duration of the project: October 2019 to March 2021

Broad Objective: Structural safety audit of the bridges through NDT and remedial measures for rehabilitation Strengthening.

The National Highways Authority of India (NHAI) had completed the construction of NH-47 (New No.544) of length about 17.121 km in the year 2015. The stretch starts from Kalamassery (Cochin town) and ends at International Container Tranship
Terminal (ICTT) Vallarpadam. This is a major road connecting NH-544 (Old NH 47) to the ICTT at Vallarpadam. The road passes through land area for a length of 8.4 km and then through the back waters of Cochin in reclaimed land from Ch km 8.4 to Ch Km 17.121. The above stretch consists of total 20 major/ minor bridges, VUP/PUP and Flyover with total length of structures in linear meter is about more than 3.5 km. The CRRI conducted the “Structural Safety Audit of the all the Structures which included Random Non-Destructive Tests (NDT) on these structures and Core tests thereof. Review of available documents related to construction history, as built drawings, progress reports and NDTs done at site followed by sample core tests at laboratory. The remedial measures for rehabilitation and strengthening including methodology were also suggested for the components wherever required. The vibration analysis has been done on the basis of test conducted at site and with FFT Analyser.

The Structural Safety audit site work has been done during the month of November-December, 2019 and laboratory testing carried in the month of December 2019.

**Investigations of the Observed Distresses in Anchor Blocks of Dobra-Chanthi Cable Suspension Bridge over Tehri Dam Reservoir, Tehri Garhwal (Uttarakhand), to know the probable Causes and Suggest Rehabilitation Measures**

Funding Agency: Uttarakhand PWD

Duration of the project: January 2019 to March 2020

Broad Objective: To find out the probable causes of the observed cracks in the front face of the Anchor Blocks

Dobra - Chanthi Cable Suspension Bridge over the Tehri Dam Reservoir located in the District Tehri Garhwal, Uttarakhand, has the main span of 440 m.
The bridge has a total length of 725 (260+440+25) m. The bridge is designed for Heavy Motor Vehicle Class 18 R, Two Lane Loading. The bridge is provided with two massive Anchor Blocks having dimensions 18000 x 20000 x 37500 mm (Dobra side – Right Main Anchor Block) and 18000 x 20000 x 25300 mm (Chanthi side – Left Main Anchor Block). A site visit was made and detailed plan of activities was prepared.

On the basis of field NDT measurements and the scrutiny of the available records related to the design and construction of the subject bridge, it can be concluded that the observed cracks in the Cable Anchorage Blocks, are passive in nature and might have occurred due to varieties of reasons such as probable deviations in the actual construction schedule from the concerned QAP as per the Contract Agreement, weather conditions, etc.

Further, during the site inspection by CRRI’s Team, it was also observed that at a few locations on the front face of the Anchor Block towards the Chanthi end side, dampness on account of probable moisture movement is observed. Study of the available records, it was found that similar dampness was observed earlier also at a few identified locations. Referring the available records pertaining to the construction sequence, RFIs, photographs taken during construction, it may be concluded that the probable source of moisture on the front face of the Anchor Block towards the Chanthi end (Fig.113) may have the following two probable sources.

1. The rain water entering through the cracks on the top roof and side walls of the Anchor Block.

2. Accumulation of Rain water in the compartments of the Cellular Boxes having Plump Concrete during construction which might have got stored due to flash rain showers when the Boulders were in place and M15 concreting was under progress. The affected compartment might have got sealed as it was due to difficulties in draining out the accumulated rain water in the pores of the Plump Concrete.

Suitable rehabilitation measures were suggested.

---

**Structural Safety Audit and Rehabilitation Measures of the 4-laning of Jetpur-Somnath Section of NH 8D from Km 0/000 to Km127/000 in the State of Gujarat**

Funding Agency: NHAI

Duration of the project: September 2019 to March 2021

Broad Objectives:

(a) Detailed Visual Inspection of all the structures in Jetpur – Somnath section. Review of documents related to design and drawings, Mix design, material tests, cube test, Pre-stress
cable test certificate and bearing test certificate, Data of schedule-I Tests i.e. NDT and Load Test Result etc. Review of Past inspection and test records.

(b) Random Non Destructive Test of structures, Carbonation Test, Core Test and Vibration Test on the various components of structures.

(c) Suggestion and Recommendations for the rehabilitation/ strengthening scheme of structures and preparation of Bill of Quantity (BOQ) for the items required for the rehabilitation/ strengthening works.

The project “Structural Safety Audit and Rehabilitation Measures of the 4-laning of Jetpur-Somnath section of NH 8D from Km 0/000 to Km127/000 in the state of Gujarat” deals with the Detailed Visual Inspection, Non Destructive Testing, carbonation test, Core Test, Vibration Test and strengthening measures of the various components of structures i.e. deck slab, girders, bearings both abutments, piers, and expansion joints. Non Destructive Test of structures comprises of random Rebound hammer Test, Ultrasonic Pulse Velocity Test, Cover measurements through cover meter and core test.

It is worthwhile to mention herewith that random checking of dimensions of the various components of structures have also been carried out by CSIR-CRRI New Delhi. The past record available such as mix design, Cube test results, NDT and Load test etc also reviewed. According to the physical condition of various components, NDT and core test etc strengthening measures have been suggested for the structures. The visual inspection, site test and laboratory test work has been done during the month of September 2019 to January 2020. The Mobile Bridge Inspection Unit (MBIU) has been used for the visual inspection and NDT for the inaccessible locations.

The following are the observations based on the above:

Severe Leaching and seepage observed on some of the structures

i) Severe cracks observed on the deck slab of various structures

ii) Honey combing observed at several locations on the structure

iii) Due to damaged seal of expansion joints, the continuous leakage of water seen on several structures

iv) At many locations on the structure concrete spalled and the rebars are completely exposed and severely corroded.

v) Poor finishes seen at various locations on the structures

vi) At several locations honey combing seen in bearing pedestal and bearing locks found in position.

vii) Severe shear cracks observed in the girders of some of the ROB.

Suitable repair/ rehabilitation/strengthening measures along with detailed methodology for repair/ rehabilitation/strengthening measures, specification of materials and Bill of quantities were recommended.

**Structural Safety Audit of Major Bridge at KM 938+485 (RHS) across the River Gowthami on NH-16 in the state of Andhra Pradesh**

Sponsoring Agency: Dwantham Tollway Pvt Ltd, Andhra Pradesh

Duration of the project: September 2019 to March 2021

Broad Objectives:

(a) Detailed visual inspection of the major bridge and Review of available documents of past inspection and maintenance.

(b) Random Non-destructive Test on the major bridge, Carbonation Test, Core Test and Vibration Test on the various components of the bridges.

(c) Recommendations for the repair/rehabilitation/strengthening scheme of structures

The bridge comprises of 48 spans of about 48.50m length. This is an old bridge opened to traffic on 20th April, 1967. The project work comprises of Detailed Visual Inspection, Non-Destructive Testing, Carbonation Test, Core Test, Vibration Test and
Strengthening Measures for the various components of structures i.e. deck slab, girders, bearings both abutments, piers, and expansion joints etc. Non-Destructive Test of structures comprises of random Rebound Hammer Test, Ultrasonic Pulse Velocity Test, Cover measurement and core test. The visual inspection, site testing and laboratory test work has been done during the month of November-December, 2019.

The bridge was inspected through Mobile Bridge Inspection Unit (MBIU)/ Man lifter/boat and ladders for all the accessible components of the structure. The condition of the various components of structure is shown in Fig. 114.

The following are the observations on the basis of visual inspection and various test results:

a. In some of the spans both the exterior girders i.e. G-1(D/s) and G-5(U/s) concrete spalled and the prestressing cable are completely exposed and severely corroded.

b. Erosion of pier at the bottom observed at Pier P-25 & P-33 and scouring seen at Pier P-36.

c. All old bearings misaligned/damaged in almost all the spans and supported by inserting a concrete block and elastomeric pad in the past. The bearing pedestals are cracked and crushed, honey combed, spalled concrete, exposed and severely corroded reinforcement. Several elastomeric bearing pads are not in contact of girders and dislocated from its position.

d. At all locations Drainage Spouts are not working properly.

e. In general Expansion joints are full with debris/damaged seal/missed out seal and damaged edge beam.

f. Leaching, Concrete de-lamination and spalling seen at many locations in decks slabs, piers and pier heads.

g. The bridge repaired in the past; however, the same has become totally ineffective.
Design and drawings of the bridge were not available. As almost all the old bearings damaged/misplaced/missing and also the existing bearing pedestal are cracked/damaged & there is no connectivity with the pier head; the load test could not be executed at the site. As per the actual conditions of the various components of the structures and the required remedial measures there is following three options available in order of technical feasibility and practical aspect:

- Construction of New Bridge adjacent to the existing bridge.
- Minimum repair and strengthening measures for light traffic
- Comprehensive repair and strengthening measures.

**Third party Technical Assistance for the Quality Assurance of the construction of two bridges across Agra canal at kms 6.820 and 28.000 at Faridabad**

Funding Agency: U P Irrigation Department, Delhi

Duration of the project: February 2019 to February 2021

Broad Objectives: Third Party Technical Assistance in Quality Assurance in the construction work of two-bridges at Faridabad:

The Quality assurance work comprises of checking of Mix design of various grades of concrete, Random checking of construction materials and testing at CRRI laboratory /RMC Plant/ project site, Checking of steel reinforcement detailing in substructure as well as superstructure before concreting, Assessment of workability of fresh concrete, Assessment of concrete in hardened state, Guiding Contractors in setting- up of site laboratory, Random checking of pre-stressed cable profile and monitoring of pre-stressing of girders.

At 28Km location, both the carriageways are having its independent substructure and foundation. Both the carriageway of the bridge is having two spans of about 23m length and approach slab of 3.5 m length. The super structures of the bridges are PSC girder with deck slab of 4-lane. However, at chainage 6.820 Km the bridge deck is of 2-lane single carriageway.
The work of construction of 2/4-lane bridges across Agra Canal at Km 6.820, and 28.000 at Faridabad comprises of RCC well foundations, RCC piers/abutments, RCC end abutment walls and pre-stressed girders, RCC diaphragms and RCC deck slabs. Four lane bridges are having 7.5m wide carriageway with 1.5m footpath and the two lane bridge is having 7m wide carriageway with 1.5m footpath on either side. PSC girders have to be supported over the POT-PTFE bridge bearings resting over the RCC pier/abutment caps. Design details of various structural elements of the bridges including well foundation, well cap, pier, pier caps, abutment walls and superstructure etc. were submitted by UPID along with the drawings to CRRI.

During the quality assurance work, CRRI is involved in all the construction related activities on random basis and providing Technical Assistance to UPID and Contractors in improving the quality of the construction work.

The concrete is being procured by the Contractors from the RMC suppliers. CRRI team randomly checked the quality of fresh concrete through the measurements of slump of concrete at the time of pouring and also segregation, if any. Representative concrete cubes are being filled and tested in CRRI Lab. CRRI team also visiting randomly the plants of the RMC suppliers and getting checked their operations, quality control mechanism being followed by them and ingredients of concrete.

CRRI team carry out the following non-destructive investigations at the different locations of the bridges:

- Schmidt Rebound Hammer test for estimating the compressive strength of concrete
- Ultrasonic pulse velocity test to check uniformity and quality of concrete
- Determination of concrete cover to structural members

CRRI is monitoring the ongoing construction work randomly. The observations and advices were given to the UPID as well as Contractor for the compliance as and when required. Before concreting of the segments, the compliance by the Contractor is being checked by CRRI and UPID representatives.

During the progress of the work, CRRI conducted field testing/laboratory testing/checking of placing of reinforcement & as per the scope of work. CRRI also provided on the spot/telephonic advice, as and when required to UPID officials/Contractors towards successful progress of the work. Checking and monitoring work of the construction of the bridge is being done randomly during the construction.

**Assessment and Rehabilitation Scheme for Shastri Bridge across River Ganga, Mirzapur**

Funding Agency: Public Works Department, Uttar Pradesh

Duration of the project: March, 2019 to March, 2021

Broad Objectives: Condition assessment and strengthening measures for Shastri Bridge across the river Ganga, at Mirzapur.

The Shastri Bridge at Mirzapur is about 44 years old, constructed during the year 1974 to 1976. The team from CSIR-CRRI visited the bridge site in last week of April, 2019 and conducted detailed visual inspection, Non-Destructive Tests (NDT), Vibration tests and load test. The concrete cores were also taken from different locations of the bridge and the same were got tested at CRRI, New Delhi. Physical dimension measurements of the various components of the bridge along with the spacing of reinforcements, its cover and diameter also carried out.
Fig. 116 shows the typical views of Shastri Bridge at Mirzapur and inspection through MBIU. The Shastri Bridge super structure comprises of two girder system with concrete deck slab. The sub structure comprises of circular piers and circular well foundations.

The Shastri Bridge has been inspected through Mobile Bridge Inspection Unit (MBIU)/ Man lifter/ boat and ladders for all the accessible components of the structure. The visual inspection of the bridge through MBIU reveals that there are cracks on the junction of supporting cantilever arms with main pier at many pier heads locations due to higher flexure stresses (Fig.117). These cracks are mainly due to higher Loads on the structure plying earlier before the restriction of the heavy loads on the bridge.

Load Test of the four spans namely A1-P1, P1-P2, P2-P3 and P3-P4 of the superstructure were carried out. It is observed that the average percent recovery of deflection on the removal of the test load is more than 85% at the mid-span of both the girders in the test spans. The IRC Special Publication 51-2015 specifies minimum percentage recovery of deflection at 24 hours after removal of test load as 85% as acceptance criteria for the pre-stressed concrete structures on the removal of the vehicular live load. Since the percentage recoveries of the tested spans are more than specified 85 percent, hence the tested span is deemed to be behaving elastically. There was no development of any new flexural cracks or growth of the existing cracks during the load tests in the spans as well as in Piers.

The vibration test shows that there is more intensity of vibration due to loss of stiffness of the structure due to cracks at the junction of cantilever supports and loss in prestressing force in the superstructures. Thus, strengthening of super structure of the bridge is to be done at the junction of Cantilevers and pier heads by widening the junctions/fibre wrapping as well as in girders/ deck slab of superstructures through external prestressing.

Based on the detailed visual inspection of the bridge, test results of random samples taken, NDT, load tests and vibration test, the suitable strengthening measures were recommended. However, Further, till the strengthening of the bridge completed, plying of vehicles more than 25 T gross loads/ heavy loaded and over dimensioned vehicles should be strictly prohibited to ensure safety of passengers as well as the Shastri Bridge Structure.
Structural Safety Audit of major bridges at Km 114+759 (LHS) and at 67+047(LHS) in the stretch of 4–Laning of Porbandar-Jetpur on NH 8B in the State of Gujarat

Funding Agency: M/s Porbandar Tollway Private Limited, Rajkot

Duration of the project: October 2019 to December 2020

Broad Objectives: Condition assessment and rehabilitation/strengthening measures of two major bridges at Km 114+759 (LHS) and 67+047(LHS) in the stretch of 4–Laning of Porbandar-Jetpur section.

A joint site inspection along with M/s NHAI officials, M/s Porbandar Tollway Private Limited, Rajkot (PTPL) officials, Authority Engineer, TOT Contractor was carried out during October, 2019 for the “Structural Safety Audit of major bridges at Km 114+759(LHS) and at 67+047(old bridge) in the stretch of 4–Laning of Porbandar-Jetpur section.

The work comprises of detailed visual inspection, Non-Destructive Test (NDT), vibration test, core test, carbonation test and strengthening measures of the various components for the two major bridges. Randomly non-destructive testing such as Rebound hammer, Ultrasonic Pulse Velocity Test and Cover measurement carried out on both the major bridges. Carbonation test and cores test also carried out on the various components on both the major bridges. Load Test and Vibration test carried out on the major bridge at Km 114+759(LHS).

Fig. 118 shows the typical views of the new major bridge at Km 114+759. The major bridge at Km 114+759 comprises of 10 spans of about 27.450m and grouped in to three continuous spans with A1 to P3 (3 spans continuous), P3 to P7 (4 spans continuous) and P7 to A2 (3 spans continuous). The old major bridge at Km 67+047 comprises of 24 spans of 6.60m length.

Fig. 118 A typical view of the major bridge at Km 114+759

The following are the general observations:

(i) Severe Leaching and seepage observed on the deck slab.

(ii) Severe cracks observed on the deck slab, both webs and soffit slab in the box girders.

(iii) Honey combing observed at several locations on the structure.

(iv) At many locations on the structure concrete spalled and the rebars are completely exposed and severely corroded.

(v) Poor finishes seen at various locations on the structures.

(vi) Expansion Joints are completely filled with BC materials and debris.
(vii) Debris found on some of the Pier heads and inside the box girders.

(viii) In the past some portion of deck slab of span A1-P1 and P1-P2 of the box girders had been reconstructed. However, severe leaching observed on the deck slab and soffit slab of box girders.

The bridge at Km 114+759(LHS) is a two-lane Bridge with footpath on downstream side only. Two spans selected for load test and 4 trucks have been used to load the structure. Suspension wire method is used to find the deflection of box girder and during load test the superstructure inspected thoroughly.

Free Vibration Characteristics have been studied in spans A1-P1, P8-P9 and P9-A2 of the major bridge at km 114+759. A number of accelerometers were installed at the central and quarter sections of the spans in the box girder. The installed sensors were placed below the deck slab, u/p and d/s web and on the soffit slab. The dynamic data obtained from accelerometers are analysed using FFT analyser as shown in Fig. 119.

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, flexural rigidity of the span needs to be increased as the maximum measured deflections during load test were much higher than the analytical values. The detailed rehabilitation measures and methodology for each and every component of both the bridge reported. Suitable repair/rehabilitation/ strengthening measures were recommended.
Research & Development (R&D) Management

- Information, Liaison & Training
- Planning, Monitoring & Evaluation
- Documentation & Library Services
- Computer Centre & Networking
- Maintenance
- Mechanical and Transport
- Quality Management
- राजभाषा (Rajbhasha)
- Administration
Information, Liaison & Training
Information Liaison & Training, ILT 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 include 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.

Dissemination of R&D products is promoted through a variety of channels i.e. publications like CSIR-CRRI Annual Report, CRRI Newsletter, CRRI Profile, CRRI at a glance, CRRI history, Training booklet, Sadak Darpan etc.

ILT also promote and popularize significant achievements and R&D Expertise through various technical exhibitions.

ILT maintains an active liaison with various highway research organizations both in India & abroad for exchange of information & technical expertise. As a result, CRRI sends number of Scientists to India/abroad to attend conferences or to receive training on any road related equipments or software’s.

ILT make efforts to disseminate information, activities, findings and recommendations by organizing various workshops and conferences at CSIR-CRRI through exchanging information and knowledge transfer on Roads and Road related areas.

ILT also commemorate National days and celebrates National Science Day on 28th Feb., 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.

In addition to the above, ILT also organizes other programs launched by honorable Prime Minister such as “Jigyasa” programme to connect

Scientists and students and inculcate the culture of inquisitiveness on one hand and scientific temper on the other, amongst the school students and their teachers. ILT division has also observed Swachchta Pakhwaras, Vigilance awareness week, Road Safety week etc. successfully.

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

Training is an important activity of the division & we have trained more than 27,000 engineers so far. Several regular and customized training 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.

**Regular Training Programmes**

Skill development of human resources by imparting training to the engineers of the user agencies / organizations is an integral part of the research and development programme of CSIR-CRRI. During this fiscal year, following refresher courses / training programmes for engineers / professionals of the user organizations related to roads and road transportation in the Govt., Public & Private Sectors was 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. The engineers / professionals who had undertaken these training programmes were not only from various parts of our country but also from foreign countries like Nepal, Bhutan, Afghanistan, Sri Lanka, Tanzania, Uganda and Ethiopia etc.

During the year 2019-2020, the institute conducted seven regular training programmes as listed below:

- **Five Days Training Programme on “Geotechnical and Landslide Investigations for Highway Projects”** from June 10 to June 14, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 13 participants from parts of India.
• Five Days Training Programme on “Design, Construction and Quality Control in Flexible Pavement” from June 24 to June 28, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 27 participants from various parts of India.

• Five Days Training Programme on “Traffic Engineering & Road Safety Audit” from July 08 to July 12, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 28 participants from various parts of India.

• Five Days Training Programme on “Quality Assurance, Health Assessment and Rehabilitation of Bridges” for the Engineers of various organisations from July 29 to August 02, 2019. The training programme was inaugurated by Dr. P. Lakshmy, Chief Scientist, CSIR-CRRI and it was attended by 13 participants from various parts of India.

• Five Days Training Programme on “Design of Bridge Structure and Foundation” from November 04 to November 08, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 24 Participants from various parts of India.

• Five Days Training Programme on “Pavement Evaluation Techniques and their Applications for Maintenance and Rehabilitation” from January 06 to January 10 2020. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 15 Participants. Among them, 6 participants were from the abroad while the remaining participants were from various parts of India.

• Five Days Training Programme on “Design, Construction, Quality Control and Maintenance of Rigid Pavements” from January 27 to January 31, 2020. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 25 participants. Among them, 4 participants were from the abroad while the remaining participants were from various parts of India.
(b) Geotechnical and Landslide Investigations for Highway Projects (June 10-14, 2019)

(a)

(b) Design, Construction and Quality Control in Flexible Pavement (June 24-28, 2019)
Traffic Engineering & Road Safety Audit (July 08-12, 2019)
Design of Bridge Structure and Foundation (November 04-08, 2019)

Quality Assurance, Health Assessment and Rehabilitation of Bridges (July 29- Aug. 02, 2019)
Pavement Evaluation Techniques and their Applications for Maintenance and Rehabilitation (January 06-10 2020)
Customised Training Programme

Besides the regular training programmes, the Institute also conducted customer oriented programmes to meet the specific training requirements of the user agencies. During the year 2019-2020, the Institute conducted the following customised training programmes:

- Five Days Customized Training Programme for Border Road Organisation young Officers on “Geotechnical & Landslide Investigation for Highway Projects” from June 17 to June 21, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by National Infrastructure Development Agency (NIRDA), Govt. of India.

- Five Days Customized Training Programme on “Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices” from July 01 to July 05, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 33 participants sponsored by NIRDA, Govt. of India.

- Five Days Customized Training Programme on “Design of Bridge Structure & Foundation” from July 22 to July 26, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 35 participants sponsored by NIRDA, Govt. of India.

- Five Days Customized Training Programme on “Quality Assurance, Health Assessment and Rehabilitation of Bridges” from August 05 to August 09, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 33 participants sponsored by NIRDA, Govt. of India.

- Five Days Customized Training Programme on “Quality Design construction & Quality Control of Flexible Pavements” from August 19 to August 23, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by NIRDA, Govt. of India.

- Five Days Customized Training Programme on “Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices” from September 09 to September 13, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 24 participants sponsored by NIRDA, Govt. of India.
Five Days Customized Training Programme on “Design construction & Quality Control of Flexible Pavements” from October 21 to October 25, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 33 participants sponsored by NIRDA, Govt. of India.

Five Days Customized Training Programme on “Landslide Mitigation & Detailed Project Report preparation” from November 25 to November 29, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 28 participants sponsored by NIRDA, Govt. of India.

Five Days Customized Training Programme on “Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices” from December 09 to December 13, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 29 participants sponsored by NIRDA, Govt. of India.

Five Days Customized Training Programme on “Landslide Mitigation & Detailed Project Report preparation” from January 06 to January 10, 2020. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 34 participants sponsored by NIRDA, Govt. of India.

Five Days Customized Training Programme on “Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices” from February 20 to February 24, 2020. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 35 participants sponsored by NIRDA, Govt. of India.

Five Days Customized Training Programme on “Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices” from February 24 to February 28, 2020. The training programme was attended by 55 participants sponsored by NIRDA, Govt. of India.

Five Days Customized Training Programme on “Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices” from March 02 to March 06, 2020. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 50 participants sponsored by NIRDA, Govt. of India.

One Day Customized Training Programme on “Road Safety Audit, for the engineers of PWD Tripura at Agartala” on June 04, 2019 at Agartala, Tripura. The training programme was attended by 37 participants sponsored by PWD Tripura, Govt. of Tripura.

Five Days Customized Training Programme on “Pavement Evaluation Techniques and
their Applications for Maintenance and Rehabilitation for the officers of Indian Air Force” from July 15 to July 19, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 15 officers sponsored by Indian Air Force, Govt. of India.

- Five Days Customized Training Programme on “Design of Bridge Structure & Foundation” from June 17 to June 21, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by SIRD, Govt. of Tamilnadu.

- Five Days Customized Training Programme on “Pavement Evaluation Techniques & their application for Maintenance & Rehabilitation” from July 01 to July 05, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by SIRD, Govt. of Tamilnadu.

- Five Days Customized Training Programme on “Design construction & Quality Control of Flexible & Rigid Pavements” from August 05 to August 09, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by SIRD, Govt. of Tamilnadu.

- Five Days Customized Training Programme on “R&D initiatives in the field of Road & Bridge Construction” from August 19 to August 23, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by SIRD, Govt. of Tamilnadu.

- Five Days Customized Training Programme on “Traffic Engineering & Road Safety Audit” from October 14 to October 18, 2019. The training programme was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 32 participants sponsored by SIRD, Govt. of Tamilnadu.

- Five Days Customized Training Programme on “Capsule on Airfield Engineering” for the officers of Border Roads Organisation” from December 02 to December 06, 2019. The training programme was attended by 15 participants sponsored by Border Roads Organisation, Govt. of India.

- Two Days Customized Training Programme on “Landslide Mitigation & Detailed Project Report Preparation” from February 10 to February 11, 2020. The training programme was attended by 11 participants sponsored by National Distaster Management Authority (NDMA), Govt. of India.

Some Glimpses of Customized Training Programme
Geotechnical & Landslide Investigation for Highway Projects (June 17-21, 2019)

Design of Bridge Structure & Foundation (July 22-26, 2019)
Quality Assurance, Health Assessment and Rehabilitation of Bridges” (August 05-09, 2019)
(b) Quality Design construction & Quality Control of Flexible Pavements (August 19-23, 2019)

(a)

(b) Landslide Mitigation & Detailed Project Report preparation (November 25-29, 2019)
Pavement Evaluation Techniques and their Applications for Maintenance and Rehabilitation (July 15-19, 2019)
(b)
R&D initiatives in the field of Road & Bridge Construction (August 19- 23, 2019)

(a)

(b)
Traffic Engineering & Road Safety Audit (October 14-18, 2019)
Capsule on Airfield Engineering (December 02-06, 2019)
International Training Programmes

- One Day Customized Training Programme on “Capacity building of delegation from Tanzania at CRRI” on August 06, 2019. The training programme was attended by 20 participants sponsored by LEA Associates South Asia Pvt. Ltd., New Delhi.
- One Day Customized Training Programme on “Capacity building of delegation from LASA at CRRI” on September 24, 2019. The training programme was attended by 20 participants sponsored by LEA Associates South Asia Pvt. Ltd., New Delhi.
- Twelve Days Customized Training Programme on “Soil Aggregate, Concrete Cement, Steel, Bitumen and Asphalt Tests” for the officers of NRAP-MRRD, Kabul – Afghanistan” from December 02 to December 13, 2019. The training programme was attended by 04 participants sponsored by NRAP-MRRD, Kabul, Afghanistan.

Glimpse of International Training Programmes

(a) Capacity building of delegation from Tanzania at CRRI on August 06, 2019.
(b) Modern Survey Techniques including GIS/GPS and Total Station & Quality Control, Material Testing Procedures & Lab Practices (February 24-28, 2020)

(a) Capacity building of delegation from LASA at CRRI on September 24, 2019.
(b) Capacity building of delegation from LASA at CRRI on September 24, 2019.
Specialized Certification Course

- CSIR-CRRI conducted 15 Days Certification Course on "ROAD SAFETY AUDIT AND OTHER ROAD SAFETY RELATED ASPECTS" from April 29 to May 13, 2019 for Road Safety Auditors / Highway Engineers / Traffic Engineers / Transportation Planners and Student Interns. The course was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 56 participants from various parts of India.

- CSIR-CRRI conducted 15 Days Certification Course on "ROAD SAFETY AUDIT AND OTHER ROAD SAFETY RELATED ASPECTS" from November 04 to November 18, 2019 for Road Safety Auditors / Highway Engineers / Traffic Engineers / Transportation Planners and Student Interns. The course was inaugurated by Prof. Satish Chandra, Director, CSIR-CRRI and it was attended by 65 participants from various parts of India.

Glimpse of Specialized Certification Course

ROAD SAFETY AUDIT AND OTHER ROAD SAFETY RELATED ASPECTS (April 29- May 13, 2019 & November 04-18, 2019)
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. The details of those who attended various training programmes and the specialized areas of training are given in section “Participation in Training Programs / Short Term Courses (Outside CRRI).

Publications

CSIR-CRRI Annual Report for the Year 2018-2019

The report is the profile of achievements of the Institute during the year 2018-2019. 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 2018-19.


During the year, two issues of CRRI Newsletters were planned to publish. The first Newsletter, April 2019-September 2019 has been already published while second Newsletter, October 2019-March 2020 is under documentation for printing. The Newsletters contained latest information related to R&D activities and other general information related to the Institute.

Other Activities

Dissemination of Publications

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 road and transporation engineering professionals / fraternity.

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 documents and shared with organisations like CSIR and Vigyan Prashar.

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 prepared and submitted for publication in various National & International Journals/Conferences by individual staff members. Once the papers were accepted for publications, cases pertaining to deputation of CRRI Scientists to attend various Conference/Symposia were processed by this division. The details of those who were deputed abroad are given in section “Deputation Abroad” on page 161.

ISTAG Activities

The scientists of the Institute were also deputed abroad under various collaborative, exchange and bilateral programme of CSIR to participate in various conferences/symposia/seminar/study programmes.

Visitors

Visits of distinguished professionals and delegates from various organizations related to road and road transportation from India and abroad to CRRI were organized facilitated during the year. The details of the visitors during the year are given in section “Visitors” on page 171.

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. The Institutional membership of the Institute is given in section “Membership of National and International Organisations” on page 180.

Technical Exhibition

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

80th IRC Annual Session from December 19 to December 22, 2019 at Patna, Bihar

As part of 80th IRC Annual Session from December 19 to December 22, 2019 at Patna, a technical exhibition was organized to showcase the latest in technologies, products and projects in the road and transport sectors for various stakeholders across the globe. CSIR-CRRI also took part of the exhibition by showcasing its expertise & capabilities in the fields of Roads & Transportation sector and got appreciation certification from the organizers.
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 2019-20 are as follows:

**PLANNING ACTIVITIES**

**Project Planning [Mission Mode/Fast Track Translational/ Focus Based Research/ 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 12 theme project proposal were prepared and submitted to CSIR. Coordinated with CRRI team in preparation of proposals and submitted to CSIR. Submitted three proposals on Focus Based Research projects for approval from CSIR. 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.

**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 affected at PME, soon after the money for the project is received along with In-Principle approval. Registration and 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/ brainstorming sessions where in every Division has come up with various plans and programmes to achieve the Government of India policies, CSIR-CRRI vision and to reach out common men.

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

**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 appropriate 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 from 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 under the chairmanship of Director. 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, PCRA, PSUs & 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 prepares the up to date projects summary and providing the information on projects that are to be ratified by the Management Councils. In addition, 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 review/evaluation by CSIR/Ministry. Projects undertaken during last 4 years by CRRI that have positive environmental impact have been provided to Niti Ayog.

**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.

PFMS: Division has facilitated and coordinated with F&A section, funding agencies, bank, Project Leaders and Research Fellows related to transfer of research grants/fund under PFMS portal.

GST related Activity

The Division regularly prepares the statement on the receipts and ensures for the payment by accounts section of GST on monthly basis. PME also prepares and files the returns of GST. 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 & Online Challan system 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 trained admin staff for effective implementation of HR module under ERP system in CRRI. In addition to it the division has facilitated administration/ F&A to to generate the salary as per 7th CPC through ERP and providing constant technical support.

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/ EOI for various projects with different organizations.

Projects Undertaken

External Cash Flow 2019-20
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.

**Services**

- 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 print journals and E journals received/accessible 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**

Book added during the period (01.04.2019 to 31.03.2020) 161
Total Number of books as on 31.03.2020 56528
Maps 688
Microforms 655
Videocassettes 122
Periodicals (Print) titles received (Foreign + Indian) 16

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.
Computer Centre & Networking
The main objective and function of CCN Division is to meet the ICT requirements in R&D related with Road & Transport area. It also Recommends and implements the information technology strategies, policies, and procedures by evaluating organization needs towards various IT services as listed below.

**LAN Infrastructure:** CRRI’s LAN Infrastructure has been secured by 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 optimal performance of LAN is maintained and made perimeter protection intact.

**Secured Wifi:** CCN operates the connectivity through a fully networked campus with state-of-the-art IT infrastructure, computing & communication resources, 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 a 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.

**Server & End-user protection:** 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.

**Application Development:** CRRI’s web portal (https:\\www.crridom.gov.in) is developed and maintained by CCN division. This Bi-lingual portal regularly updates the news& events, tender details, training programme details, Information on RTI Suo-motu disclosure etc.

CCN has developed and user interface software for an interactive KISOK system named **Archive Gallery Data Store and Retrieval System (AGDSR)** which is being operational at Geo- Engineering Materials Archives Gallery.

**Intranet Site Support:** CRRI Intranet Site provides the support for Online Library Search (Web OPAC), BIS Searching facility, Transport Database, Links for subscribed E-Journal, Driver Testing Software. Development of highly interactive intranet site is operational alongside.

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.
- Conducting Training programmes for increasing IT literacy among Group 1 and 2 Staff, Providing Industrial / summer internship project guidance to B.Tech Students etc.
- IT supports for Seminars, and Video conferencing and webinars
- Maintenance of AEBAS activities in the institute
- Providing E-Mail facility to all the Staff in the institute
- Alignment of CRRI with RTI Online, Govt of India portal, Suo-motu disclosure, submission of quarterly reports etc.
Maintenance
CIVIL infrastructure works executed during 2019-20 are as follows:

**COMPLETED WORKS:**

1. Renovation of rooma in Guest House - II

2. Renovation of Ground Floor Corridor and 1st Floor of Administration Block

3. Renovation of Civil Section (1st Floor of GTE division)

4. Supply, Installation, Testing and Commissioning of CCTV cameras at different locations of Institute premises
5. Creation of Modern Laboratory on Steel Slag & Alteration work in Rigid Pavement Division

6. Provision of Fire Alarm & Extinguishers system

7. Supply and laying of underground cables and installation of electrical panels/distribution boards
Mechanical and Transport
Thrust Areas

- Design and development of mechanical equipment required by R&D divisions
- Repair of mechanical equipment
- Transport Management

Significant Achievements

- Fabrication of Mould for I - Section Beam Casting
- Development of Ponding cum Debris Expulsion Test Equipment (Patent Applied)
- Creation of Expansion Joint Testing Facility
- Development of Nuclear Density Gauge mounting device
- Development of LVDT mounting device
- Development of Falling Weight Impact Tester
- Fabrication of Chimney models etc.
- Design & Development of Gym Facility

Major Infrastructural Facilities

- Spot Welding machine
- Lathe machine
- Welding Set (portable)
- Surface Grinder
- Gas welding set
Quality Management
Quality Management

Quality Management Division is responsible to ensure that IS/ISO 9001:2015 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 cum Change over audit for switching over to requirements of IS/ISO 9001: 2015, a higher level of quality standards in the working of the Institute. IS/ISO 9001:2008 Quality Management System was switched over to IS/ISO 9001:2015 Quality Management System in the Institute w.e.f. 01.06.2018.

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.
- To ensure Institute’s readiness for switching over to IS/ISO 9001:2015

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 subsequently and NC’s were closed.

Internal Quality Audit of the Institute was carried out from 14.9.18 to 27.9.18 to check and ensure whether the IS/ISO 9001:2015 QMS is effectively and efficiently in place in the Institute for Surveillance cum Change over audit to be conducted by certification agency i.e Bureau of Indian Standards (BIS) for IS/ISO 9001: 2015 certification. The audit findings were discussed in the Management Review Meeting.

Management Review Meeting (MRM)

Management Review Committee meeting chaired by Director, CSIR- Central Road Research Institute was held on 03.10.2018. Updation of Quality Management System (QMS) as per the requirements of IS/ISO 9001: 2015 to switch over to the new standard was discussed. The findings of the internal quality audit and its reports were discussed in detail in the Management Review Committee meeting held on 03.10.2018. 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.

Surveillance cum Change over Audit

Updated Quality System documentation comprising of Quality Manual of the Institute and QMD procedures was submitted to Certification Agency in the month of September, 2018 for conducting the surveillance cum switch over audit of the Institute. Surveillance cum Changeover audit was conducted by certification agency team on 12 & 13 November 2018 as per IS/ISO 9001: 2015 requirements. Institute has been licensed for IS/ISO 9001: 2015 Quality Management System.
राजभाषा (Rajbhasha)
Different types of activities were conducted during the last year 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 Pakhwada. Cash prize and certificates were also distributed to all 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. Almost two dozen research papers and articles were presented in different intellectual gatherings. Scientists were awarded cash incentives and certificates for four papers which were adjudged best in the technical Hindi paper competition organized during the last year. The Official Language Monitoring Committee, constituted by the Director, reviewed the Hindi work of sections and divisions from time to time.

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. The National Hindi Scientific Workshop on "Contribution of Science and Technology in Development of Infrastructure: 21st Century Challenges" was organized on 6th September 2019 at the Institute to promote the use of Hindi in scientific and technical works. 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, eighteenth & nineteenth issues of “Sarak Darpan”, the scientific magazine of CRRI were published.

राजभाषा प्रचार से संबंधित आयोजन

(1) हिंदी कार्यशाला

संस्थान के अनुसंधान और विकास तथा प्रशासन से संबंधित विभिन्न विषयों पर प्रत्येक तिमाही में हिंदी कार्यशाला का आयोजन किया गया अर्थात् वर्ष के दौरान ऐसी चार कार्यशालाएं आयोजित की गईं। इन कार्यशालाओं के लिए राजभाषा हिंदी के विशेषज्ञों, सूचना प्रौद्योगिकी के जानकारों, वैज्ञानिकों एवं तकनीकियों को संस्थान में आमंत्रित किया गया। इन विद्वानों ने हिंदी कार्यशाला के प्रतिमागियों को हिंदी में अपने विषय से संबंधित जानकारी दी तथा सभी प्रतिमागियों से अभ्यास कार्य भी करवाया। कार्यशालाओं के दौरान सरकारी कार्य में हिंदी में अभिव्यक्ति व उपयोग को बढ़ाने के लिए राजभाषा नीति एवं राजभाषा संबंधी प्रावधानों पर भी व्यापक चर्चा की गई।

हिंदी कार्यशाला के लिए आमंत्रित विशेषज्ञों में श्री विजय कुमार मल्लोत्रा, पूर्व निदेशक, रेल मंत्रालय तथा डॉ. मनीष मोहन गोरे, वैज्ञानिक अधिकारी, विज्ञान प्रसार समिति थे। पारस्परिक विचार-विमर्श एवं संयोजन के माध्यम से हिंदी कार्य को आराम बनाने के लिए हिंदी टेबल कार्यशालाओं का आयोजन भी किया गया। इनमें राजभाषा विभाग, गृह मंत्रालय के वार्षिक कार्यक्रम 2019-20 के अंतर्गत सरकार द्वारा निर्धारित लघु अनुपालन के साथ साथ संसदीय राजभाषा संस्थि के अनुसार अपेक्षित दायित्व को पूरा करने की आवश्यकता पर चर्चा की गई।

सरकारी आंकड़ों का रखरखाव, विभागीय प्रमाण पीपर्टेर्ड भरना, सुगमतापूर्वक हिंदी में कार्य करने की डिजिटल विधियाँ जैसे महत्वपूर्ण विषयों पर अंतःक्रियात्मक संवाद के माध्यम से संस्थान के सभी अधिकारियों और कर्मचारियों को अपना मूल कार्य हिंदी में करने के लिए प्रोत्साहित किया गया।
(2) हिंदी व्याख्यान व प्रस्तुतीकरण

संस्थान में विभिन्न विषयों पर हिंदी में व्याख्यान और
tकनीकी प्रस्तुतीकरण के आयोजन संबंधी नियमित श्रृंखला
को गत वर्ष भी जारी रखा गया। पिछले वर्ष के दौरान
संस्थान में हिंदी में निम्नलिखित व्याख्यान एवं तकनीकी
प्रस्तुतीकरण का आयोजन किया गया —

1. ‘सफलता के लिए जरूरी सकारात्मक सोच’
   — श्री एस.एस. गहर्वार, वरिष्ठ प्रधान वैज्ञानिक,
   सीआरआरआई, दिनांक 07 मार्च 2019

2. ‘सड़क पर दाएं या बाएं चलने का चलन कैसे
   आया’ — प्रो. सतीश चन्द्र, निदेशक, सीआरआरआई,
   दिनांक 20 मई 2019

3. ‘चांद और उस पर मानव के कदम’ — श्री रघुनाथ
   शिशू, लेखक, अन्वेषक व गेट्टे पार्कड़ी, दिनांक
   14 अगस्त 2019

4. ‘भूमंडलीकरण के दौर में हिंदी की चुनौतियां और
   समाधानां’ — प्रोफेसर कुमार शर्मा, हिंदी विभाग,
   दिल्ली विश्वविद्यालय, दिनांक 02 सितंबर 2019

5. ‘हिंदी में विज्ञान तथा प्रौद्योगिकी लेखन दू स्कूल और
   कैसे?’ श्री देवेन्द्र मेवाड़ी, विज्ञान लेखन व बाल
   साहित्यकार, दिनांक 12 सितंबर 2019

6. ‘सूक्ष्म सतहीकरण रू शहरी सड़क के रखरखाव
   हेतु पर्यावरण प्रदूषण मुक्त तकनीक’ — श्री सुनील
   जैन, वरिष्ठ प्रधान वैज्ञानिक, सीआरआरआई, दिनांक
   12 दिसंबर 2019
राजभाषा अनुभाग

(3) राष्ट्रीय हिंदी कार्यशाला, दिनांक 06.09.2019
सीआईआर—केंद्रीय सड़क अनुसंधान संस्थान में 6 सितंबर 2019 को ‘आधारभूत ढांचा के विकास में विज्ञान और प्रौद्योगिकी का योगदान : 21वीं सदी की चुनौतियाँ’ विषय पर राष्ट्रीय स्तर की एक कार्यशाला का आयोजन किया गया। भारत सरकार के पृथ्वी विज्ञान मंत्रालय ने कार्यशाला के आयोजन में सहयोग दिया। कार्यशाला में 21वीं सदी की उन चुनौतियों पर चर्चा की गई जिनका सामना वर्तमान में हमारा देश कर रहा है। सड़कों, यातायात, स्मार्ट विदेश, स्मार्ट संरचना, ग्रीन संरचना और स्मार्ट सामग्री के क्षेत्र में विशेष रूप से ये चुनौतियाँ गंभीर रूप धारण कर रही हैं। इनमें सबसे प्रमुख चुनौती संचार की उस भाषा के संबंध में है जिसका उपयोग जमीनी स्तर पर लोगों के एक बड़े वर्ग के द्वारा किया जाता है।
कार्यशाला के उद्घाटन समारोह में मुख्य अधिकारी डॉ. नक्सुल पारसर एवं विशिष्ट अधिकारी डॉ. दिनेश चमोला ‘शैलेश’ ने समारोह की शोभा बढ़ाई। उद्घाटन समारोह में आमंत्रित विद्वानों ने हिंदी के विकास में आने वाली बाधाओं, चुनौतियों और संभावनाओं पर विचार से प्रकाश डाला। इस राष्ट्रीय कार्यशाला में देश के विभिन्न संगठनों के 150 से अधिक प्रतिनिधियों ने भाग लिया तथा इसमें विभिन्न विषयों पर 30 से अधिक शैक्षिक हिंदी भाषा में प्रस्तुत किए गए।

कार्यशाला के दौरान कुल पांच समारोह आयोजित किए गए जिनकी अवधिकार मुख्य अधिकारी प्रो. डॉ. दिनेश चमोला शैलेश, डॉ. आई के पटेल, डॉ. पवन कुमार, डॉ. जगजीव सिंह ने किया।

इस संगोष्ठी के पैनल परिचार्यों में डॉ. मनोज पटेल, निदेशक निसकेयर, डॉ. जगजीव सिंह, निदेशक, पूर्वी विज्ञान मंत्रालय, डॉ. पवन कुमार, एसोसिएट योजनाविद, शहीद विकास मंत्रालय और प्रो. शतीश चंद्र, निदेशक, सीआरआरआई ने भाग लिया। पैनल परिचार्यों के दौरान इस बात पर बल दिया गया कि डिजाइन गाइडलाइन, ऑपरेशनल प्रशिक्षण मैनुअल, संपेक्षित ज्ञान का डेटाबेस मैनुअल को हिंदी भाषा में विकसित करने की आवश्यकता है। यह तभी संभव है जब केंद्र सरकार की आधिकारिक राजभाषा के रूप में हिंदी का उपयोग वैज्ञानिक और तकनीकी से संबंधित हर क्षेत्र में प्रमुख रूप से सुनिश्चित किया जाए।

(4) हिंदी पर्व 2019

हिंदी पर्व का उद्घाटन दिनांक 2 सितंबर 2019 को किया गया। उद्घाटन समारोह में सर्वप्रथम संस्थान के निदेशक प्रो. शतीश चंद्र ने सभी कर्मचारियों को हिंदी में काम करने के लिए प्रोत्साहित किया और पर्व के दौरान होने वाली विभिन्न प्रतियोगिताओं में भाग लेने के लिए आमंत्रित किया। पर्व के उद्घाटन समारोह की मुख्य अधिकारी प्रो. कुमुद शर्मा, दिल्ली विश्वविद्यालय ने अपने वक्तव्य में हिंदी के प्रचार व प्रसार के लिए गम्भीर प्रयास करने पर बल दिया। इस समारोह में संस्थान की हिंदी पत्रिका ‘सादर दर्पण’ किसको अंक 18 का विमोचन किया गया।
राजभाषा अनुभाग

हिंदी पखड़े के दौरान संस्थान के कर्मियों के लिए विभिन्न प्रतियोगिताओं का आयोजन किया गया जैसे – हिंदी निबंध लेखन प्रतियोगिता, आशु कहानी प्रतियोगिता, तकनीकी लेख प्रतियोगिता, भाषण प्रतियोगिता आदि का आयोजन किया गया। इन सभी प्रतियोगिताओं को हिंदी भाषी व अहिंदी भाषी दोनों वर्गों में आयोजित किया गया। विभिन्न विषयों से संबंधित प्रश्नोत्तरी प्रतियोगिता का आयोजन 09 सितंबर 2019 को अपराह्न में किया गया। हिंदी में ज्ञान बढ़ाने के साथ ही मनोरंजन एवं स्वस्थ प्रतिस्पर्धा का विकास करना प्रश्नोत्तरी का उद्देश्य था जिसमें यह प्रतियोगिता सफल रही।

दिनांक 17 सितंबर 2019 को हिंदी पखड़े का समापन एवं पुरस्कार वितरण समारोह का आयोजन किया गया। इस अवसर पर विभिन्न प्रतियोगिताओं के विजेताओं तथा हिंदी में सर्वश्रेष्ठ कार्य हेतु प्रशिक्षक, अनुभवी एवं कर्मचारियों को निदेशक महोदय द्वारा पुरस्कार दिए गए। हिंदी प्रतियोगिता में समीक्षित हिंदी तथा हिंदीतर, इन दोनों वर्गों के लिए प्रथम, द्वितीय व तृतीय पुरस्कार के अलावा सांतवर्ण पुरस्कार प्रदान किए गए।
संस्थान में पूरे वर्ष हिंदी में सरकारी कामकाज करने वाले कार्यकर्ताओं को मूल रूप से टिपणी व प्रारूप लेखन पुरस्कार योजना के अंतर्गत पुरस्कार व प्रमाणपत्र देकर सम्मानित किया गया। अधिकारियों हेतु चलाई जा रही निदेशक प्रोत्साहन पुरस्कार योजना के अंतर्गत प्रशासन तथा वैज्ञानिक व तकनीकी प्रमाणों से उल्लेखनीय हिंदी कार्य करने वाले अधिकारियों की भी पुरस्कृत किया गया। इसके अलावा इस वर्ष से निदेशक प्रोत्साहन पुरस्कार योजना शुरू की गई, जिसमें हिंदी में सर्वश्रेष्ठ कार्य हेतु एक अनुभाग एवं एक प्रभाग को निदेशक प्रोत्साहन पुरस्कार दिया गया। इस अवसर पर अपने संबोधन में संस्थान के निदेशक, प्रो सतीश चंद्र ने सभी पुरस्कार विजेताओं को बधाई दी तथा सभी कार्यकर्ताओं से हिंदी कार्य में उद्देश्य हेतु सामूहिक रूप से प्रयास करने का आह्वान किया।
संस्थान की राजभाषा कार्यान्वयन समिति की तिमाही बैठक का कार्यवृत्त

संस्थान की राजभाषा कार्यान्वयन समिति की वर्ष 2019 की चौथी एवं अंतिम तिमाही बैठक संस्थान के निदेशक, प्रो. सतीश चंद्र वर्गी की अध्यक्षता में दिनांक 24/10/2019 को संस्थान के सम्मेलन कक्ष में संपन्न हुई। बैठक में समिति के अध्यक्ष सहित 25 सदस्य एवं प्रतिनिधियों सम्मिलित हुए। सर्वप्रथम संस्थान के निदेशक एवं राक्षस के अध्यक्ष प्रो. सतीश चंद्र ने बैठक में उपस्थित समिति के सदस्यों का रवागत किया। तत्पश्चात निदेशक महोदय की अनुमति से सदस्य सचिव ने बैठक की कार्यसूची की मदद को क्रमशः प्रस्तुत किया।

मद सं 1 बैठक में सदस्य सचिव ने सीएसआईआर व राजभाषा बिभाग से प्राप्त विश्लेषणों तथा वार्षिक कार्यक्रम 2019-20 के निर्धारित लक्ष्यों की प्राप्ति सुनिश्चित करने पर बल दिया। राजभाषा से सम्बन्धित संवैधानिक प्रावधानों का उल्लेख करते हुए सभी प्रमुख व सदस्यों से निमंत्रण के अनुसार हिंदी में कार्य सुनिश्चित करने का अनुरोध
किया गया। इसके लिए यह सुझाव दिया गया कि सभी प्रमुखों का एक बैठक के लिए अनुमति दी जाए। इससे हिंदी से समाबिष्ट सूचनाओं को अविलंब प्रस्तुत किया जा सके। इसके लिए श्री डी. रविन्द्र, पीएम मोदी को यह कार्य सौंप गया गया।

मद सं 2 बैठक में जुलाई से सितंबर 2019 की तिमाही के लिए अनुभागों एवं प्रभागों से प्राप्त राजभाषा कार्यान्वयन संबंधी प्रमुख रिपोर्ट में पत्राचार, फाइल्स एवं अन्य दस्तावेजों पर टिपणी लेखन तथा धारा 3(3) के संबंध में दिए गए आंकों पर चर्चा की गई। सदस्य सचिव ने बताया कि प्रमुख रिपोर्ट में दिए गए आंकों के रिकार्ड का रखरखाव आवश्यक है ताकि राजभाषा मानीटर समिति के द्वारा आंकों का प्रभाव समाप्त किया जा सके। निदेशक महोदय ने नौटी प्रभाग को पत्राचार में हिंदी बदाने का निदेश दिया ताकि संस्था की समेतता तिमाही रिपोर्ट में बेहतर आंके दिए जा सकें।

मद सं 3 बैठक में सदस्य सचिव ने बताया कि हिंदी के प्रति सकारात्मक वातावरण का निर्माण करने के लिए हिंदी पत्राचार्ड के दौरान अनेक प्रतियोगिताओं का आयोजन किया गया। हिंदी पत्राचार्ड के दौरान अनेक वाणिज्यिक एवं विद्यार्थियों का संसरण में आमंत्रित भी किया गया, जिससे हिंदी से जुड़ी ज्ञानवर्धक जानकारी प्राप्त हुई। इसके साथ ही राष्ट्रीय हिंदी कार्यालय का आयोजन भी किया गया जिसके द्वारा संस्था में हिंदी के प्रति सकारात्मक वातावरण तैयार हुआ तथा राष्ट्रीय स्तर पर संस्था को ख्याति प्राप्त हुई। निदेशक महोदय ने नरकास, दक्षिण दिल्ली को कार्यालय की स्थानिक के साथ इसकी संक्षिप्त रिपोर्ट श्रेयित करने का निदेश भी दिया।

मद सं 4 बैठक में निदेशक महोदय ने यह सुझाव दिया कि स्वागती पर लगे डिजिटल हिस्ट्री बोर्ड को भी हिमाली डिस्प्ले किया जाए। इसके लिए सीसीए ग्राम पर हिमाली सामग्री उत्पादन के निदेश दिए गए तथा प्रशिक्षण कार्यक्रम की सूचना के संदर्भ में इसका कार्यान्वयन आईएसटी प्रभाग को सुनिश्चित करने को कहा गया। सदस्य सचिव ने यह भी बताया कि स्वागती कक्ष में सूचना बोर्ड की तरह प्रस्तुत स्टेडियम के केवल राजभाषा संबंधी गतिविधियों की सूचना के लिए प्रयोग किया जा रहा है।

मद सं 5 बैठक में सदस्य सचिव ने बताया कि ‘सड़क दर्पण’ पंजीकृत अंक 18 का प्रकाशन एवं वितरण किया गया तथा अगले अंक के प्रकाशन के लिए संस्थान के कार्यालयों से सामान्य विषयों पर अधिक से अधिक लेख और चर्चाएं अध्याय का अनुरोध किया गया है। निदेशक महोदय ने ‘सड़क दर्पण’ के अगले अंकों में संपन्न हुई राष्ट्रीय कार्यालय में प्रस्तुत किए गए कुछ लेखों को शामिल करने का सुझाव दिया।

अध्यक्ष महोदय को धन्यवाद के लिए बैठक का समापन किया गया।

हिंदी में तकनीकी प्रस्तुतीकरण
सीआरआरसीआई एक अनुसंधान एवं विकास प्रयोगशाला है जिसमें मूलतः वैज्ञानिक कार्यों में हिंदी के प्रयोग को बढ़ाने के लिए तकनीकी प्रस्तुतीकरण का नियमित आयोजन किया जाता है। तकनीकी विषयों की हिंदी में प्रस्तुतीकरण एवं व्याख्यान की श्रृंखला के अंतर्गत 12 दिसंबर 2019 को ‘सूक्ष्म सतहीकरण: राही सड़क के रखरखाव हेतु पदार्थ बदलने मुक्त तकनीक’ विषय पर हिंदी में एक तकनीकी प्रस्तुतीकरण का आयोजन किया गया।

पीईडी प्रभाग के वरिष्ठ प्रबंधक वैज्ञानिक श्री सुनील जैन ने सूक्ष्म सतहीकरण या मैट्रिक्सक्सिंग विषय पर तैयार किए गए अपने पावर बॉइल प्रस्तुतीकरण में बताया कि सड़क निर्माण के क्षेत्र में सूक्ष्म सतहीकरण एक अत्यंत महत्वपूर्ण विषय है जिसकी सहायता से सड़क के सेवाकाल में बढ़ोत्री रहती है। इस विषय से मरम्मत कार्य की लागत में बचत के साथ सड़क की उल्टी सतह सुनिश्चित करना भी संभव होता है जिससे परिवहन लागत में उल्लेखनीय कमी आती है।
श्री सुनील जैन ने अपने प्रस्तुतीकरण में यह दिखाया कि यह तकनीक हर दृष्टि से लागू है। तच्छित सेंटिंग भिंद्रण, तेजी से निर्माण, कम लागत, कुश्तिम क्षमता का रिप्रीकरण सड़क की दृष्टि में बढ़ोतरी, ऊर्जा का संस्कार व ध्वनि एवं वायु प्रदूषण में कमी जैसे बहुमुखी लाभ सड़क के क्षेत्र में मिल सकता है। प्रदूषण रहित इस तकनीक के माध्यम से रोड़ी की खपत में लगभग 80 प्रतिशत की कमी पाई गई है। शहरी सड़कों के रास्तों अपने दृष्टि से यौनीकृत व सस्ती तकनीक है।

हिंदी के माध्यम से आयोजित इस व्याख्यान के माध्यम से उर्जा संस्कार हेतु सूक्ष्म सहजकरण का वैज्ञानिक प्रक्रिया के विस्तारपूर्वक प्रदर्शन से संसाधन की सामी वैज्ञानिक लाभान्वित हुए। व्याख्यान के अंत में श्री सुनील जैन ने सभी संकारों और प्रश्नों का समाधान प्रस्तुत किया।

राकास तिमाही बैठक, दिनांक 15 जनवरी 2020
संसदान के राजमार्ग कार्यान्वयन समिति की वर्ष 2020 की पहली तिमाही बैठक संसदान के कार्यकारी निदेशक, डा. अनुराधा शुक्ला के अध्यक्षता में दिनांक 15 जनवरी 2020 को संसदान के परिसर कक्ष में हुई। बैठक में समिति के निष्पादित सदस्यों के साथ साथ आमंत्रित सदस्यों, नामित सदस्यों एवं प्रमुखों के प्रतिनिधियों ने भाग लिया। संसदान में राजमार्ग कार्यान्वयन को गाते देने के लिए राजमार्ग कार्यों की समीक्षा की गई और निम्नलिखित निर्णय लिए गए –

मद सं 1 बैठक में सदस्य सचिव ने बताया कि राजमार्ग कार्यान्वयन से संबंधित सूचनाओं के आदान-प्रदान के लिए संसदान के सभी प्रमुखों का व्हाट्सएप युप बना दिया गया है। इस समूह में कार्यालय की आवश्यक सूचनाओं के साथ-साथ हिंदी से संबंधित जानकारियों को साझा किया जाता है। बैठक में राजमार्ग विभाग, भारत सरकार से प्राप्त दिशानिर्देशों तथा वार्षिक कार्यक्रम 2019-20 के निर्माणित लक्ष्यों के संरचन में संसदान की राजमार्ग से संबंधित प्रगति पर चर्चा की गई। संसदान में राजमार्ग संभव लक्ष्यों की पूर्ति के लिए बनाए गए जांच विविधों द्वारा कदाई से नियमों के अनुपालन पर बल दिया गया।

समिति ने इस पर अपनी सहमति व्यक्त की।

मद सं 2 बैठक में अक्टूबर से दिसंबर की तिमाही के लिए अनुमानों एवं प्रमाणों से प्राप्त तिमाही के आंकड़ों पर चर्चा की गई। कार्यकारी अध्यक्ष महोदय ने इस बात पर बल दिया कि तिमाही प्रगति रिपोर्ट में व्यक्तिक आंकड़े ही दिए जाएं। इस दृष्टि से प्रदान, फाइल्स एवं अन्य दस्तावेजों पर टिप्पणी लेखन तथा धारा 3(3) के संबंध में सभी अनुमानों एवं प्रमाणों के द्वारा रिकॉर्ड का नियमित रखरखाव किया जाना आवश्यक है। राजमार्ग सलाहकार समिति के द्वारा निर्मित अंतराल पर आंकड़ों का प्रयोग सामान्य एवं संबंधित रिकॉर्ड की जांच किया जाना भी अपेक्षित है। इस रिकॉर्ड के अंतराल हिंदी में किए गए विशेष कार्यों, उपलब्धियों तथा राजमार्ग कार्यान्वयन संबंधित विषयों उपयोग का विवरण अनिवार्यतः दर्ज किया जाए तथा तिमाही प्रगति रिपोर्ट में इसकी प्रविष्टि की जाए। यह निर्णय दिया गया कि सभी अनुमान एवं प्रमाण हिंदी के उल्लेखनीय कार्यों की मासिक रिपोर्ट राजमार्ग अनुमान को भेजेंगे।

मद सं 3 संसदान की तिमाही प्रगति रिपोर्ट के संबंध में राजमार्ग विभाग, गृह मंत्रालय तथा राकास, दक्षिणी
राजभाषा अनुभाग
dilili se prap tai shiksha ke pattron par baetak me chaar ki gaai. upyukta pharon me utaye gaar vinucon ke aalok ke sada shivich ne bataaya ki 'ka' aur 'ka' kehon ke liye hindi me apshikhat pranchar 100% hai lekin hamaara sanshathan abhi isse thodha pichhe hai, jiskay 'ga' kehtay ke liye nirvishan 65% ke turno me hamaara pranchar bhatu abhik hai. issi prakar, hindi me taypini lekhon ke liye bahar sarkar svara nirvishan laky 75% hain jabkay picchili tithamai ke dooana sanshathan me laghama 92% taypiniyana hindi me likhe ga hai. yeh bhatu abhikshay hai ki tithamai pragati riport ko savkhama-purvikh bhata jaaye aur sahi aankh de de de jaaye.

Mad 4: baetak me tithamai pragati riport me utlipit anumagayon aur pramanayon dvara sampan vishesh hindi karyar par chaar ki gaai. sada shivich ne bataaya ki sanshathan ke vekhsait par sieasat, fand se sanshikht suutanu jiitaya praman ke dharaya hindi me bhi darshayi ga hai jo adhik sapta aur pramanik hai kyono sanshikht abhikar hara isse mulk rup se hindi me swamb taymar kiyaa ga hai. samiti ko sochita kiyaa ga ki vartman tithamai ke antagant hindi me prasashantik nayon se sanshikht karvanarala ke aayojan prashishit hai. pramanay abhikar shree santev ne is karvanarala ke liye aieaistam, avakasvistjor aadhi se visheshon ko buanal calle sujalva digha. isse xarap, akshar, tith, daa, daa, daa ke nayon abhikar par chaar ke jh sakthe hai. yeh karvanarala vishesh rup se nanvanikud karvikon ke saath-sath sanshathan ke sambhava rup ke karvikon ke liye upyogini sihie hongo.

Mad 5: baetak me sada shivich ne bataaya ki 'sadhk daya' patniara, anok 19 ki vishya samamrhi ko adhikm rup diya ja raha hai. samiti ne picchili tithamai me aeyojit takniki prastuti karan ke shrothakala ko jagati rakhne ke sujaya digha. sadas shivich ne bataaya ki aaya sanshanon ke tath sanshathan me aaye din ke antakhir takniki karvanarala ko aayojan kiyaa ja sakthe hai. do ya teeran aarandiki praman minlar takniki karvanarala me prastuti karan deyega tatha shej praman aayog me tithamaiyone ke aayojan me sushayog kareme. karvanarali

अध्यक्ष महोदय ने सुझाव दिया कि चारों तिमाहियों के संगम में राजभाषा के कायाँ में प्रगति को दर्शाने वाला प्राक्त या रिपोर्ट समिति को प्रस्तुत किया जाए। प्रशासन अधिकारी ने सुझाव दिया कि राजभाषा कार्यमूलक समिति में संगम के वित्त और लेखन तथा मंडल व क्रय अनुमोदन के दोनों अनुमोदन अधिकारियों को भी पदेन सदस्य बनाया जाना चाहिए। समिति ने इस पर अपनी सहमति यथक की।

हिंदी कार्यशाला, दिनांक 04 दिसंबर 2019
राजभाषा कार्यमूलक को अधिक प्रभावी बनाने में हिंदी में नियोजित कार्यशाला का आयोजन महत्वपूर्ण होता है। संघ सरकार की राजभाषा नीति, राजभाषा से संबंधित नियमों आदि की जाँचकारी देना, हिंदी में सुगम विधि से कार्य करने के संबंध में चर्चा करना एवं अध्ययन कार्य आदि हिंदी कार्यशाला के आयोजन का उद्देश्य होता है। समय रूप से यह राजभाषा कार्यमूलक को गति देने की दृष्टि से महत्वपूर्ण है। यही कारण है कि हिंदी कार्यशाला से संबंधित आंकड़े यथा तिमाही के दौरान कार्यशाला आयोजन की तिथि एवं संख्या, प्रशिक्षण की अवधि (घंतों में), प्रशिक्षित अधिकारियों की संख्या, प्रशिक्षित कर्मचारियों की संख्या तथा कुल संख्या आदि संस्थान की तिमाही प्रगति रिपोर्ट में दिए जाते हैं।
राजभाषा के प्रभावी कार्यमूलक के इस उद्देश्य को ध्यान में रखते हुए 04 दिसंबर 2019 को संस्थान में हिंदी कार्यशाला का आयोजन किया गया। इसमें आरएडी प्रमाण तथा प्रशासनिक प्रमाणों के 34 प्रतिभागी (10 अधिकारी एवं 24 कामिक) शामिल हुए। सर्वप्रथम श्री एस.एस. गहलोत, विद्यार्थी प्राप्त विज्ञानके ने रिसर्च परियोजनाओं को जगमनी तत्त्व पर लागू करने में हिंदी भाषा की भूमिका विषय पर अपना व्यक्तिमत दिया। उन्होंने बताया कि आरएडी कार्यों के परियोजना को जनता तक पहुँचाने के लिए तथा राजभाषा नीति के पालन की दृष्टि से हिंदी का उपयोग महत्वपूर्ण है। हिंदी एवं अंग्रेजी मिश्रित भाषा में परियोजनात्मक करने जन उपयोगी आरएडी कार्यों का प्रचार और प्रसार किया जा सकता है।

130 CSIR-CRRI Annual Report 2019-20
राजभाषा अनुभाग

कार्यशाला के दूसरे सत्र में तिमाही प्रगति रिपोर्ट भरने के संबंध में चर्चा की गई। राजभाषा विभाग, गृह मंत्रालय के वार्षिक कार्यक्रम 2019–20 के अंतर्गत सरकार द्वारा निर्धारित लक्ष्यों के पूर्ति पर अनुपालन के साथ साथ संसदीय राजभाषा समिति के अनुसार अपेक्षित दायित्व को पूरा करने के लिए सरकारी कामकाज से संबंधित आंकों का खराबान अपेक्षित होता है। सत्र में तिमाही प्रगति रिपोर्ट भरने में आने वाली कार्यनालय के संबंध में चर्चा की गई और सभी समस्याओं का समाधान किया गया। हिंदी कार्य को आसानी और शीघ्रता से करने में सहायक विविध विज्ञाता दृष्टि पर चर्चा की दौरान भारत सरकार के राजभाषा विभाग के साइट पर उपलब्ध विभिन्न सुविधाओं के उपयोग की जानकारी भी दी गई।

संसदीय में आयोजित हिंदी कार्यशाला के अंतिम सत्र में राजभाषा मॉनिटर समिति के दोनों सदस्यों – वर्तमान प्रधान वैज्ञानिक श्री सुनील जैन व श्री एस एस गांधी के सहयोग से हिंदी अधिकारी ने हिंदी में कार्य करने संबंधी समस्याओं का समाधान प्रस्तुत किए। प्रतिभागियों को हिंदी में काम बढाने के लिए विज्ञाता सुविधाओं का अधिकारिक प्रयोग करने के लिए प्रेरित किया गया। इस सत्र में, वॉलेस टाइपिंग, ऑनलाइन अनुवाद, हिंदी में इंग्लिश, ऑनलाइन शब्दकोश संबंधी सुविधाओं पर भी चर्चा की गई तथा हिंदी में काम बढाने के लिए प्रतिभागियों को प्रेरित किया गया।

हिंदी संपर्क कार्यशाला

अवधि – जनवरी से मार्च 2020

वर्ष 2020 की पहली हिंदी कार्यशाला को कौन्सल संपर्क कार्यशाला के रूप में आयोजित किए गये। कॉविड-19 जनित विशेष परिस्थितियों को व्यवस्था में रखते हुए जनवरी से मार्च की अवधि के लिए इस तिमाही कार्यशाला का आयोजन गैर राजनीतिक विचार से संपन्न किया गया। इसके लिए विज्ञाता विशेष एवं सामाजिक संचार का उपयोग करते हुए, संदेश और संचार का माध्यम अपनाया गया तथा हिंदी में काम बढ़ाने के लिए प्रेरित किया गया। कॉविड-19 के कारण घोषित लॉकडाउन तथा कार्यवाही में अधिकांश कार्यालयों की अनुपस्थिति को देखते हुए इंग्लिश व वॉलेसएप्स के द्वारा राजभाषा कार्यन्यय की प्रमुख बातों को जानकारी समी प्रमुखों को प्रेरित की गई।

संपर्क कार्यशाला के दौरान सभी आरएंडडी प्रमाणियों में हिंदी में कार्य को अपेक्षित मात्रा तक बढ़ाने के लिए सभी प्रमुखों से अनुरोध किया गया कि पत्राचार, फाइल बकरी, टिप्पणी लेखन आदि मूल रूप से हिंदी में ही करें और करवाएं। इसके साथ साथ आवेदन लिखना, टेस्टिंग
रिपोर्ट बनाना, हस्ताक्षर करना, रिकॉर्ड रखना आदि में हिंदी का ही प्रयोग अपेक्षित है। प्रमाणों के द्वारा व्याख्यान, शोध पत्र, लेखन व प्रकाशन आदि हिंदी में सुनिश्चित किए जाएं। साथ ही, प्रमाणों में चार्ट, डिस्प्ले सामग्री, यंजों पर पर दर्शावं गए विवरण, नेमप्लेट, मुलाकाती कार्ड, मुहर आदि हिंदी या उच्चारित होने चाहिए। तकनीकी रिपोर्ट, परियोजना रिपोर्ट, अन्य रिपोर्ट आदि में भी हिंदी का अधिकारिक प्रयोग अपेक्षित है।

सभी प्रमुखों को सूचित किया गया कि संघ का राजकीय कार्य हिंदी में करने के लिए भारत सरकार के गृह मंत्रालय द्वारा वार्षिक कार्यक्रम 2020–2021 जारी कर दिया गया है। इसकी पीडीएफ प्रति सभी की सूचनार्थ एवं अनुपालन के लिए मेजी गई और राजमार्ग संबंधी भारत सरकार के दिशानिर्देश के अनुपालन का अनुष्ठान किया गया। संघ सरकार की राजमार्ग नीति के अनुसार हिंदी में कार्य करना सबका संवैधानिक दायित्व है। संस्थान में निर्धारित हिंदी के जांच प्रश्नों के अनुसार भी सबको भारत सरकार के दिशानिर्देशों का अनुपालन सुनिश्चित करना चाहिए।

वर्ष 2020–2021 में संघ के कार्यवाहक आयोग के प्रमुख अर्थव्यवस्था सदस्यों, हिंदी में प्रदीषण तथा सभी अधिकारियों तथा सभी वैज्ञानिकों का यह सामूहिक दायित्व है कि मार्ग संबंधी दिशानिर्देशों का पूर्ण अनुपालन सुनिश्चित कराएं।
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, and disciplinary issues, apart from other service matter that may come up from time to time. This division has the following sub-divisions.

- DRRI SECRETARIAT
- PERSONNEL CELL
- VIGILANCE CELL
- ESTABLISHMENT-I
- ESTABLISHMENT-II
- SECURITY
- GUEST HOUSE (WING I & II)
- CANTEEN
- FINANCE & ACCOUNTS
- STORES & PURCHASE DIVISION
General Information
Important Days Celebrations
Important Days Celebrations

NATIONAL TECHNOLOGY DAY (MAY 10, 2019)
National Technology Day 2019 was celebrated on Friday, May 10, 2019. On this occasion, a lecture on the topic “Bitumen Stabilized Aggregate for Rehabilitation” was delivered by Shri Vijay Kumar Singh, Engineer in Chief & Head of the Department, UP Public Works Department who was invited as the Chief Guest for the Function.

ANTI-TERRORISM DAY (MAY 21, 2019)
Anti-Terrorism Day 2019 is observed in the country every year on 21st May to wean away the people specially youth from terrorism and cult of violence by enlightening the sufferings of the common people due to commission of such acts and showing how it is prejudicial to the national interest. A pledge taking ceremony on the observance of the anti-terrorism day was held on May 21, 2019 at CSIR-CRRI campus and it was administered by Prof. Satish Chandra, Director, CSIR-CRRI and attended by scientists & staff members of the Institute.
WORLD ENVIRONMENT DAY (JUNE 07, 2019)

World Environment Day 2019 was observed on June 07, 2019 to raise the awareness about protecting the environment as per United Nation’s initiative. On this occasion, Ms. Neha Vyas, Senior Environment Specialist, The World Bank, New Delhi was the Chief Guest and she delivered a lecture on the topic “Roads & Environment: Going Green”. As a part of this observance, a tree plantation drive was made in CSIR-CRRI campus (behind the Guest House Wing-II) by Prof. Satish Chandra, Director, CSIR-CRRI.

INTERNATIONAL YOGA DAY (21 JUNE, 2019)

CSIR-CRRI celebrated the International day of Yoga by organizing Yoga session in the morning of June 21, 2019. The YOGA session was conducted by Dr. Neelam J Gupta, Principal Scientist & Head, ILT of CSIR-CRRI. Prof. Satish Chandra, Director, CSIR-CRRI graced the occasion by inaugurating the Yoga session with prayer and it was concluded with a pledge. The dedication and enthusiasm shown by staff members and trainee engineers were commendable.
CRRI FOUNDATION DAY (JULY 16, 2019)
CSIR-CRRI Foundation Day was celebrated on July 16, 2019. On this occasion, Dr. Shekhar C Mande, Director General, CSIR & Secretary DSIR New Delhi was the Chief Guest. Dr. Shekhar C Munde addressed all the scientists and staff members during the Foundation Day lecture and emphasized for more innovative research to fulfill the needs of the society.

INDIA INDEPENDENCE DAY (AUGUST 15, 2019)
On the occasion of 72nd India Independence day, Prof. Satish Chandra, Director, CSIR-CRRI hoisted the National Flag on August 15, 2019 at CSIR-CRRI campus. The function was attended by the scientists, students and staff members and also their family members. The devotional and patriotic songs / poems were sung / recited on this occasion by the CRRI staff members and their wards.
**CSIR FOUNDATION DAY (SEPTEMBER 26, 2019)**

CSIR Foundation Day was celebrated on September 26, 2019 at CSIR-CRRI. On this occasion, Sh. Bhupendra Kainthola, Director, Film and Television Institute of India, Pune was the Chief Guest and he delivered the foundation day lecture. The function was attended by the Scientists, staff members, other employees and ex-colleagues of CSIR-CRRI. Prof. Satish Chandar, Director, CSIR-CRRI addressed the gathering and highlighted the progress and the journey made by CSIR-CRRI over the years. Various prizes were given away by the Chief Guest to the winners of various competitions organized by CSIR-CRRI for the children of CSIR-CRRI’s employees as a part of this celebration. CSIR-CRRI employees who had completed 25 years of their service in CSIR-CRRI and all those who retired during September 2018 to August 2019 were also honoured and mementoes were presented to them by the Director, CSIR-CRRI. On this occasion the Chief Guest also released CSIR-CRRI Telephone Directory and CSIR-CRRI Annual Report for the year 2018-19.

**VIGILENCE AWARENESS WEEK (OCTOBER 29 to NOVEMBER 01, 2019)**

Vigilance Awareness Week “Integrity- A way of life” was observed at CSIR-CRRI during 28th October to 1st November 2019. On October 28, 2019 a pledge was administered by the Director, CSIR-CRRI to the staff members of CRRI for maintaining integrity and to continue to strive to bring about transparency in all spheres of life. Banners and posters were displayed at the prime location in the premise of the Institute. Various competitions like quiz, speech/debate and Nukkad Natak were organised at CRRI for Vigilance awareness among staff and the students.
Important Days Celebrations
RASHTRIY EKTA DIVAS (OCTOBER 31, 2019)

On the eve of “Communal Harmony Campaign and Fund Raising Week” and Sardar Vallabh Bhai Jayanti, a National Integrity Pledge was taken by all the staff members of CSIR-CRRI on October 31, 2019.
**NATIONAL INTEGRATION WEEK (NOVEMBER 19-25, 2019)**

National integrity pledge was administered by the Director, CSIR-CRRI to the staff members of CSIR-CRRI on November 19, 2019.

**NEW YEAR DAY (JANUARY 01, 2020)**

A get-together was organised on the occasion of New Year Day at CSIR-CRRI on 1st January 2020. Prof. Satish Chandra, Director CSIR-CRRI, in his address highlighted the achievements of the Institute during the preceding year (2019) and expressed the hope that the scientists and technologists will do more R&D work in the coming year and motivated the CRRI family to meet new challenges and demands in the field. Prof. Satish Chandra extended best wishes to all the staff members and their families of the institute.
31st NATIONAL ROAD SAFETY WEEK and ROAD SAFETY AWARENESS CAMPAIGN (January 11-17, 2020)

31st Road Safety Week was observed to increase understanding of the dangers related to high speeding and other risk taking practices, thereby saving lives on the roads. As a part of Road safety week, various activities were conducted by CSIR-CRRI team for Bicycle safety, two wheeler safety, bus safety and pedestrian safety. The main theme of the week was pedestrians’ safety campaign in which approximately, 5000 pamphlets in bilingual message and full length Road Safety banners were prepared displaying safety aspects for pedestrians and bicyclists’ safe movements and safety rules. These banners showing safe activities and road safety rules for all categories of road users were fixed on the walls of institute premises so that all road users commuting on the NH-2 can see and learn from them. Posters and Pamphlets were also distributed to pedestrians and vehicle users on Delhi-Mathura Road.
Workshops/Conferences
& Meetings Organised
Inauguration of “Geo-engineering Material Archive Gallery” on April 23, 2019

A new and unique facility “Geo-engineering Material Archive Gallery” has been created under an in-house project in Geotechnical Engineering Division. This facility was formally inaugurated on April 23, 2019 by Prof. Satish Chandra, Director, CSIR-CRRI, New Delhi. Geo-engineering Material Archive Gallery is now functional and opened for the trainees and other visitors. Basic aim of this project was to create a unique facility in CSIR-CRRI, New Delhi to display various rocks, soils and other different engineering materials (synthetic and natural) used in road construction as well as in the slope protection works at one place for visitors, trainees and students.

123rd Research Council Meeting on May 14-15, 2019

123rd Research Council Meeting of CSIR-CRRI was held on May 14-15, 2019 in CSIR-CRRI. Prof. Satish Chandra, Director, CSIR-CRRI welcomed Prof. Tarun Kant, the Chairman and all other members of the research council. Various presentations were made by scientists of the institute during the meeting.

50th Management Council Meeting on July 19, 2019

50th Management Council Meeting of CSIR-CRRI was held on July 19, 2019 under Chairmanship of Prof. Satish Chandra, Director, CSIR-CRRI. Various agenda items / issues submitted by respective HoDs/Sectional Heads of the institute were discussed and approved.

Inauguration of 4th Arvind Verma Memorial Lecture on August 21, 2019

Prof. Satish Chandra, Director, CSIR-CRRI hosted and inaugurated “4th Arvind Verma Memorial Lecture” on August 21, 2019 organized by IGS Delhi Chapter. Two invited keynote speakers Dr R K Bhandari
(Topic - The Urgency for Resurgence of the Culture of Geotechnical Engineering Practice in India and Prof. G V Rao (Topic - Geosynthetic Reinforced Soil Structures - The Road Ahead) delivered lectures. The event was attended by the members of IGS and other staff members of CSIR-CRRI.

**Second Dr. P. Raychaudhuri Memorial Lecture on August 28, 2019**

CSIR-CRRI started “Dr. P. Raychaudhuri Memorial Lecture Series” in 2018 in the honour of Late Dr. P. Raychaudhuri, the First Head, Bridge Division, for his significant professional contributions to the Nation. The 2nd Lecture of the Series was organised on August 28, 2019 and Prof. Tarun Kant, Emeritus Professor & INSA Senior Scientist, IIT-Mumbai and Chairman, Research Council, CSIR-CRRI delivered the lecture on “Six Decades of Research in Mechanics of Composites”. Prof. Satish Chandra, Director, CSIR-CRRI felicitated Prof. Tarun Kant and Mrs. P. Raychaudhuri.

**Audit of CSIR-CRRI as per IS/ISO 9001: 2015 Requirements**

Audit of CSIR-CRRI as per IS/ISO 9001: 2015 requirements was conducted on September 04, 2019 by auditors of BIS, certification agency. The auditors were satisfied with the current system / procedure followed in CSIR-CRRI and approved the extension of ISO 9001 certificate to CSIR-CRRI.

**National Hindi Workshop on “Development of Basic Infrastructure Development and Challenges of 21st century” was organised on September 06, 2019**

A National level Hindi Workshop on “Development of Basic Infrastructure and Challenges of 21st Century” was organised on September 06, 2019 by CSIR-CRRI in association with the Ministry of Earth Sciences as a part of Hindi Pakhwara. The
Professors, Engineers and Architects stressed upon the usage of Hindi language. During the workshop many students, architecture and engineers presented their research papers on various topics related to infrastructure development & challenges and spoke on the importance of Hindi language.

**Inauguration of Half Day Workshop on “Geotechnical Engineering Practice - Case studies” on September 24, 2019**

Prof. Satish Chandra, Director, CSIR -CRRI hosted and inaugurated half day workshop on “Geotechnical Engineering Practice - Case studies” on September 24, 2019 which was organized by Indian Geotechnical Society, Delhi Chapter. Details of presentations made during the workshop by different experts are given below:

a.) Mrs. Atasi Das, GM, G R Infraprojects Ltd.
   
   Title of presentation: “Reinforced Earth Structures for Hill Roads”.

b.) Dr. P S Prasad, Principal Scientist, CSIR-CRRI
   
   Title of presentation: “Importance of Field Investigation for Geotechnical Solutions”.

C.) Sh. Mohit Jhalani, Manager, NTPC
   
   Title of presentation: “Planning and Design of Ash Disposal System”.

**Awareness Program on Fire & Safety on September 20, 2019**

A one day workshop on “Fire & Safety” was organised on September 20, 2019 by the Maintenance Division for staff members of CSIR-CRRI.
CSIR-CRRI organised Scientist-Student Interactive Workshops under JIGYASA Programme

The Council of Scientific and Industrial Research (CSIR) has launched a student-scientist connect programme called 'JIGYASA' on July 06, 2017, under which CSIR has joined hands with Kendriya Vidyalaya Sangathan. The focus of this programme is to connect school students and scientists so as to extend student’s classroom learning with that of a very well planned research laboratory based learning. This initiated scientific interaction between present scientific fraternities and the upcoming generation and also imbibed curiosity and scientific vision in children. The mentorship and encouragement of our scientists to foster scientific temper give continuity for technological advancement of India. This inculcated the culture of inquisitiveness on one hand and scientific temper on the other, amongst the school students and their teachers. As a part of JIGYASA programme, CSIR-CRRI organised various interactive meets from April 01, 2019 to March 31, 2019 for the students of different schools of Delhi NCR. A total of 781 students and 55 teachers participated in these meets.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Date</th>
<th>Name of the Programme</th>
<th>No. of Days</th>
<th>No. of KV Schools</th>
<th>No. of Students</th>
<th>No. of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>05-04-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>2</td>
<td>47</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>25-06-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>2</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>09-07-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>2</td>
<td>91</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>30-07-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>2</td>
<td>73</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>26-08-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>8</td>
<td>374</td>
<td>23</td>
</tr>
<tr>
<td>6</td>
<td>30-10-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>1</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>27-12-2019</td>
<td>Interactive Meet/Workshop</td>
<td>1</td>
<td>1</td>
<td>56</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>18</td>
<td>781</td>
<td>55</td>
</tr>
</tbody>
</table>
124th Research Council Meeting of CSIR-CRRI on December 02-03, 2019

124th Research Council Meeting of CSIR-CRRI was held on December 02-03, 2019 in CSIR-CRRI. Prof. Satish Chandra, Director, CSIR-CRRI welcomed Prof. Tarun Kant, the chairman and all the members of the research council. Various presentations were made by scientists of the institute during the meeting.

Mass Housing Workshop on February 20, 2020

Mass housing workshop was organised on February 20, 2020 at CSIR-CRRI for Skill Development and Technology dissemination. It was attended by students, researchers, technocrats and other stake holders.
Honours & Awards Received
Prof. Satish Chandra, Director, CSIR-CRRI was elected Fellow of National Academy of Science (India), FNASc.

Sh. S.S. Gaharwar, Sr. Pr. Scientist received the ‘Outstanding Concrete Technologist Award of Western U.P – 2019’, from the Indian Concrete Institute, Western U.P Centre, Ghaziabad (U.P).

Dr. Vasant G. Havangi, Chief Scientist received CIDC Vishwakarma award (2019). A Trophy and Scroll of commendation from was given to him from the Board of Governors of Construction Industry Development Council (CIDC) for outstanding contribution to Research and Development under the Category ‘Scientist’. New Delhi.

Smt. G. S. Parvathi, Scientist received IGS Delhi Chapter Young Geotechnical Engineer Award 2019 on September 27, 2019.

Mr. Dinesh V. Ganvir, Principal Scientist was invited as Session Chair for theme on “Utilization of waste materials, Sustainability” during 5th Conference of Transportation Research Group (CTRG-2019), December 18-21, 2019, Bhopal.

Ms. Kamini Gupta, Senior Technical Officer received appreciation certificate under Oral Paper presentation category in CTSEM May 23-24, 2019, organised by SVNIT, Surat.

Sh. S.S. Gaharwar, Sr. Pr. Scientist received the ‘Bharat Vikas Award – 2019’, from the Institute of Self Reliance, Bhubaneshwar (Odisha) for ‘Quality Standardization in Highway Engineering’.
Invited Lectures/Talks Delivered/Meetings Attended (Outside Crri)
## Invited Lectures/Talks Delivered/Meetings Attended (Outside Crri)

<table>
<thead>
<tr>
<th>Name &amp; Designation of Staff</th>
<th>Title of Lecture/Speech</th>
<th>Purpose (conference or otherwise) Give full details</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Satish Chandra, Director</td>
<td>Application of UAV in Highway Sector</td>
<td>International Conference on Unmanned Aerial Systems in Geomatics, IIT Roorkee at Noida</td>
<td>Apr 06, 2019</td>
</tr>
<tr>
<td></td>
<td>Road Safety at Intersections</td>
<td>Safer Mobility 2019 (ICSM-19) at IIT Delhi</td>
<td>May 31, 2019</td>
</tr>
<tr>
<td></td>
<td>Challenges of Transport Sector</td>
<td>FCE 2019 at Mahindra Ecole Centrale, Hyderabad</td>
<td>Aug 30, 2019</td>
</tr>
<tr>
<td></td>
<td>Green Technologies for Highway construction</td>
<td>Workshop on ‘Highway Development – Challenges and Way Forward’ organized by Indian Academy of Highway Engineers (IAHE), Noida</td>
<td>Nov 19, 2019</td>
</tr>
<tr>
<td>Dr. Pardeep Kumar, Sr. Principal Scientist &amp; Team</td>
<td>Meeting with Sh. G. Sudhakaran, Minister for Public Works and Registration, Govt. of Kerala at Thiruvananthapuram</td>
<td>Development of Road Maintenance Management System (RMMS) for PWD, Kerala</td>
<td>Jun 19, 2019</td>
</tr>
<tr>
<td>Dr. Anuradha Shukla, Chief Scientist</td>
<td>Climate Resilient Roads for Adaptation to Climate Change</td>
<td>International Conference on “Climate Change Impacts Management (CCIM 2019)” at Gujarat University, Ahmedabad</td>
<td>Aug 05-06, 2019</td>
</tr>
<tr>
<td>Mr. G K Sahu, Sr. Principal Scientist</td>
<td>Health Monitoring of Bridges through Instrumentation</td>
<td>Civil Engineering Department, MN NIT Allahabad</td>
<td>Sep 20, 2019</td>
</tr>
<tr>
<td>Mr. Manoj K. Shukla, Sr. Pr. Scientist</td>
<td>(i) Guidelines for Cement Grouted Bituminous Mixes (CGBM),</td>
<td>Mid Term Council Meeting of IRC at Goa</td>
<td>Aug 08, 2019</td>
</tr>
<tr>
<td></td>
<td>(ii) The Revision of IRC 105 on Guidelines for Design of DBM and BC Mixes for Airfield Pavements”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cold Mix Technology for Road Construction</td>
<td>Workshop cum Demonstration on “Cold Mix Technology” organized by Public Works Department, Raipur CG</td>
<td>Sept, 2019</td>
</tr>
<tr>
<td></td>
<td>Cement Grouted Bituminous Mix for Maintenance of Pavements</td>
<td>Annual Day of NHIDCL Delhi</td>
<td>Jul 16, 2019</td>
</tr>
<tr>
<td>Name &amp; Designation of Staff</td>
<td>Title of Lecture/Speech</td>
<td>Purpose (conference or otherwise) Give full details</td>
<td>Date</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Dr. Ambika Behl, Principal Scientist</td>
<td>Discussion</td>
<td>Meeting with Commissioner Kolkata Municipal Corporation and officials of KMC and NGT and PWD Kolkata for Implementation of Environmental friendly Cold Mix Technology in Kolkata City</td>
<td>Feb 07, 2020</td>
</tr>
<tr>
<td>Dr. Ambika Behl, Principal Scientist</td>
<td>The Revision of IRC: 101 Document on Warm Mix Asphalt</td>
<td>Mid Term Council Meeting of IRC at Goa</td>
<td>Aug 08, 2019</td>
</tr>
<tr>
<td>Dr. Ambika Behl, Principal Scientist</td>
<td>Waste Plastic Technology for Roads (Invited Talk)</td>
<td>AME Bitumen and Road Construction Conference 2020, Dubai</td>
<td>Jan, 2020</td>
</tr>
<tr>
<td>Dr. Ravindra Kumar, Sr Pr Scientist &amp; Dr. Ch. Ravisekhar, Pr.Scientist</td>
<td>Meeting with Sh. Sudhir Garg, Joint Secretary, Ministry of Micro, Small &amp; Medium Enterprises (MSME) and Sh. Nitin Gadkari ji, Hon’ble Minister, MORTH, Govt. of India</td>
<td>Feasibility Study for Demonstration of Pilot Test of e-Highway on Indian Roads</td>
<td>Jun 13, 2019</td>
</tr>
<tr>
<td>Dr. Siksha Swaroopa Kar, Senior Scientist</td>
<td>New Technologies for Rural Road Construction</td>
<td>Regional Workshop on “Quality Control, New Materials &amp; Techniques in Road Sector” organized by IRC and IIT, Roorkee</td>
<td>Feb 07-08, 2020</td>
</tr>
<tr>
<td>Dr. Siksha Swaroopa Kar, Senior Scientist</td>
<td>Cold Mix Technology for Road Construction</td>
<td>Workshop cum Demonstration on “Cold Mix Technology” organized by Public Works Department, Aizwal, Mizoram</td>
<td>Dec 03, 2019</td>
</tr>
<tr>
<td>Dr. Siksha Swaroopa Kar, Senior Scientist</td>
<td>Large scale adoption of Cold Mix Technology and Green Roads in the State of Odisha</td>
<td>Workshop on “Cold Mix Technology” organized by Works Department, Odisha Govt.</td>
<td>Jan 28, 2020</td>
</tr>
<tr>
<td>Dr. Pankaj Gupta, Sr. Principal Scientist</td>
<td>Landslide Investigation - Gaps and Ways forward</td>
<td>First International Conference on Landslides Risk Reduction and Resilience – 2019, New Delhi</td>
<td>Nov 28, 2019</td>
</tr>
<tr>
<td>Dr A K Sinha, Principal Scientist</td>
<td>Industrial waste material for road construction</td>
<td>National seminar on alternative highway construction material, Ranchi</td>
<td>Dec 14-15, 2019</td>
</tr>
<tr>
<td>Sh. K. Sitaramanjaneyulu, Chief Scientist</td>
<td>New and Innovative Materials in construction and Maintenance of Pavements</td>
<td>BITS, Pilani (M. Tech. Students)</td>
<td>Apr 30, 2019</td>
</tr>
<tr>
<td>Name &amp; Designation of Staff</td>
<td>Title of Lecture/Speech</td>
<td>Purpose (conference or otherwise) Give full details</td>
<td>Date</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>----------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Sh. Sunil Jain, Senior Principal Scientist</td>
<td>National Roads and Highways Summit – 2019</td>
<td>PHD House, New Delhi</td>
<td>July 10, 2019</td>
</tr>
<tr>
<td></td>
<td>Infrastructure Conclave 2019- Challenges and way Forward</td>
<td>PHD House, New Delhi</td>
<td>Nov 06, 2019</td>
</tr>
<tr>
<td>Sh. Binod Kumar Sr. Principal Scientist</td>
<td>Flexible Pavement Surface Distresses, their Identification, Causes, Measurements and Maintenance</td>
<td>Training cum Workshop Programme at Deenbandhu Chhotu Ram University of Science and Technology, Murthal</td>
<td>Jan, 2020</td>
</tr>
<tr>
<td>Dr. Rakesh Kumar, Sr. Principal Scientist</td>
<td>Design and Maintenance of Rigid Pavements</td>
<td>National CPWD Academy, Ghaziabad, Course on “Contemporary Practice for Design and Construction of Rigid and Flexible Pavements”</td>
<td>Nov 26, 2019</td>
</tr>
<tr>
<td></td>
<td>Design and Construction Aspects of Rigid Pavement</td>
<td>One day seminar on construction and quality control of rigid pavement, organized by NHAI, Nagpur</td>
<td>Apr 27, 2019</td>
</tr>
<tr>
<td>Sh. Binod Kumar Sr. Principal Scientist</td>
<td>Design and Construction of Whitetopping for City Roads”</td>
<td>National Conference on Technological Advances in Concrete Pavements and Bridges, Organised by ICI, Hotel Best Western Ashoka, Hyderabad.</td>
<td>July 06, 2019</td>
</tr>
<tr>
<td></td>
<td>Design and Construction of Short Paneled Concrete Pavement</td>
<td>One day workshop on Plastic Waste in Bituminous Road Construction and Whitetopping, Organised by Lucknow Development Authority,Lucknow.</td>
<td>Nov 29, 2019</td>
</tr>
<tr>
<td></td>
<td>Sustainability Features of Design, Construction, Operation and Maintenance of Rigid Pavements</td>
<td>One-day seminar on Sustainability of Infrastructure, Organised by S. V. Polytechnic College, Bhopal.</td>
<td>Feb 29, 2020</td>
</tr>
<tr>
<td>Sh. Dinesh V. Ganvir, Pr. Scientist</td>
<td>Whitetopping: Cement Concrete Overlay on Bituminous Roads</td>
<td>16th NCB International Seminar on Cement, Concrete and Building Materials</td>
<td>Dec 05, 2019</td>
</tr>
<tr>
<td></td>
<td>Effect of Jarosite as Partial Replacement of Fine Aggregate in Pavement Quality Concrete Mixes”</td>
<td>5th Conference of Transportation Research Group (CTRG-2019), Bhopal</td>
<td>Dec 21, 2020</td>
</tr>
<tr>
<td>Name &amp; Designation of Staff</td>
<td>Title of Lecture/Speech</td>
<td>Purpose (conference or otherwise) Give full details</td>
<td>Date</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Dr. A. Mohan Rao, Sr. Principal Scientist</td>
<td>Guest of Honor</td>
<td>Delivered a motivation speech in Annual Day function, St.Gregorios School, Sector – 11, Dwarka, as a part of JIGYASA CSIR</td>
<td>Nov 15, 2019</td>
</tr>
<tr>
<td>Dr. Lakshmy Parameswaran, Chief Scientist</td>
<td>Wind tunnel testing and design of long span bridges for wind forces</td>
<td>3-days International Course on Recent Advances in Bridge Design and Construction, organized by IIT Roorkee (7-9, August 2019)</td>
<td>9th Aug, 2019</td>
</tr>
<tr>
<td>Dr. Lakshmy Parameswaran, Chief Scientist</td>
<td>Seismic design Methods</td>
<td>Refresher Course on Application of New Seismic Code for highway bridges IRC; SP:114-2018 organised by Indian Association of Structural Engineers, New Delhi</td>
<td>14, Sep 2019</td>
</tr>
<tr>
<td>Dr. Lakshmy Parameswaran, Chief Scientist</td>
<td>Quality Control and New Techniques in Bridges, Grade Separators and Elevated Structures</td>
<td>Regional workshop on “Quality Control, New Advances in Bridge Design and Construction”, 26-27, July 2019, Hyderabad (Organised by IRC)</td>
<td>27, July 2019</td>
</tr>
<tr>
<td>Dr. Lakshmy Parameswaran, Chief Scientist</td>
<td>Safe and Sound Highway</td>
<td>3rd International Galvanizing Conference, September 19-20, 2019, New Delhi (Organised by International Zinc Association)</td>
<td>19, Sep, 2019</td>
</tr>
<tr>
<td>Sh. S.S. Gaharwar, Sr Pr. Scientist</td>
<td>Quality Assurance for Precast Bridges</td>
<td>Site Engineers of M/s L&amp;T of Dwarka Expressway Project, New Delhi, organized by M/s Ultratech Cement at Hotel Country Inn, Gurugram</td>
<td>Mar 06, 2020</td>
</tr>
<tr>
<td>Dr. Naveet Kaur, Sr. Scientist</td>
<td>Structural Health Monitoring and Energy harvesting using Piezoelectric Transducers</td>
<td>Organised by Indian association of structural Engineers (IAsructE) at Indian Habitat Centre</td>
<td>Nov 28, 2019</td>
</tr>
<tr>
<td>Dr. Naveet Kaur, Sr. Scientist</td>
<td>Advanced Sensing and Energy Harvesting Solutions for Infrastructure in Smart Cities</td>
<td>Centre for SeNSE, IIT Delhi</td>
<td>Mar 05, 2020</td>
</tr>
</tbody>
</table>
New Facilities / Equipment
Procured
## New Facilities/Equipment Procured

<table>
<thead>
<tr>
<th>Name of the Division</th>
<th>Name of the Facility/Equipment</th>
<th>Grant code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Evaluation Division</td>
<td>Heavy-Falling Weight Deflectometer</td>
<td>Institute Fund</td>
</tr>
<tr>
<td>Pavement Evaluation Division</td>
<td>PAVER-Airfield Pavement Management Software</td>
<td>Consultancy Project</td>
</tr>
<tr>
<td>Rigid Pavement Division</td>
<td>Plastic shrinkage testing of concrete</td>
<td>Institute Fund</td>
</tr>
<tr>
<td>Traffic Engineering and Safety</td>
<td>internet based Micro Accident Analysis Package (iMAAP)</td>
<td>Institute Fund</td>
</tr>
<tr>
<td>Transportation Planning and Environment</td>
<td>EMME Software</td>
<td>Institute Fund</td>
</tr>
<tr>
<td>Bridges Engineering and Structures</td>
<td>6.5 Digit Data Acquisition and Logging, Multimeter System</td>
<td>R &amp; D Project</td>
</tr>
<tr>
<td>Bridges Engineering and Structures</td>
<td>COMSOL Software</td>
<td>R &amp; D Project</td>
</tr>
</tbody>
</table>
Deputation Abroad
## Deputation Abroad

<table>
<thead>
<tr>
<th>Name of Scientist &amp; Designation</th>
<th>Country visited</th>
<th>From</th>
<th>To</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Satish Chandra, Director, CSIR-CRRI</td>
<td>Dhaka, Bangladesh</td>
<td>27.07.2019</td>
<td>30.07.2019</td>
<td>Meeting with Govt. officials for areas of collaboration</td>
</tr>
<tr>
<td>Dr. Rakesh Kumar, Sr. Principal Scientist</td>
<td>Kingston University, London, UK</td>
<td>14.07.2019</td>
<td>17.07.2019</td>
<td>5th International Conference on Sustainable Construction Materials and Technologies (SCMT5)</td>
</tr>
<tr>
<td>Sh. M. N. Nagabhushana, Sr. Principal Scientist; Sh. P. V. Pradeep Kumar, Sr. Principal Scientist; Dr. G. Bharath, Scientist</td>
<td>Dhaka, Bangladesh</td>
<td>25.05.2019</td>
<td>27.05.2019</td>
<td>Signing of MoU with Roads &amp; Highways Department, Govt. of Bangladesh</td>
</tr>
<tr>
<td>Dr. Ambika Behl, Principal Scientist</td>
<td>Dubai</td>
<td>08.01.2020</td>
<td>09.01.2020</td>
<td>Speaker at AME Bitumen &amp; Road Construction Conference 2020</td>
</tr>
<tr>
<td>Dr. Mukti Advani, Principal Scientist</td>
<td>Washington D.C., USA</td>
<td>12.01.2020</td>
<td>16.01.2020</td>
<td>To attend and present paper at 99th of Annual Meeting Transportation Research Board (TRB) at Washington D.C.</td>
</tr>
</tbody>
</table>
Thesis/Dissertations Supervision
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Names of Student</th>
<th>Institute</th>
<th>Title of Project/Thesis</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ms. Minal</td>
<td>AcSIR-CRRI</td>
<td>Integrated Travel Demand Model for Evaluation of Sustainable Transport System (Thesis Submitted)</td>
<td>Dr. Ch. Ravi Sekhar and Dr. E. Madhu</td>
</tr>
<tr>
<td>2</td>
<td>Shri Shahbaz Khan</td>
<td>AcSIR - CRRI</td>
<td>Performance Evaluation of Inverted Pavement with Cement Fly Ash Base Layer</td>
<td>Devesh Tiwari, M.N. Nagabhushana (Retd.), Dr. Dharamveer Singh</td>
</tr>
<tr>
<td>3</td>
<td>Fadamoro, Oluwafemi Festus</td>
<td>AcSIR-CRRI, Joined under TWAS-CSIR fellowship programme</td>
<td>Performance Evaluation of Foam Bitumen Stabilization Using Warm RAP Material and Aggregates</td>
<td>Devesh Tiwari, Dr. Siksha Swaroopa</td>
</tr>
<tr>
<td>4</td>
<td>Shri Gagandeep Singh</td>
<td>AcSIR - CRRI</td>
<td>Investigation of Fatigue Endurance Limit in Bituminous Mixes Containing Modified Bitumen</td>
<td>Devesh Tiwari, Dr. P.K. Jain (Retd.), Dr. A.K. Swamy</td>
</tr>
<tr>
<td>5</td>
<td>Shri Bhavesh Jain</td>
<td>Centre of Transportation System (CTTRANS), CED, IIT, Roorkee, Uttarakhand,</td>
<td>Development of Asset Management System for the Road Network of a Smart City</td>
<td>Prof. (Dr.) Manoranjan Parida, Devesh Tiwari, Dr. Ramesh Anbanandam,</td>
</tr>
<tr>
<td>6</td>
<td>Mr. Satbir Singh Puwar</td>
<td>AcSIR-CRRI</td>
<td>Development of Surrogate Safety Measures for a typical Interurban Corridor</td>
<td>Dr. S.Velmurugan, Dr A. Mohan Rao</td>
</tr>
<tr>
<td>7</td>
<td>Mr. Yatin Chaudary</td>
<td>AcSIR-CRRI</td>
<td>Driver Fatigue and its effect on Safety of Roads</td>
<td>Dr A. Mohan Rao</td>
</tr>
<tr>
<td>8</td>
<td>Mr. Neeraj Jain</td>
<td>AcSIR-CRRI</td>
<td>To study &amp; explore the introduction of Multi-layered bridges</td>
<td>Dr. Rajeev Goel</td>
</tr>
<tr>
<td>9</td>
<td>Mr. Gaurav Verma</td>
<td>AcSIR-CRRI</td>
<td>Development and characterisation of high-performance Graphene based natural fibre epoxy composites for structural applications</td>
<td>Dr. Rajeev Goel, Dr. Naveet Kaur</td>
</tr>
<tr>
<td>10</td>
<td>Ms. Lincy Varghese</td>
<td>AcSIR-CRRI</td>
<td>Characterization of Engineering Properties of High Volume Siliceous Flyash Concrete Containing Colloidal Nanosilica (Awarded) Jan 2020</td>
<td>Dr. VVLK Rao, Dr. Lakshmy Parameswaran</td>
</tr>
<tr>
<td>S.No.</td>
<td>Names of Student</td>
<td>Institute</td>
<td>Title of Project/Thesis</td>
<td>Supervisors</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>-----------</td>
<td>-------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>11</td>
<td>Mr. Dinesh Kumar</td>
<td>AcSIR-CRRI</td>
<td>A study on Structural Properties of Self Compacting Concrete made with Recycled Concrete Aggregate</td>
<td>Dr. VVLK Rao, Dr. Lakshmy Parameswaran</td>
</tr>
<tr>
<td>12</td>
<td>Ms. Beenu Raj</td>
<td>AcSIR-CIMFR-CRRI</td>
<td>Study on polyester terephthalate packaging waste conversion to unsaturated polyester resin and application of its products in mining and for concrete repair</td>
<td>Dr. VVLK Rao, Dr. Jagdish</td>
</tr>
<tr>
<td>13</td>
<td>Mr. Narmadeswar Sahay</td>
<td>Birla Institute of Technology, Mesra, Ranchi</td>
<td>Performance Based Seismic Design for Indian Highway Bridges</td>
<td>Dr. Siddharth Sengupta, Dr. Arun Kumar, Dr. Lakshmy Parameswaran</td>
</tr>
<tr>
<td>14</td>
<td>Mr. Kumar Shashi Bhushan</td>
<td>Delhi Technological University</td>
<td>Soil-structure interaction</td>
<td>Dr. Rajeev Goel</td>
</tr>
<tr>
<td>15</td>
<td>Ms. Neha</td>
<td>North Eastern Regional Institute of Science and Technology (NERIST), Nirjuli, Itanagar, Arunachal Pradesh</td>
<td>Construction and demolition waste - A viable source of coarse aggregate for sustainability</td>
<td>Prof. Sudhist Mishra, Dr. Rajeev Goel</td>
</tr>
<tr>
<td>16</td>
<td>Er. Jasvir Singh</td>
<td>Shri Venkateshwara University, Uttar Pradesh</td>
<td>A study of soil structure interaction in framed structures</td>
<td>Dr. Rajeev Goel, Dr. Ajit Kumar</td>
</tr>
<tr>
<td>17</td>
<td>Mr. Kamal Dhiman</td>
<td>Thapar University, Patiala</td>
<td>Investigating the strength gain of self-healing concrete using piezoelectric material</td>
<td>Dr. Naveet Kaur, Dr. Shweta Goyal</td>
</tr>
<tr>
<td>18</td>
<td>Mr. Sanjay Kumar Dave</td>
<td>SVNIT, Surat</td>
<td>Study of On-Street Parking Demand Characteristics and Modelling Response to Paid Parking Policies in CBD Area (Thesis Submitted)</td>
<td>Prof. GJ Joshi, Dr. Kayitha Ravinder</td>
</tr>
<tr>
<td>19</td>
<td>Mr. Raghu Raman</td>
<td>AcSIR-CRRI</td>
<td>Study on Development of Road Crash Model for Prioritization of Infrastructure Facilities</td>
<td>Dr. Kayitha Ravinder, Dr. Errampalli Madhu</td>
</tr>
<tr>
<td>20</td>
<td>M. Sitanathan</td>
<td>AcSIR-CRRI</td>
<td>Real world driving cycle for motorcycles in Delhi NCR and admixtures performance evaluation</td>
<td>Dr. Ravindra Kumar</td>
</tr>
<tr>
<td>21</td>
<td>Asif Hussain</td>
<td>Delhi Technological University</td>
<td>Sustainable Transportation System</td>
<td>Dr. Rajeev Mishra, Dr. Ravindra Kumar</td>
</tr>
</tbody>
</table>
## M. TECH DISSERTATIONS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Students</th>
<th>Institute</th>
<th>Title of Project/Thesis</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mr. Akash Vashisht</td>
<td>Amity University, Haryana</td>
<td>Structural Health Monitoring of Masonry Arch. Bridge using Piezo Electric sensor</td>
<td>Dr. Naveet Kaur</td>
</tr>
<tr>
<td>2.</td>
<td>Ms. Anamika Yadav</td>
<td>MANIT, Bhopal, Madhya Pradesh</td>
<td>Evaluation of Pavement Layers using GPR Related Study</td>
<td>Dr. Devesh Tiwari, Mr. Sunil Jain</td>
</tr>
<tr>
<td>3.</td>
<td>Ms. Angel Maria Mathew</td>
<td>Rajiv Gandhi Institute of Technology, Kottayam</td>
<td>Road Crash Analysis and Evaluation of Mitigation Measures using iMAAP Software for an Inter-Urban Corridor</td>
<td>Dr. A Mohan Rao, Dr. Velumurgan</td>
</tr>
<tr>
<td>4.</td>
<td>Mr. Ankit Gupta</td>
<td>Bundelkhand Institute of Engineering &amp; Technology, Jhansi, Uttar Pradesh</td>
<td>Safety Management for construction of Road Underpass By using Box Jacking with Soil Nailing</td>
<td>Dr. Kanwar Singh</td>
</tr>
<tr>
<td>5.</td>
<td>Mr. Arun Kumar Y</td>
<td>Siddaganga Institute of Technology, Tumakuru, Karnataka</td>
<td>Strengthening of Distressed RCC Continue Span Bridge</td>
<td>Dr. Rajeev Goyal</td>
</tr>
<tr>
<td>6.</td>
<td>Ms Ayushi Jain</td>
<td>Parul University, Vadodara, Gujarat</td>
<td>Factors Influencing Mode Choice Behaviour in Mass Housing Areas</td>
<td>Dr. Ch. Ravi Sekhar, Ms. Minal</td>
</tr>
<tr>
<td>7.</td>
<td>Mr. B. Pavan Kumar Megalaskshmi</td>
<td>JNNCE Shimoga, Karnataka</td>
<td>Evaluation of Bottom Residue for Application in Road Works</td>
<td>Dr. Shiksha Swarooka Kar</td>
</tr>
<tr>
<td>8.</td>
<td>Mr. Bharatram Mehar</td>
<td>IIT, Kharagpur, Kolkata</td>
<td>Pavements in high altitude Regions using Geosynthetics Physical Connectivity</td>
<td>Dr. G. Bharath</td>
</tr>
<tr>
<td>9.</td>
<td>Ms. Chaithra C L</td>
<td>Siddaganga Institute of Technology, Tumkur</td>
<td>Lab and Field Evaluation of Pavement Constructed using High Percentage of Plastics</td>
<td>Dr. Siksha Swaroopa Kar</td>
</tr>
<tr>
<td>10.</td>
<td>Ms. Chaithra N S</td>
<td>RASTA - Centre for Road Technology, Bengaluru</td>
<td>A Study on Hybrid Fibre Reinforced Concrete.</td>
<td>Dr. Rakesh Kumar</td>
</tr>
<tr>
<td>11.</td>
<td>Ms. Chinmaya S</td>
<td>Siddaganga Institute of Technology, Tumkur</td>
<td>Comparison between Field Produced High Modulus Asphalt Mixture ad Conventional Asphalt Mixture</td>
<td>Dr. G. Bharath</td>
</tr>
<tr>
<td>12.</td>
<td>Mr. Darshan Dharmendra Jariwala</td>
<td>MSU, Baroda, Gujarat</td>
<td>Effect of Aggregate Gradation on Performance of Cold Mix</td>
<td>Dr. Siksha Swaroopa Kar</td>
</tr>
<tr>
<td>S.No.</td>
<td>Name of Students</td>
<td>Institute</td>
<td>Title of Project/Thesis</td>
<td>Supervisors</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>-----------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>13.</td>
<td>Mr. Devesh Kumar Pandey</td>
<td>Gautam Buddha University, Uttar Pradesh</td>
<td>Remaining Service Life Assessment of Existing of Concrete Road Bridge Subjected to Corrosion</td>
<td>Dr. Lakshmy Parmeswaran</td>
</tr>
<tr>
<td>14.</td>
<td>Mr. Devesh Kumar Saraswat</td>
<td>BIET, Jhansi</td>
<td>Designing a Rating System for Road</td>
<td>Dr. A Saurikhia</td>
</tr>
<tr>
<td>15.</td>
<td>Ms. Gargi PrakashBhai Jagad</td>
<td>Faculty of technology and Engineering, MSU, Baroda</td>
<td>Performance Characteristics of Asphalt Mix Containing RAP Material</td>
<td>Dr. Ambika Behl</td>
</tr>
<tr>
<td>16.</td>
<td>Mr. Gaurav Singh</td>
<td>Faculty of Technology and Engineering, MSU Baroda, Vadodara Gujarati</td>
<td>Assessment of Stabilized Layers Modulus Using Falling Weight Deflectometer &amp; Field Cores</td>
<td>Sh. Sunil Jain, Dr. Devesh Tiwari</td>
</tr>
<tr>
<td>17.</td>
<td>Mr. Gourav Chauhan</td>
<td>TIET, Patiala</td>
<td>Traffic System Analysis for different Land use Pattern-Use of Trip Generation Modelling</td>
<td>Dr. Ravindra Kumar, Dr. Ch. Ravisekhar</td>
</tr>
<tr>
<td>18.</td>
<td>Mr. Harsh Dhirajlal Bhimaiyani</td>
<td>Faculty of Technology and Engineering, MSU Baroda, Vadodara Gujarati</td>
<td>Analysis of Asphalt Pavement using Reliability Approach</td>
<td>Sh. Abhishek Mittal</td>
</tr>
<tr>
<td>19.</td>
<td>Mr. Himanshu Jain</td>
<td>Samrat Ashok Technological Institute, Vidisha, Madhya Pradesh</td>
<td>Maintenance and Rehabilitation Assessment of Artificial Permanent Based on function and Structural Evaluation</td>
<td>Dr. Pradeep Kumar</td>
</tr>
<tr>
<td>20.</td>
<td>Mr. Kabi Prasad Parida</td>
<td>Institute of Infrastructure Technology Research and Management, Ahmedabad</td>
<td>Modelling the Operating Speed of a Road and its Impact on Road Safety</td>
<td>Dr. A Mohan Rao</td>
</tr>
<tr>
<td>21.</td>
<td>Ms. Kavya G.M.</td>
<td>Jawaharlal Nehru College of Engineering, Shimoga, Karnataka</td>
<td>Study on Diffusion Coefficient rate of Rejuvenator and Reclaimed Asphalt Pavement</td>
<td>Dr. Siksha Swaroopa, Kar Sh. M N Nagabhushana</td>
</tr>
<tr>
<td>22.</td>
<td>Mr. Manish Tomar</td>
<td>Gautam Buddha University, Uttar Pradesh</td>
<td>Effect of Truck Load on Response of Concrete Road Bridge</td>
<td>Dr. Lakshmy Parreswaran</td>
</tr>
<tr>
<td>23.</td>
<td>Mr. Mohd. Atif</td>
<td>Maulana Azad National Institute of Technology, Bhopal, Madhya Pradesh, India</td>
<td>Performance Evaluation of Flexible Pavement with Stabilized Layers using FWD</td>
<td>Mr. R K Srivastava</td>
</tr>
<tr>
<td>S.No.</td>
<td>Name of Students</td>
<td>Institute</td>
<td>Title of Project/Thesis</td>
<td>Supervisors</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>24.</td>
<td>Mr. Naveen Pandey</td>
<td>Shri Shankaracharya Group of Institutions Bhilai, Chattisgarh</td>
<td>Interface Frictional Behavior of Geosynthetic with different Industrial Waste</td>
<td>Dr. PS Prasad</td>
</tr>
<tr>
<td>25.</td>
<td>Ms. Neena V S</td>
<td>Rajiv Gandhi Institute of Technology, Kottayam</td>
<td>Comparative Study on Dynamic and Static PEV on Road</td>
<td>Prof. Satish Chandra</td>
</tr>
<tr>
<td>26.</td>
<td>Mr. Nipun Madaan</td>
<td>Thapar Institute of Engineering and Technology, Patiala</td>
<td>Development of emulsion based CGBM</td>
<td>Manoj Shukla.</td>
</tr>
<tr>
<td>27.</td>
<td>Mr. Nitin Kumar Shukla</td>
<td>Samrat Ashok Technological Institute, Vidisha, Madhya Pradesh</td>
<td>Study on Parking Demand analysis and Management</td>
<td>Dr. Ch. Ravi Shekhar</td>
</tr>
<tr>
<td>28.</td>
<td>Mr. Prince Kumar Singh</td>
<td>Shri Govindram Seksaria Institute of Technology and Science, Indore,</td>
<td>Analysis of Steel Slag Use in Flexible Pavement as an Aggregate</td>
<td>Sh. Satish Pandey</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Madhya Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>Mr. Rane Yash Nitin</td>
<td>Parul University, PO. Limda. Ta. Waghodia Dist. Vadodara, Gujarat</td>
<td>Impact of Alternate Circulation Plant Around Metro Station on Level of Service of Road</td>
<td>Dr. Mukti Advani</td>
</tr>
<tr>
<td>30.</td>
<td>Ms. Ranjitha R L</td>
<td>RASTA- Centre for Road Technology</td>
<td>Comparison of different PCI and SCI Rating Procedure for Prioritization of rural Road</td>
<td>Dr. Mukti Advani</td>
</tr>
<tr>
<td>31.</td>
<td>Ms. Ritika Srivastava</td>
<td>Banaras Hindu University, Varanasi</td>
<td>Impact of Engineered Nanoparticles on Environment and Health</td>
<td>Dr. Ravinder Kumar</td>
</tr>
<tr>
<td>32.</td>
<td>Mr. Shubham Saxena</td>
<td>Malviya National Institute of Technology, Jaipur</td>
<td>Performance Modelling of Bituminous Mixer with High RAP Content</td>
<td>Mr. Abhishek Mittal</td>
</tr>
<tr>
<td>33.</td>
<td>Somani Sagar</td>
<td>GGPUI, Dwarka, Delhi</td>
<td>EIA Project and Lane Highway Project Proposed from Gurugram to Kota – Wild Life Project</td>
<td>Dr. Nasim Akhtar</td>
</tr>
<tr>
<td>34.</td>
<td>Vishnu J. Pillai</td>
<td>Amity Univerity, Gurgaon, Haryana</td>
<td>Strengthening Techniques of Distrengthened Concrete Bridge</td>
<td>Dr. Rajeev Goyal</td>
</tr>
</tbody>
</table>
### B. TECH DISSERTATIONS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Names of Student</th>
<th>Institute</th>
<th>Title of Project/Thesis</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr. Aryan Chandrakar</td>
<td>Vellore Institute of Technology, Vellore</td>
<td>Mode Choice Analysis for Commercial Complex</td>
<td>Dr. Ravinder Kumar</td>
</tr>
<tr>
<td>2</td>
<td>Mr. Karan Sharma</td>
<td>Shiva Institute of Engineering &amp; Technology, Bilaspur, Himachal Pradesh</td>
<td>Fatigue Performance of Induction Heating Based on Self-Healing Bituminous Concrete Mix</td>
<td>Sh. Sampath Kumar P.</td>
</tr>
<tr>
<td>3</td>
<td>Mr. Madhav Verma</td>
<td>Thapar Institute of Engineering and Technology, Patiala, Punjab</td>
<td>Use of Warm Mix Technology to Incorporate High Percentage of RAP in Asphalt Mixes.</td>
<td>Dr. Ambika Behl</td>
</tr>
<tr>
<td>4</td>
<td>Mr. Vaibhav Samadhiya</td>
<td>Thapar Institute of Engineering and Technology, Patiala, Punjab</td>
<td>Indirect Estimation of Resilient Modulus of Asphalt Mixes</td>
<td>Dr. Ambika Behl</td>
</tr>
<tr>
<td>5</td>
<td>Mr. Vikas Sharma</td>
<td>Vellore Institute of Technology, Vellore</td>
<td>Impact of Traffic on Air Quality at Selected Location in Delhi</td>
<td>Dr. Anuradha Shukla</td>
</tr>
</tbody>
</table>

### M. TECH. SUMMER INTERNSHIP

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Names of Student</th>
<th>Institute</th>
<th>Title of Project/Thesis</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ms. Sumenri Thongam</td>
<td>Manipur Institute of Technology, Imphal, Manipur</td>
<td>Estimating Effect of on-Street Parking On Traffic in Area Around Metro Station Using Simulation Technique</td>
<td>Dr. Mukti Advani</td>
</tr>
</tbody>
</table>

### B. TECH. SUMMER INTERNSHIP

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Names of Student</th>
<th>Institute</th>
<th>Title of Project/Thesis</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ms. Kanishka</td>
<td>Ligayay's GVKSINT, Faridabad</td>
<td>Accident Analysis and Mitigation</td>
<td>Dr. Ravishekar</td>
</tr>
<tr>
<td>2</td>
<td>Mr. Gaurav Kumar</td>
<td>Noida Institute of Engineering and Technology, Uttar Pradesh</td>
<td>Exposure Study on wired and wireless network connections at CRRI</td>
<td>Mr. Vivek Dubey</td>
</tr>
<tr>
<td>3</td>
<td>Mohd. Haroon</td>
<td>Phonics Group of Institution, Roorkee, Uttarakhand</td>
<td>Design of Dense Bituminous Macadam</td>
<td>Sh. Manoj Kumar Shukla</td>
</tr>
<tr>
<td>S.No.</td>
<td>Names of Student</td>
<td>Institute</td>
<td>Title of Project/Thesis</td>
<td>Supervisors</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------</td>
<td>-----------------------------------------------------</td>
<td>-------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Mr. Harshit Saini</td>
<td>Chhotu Ram Rural Institute of Technology, Kanjhaala, Delhi</td>
<td>Geotechnical Characterisation of Black Cotton Soil</td>
<td>Mr. Vijay Kanaujia</td>
</tr>
<tr>
<td>5</td>
<td>Mr. Lokhandwala Abbas</td>
<td>LD College of Engineering &amp; Technology, Ahmedabad, Gujarat</td>
<td>Health Maintaining of Bridge through Instrumentation</td>
<td>Mr. G K Sahu</td>
</tr>
<tr>
<td>6</td>
<td>Mr. Lukmaan Choudhary</td>
<td>Phonics Group of Institution, Roorkee, Uttrachnal</td>
<td>Design of Dense Bituminous Macadam</td>
<td>Sh. Manoj Kumar Shukla</td>
</tr>
<tr>
<td>7</td>
<td>Mr. Mohit S Tulsani</td>
<td>Gyanmanjri Institute of Technology, Near ISCON Sidsar Road Bhavnagar, Gujarat</td>
<td>Alternate Circulation Plan around Karol Bagh Metro Station</td>
<td>Dr. Mukti Advani</td>
</tr>
</tbody>
</table>
Visitors
Visitors

- Two groups of delegation from Tanzania and Lea Associates South Asia Pvt. Ltd. visited CSIR-CRRI on August 06, 2019 and September 24, 2019.

- A delegation from South Asian Countries and Bureau of Indian Standards visited the institute on September 12, 2019.
Visitors

- Mr. Bhupendra Kainthola, Director, IIFT, Pune visited CSIR-CRRI on CSIR Foundation Day, September 26, 2019.

- Mr. Sanjay Kumar, CGM, BSRDCL, Patna and Mr. Sohail Akhtar, Chief Engineer, CDO, RCD, Patna visited CSIR-CRRI on September 13, 2019 for setting up a Research centre at Patna, Bihar.
Visitors

- Dr. Peter Savolainen from Michigan State University, USA visited CSIR-CRRI on October 04, 2019 for research collaboration on traffic safety.

- Mr. Michael Huang from Yutong Group, China visited CSIR-CRRI on July 16, 2019 for a technical collaboration on making of MBIU.

- Prof. Hussain Bahia, Director, Modified Asphalt Research Centre of University of Wisconsin Madison, USA visited CSIR-CRRI on January 28, 2020 for an interactive session with scientists of CSIR-CRRI.
Membership of Staff in Various Technical Committees
## Membership of Staff in Various Technical Committees

<table>
<thead>
<tr>
<th>Name of the scientist/Staff</th>
<th>Position held</th>
<th>Name of the committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Satish Chandra, Director</td>
<td>Chairman</td>
<td>PCD-6 of BIS</td>
</tr>
<tr>
<td></td>
<td>Convener</td>
<td>H-1 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Convener</td>
<td>IMRA committee of IRC</td>
</tr>
<tr>
<td>Sh. Manoj Kumar Shukla</td>
<td>Member Secretary</td>
<td>H-2 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>H-9 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Council Member</td>
<td>Road Wing-AASOCHAM</td>
</tr>
<tr>
<td>Dr Ambika Behl</td>
<td>Member</td>
<td>BIS PCD 6</td>
</tr>
<tr>
<td></td>
<td>Council Member</td>
<td>Road Wing-AASOCHAM</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>H-9 Committee of IRC</td>
</tr>
<tr>
<td>Dr Siksha Swaroopa Kar</td>
<td>Member</td>
<td>H-6 Committee of IRC</td>
</tr>
<tr>
<td>Sh. U.K. Guru Vittal</td>
<td>Member</td>
<td>H-4 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member (Representing Director, CRRI)</td>
<td>Ministry of Rural Development - Empowered Committee for Sanctioning PMGSY Proposals</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>Standing Technical Advisory Committee, MCGB, Mumbai</td>
</tr>
<tr>
<td>Dr. Pankaj Gupta</td>
<td>Member</td>
<td>CED 48 &amp; 56 Committee of BIS</td>
</tr>
<tr>
<td>Dr Vasant G Havanagi</td>
<td>Member Secretary</td>
<td>H-4 Committee of IRC</td>
</tr>
<tr>
<td>Dr A K Sinha</td>
<td>Member</td>
<td>H-4 Committee of IRC</td>
</tr>
<tr>
<td>Dr P S Prasad</td>
<td>Member Secretary</td>
<td>G-6 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>BOS of Civil Engineering, Rajeev Gandhi Memorial College of Engg. &amp; Tech., Nandyal, Andhra Pradesh</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>BOS of Civil Engineering (M. Tech), NIT Warangal, Telangana.</td>
</tr>
<tr>
<td>Sh. K. Sitaramanjeyulu</td>
<td>Co-Convener</td>
<td>H-6 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member Secretary</td>
<td>H-2 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>CED-6 Committee of BIS</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>Bhagalpur College of Engineering, Bhagalpur, Board of Governors</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>NIT, Tirucherappalli, Research Advisory Board of Centre of Excellence in Transportation Engineering (CETransE)</td>
</tr>
<tr>
<td>Dr. Pradeep Kumar</td>
<td>Member</td>
<td>H-6 Committee of IRC</td>
</tr>
</tbody>
</table>
## Membership of Staff in Various Technical Committees

<table>
<thead>
<tr>
<th>Name of the scientist/Staff</th>
<th>Position held</th>
<th>Name of the committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh. R.K. Srivastava</td>
<td>Member</td>
<td>H-3 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Invite Member</td>
<td>H-8 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>CED 2/P3 Committee of BIS</td>
</tr>
<tr>
<td>Dr. Devesh Tiwari</td>
<td>Member</td>
<td>HUDCO's research and training arm, Centre for Project Management and Development, Human Settlement Management Institute (HSMI), HUDCO Bhawan, Lodhi Road, New Delhi</td>
</tr>
<tr>
<td>Dr. Jakkula Nataraju</td>
<td>Member</td>
<td>BIS TED 28 committee on Intelligent Transport Systems</td>
</tr>
<tr>
<td></td>
<td>Attending on behalf of Director, CRRI</td>
<td>FOB committee chaired by PWD Secretary, Delhi</td>
</tr>
<tr>
<td>Dr. A. Mohan Rao</td>
<td>Member</td>
<td>TED 28 Committee of BIS</td>
</tr>
<tr>
<td></td>
<td>As an expert member representing CRRI</td>
<td>FOB committee chaired by PWD Secretary, Delhi</td>
</tr>
<tr>
<td>Dr. S. Velmurugan</td>
<td>Co-Convener</td>
<td>H-7 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>H-1 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Sub-Group Convener and Member</td>
<td>H-8 Committee of IRC</td>
</tr>
<tr>
<td>Ms. Kamini Gupta</td>
<td>As a member representing CRRI</td>
<td>FOB Sub-committee chaired by Local Public Representatives Delhi</td>
</tr>
<tr>
<td>Dr. Mukti Advani</td>
<td>Member</td>
<td>TRB Committee on Accessible Transportation and Mobility, ABE60 (TRANSED)</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>Editorial Advisory Board, Transportation Letters: The International Journal of Transportation Research</td>
</tr>
<tr>
<td>Dr. Ch.Ravi Sekhar</td>
<td>Member Secretary</td>
<td>H8 Committee of IRC</td>
</tr>
<tr>
<td>Dr Lakshmy Parameswaran</td>
<td>Co-Convener</td>
<td>B-2 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member Secretary</td>
<td>B-9 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>IRC Expert Group Constituted for the preparation of National Bridge Code</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>B-4 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>B-5 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>B-8 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>H-5 Committee of IRC</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>IRC HRB: Identification, Monitoring &amp; Research Application (IMRA) Committee</td>
</tr>
<tr>
<td>Name of the scientist/Staff</td>
<td>Position held</td>
<td>Name of the committee</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Member</td>
<td>G-4 Committee of IRC</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Civil Engineering Divisional Council, Bureau of Indian Standards, New Delhi</td>
<td></td>
</tr>
<tr>
<td>Alternate Member</td>
<td>BIS CED: 38 Special Structure Committee</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Drafting Group: IS-1893(Part 3)</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Expert Group for Suggesting Measures for Cost Reduction in Rural roads (NRRDA)</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Research Advisory Council, National Council of Cement and Building Materials, Ballabhgarh</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Project Review Board, Ocean Structures Group, National Institute of Ocean Technology, Chennai.</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Project Review Committee (PRC) Institute of Steel Development and Growth, Kolkata</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>Committee for Empanelment of Bearing and Expansion Joint Manufacturers and Suppliers, MoRTH, New Delhi</td>
<td></td>
</tr>
<tr>
<td>Member</td>
<td>STAC Committee, Pune Municipal Corporation (Bridge Expert)</td>
<td></td>
</tr>
</tbody>
</table>

Dr. Rajeev Kumar Garg | Member | CED: 38 Committee of BIS |

Sh. S.S. Gaharwar | Member Secretary | B-3 Committee of IRC |
| Member Secretary | B-6 Committee of IRC |
| Member | Appellate Committee of National Rural Roads Development Authority |
| Alternate Member | CED:54 Committee of BIS |

Sh. G. K. Sahu | Member | B-7 Committee of IRC |
| Member | IRC BSS Committee: Bridge Specification & Standards |

Dr. Rajeev Goel | Member | B-1 Committee of IRC |
| Member | BIS Committee for Framing document for launching Ready Mix Concrete certification |
| Alternate Member | CED: 38 Committee of BIS |
| Alternate Member | CED : 46/P8 Committee of BIS |
| Member | Action Plan, Seminar & Workshop Committee of IAStructE |
| Member | Jury for evaluation of the nominations for various award of ICI Western UP Centre Ghaziabad |
### Membership of Staff in Various Technical Committees

<table>
<thead>
<tr>
<th>Name of the scientist/Staff</th>
<th>Position held</th>
<th>Name of the committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. V.V.L. Kanta Rao</td>
<td>Member</td>
<td>Advisory Committee of Fourth International Conference on Innovative, Advancements in Engineering and Technology (IAET-2020), organised by Jaipur National University in association with Myongji University, South Korea during February 21-22, 2020 at Jaipur National University, Jaipur.</td>
</tr>
<tr>
<td></td>
<td>Chairman</td>
<td>Committee to give advice/recommendations on the various points for entering into an agreement with Dakshin Dilli Swatch Initiative Limited (DDSIL) for solid waste management</td>
</tr>
<tr>
<td></td>
<td>Chairman</td>
<td>Amendment in clauses of general Conditions of Contracts after implementation of GST</td>
</tr>
</tbody>
</table>

| Dr. V.V.L. Kanta Rao        | Member        | B-8 Committee of IRC |
|                            | Alternate Member | CED: 2 Committee of BIS |
|                            | Honorary Secretary | Indian Concrete Institute, New Delhi Chapter |

**Sh. Jitendra Kumar Goyal**

<table>
<thead>
<tr>
<th>Name of the scientist/Staff</th>
<th>Position held</th>
<th>Name of the committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr P. S. Prasad</td>
<td>Member</td>
<td>G-1 Committee of IRC</td>
</tr>
</tbody>
</table>

**Other Activities**

<table>
<thead>
<tr>
<th>Name of the scientist/Staff</th>
<th>Position held</th>
<th>Name of the committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Pankaj Gupta</td>
<td>Examiner to conduct practical examination of M.Sc. (Tech.) geophysics students</td>
<td>Dept. of Geophysics, Kurukshetra University</td>
</tr>
<tr>
<td></td>
<td>Invited as expert to select Consultant (Landslide and Avalanches)</td>
<td>National Disaster Management authority, NDMA Bhawan, A-1, New Delhi</td>
</tr>
</tbody>
</table>

| Dr. Pankaj Gupta            | As a Special Invitee investigated the geological hotspots and new alignments /realignments of “Chardham project” by High Power committee (HPC) constituted in compliance of the Honourable Supreme Court order by Secretary of Forest & Environment, Uttarakhand. | High Power committee (HPC) constituted in compliance of the Honourable Supreme Court order by Secretary of Forest & Environment, Uttarakhand. |

| Dr. Rajeev Goel             | External Examiner | Evaluation of PhD thesis and Conducting Open Viva-voice of RTM Nagpur University, Nagpur |
Membership of National and International Organisations
Membership of National and International Organisations

- Australian Road Research Board (ARRB)
- Bureau of Indian Standards, Manak Bhawan, 9. Bahadur Shah Zafar Marg, New Delhi
- 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
MoUs, Agreements and Patents
Agreements signed

- Rural Connectivity Training and Research Centre (RCTRC) of Assam, Chattisgarh & Madhya Pradesh on January 10, 2020.
- Ahmedabad City Police (Traffic) on May 03, 2019 in connection with a consultancy assignment.
- Earth Watch Institute India Trust for a project "pavement evaluation of process waste plastic incorporated pavement section with user perspective" in Dec 2019.

MoUs signed

- Indian Institute of Technology (IIT), Indore on August 04, 2019
- National Highway & Infrastructure Development Corporation Ltd on November 12, 2019
- Madhav Institute of Technology & Science (MITS), Gwalior on November 27, 2019
- LN Petrochem Pvt Ltd., New Delhi in March 03, 2020
- Manipur Institute of Technology, Imphal on February 17, 2020.

Intellectual Property Management

IP/Patent Filed

- Process for construction of shallow multidirectional underpass intersection by box jacking and soil nailing without affecting the existing traffic (Application No. 0128/NF/2019) on August 08, 2019.
MoUs, Agreements and Patents

- Engineering of bitumen emulsion based pot hole repair system (Application No. 201911017676) on May 03, 2019

Patent Granted

- New Design for Box Insertion through highly unstable cohesionless soil by stabilisation of vertical cut slopes. (Patent No. GB2519270)-UK Patent on June 12, 2019

Trade Mark Filed:

- Trade Mark application for Rejupave under class 19 filed jointly with Verma Industries, Application No. 4348225 on November 15, 2019
- Trade Mark Application for Truck suvidha filed jointly with M/s Sarvodhya Industries on August 14, 2019

Technology Transferred

- Rejuvenator for recycling of Asphalt pavement material for Hot in plant and Hot in situ recycling of bituminous Asphalt pavement (Exclusive Licence to Verma Industries, New Delhi) on November 04, 2019
- Design of noise barrier based on different frequencies to M/s Technocrafts Kohlhauer Infrastructure Pvt Ltd., Mumbai (agreement signed on CRRI Foundation day, July 16, 2019, in the presence of Dr. Shekhar C. Mande, DG, CSIR) on July 16, 2019
- Development of mobile application for supply chain and freight transportation. (Exclusive License to M/s Truck suvidha- Sarvodhya Infotech Pvt. Ltd., Haryana) on June 26, 2019
- Customized Bitumen Emulsion for mix seal surfacing based on Aggregates of UP state. (Exclusive License to JMVD Industries pvt Ltd, Lucknow) on March 05, 2020
Papers in Journals


Papers in Conferences/Seminars

2. Ambika Behl and M.N Nagabhushana, “Evaluation of Rust Spots on an Airport Runway”, at 5th Conference of the Transportation Research Group of India, December 18-21, 2019, Bhopal


6. Siksha Swraoop Kar, Ambika Behl and M N Nagabhushana, “Evaluation of Appropriate Performance Grade Bitumen for Road Construction according to Indian Climate Change Scenario”, 5th Conference of Transportation Research Group, December 18-21, 2019, Bhopal, India

7. Shubham Suryawanshi, Gagandeep Singh and Dr. Vandana Tare, “Laboratory Study of Stone Matrix Asphalt produced using Steel Slag Aggregates”, Proceedings, 5th Conference of the Transportation Research Group of India (CTRG-2019), December 18-21, 2019, Bhopal, India, pp.507


Papers in Conferences/Seminars

...and Overlay Design of Concrete Pavement”, 5th Conference of Transportation Research Group of India (CTRG-2019), December 18-21, 2019, Bhopal.


35. मीनन, तथा सी.एच. रविशेखर (2019), भारत में स्मार्ट नगर का विकास, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

36. रविद्र कुमार (2019), निर्माण और विस्फोट कचरे के सीमेंट कंक्रीट युक्त घटकों के पुनर्वर्गण से प्राप्त पुनर्वर्गणकरण मोटे एएमएनए प्रयोग पर राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

37. रविद्र कुमार (2019), भारत में अवसंरचना विकास: भू-रचनात्मक प्रौढ़गोत्रीकी का उपयोग, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

38. अभिवेदन मित्रल, दिनेश गणवीर, तथा के.के. गोला (2019), भक्ति और एक बड़ी लघु का उपयोग करके आंशिक को मोटाई के अनुमान की तुलना - एक अध्ययन, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

39. ललिता जगपांती, तथा योगिता गरब्याल (2019), राजमार्गों में मूल्यवान का भ्रमण तथा निर्माण, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

40. रीता सिंह (2019), कुट्टिम अभियांत्रिकी और पर्यावरण क्षेत्र में नैनो विज्ञान का महत्व, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

41. जनक परमार, ग्रीतिकुण्ड दास, तथा प्रभु आयाद (2019), आर्टिफिशियल न्यूरल नेटवर्क (ANN) का उपयोग करके पारिक्रम नोड विभाग का मूल्यांकन और सेट के डेटा पर उसका प्रभाव, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

42. राजेश राणा, तथा पी.लक्ष्मी (2019), जलसह डिजिटल (वायरलप्रूफिंग एंडेवर्स) के गुणों का मूल्यांकन और सेट के डेटा पर उसका प्रभाव, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

43. आलोक रंजन (2019), क्षेत्रांश सड़कों की संकल्पना, राष्ट्रीय हिंदी वैज्ञानिक कार्यशाला, सीआरआरआई, नई दिल्ली, 6 सितंबर 2019

44. अजय कुमार, तथा रविद्र कुमार (2019), तेम्पल–जिव कंप्रेशन तथा लॉगेस्ट कोण्नन सबसीस्वेंस एलाओरिथ्म के
Papers in Conferences/Seminars


52. Nishant Kaur (2019), "Advances in Information Technology". Seminar on "Advances in Information Technology", 9th September 2019


Articles in Books/Magazines


8. आलोक रंजन, योगेंद्र सिंह, तथा कुमार शाशु भूषण (2019), ‘भूमि के अंगरक्त संचारित तरंगों की प्रकृति’, ‘सड़क दर्पण’, अंक 18, जून 2019, सीआरआई, नई दिल्ली

9. निन्दिता खेर्वा (2019), ‘वैद्यकिक संपदा अधिकार एवं इसके महत्व’, ‘सड़क दर्पण’, अंक 18, जून 2019, सीआरआई, नई दिल्ली

10. विजय कुमार किस्नी, अनिल कुमार सिन्हा, तथा पी एस प्रसाद (2019), ‘ब्लेकेट सामग्रियों के मिक्स डिजाइन की जांच और समीक्षा करना’, ‘सड़क दर्पण’, अंक 18, जून 2019, सीआरआई, नई दिल्ली

11. एस पदमा, जे नटराजू ई मुह । तथा रविन्द्र कुमार (2019), ‘लाइन चॉइस संभाव्यता की गणना ट्रांजिट स्टॉप पर उलटी गिनती जानकारी – दिल्ली बस ट्रांजिट नेटवर्क के एक खंड के लिए केस स्टडी’, ‘सड़क दर्पण’, अंक 18, जून 2019, सीआरआई, नई दिल्ली

12. रविन्द्र कुमार, तथा नेहा चौधरी (2019), ‘पायथन प्रोग्रामिंग और इंजीनियरिंग का उपयोग कर बाहर गिनती और वर्गीकरण’, ‘सड़क दर्पण’, अंक 18, जून 2019, सीआरआई, नई दिल्ली


14. कामिनी गुप्ता, नीलिमा चक्रवर्ती, तथा राजन कुमार (2019), ‘सड़क सुरक्षा में चालकों के व्यवहारिक कृत्यों के आकलन हेतु नेट्रैल ट्रैक्ट का उपयोग’, ‘सड़क दर्पण’, अंक 19, दिसंबर 2019, सीआरआई, नई दिल्ली

15. नेहरुका दी.गायकवाड़, तुषार बागुल, अशोक मोरे, तथा रविन्द्र कुमार (2019), ‘प्लास्टिक कचरे से उपचन ऊर्जा ईल्यूशन के लक्षण और इसके प्रभाव’, ‘सड़क दर्पण’, अंक 19, दिसंबर 2019, सीआरआई, नई दिल्ली
16. आलोक रंजन (2019), ‘संवेदनशील उपकरणों एवं महत्वपूर्ण संरचनाओं के परीक्षण के लिए हल्के एवं संध्याकुंक पदार्थों की उपयोगिता’, ‘सड़क दर्पण’, अंक 19, दिसंबर 2019, सीआरआरआई, नई दिल्ली

17. अमरेश कुमार, मयूर अखतर, के सीतारामनारायण, के तथा प्रदीप कुमार (2019), ‘सड़कों के निर्माण और रखरखाव के लिए नवीन प्रौद्योगिकियाँ’, ‘सड़क दर्पण’, अंक 19, दिसंबर 2019, सीआरआरआई, नई दिल्ली

18. संजय चौधरी, तथा नित्यानंद चौधरी (2019), ‘तकनीक से हासिल निर्मित जल’, ‘जल चेतना’, खंड 8, अंक 1, वर्ष 2019, प्रांतों सं. 61–64.

19. संजय चौधरी, तथा नित्यानंद चौधरी (2019), ‘सड़क दुर्घटनाओं में वृद्धि के परिक्षण में सड़क सुरक्षा कानून में बदलाव की आवश्यकता’, ‘जिज्ञासा’, अंक 33, वर्ष 2019, आईआईटी दिल्ली, प्रश्नों 111–117, ISSN 2349–560X
CSIR-CRRI in Media
Speaker Announcement!

We welcome Prof. Satish Chandra, Director of Central Road Research Institute (CRRI), a constituent laboratory of Council of Scientific and Industrial Research (CSIR), as a speaker at Asia-Middle East Conference 2019. Organised by Rex Fuels.

21st-22nd August 2019, Sahara Star, Mumbai, India.

Registration: https://hml.in/kJVuNQM.

#bitumen #India #middleeast #oilandgas #baseoil #oilandgascindustry #august #conference #speaker

Speaker

Prof. Satish Chandra
Director
CRRI

Asia & Middle East (AME) Bitumen & Base Oil Conference 2019

Sahara Star, Mumbai
21-22 August 2019

www.ameforum.com
Airfield pavement management system in India for the first time

ABBINAYA KUZHANDHAIVEL
NEW DELHI, SEPTEMBER 10

THE AIRPORTS Authority of India (AAI), along with the CSIR-Central Road Research Institute (CRRI), is set to install airfield pavement management systems (APMS) in 10 airports across India.

Chennai, Surat, Kolkata, Gaggal, Imphal, Agartala, Vadodara, Rajahmundry, Khajuraho and Gaya are the medium traffic airports shortlisted for the APMS project. It will assist airport managers in developing viable strategies to maintain the pavements in a serviceable condition over a given period and quantify information on maintaining a pavement network at an acceptable level of service. It will also optimise pavement-related expenditure. The APMS will work in the concept of digitisation with scientific equipment. The CSIR-CRRI will assess the runways’ functional and structural condition using state-of-the-art technology. Based on the survey parameters, the APMS system will function as a condition index, which will score the status as excellent, poor or poor. The runways can be revamped or conditioned ensuring good maintenance.

Anil Kumar Pathak, Member (planning), AAI, said, “The pavement is probably the most important airport asset. This is particularly the case for single-runway airports such as a majority of the Indian airports. It should be constructed and maintained at acceptable levels like runway pavement surface distress, profile, friction, pavement classification number, along with some health indicators, will be used to get the rating scores to decide the maintenance strategies scientifically. Some medium traffic airports were shortlisted,” said Kumar.

Pathak added: “Airfield pavements comprise multiple layers of engineering materials, such as asphalt, concrete and granular materials, designed to carry aircraft loading. Pavements deteriorate with time under loading and from environmental variations. Maintenance and rehabilitation are required to maintain serviceability throughout the pavement asset’s life.”

The project fieldwork is expected to start in October and will continue for three years. The budget has been set at Rs 4.5 crore. Pathak further added that as per prevalent practice, the full length of the pavement would be resurfaced after a certain period in case of deterioration and with APMS, the weak portion could be identified well in advance to take up necessary rehabilitation or repair measures for that particular area.

With American and European countries having their own pavement management systems, India is not too late to start ensuring safety management. Kumar added that the civil aviation ministry initiated the process. “The damages or faults in the pavements can be identified well in advance, which will help to avoid complete revamping of the pavement,” said Kumar.
Participation in Conferences/Seminars/Workshops
<table>
<thead>
<tr>
<th>Name &amp; designation of staff</th>
<th>Details of conference/seminar</th>
<th>Venue</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Satish Chandra</td>
<td>International conference on unmanned Aerial System in Geomatics</td>
<td>IIT Roorkee, Noida</td>
<td>April 06, 2019</td>
</tr>
<tr>
<td></td>
<td>International conference on safer mobility – 19.</td>
<td>IIT Delhi</td>
<td>May 19, 2019</td>
</tr>
<tr>
<td></td>
<td>Futuristic Approaches in Civil Engineering, FACE 2019</td>
<td>Mahindra Ecole Centrale, Hyderabad</td>
<td>Aug 30, 2019</td>
</tr>
<tr>
<td></td>
<td>Shaping the next generation paving solutions</td>
<td>FICCI House, New Delhi</td>
<td>Dec 06, 2019</td>
</tr>
<tr>
<td></td>
<td>RoadTech organized by ASSOCHAM</td>
<td>New Delhi</td>
<td>Oct 30, 2019</td>
</tr>
<tr>
<td></td>
<td>Workshop on ‘Highway Development – Challenges and Way Forward’</td>
<td>Indian Academy of Highway Engineers (IAHE), Noida</td>
<td>Nov 19, 2019</td>
</tr>
<tr>
<td>Sh. Abhishek Mittal, Principal Scientist</td>
<td>Conference on New and Emerging Technologies in Road Construction</td>
<td>FICCI – Federation House, New Delhi</td>
<td>Dec 06, 2019</td>
</tr>
<tr>
<td></td>
<td>92nd Annual Convention of FICCI</td>
<td>Hotel Taj Palace, New Delhi</td>
<td>Dec 20-21, 2019</td>
</tr>
<tr>
<td></td>
<td>National Hindi Karyashala 2019</td>
<td>CSIR-CRRI, New Delhi</td>
<td>Sep 06, 2019</td>
</tr>
<tr>
<td>Dr Ambika Behl, Pr Scientist</td>
<td>5th Conference of Transportation Research Group, 2019</td>
<td>Bhopal, India</td>
<td>Dec 18-21, 2019</td>
</tr>
<tr>
<td>Dr Siksha Swaroopa Kar, Senior Scientist</td>
<td>5th Conference of Transportation Research Group, 2019,</td>
<td>Bhopal, India</td>
<td>Dec 18-21, 2019</td>
</tr>
<tr>
<td>Sh. Manoj Kumar shukla, Principial Scientist</td>
<td>Use of Green Technologies for Road Construction, National conference organized by FICCI and PWD UP</td>
<td>Lucknow</td>
<td>May 21, 2019</td>
</tr>
<tr>
<td>Dr. Pankaj Gupta, Sr. Principal Scientist</td>
<td>First International Conference on Landslides Risk Reduction and Resilience – 2019</td>
<td>Asoka Hotel, , New Delhi</td>
<td>Nov 28, 2019</td>
</tr>
<tr>
<td></td>
<td>INDOROCK 2019: Eighth Indian Rock Conference</td>
<td>India International Center (IIC), Lodi Road, New Delhi</td>
<td>Nov 4-5, 2019</td>
</tr>
<tr>
<td>Dr Vasant G Havanagi, Chief Scientist</td>
<td>80th Annual Session of Indian Roads Congress</td>
<td>Patna</td>
<td>Dec 19-22, 2019</td>
</tr>
<tr>
<td>Dr A K Sinha, Principal Scientist</td>
<td>International Seminar on Contaminated sites and Conference on Geoenvironment &amp; Sustainability</td>
<td>IIT Delhi</td>
<td>Feb 17-19, 2020</td>
</tr>
<tr>
<td>Name &amp; designation of staff</td>
<td>Details of conference/seminar</td>
<td>Venue</td>
<td>Date</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>संजय चौधरी&lt;br&gt;हिंदी अधिकारी</td>
<td>चौथी राज्यीय जल संगोष्ठी 2019 ‘जल संरक्षण एवं पर्यावरण’</td>
<td>राष्ट्रीय जलविज्ञान संस्थान, तुमकू</td>
<td>16 व 17 दिसंबर 2019</td>
</tr>
<tr>
<td>Sh. Sumer Singh&lt;br&gt;Chhachhia, Sh. Virendra Kumar Dussya</td>
<td>National Seminar on Opportunities and Challenges for Supply Chain Management Vision 2022</td>
<td>Alwar</td>
<td>Apr 27, 2019</td>
</tr>
<tr>
<td>Dr. R K Garg</td>
<td>Geotechnical Aspects of Heritage Structures (ISGHS)</td>
<td>IIT Madras</td>
<td>Sep 16-18, 2019</td>
</tr>
<tr>
<td>Dr. Rajeev Goel&lt;br&gt;Sh. G K Sahu&lt;br&gt;Sh. J K Goyal&lt;br&gt;Dr. Naveet Kaur&lt;br&gt;Sh. D.P. Golla</td>
<td>Precast Concrete for Sustainable Construction</td>
<td>New Delhi</td>
<td>Sep 19-20, 2019</td>
</tr>
<tr>
<td>Dr. Pankaj Gupta&lt;br&gt;Sh. R K Panigrahi</td>
<td>IndoRock 2019 : 8th Indian Rock Conference</td>
<td>New Delhi</td>
<td>Nov 4-5, 2019</td>
</tr>
<tr>
<td>Dr. R K Garg&lt;br&gt;Dr. Rajeev Goel&lt;br&gt;Sh. G K Sahu</td>
<td>Performance Based Design of Buildings &amp; Bridges for Enhanced Seismic Resilience</td>
<td>New Delhi</td>
<td>Nov 8-9, 2019</td>
</tr>
<tr>
<td>Binod Kumar, Sr. Principal Scientist</td>
<td>16th NCB International Seminar on Cement, Concrete and Building Materials</td>
<td>New Delhi</td>
<td>Dec 3-6, 2019</td>
</tr>
<tr>
<td>Dr. Ravinder Kumar</td>
<td>Air Pollution and Public Health – Challenges and Interventions</td>
<td>Delhi</td>
<td>Feb 5-7, 2020</td>
</tr>
<tr>
<td>Sh. Dinesh V. Ganvir, Principal Scientist</td>
<td>Transportation Research Group of India (CTRG-2019)</td>
<td>Madhya Pradesh</td>
<td>Dec 18-21, 2019</td>
</tr>
<tr>
<td>Dr. Devesh Tiwari, Senior Principal Scientist</td>
<td>National workshop on the role of science &amp; Technology in Development of basic infrastructure Development and challenges of 21st century</td>
<td>CSIR-CRRI, NewDelhi</td>
<td>6 Sep 06, 2019</td>
</tr>
<tr>
<td>Sh. Sunil Jain, Senior Principal Scientist</td>
<td>Interactive session on Road Rehabilitation and Stabilization Technologies, by WIRTGEN Group</td>
<td>Pullman Aerocity, New Delhi</td>
<td>Oct 22, 2019</td>
</tr>
<tr>
<td>Sh. Sunil Jain, Senior Principal Scientist</td>
<td>Interactive session on Road Rehabilitation and Stabilization Technologies, by WIRTGEN Group</td>
<td>Pullman Aerocity, New Delhi</td>
<td>Oct 22, 2019</td>
</tr>
<tr>
<td>Name &amp; designation of staff</td>
<td>Details of conference/seminar</td>
<td>Venue</td>
<td>Date</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>Sh. Sampath Kumar Pasupunuri, Scientist</td>
<td>9th India Road Conference at India Construction Festival</td>
<td>ITC Maurya, New Delhi</td>
<td>Oct 15, 2019</td>
</tr>
<tr>
<td>Sr. Principal Scientist Dr. Rakesh Kumar,</td>
<td>5th International Conference on Sustainable Construction Materials and Technology (SCMT5)</td>
<td>Kingston University, London, U.K.</td>
<td>Jul 14-17, 2019</td>
</tr>
<tr>
<td>Dr. A. Mohan Rao</td>
<td>National Seminar on Road Safety organized by National safety Council of India, 15-16 October, 2019</td>
<td>Auditorium, India Habitat Centre, New Delhi</td>
<td>Oct 15-16, 2019</td>
</tr>
<tr>
<td>Ms. Kamini Gupta</td>
<td>Sixth Colloquium on Transportation systems, Engineering &amp; Management, CTSEM</td>
<td>SVNIT, Surat</td>
<td>May 23-24, 2019</td>
</tr>
<tr>
<td></td>
<td>Fifth Conference of Transportation Research Group of India( CTRG-2019)</td>
<td>MANIT, Bhopal</td>
<td>Dec 18- 21, 2019</td>
</tr>
<tr>
<td>Dr. Mukti Advani</td>
<td>Transportation Research Board’s 99th Annual Meeting</td>
<td>Washington, DC</td>
<td>Jan 11-16, 2020</td>
</tr>
<tr>
<td>Dr. Ch. Ravi Sekhar</td>
<td>Inaugural Conclave on NCR-2041 Planning for Tomorrow’s Greatest capital Region</td>
<td>Vigyan Bhawan New Delhi</td>
<td>Nov 11, 2019</td>
</tr>
<tr>
<td></td>
<td>5thConference of Transportation Research Group of India (CTRG-2019)</td>
<td>Bhopal, Madhya Pradesh</td>
<td>Dec 18- 21, 2019</td>
</tr>
<tr>
<td></td>
<td>80th Annual Session of Indian Roads Congress</td>
<td>Patna, Bihar</td>
<td>Dec 19- 22, 2019</td>
</tr>
<tr>
<td>Dr. Errampalli Madhu</td>
<td>15th World Conference on Transport Research (WCTR) 2019</td>
<td>IIT Bombay</td>
<td>May 26-31 , 2019</td>
</tr>
<tr>
<td>Dr. Lakshmy Parameswaran</td>
<td>Two-days Conference on ‘Precast Concrete for Sustainable Construction, organised by ICI, Delhi</td>
<td>New Delhi</td>
<td>Sep 19, 2019</td>
</tr>
<tr>
<td>Sh. G.K. Sahu</td>
<td>Two-days Conference on ‘Precast Concrete for Sustainable Construction, organised by ICI, Delhi</td>
<td>New Delhi</td>
<td>Sep 19, 2019</td>
</tr>
<tr>
<td></td>
<td>International seminar on ‘Performance Based Design of Buildings and Bridges for Enhanced Seismic Resilience’, organised by IAStructE</td>
<td>PHD house, New Delhi</td>
<td>Nov 8-9, 2019</td>
</tr>
<tr>
<td></td>
<td>Seminar on “Integrated Bridge Analysis and Design Software” organized by Bentley</td>
<td>Royal Plaza, New Delhi</td>
<td>Jul 12, 2019</td>
</tr>
</tbody>
</table>
## Participation in Conferences/Seminars/Workshops

<table>
<thead>
<tr>
<th>Name &amp; designation of staff</th>
<th>Details of conference/seminar</th>
<th>Venue</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Rajeev Goel</td>
<td>Arvind Verma Memorial Lecture, organized by IGS Delhi and AIMIL</td>
<td>CSIR-CRRI, New Delhi</td>
<td>Aug 21, 2019</td>
</tr>
<tr>
<td></td>
<td>Concrete Day Celebrations, organised by ICI Ghaziabad</td>
<td>Hotel Radisson Blu, Kaushambi, Ghaziabad</td>
<td>Sep 07, 2019</td>
</tr>
<tr>
<td></td>
<td>Two-days Conference on ‘Precast Concrete for Sustainable Construction, organised by ICI, Delhi</td>
<td>New Delhi</td>
<td>Sep 19-20, 2019</td>
</tr>
<tr>
<td></td>
<td>Geotechnical Engineering Practice – Case Study, organized by IGS Delhi</td>
<td>CSIR-CRRI, New Delhi</td>
<td>Sep 24, 2019</td>
</tr>
<tr>
<td></td>
<td>India Next Finale, organised by UltraTech Cement</td>
<td>Mumbai</td>
<td>Oct 18-19, 2019</td>
</tr>
<tr>
<td></td>
<td>International seminar on ‘Performance Based Design of Buildings and Bridges for Enhanced Seismic Resilience’, organised by IAStructE</td>
<td>PHD house, New Delhi</td>
<td>Nov 8-9, 2019</td>
</tr>
<tr>
<td></td>
<td>Seminar on ‘3D and 2D FEM in Tunnels and Underground Metro Structures’, Organised by MIDAS R&amp;D Centre (P) Ltd.</td>
<td>Delhi</td>
<td>Mar 06, 2020</td>
</tr>
<tr>
<td></td>
<td>Architect of the Year award 2019, Organised by Ambuja Cement</td>
<td>New Delhi</td>
<td>Dec 14, 2019</td>
</tr>
<tr>
<td></td>
<td>Seminar on “Integrated Bridge Analysis and Design Software” organized by Bentley</td>
<td>Royal Plaza, New Delhi</td>
<td>Jul 12, 2019</td>
</tr>
<tr>
<td>Dr. Naveet Kaur</td>
<td>A two-day conference on “Precast Concrete for Sustainable Construction”.</td>
<td>CSOI, Vinay Marg, Chanakyapuri, New Delhi</td>
<td>Sep 19-20, 2019</td>
</tr>
<tr>
<td></td>
<td>Two-day training programme on SAP2000 software and its CSI Bridge module</td>
<td>CSIR-CRRI</td>
<td>Oct 14-15, 2019</td>
</tr>
<tr>
<td></td>
<td>Seminar on “Composite Beams”</td>
<td>CSIR-CRRI</td>
<td>May 30, 2019</td>
</tr>
<tr>
<td>Dr. VVLK Rao</td>
<td>Two-day conference &amp; exhibition on “Precast Concrete for Sustainable Construction”, organized by Indian Concrete Institute, Delhi</td>
<td>New Delhi</td>
<td>Sep 19-20, 2019</td>
</tr>
<tr>
<td>Sh. S.S. Gaharwar</td>
<td>National Seminar on ‘Use of Waste Materials &amp; Plastics in Road Construction, organized by Lucknow Development Authority</td>
<td>Lucknow</td>
<td>Nov 29, 2019</td>
</tr>
<tr>
<td>Name &amp; designation of staff</td>
<td>Details of conference/seminar</td>
<td>Venue</td>
<td>Date</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>All India Seminar on ‘Alternative Highway Construction Material’, organized by the Institutions of Engineers, Jharkhand State Centre</td>
<td>Ranchi</td>
<td>Dec 14-15, 2019</td>
</tr>
<tr>
<td>Dr. Neelam J Gupta</td>
<td>80th Annual Session of IRC</td>
<td>Patna</td>
<td>Dec 19-22, 2019</td>
</tr>
<tr>
<td>Dr. H. Lokeshwor Singh</td>
<td>80th Annual Session of IRC</td>
<td>Patna</td>
<td>Dec 19-22, 2019</td>
</tr>
</tbody>
</table>
Participation in Training Programs/Short Term Courses (Outside CRRI)
<table>
<thead>
<tr>
<th>Name &amp; designation of staff</th>
<th>Details of Training</th>
<th>Venue</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smt. Reeta Kukreja Sh. Anil Kumar</td>
<td>केंद्रीय हिंदी प्रशिक्षण संस्थान, राजभाषा विभाग के गहन हिंदी कार्यशाला में प्रतिमागिता की पुष्टि</td>
<td>केंद्रीय हिंदी प्रशिक्षण संस्थान, 2-A Prithviraj Road, New Delhi</td>
<td>Nov 4-8, 2019</td>
</tr>
<tr>
<td>Dr. R.N. Dutta Sh. Vivek Dubey Sh. S. Mariappan</td>
<td>WICS DeepTech Summit</td>
<td>Scope Convention Centre, CGO Complex</td>
<td>Nov 6-7, 2019</td>
</tr>
<tr>
<td>संजय चौधरी (2019) हिंदी अधिकारी</td>
<td>पांच पूर्ण कार्य दिवसीय अभिमुखी कार्यक्रम</td>
<td>केंद्रीय हिंदी प्रशिक्षण संस्थान, राजभाषा विभाग, गृह मंत्रालय, 2-ए, पूर्वीराज रोड, नई दिल्ली</td>
<td>14.10.2019 से 18.10.2019 तक</td>
</tr>
<tr>
<td>Ms. G. S. Parvathi, Senior Scientist</td>
<td>Climate Change, Hill Area Development and Landslides Management</td>
<td>Mascot Hotel, Thiruvananthapuram, Kerala</td>
<td>Jun 10-14, 2019</td>
</tr>
<tr>
<td>Dr. Pankaj Gupta, Sr. Principal Scientist</td>
<td>Role of technology in the community level disaster mitigation</td>
<td>Lal Bahadur Shastri National Academy of Administration (Govt. of India), Mussoorie248779 (UK)</td>
<td>Aug 19-23, 2019</td>
</tr>
<tr>
<td>Alok Ranjan, Principal Scientist</td>
<td>(i) Vibration monitoring of Metro trains.</td>
<td>AIMIL, Sarita Vihar, New Delhi</td>
<td>Feb 26, 2020</td>
</tr>
<tr>
<td></td>
<td>(ii) MIDAS Software</td>
<td>Hotel Hayat, New Delhi</td>
<td>Mar 06, 2020</td>
</tr>
<tr>
<td>Ms. G.S. Parvathi, Senior Scientist</td>
<td>Climate Change, Hill Area Development and Landslide Management</td>
<td>Kerala</td>
<td>Jun 10-14, 2019</td>
</tr>
<tr>
<td>Ms. G.S. Parvathi Ms. Pritikana Das</td>
<td>Work-Life Balance for Women Scientists and Officers in Research Environment</td>
<td>Ghaziabad</td>
<td>July 24-26, 2019</td>
</tr>
<tr>
<td>Sh. P.V. Pradeep Kumar, Sr. Principal Scientist</td>
<td>Effective Science Communication in Digital Age</td>
<td>Ghaziabad</td>
<td>Aug 21-23, 2019</td>
</tr>
<tr>
<td>D.Ravinder Nidhi</td>
<td>Socio Economic Impact assessment of R&amp;D outcomes</td>
<td>Ghaziabad</td>
<td>Aug 21-23, 2019</td>
</tr>
<tr>
<td>Name &amp; designation of staff</td>
<td>Details of Training</td>
<td>Venue</td>
<td>Date</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>Sh. Kartik Acharya</td>
<td>Recruitment and Assessment Activities</td>
<td>Ghaziabad</td>
<td>Aug 05, 2019</td>
</tr>
<tr>
<td>Sh. Anil Kumar Sh. Nimish Mishra</td>
<td>Global Initiative of Academic Network (GIAN) course on “Design and Construction of Sustainable Concrete Pavement”</td>
<td>IIT Madras</td>
<td>Dec 09-13, 2019</td>
</tr>
<tr>
<td>Dinesh Ganvir, Principal Scientist</td>
<td>Basic Fundamental Aspects of Administration Accounts &amp; Purchase</td>
<td>Ghaziabad</td>
<td>Dec 9-14, 2019</td>
</tr>
<tr>
<td>Sh. Sachin Kumar Sh. Umesh Kumar Ms. Parul Jain Ms. Deepa Rawat</td>
<td>Training Programme on &quot;Road Safety Audit and Other Road Safety Related Aspects” Certification Course for Road Safety Auditors for Chhattisgarh Public Works Department Engineers at New Circuit House, Raipur</td>
<td>60 PWD, Chhattisgarh</td>
<td>July 01-05, 2019 and Oct 21-25, 2019</td>
</tr>
<tr>
<td>Sh. Subhash Chand Dr. E. Madhu Dr. K. Ravinder Dr. J. Nataraju and Dr. A. Mohan Rao</td>
<td>Skill Development on Road Safety Audit and other Road Safety related aspects for Engineers of PWD, Bilaspur Circle, Chhattisgarh,</td>
<td>60 PWD, Chhattisgarh</td>
<td>Sep 21-25, 2019 and Nov 25-29, 2019</td>
</tr>
<tr>
<td>Sh. Subhash Chand Dr. J. Nataraju and Dr. A. Mohan Rao</td>
<td>Customized Training Programme on “Traffic Engineering and Road Safety” for Engineers of UPEIDA at Lucknow, Uttar Pradesh</td>
<td>60 UPEDIA,</td>
<td>Nov 01-02, 2019</td>
</tr>
</tbody>
</table>
Staff News (Retirements, VRS, Transfer to CRRI, Transfer from CRRI, New Joinings in CRRI)
Retirements from CSIR-CRRI

Following staff members have retired from service of the Institute during the period. CSIR-CRRI Welfare Committee organized functions to bid all of them a grand farewell.

Shri OM Prakash, Sr. Technician (2)
On 30-04-2019

Dr. Sangeeta, Sr. Principal Scientist
On 30-04-2019

Shri. Sam Kuriyan, Assistant Grade-1
On 31-05-2019

Dr. B. Kangdurai, Chief Scientist
On 31-07-2019

Shri. Kavaljeet Singh Kapoor
On 31-07-2019

Dr. Kishor Kumar, Chief Scientist
On 31-08-2019

Shri. Lakhbindar Singh, Sr. Technician (2)
On 31-08-2019

Shri. F. A. Siddiqui, Sr. TO (2)
On 31-09-2019
Retirements from CSIR-CRRI

Shri. Bhavesh Passwan, Head Arm Guard  
On 30-11-2019

Dr. M.N. Nagbhushan, Sr. Pr. Scientist  
On 31-12-2019

Shri. Jagdish Singh Jangpangi, Sr. Technician (2)  
On 31-12-2019

Smt. Praveen Bhatia, Assistant Grade-1 (2)  
On 31-01-2020

Shri Veena Varma, Assistant Grade-1  
On 31-01-2020

Shri. Harish Kumar, Sr. Technician (2)  
On 29-02-2020

Shri Renu Chadha, Pr. TO  
On 29-02-2020

Shri. Satyaveer Singh, Sr. Technician (2)  
On 29-02-2020
## Transfer & New Joinings

### Transfer from CSIR-CRRI
- Mr. Satish Kumar, Private Secretary Transferred to CSIR Headquarters, New Delhi w.e.f November 25, 2019.

### Transfer to CSIR-CRRI
- Mrs. Sumit Panwar, Section Officer (F&A) Transferred from CSIR-NPL, New Delhi w.e.f April 01, 2019.

### New Joinings in CSIR-CRRI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Employee</th>
<th>Designation</th>
<th>Date of Joining</th>
<th>Place of Posting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manab Giri</td>
<td>Tech. I</td>
<td>19.09.2019</td>
<td>ILT</td>
</tr>
<tr>
<td>3</td>
<td>Anupriya</td>
<td>Tech. I</td>
<td>30.12.2019</td>
<td>FPD</td>
</tr>
<tr>
<td>4</td>
<td>Abhijeet Kumar</td>
<td>Tech. I</td>
<td>31.12.2019</td>
<td>MBSQ</td>
</tr>
<tr>
<td>5</td>
<td>Chandan Kumar</td>
<td>Tech. I</td>
<td>31.12.2019</td>
<td>BES</td>
</tr>
<tr>
<td>7</td>
<td>Vimal Khushwaha</td>
<td>Tech. I</td>
<td>31.12.2019</td>
<td>MBSQ</td>
</tr>
<tr>
<td>8</td>
<td>Amit Wasnik</td>
<td>Tech. I</td>
<td>02.01.2020</td>
<td>GTE</td>
</tr>
<tr>
<td>9</td>
<td>Sikander</td>
<td>Tech. I</td>
<td>02.01.2020</td>
<td>TES</td>
</tr>
<tr>
<td>10</td>
<td>Saurab Chandra</td>
<td>Tech. I</td>
<td>02.01.2020</td>
<td>FPD</td>
</tr>
<tr>
<td>11</td>
<td>Ashwani Kumar</td>
<td>Tech. I</td>
<td>02.01.2020</td>
<td>RPD</td>
</tr>
<tr>
<td>12</td>
<td>Sujit Kumar</td>
<td>Tech. I</td>
<td>06.01.2020</td>
<td>FPD</td>
</tr>
<tr>
<td>13</td>
<td>Happy kumar Mahawar</td>
<td>Tech. I</td>
<td>07.01.2020</td>
<td>BES</td>
</tr>
<tr>
<td>14</td>
<td>Abhi Mandal</td>
<td>Tech. I</td>
<td>07.01.2020</td>
<td>TPE</td>
</tr>
<tr>
<td>15</td>
<td>Anand</td>
<td>Tech. I</td>
<td>08.01.2020</td>
<td>GTE</td>
</tr>
<tr>
<td>16</td>
<td>Ashish Tripathi</td>
<td>Tech. I</td>
<td>09.01.2020</td>
<td>PED</td>
</tr>
<tr>
<td>17</td>
<td>Nitin Mishra</td>
<td>Tech. I</td>
<td>10.01.2020</td>
<td>PED</td>
</tr>
<tr>
<td>19</td>
<td>Chirag Kapoor</td>
<td>Tech. I</td>
<td>15.01.2020</td>
<td>BES</td>
</tr>
<tr>
<td>20</td>
<td>Anija TS</td>
<td>Tech. I</td>
<td>23.01.2020</td>
<td>TES</td>
</tr>
<tr>
<td>21</td>
<td>Prajapati Abhay Chandrabhushan</td>
<td>Tech. I</td>
<td>27.01.2020</td>
<td>ILT</td>
</tr>
<tr>
<td>22</td>
<td>Sakshi Gupta</td>
<td>Tech. I</td>
<td>28.01.2020</td>
<td>TPE</td>
</tr>
<tr>
<td>23</td>
<td>Neeraj Prajapati</td>
<td>Tech. Asstt.</td>
<td>15.07.2019</td>
<td>TPE</td>
</tr>
<tr>
<td>27</td>
<td>Rajesh Kumar</td>
<td>Tech. Asstt.</td>
<td>01.01.2020</td>
<td>PME</td>
</tr>
<tr>
<td>28</td>
<td>Rohit Chamoli</td>
<td>Tech. Asstt.</td>
<td>01.01.2020</td>
<td>GTE</td>
</tr>
<tr>
<td>29</td>
<td>Dinesh Kumar Mandal</td>
<td>Tech. Asstt.</td>
<td>07.01.2020</td>
<td>BES</td>
</tr>
<tr>
<td>30</td>
<td>Muzahid Hussain</td>
<td>Tech. Asstt.</td>
<td>07.01.2020</td>
<td>CCN</td>
</tr>
<tr>
<td>31</td>
<td>Keshav Kaushik</td>
<td>Tech. Asstt.</td>
<td>08.01.2020</td>
<td>TPE</td>
</tr>
<tr>
<td>32</td>
<td>Avala Narayana Rao</td>
<td>Tech. Asstt.</td>
<td>08.01.2020</td>
<td>BES</td>
</tr>
<tr>
<td>33</td>
<td>Ankit Kumar Nishad</td>
<td>Tech. Asstt.</td>
<td>13.01.2020</td>
<td>PED</td>
</tr>
<tr>
<td>34</td>
<td>Satyajit Nayak</td>
<td>Tech. Asstt.</td>
<td>16.01.2020</td>
<td>DLS</td>
</tr>
<tr>
<td>35</td>
<td>Jitender Kumar Yadav</td>
<td>Tech. Asstt.</td>
<td>17.01.2020</td>
<td>G.House</td>
</tr>
<tr>
<td>36</td>
<td>Amit Shekhar</td>
<td>Tech. Asstt.</td>
<td>17.01.2020</td>
<td>PED</td>
</tr>
<tr>
<td>37</td>
<td>Ratan Bishwash</td>
<td>Tech. Asstt.</td>
<td>28.01.2020</td>
<td>MBSQ</td>
</tr>
<tr>
<td>38</td>
<td>Prakash Singh</td>
<td>Tech. Asstt.</td>
<td>31.01.2020</td>
<td>CCN</td>
</tr>
</tbody>
</table>
Manpower Position
(as on 31.03.2020)
**Director**
Prof. Satish Chandra, B.E. (Civil), M.E.(Transportation Engineering) (Hons), Ph.D

**R&D DIVISIONS**
**Geotechnical Engineering (GTE)**
**Head**
Dr. Prasad P.S., M.E. (Geotechnical Engg.), Ph.D

**Scientists**
Dr. Kishore Kumar, M.Sc (Geology), Ph.D (Retired on 31/08/2019)
Sh. U.K. Guru Vittal, M.E. (Highway)
Dr. Vasant G. Havanagi, M.Tech (Highway & Traffic Engg.), Ph.D
Dr. Pankaj Gupta, M.Tech. (Applied Geology), Ph.D
Dr. Ambrish Saurikhia, M.Sc. (Env. & Water resources Engg.), Ph.D
Dr. Kanwar Singh, M.Tech (Geotechnical Engg.), Ph.D
Sh. Alok Ranjan, M.Tech. (Engineering Geology)
Dr. Anil Kumar Sinha, M.Tech. (Geotechnical Engg.), Ph.D
Ms. Parvathi G.S., M.Tech. (Geotechnical Engineering)
Sh. Nitesh Kumar Goel, M.Tech (Transportation Engg.) (On Deputation)

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

**Scientists**
Dr. Sangita, M.Sc., Ph.D. (Polymer Chemistry) (Retired on 30/04/2019)
Sh. M.N. Nagabhushana, M.Sc. (Highway Engg.) (Retired on 31/12/2019)
Sh. Abhishek Mittal, 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

**Technical Officers/Technical Assistants**
Ms. Shanta Kumar, B.Sc., L.L.B.
Dr. C. Kamaraj, M.E, Ph.D
Sh. Shankh Dass, B.E. (Civil)
Sh. Madan Pal Singh, B.Sc.
Sh. Amit Kumar, B.Tech (Civil)
Sh. Kaushal Kumar
Sh. Saurabh k. Verma, Dip. in Mechanical Engg. & Post Dipl.(CAD&CAM)
Sh. Mayank Grover, Diploma in Civil Engg.

**S&T and Supporting Staffs**
Sh. Saurabh Chandra, ITI-Electrical
Ms. Anupriya, ITI Electronic, CIT-Electronics
Sh. Sujit Kumar, ITI-Electrical, CIT-Electrical
Ms. Karuna Saini, M.A. (Economics)
Sh. Raghusharan Balmiki, Non-Matric

**Rigid Pavement (RP)**
**Head**
Dr. Rakesh Kumar, B.E., Ph.D. (Civil Engg)

**Scientists**
Sh. Binod Kumar, M.E. (Hill Area Development Engineering)
Manpower Position (as on 31.03.2020)

Ms. Lalita Jangpangi, B.Sc. (Engg. & ECE), M.E. (Instrumentation & Control)
Sh. Dinesh V. Ganvir, M.E. (Highway & Transportation)
Sh. Romeil Sagwal, M.Tech (Transportation Engineering)
Sh. Ravi Shankar S, M.Tech (Transportation Engineering)

Technical Officers/Technical Assistants
Sh. Pankaj Goel, M.Tech (Const. Engg. & Management)
Sh. Manoj Kumar Singh, B.E. (Civil), M.Tech (Transportation Engineering)
Sh. Surendra Singh, M.Tech, (Geotechnical Engineering)

S&T and Supporting Staffs
Sh. Pratap Singh, Matric ,ITI
Sh. Subhash, Cert. in Draftsman
Ms. Neha Dhiman, B. Tech. Civil
Sh. Rohit Goutam, B.Tech. Civil
Sh. Sunil Datt, Non Matric
Sh. Ashish Tripathi, Diploma (Electronics)
Sh. Nitin Mishra, ITI in Instrumentation

Traffic Engineering & Safety (TES)
Head
Sh. Subhash Chand, M.E. (Highways)

Scientists
Dr. S. Velmurugan, M.E., Ph.D. (Transportation Engineering)
Dr. Neelima Chakraborty, M.A., (Psycho.), P.G. Dip. (Environmental Psycho.), Ph.D.
Dr. A. Mohan Rao, M.Tech. (Transportation Engineering), Ph.D
Dr. J. Natraju, M.E.(Highways) , Ph.D
Dr. Sippy K. Chauhan, M.Sc., Ph.D. (Chemistry)
Sh. Ashutosh Arun, M.Tech
Sh. Ramesh Ch. Majhi, M.Tech

Technical Officers/Technical Assistants
Ms. Renu Chadha, M.Sc. (Botany)
Manpower Position (as on 31.03.2020)

Sh. Rajan Verma, Diploma in Civil Engg, B.E. (Civil)
Sh. Vijay Kumar, B.Tech. (Civil)

S&T and Supporting Staffs
Sh. Aniket Ranjan, ITI.
Ms. Krishna Verma, BA
Sh. Mukesh Kumar, ITI (civil)
Sh. Narender Kumar, Matric
Ms. Raj Bala, Non-Matric
Sh. Sikander, (ITI)
Ms. Anija, B.A.

Transportation Planning and Environment (TPE)

Head
Dr. Ravindra Kumar, ME (Transportation Engg.), Ph.D

Scientists
Dr. K. Ravinder, M. Tech. (Transportation Engg.) Ph.D
Dr. Anuradha Shukla, M.Sc., M.Tech., PG. Diploma in Ecology & Environment Science, Ph.D
Dr. Niraj Sharma, M.Tech. (Environmental Engg.), Ph.D
Dr. Errampalli Madhu, M.Tech (Transportation Engineering), Ph. D
Dr. Nasim Akhtar, M.Tech. (Environmental Engg.), Ph.D
Dr. Ch. Ravi Sekhar, M.E. (Transportation Engineering), Ph.D
Ms. Farhat Azad , M.Tech (Geotechnical & Geoenvironmental Engineering)
Dr. Rina Singh, M. Tech. (Material Science), Ph.D (Nanotechnology, Physics)
Dr. S. Padma, M.Tech.(Urban Engineering), Ph. D
Dr. Mukti Advani, M.E. (Transportation Engineering), Ph.D
Ms. Minal, M.Tech (Transportation Engineering)
Dr. Pritikana Das, M.tech (Transportation Engineering),Ph.D (Resigned on 16-03-2020)

Technical Officers/Technical Assistants
Sh. R.C. Agarwal, B.E. (Mechanical Engg.)
Sh. Satish Kumar, Diploma in Electronics & Communication Engineering.
Ms. Preeti Sinha, B.C.A.
Sh. Keshav Kaushik, Diploma in Civil, AMIE in Civil Engg.
Sh. Abhi Mandal, Diploma in Civil Engg.

S&T and Supporting Staffs
Sh. Jagdish Singh, Intermediate (Retired on 31-12-2019)
Mr. Sanjay Kumar, M.A. (Pub. Admn.), B.Lib. (Science)
Sh. Daya Ram, B.A.
Ms. Neha Chaudhary, Diploma in PHEE, B.E.(Civil), PG Dip (EIA & Monitoring)
Ms. Sakshi Gupta, Diploma in Civil Engg.
Ms. Sarita Sethi, M.A. (Sociology)
Sh. Sunil Kumar, Graduate
Ms. Shakuntla Devi, Non-Matric

Bridge Engineering & Structures (BES)

Head
Sh. G. K. Sahu, B.E. (Civil), M.E. (Structures)

Scientists
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. S. S. Gaharwar, B.E. (Civil), M.E. (Structures)
Dr. Rajeev Goel, B.E. (Civil), M.E. (Structural Engineering), Ph.D
Dr. V.V.L. Kanta Rao., M.Sc., Ph.D.
Sh. J. K. Goyal, B.E. (Civil), M.E.(Structures)
Sh. M. K. Meena, B. Tech (Civil), M. Tech. (Environmental Science & Engineering)
Sh. Durga Prasad Golla, B. Tech. (Civil), M. Tech. (Structures)
Dr. Naveet Kaur, B.E. (Civil), M. Tech. (Structures) Ph.D
Manpower Position (as on 31.03.2020)

Technical Officers/Technical Assistants
Sh. Narendra Kumar, M.Sc.
Sh. Pardeep Kumar, Diploma in Civil, AMIE (Civil), M.E. (Structures)
Sh. Yogender Kumar Singh, Diploma in Electronics
Sh. Rajesh Rana, Diploma (Production & Industrial Management), AMIE (Mechanical)
Sh. Shashi Kumar Bhushan, Diploma (Civil Engg.), AMIE (Civil Engg.), M.E. (Structures)
Sh. Surendra Kumar Verma, Diploma in Civil Engineering, BE (Civil)
Sh. Prateek Sharma, B.Tech (Civil), M.Tech (Structures)
Sh. Sudhanshu Bhagat, Diploma in Civil Engineering
Sh. Dinesh Kumar Mandal, Diploma in Mechanical Engineering
Sh. Avala Narayana Rao, B.Tech (Electronics and Electrical Engineering)

S&T and Supporting Staffs
Sh. Om Kumar, B.A., I.T.I.
Er. Vijay Kumar, ITI (Civil), Diploma in Civil Engineering
Sh. Chandan Kumar, Intermediate, ITI (Mechanical)
Sh. Happy K. Mahawar, B.Com, ITI (Civil), Pursuing Diploma in Civil Engineering
Sh. Chirag Kapoor, Intermediate, ITI (Electronics)
Sh. Rajveer Singh, Non-matric
Mrs. Indu Rani, B.A.

R&D MANAGEMENT DIVISIONS
Information, Liaison & Training (ILT)
Head
Dr. Neelam Jain Gupta, M.Sc, M.Phil (Computer Application), Ph.D (Numerical Analysis)
Scientist
Sh. Subodh Kumar, B.Sc. Engg. (Electrical), MS (Electronics & Control Engg.), M.B.A.

Technical Officers/Technical Assistants
Ms. Kamla Masih, Diploma in Electronics, M.C.A
Dr. H. Lokeshwor Singh, B.Sc. (Instrumentation), M.Sc. (Electronics), Ph.D. (IT)
Sh. K.K. Gola, Diploma in Mechanical Engg., PG Diploma in R/AC
Sh. Vijay Kumar Kaushal, Dip. in Computers, BCA, MCA, OCA, MBA

S&T and Supporting Staffs
Sh. Amin Ali Khan, M.A. (Political Science)
Sh. Manab Giri, Diploma in Civil Engineering, ITI (Surveyor)
Sh. Abhay C. Prajapati, Diploma in Civil Engineering
Sh. Rakesh Kumar, Intermediate
Ms. Sumitra Bai, Non-Matric

Project Monitoring Evaluation (PME)
Head
Sh. P.V. Pradeep Kumar, M.E. (Mech.), M.B.A.
Scientists
Advisor R&D, BD
Dr. B. Kanaga Durai, M.A. (Eco), M.R.P. (Regional Planning) Ph. D.

Technical Officers/Technical Assistants
Sh. Ravinder Deekonda, Diploma in Computer Engg., BCA, MCA
Ms. Nidhi, M.Sc. (Chemistry)
Sh. Anshul Saxena, M.Tech (IT)
Sh. Rajesh Kumar, Diploma in Computer Science & Engineering

S&T and Supporting Staffs
Sh. Dinesh Prakash, Non-Matric
Ms. Santosh, Non-matric

Mechanical & Transport Division
Coordinator
Sh. N.K. Sharma, Diploma in Instruments
Manpower Position (as on 31.03.2020)

**Technology, B.A., B.Tech (Mechanical)**

**Technical Officers/Technical Assistants**

**S&T and Supporting Staffs**
Sh. Devender Kumar, I.T.I (Motor Mech.)
Sh. Om Prakash, I.T.I. (Fitting) (Retired in April 2019)

**Computer Centre & Networking (CCN)**

**Head**
Sh. Vivek Dubey, M.C.A., PGDBM (Finance & Marketing)

**Scientists**
Dr. R. N. Dutta, M.Sc. (Operational Research), Ph.D

**Technical Officers/Technical Assistants**
Sh. S. Mariappan, M.C.A.
Ms. Reeta Kukreja, M.Sc. (IT), M.B.A.
Sh. Prakash Singh, B.Tech.
Sh. Muzahid Hussainm B.E.

**S&T and Supporting Staffs**
Sh. Anil Kumar, Dip. in Computer Hardware
Sh. Shiv Lal, Dip. in Computer Hardware

**Maintenance**

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

**Technical Officers/Technical Assistants**
Sh. Ashok Kumar, M.Sc. (Hort.) (On deputation)
Sh. V.K. Tyagi, Dip. in Civil Engg.
Sh. Mukesh Kumar, Diploma (Civil Engg.), B.E.(Civil Engg.), M.Tech (Construcción Engg. & Management)
Sh. Vaibhav Varshney, Diploma in Civil Engineering
Sh. Hemraj Meena, B.Tech (Civil Engg.)

**S&T and Supporting Staffs**
Sh. K.J.S.Kapoor, B.Com, I.T.I (Retd on 31-07-2019)
Sh. Kishan Swaroop, ITI (Electrician)
Sh. Krishan Kanhaiya Lodha, ITI (Electrician)
Sh. Vinit Kumar, ITI (Electronics Mechanics), Diploma (EC E.)
Sh. Kartik Dutta, ITI (Carpenter), Diploma (Mechanical Engg.)
Sh. Asif Hussain Choudhary, B.Com. (Retired on 31-03-2019)
Sh. Kailash Kumar, Matric

**Documentation & Library Services (DLS)**

**Head**
Dr. Neera Aggarwal, M.A., B.LI. Sc., Ph. D

**Technical Officers/Technical Assistants**
Ms. Mitali Mohapatra, DLISc., PDLSc., MLSc., PGDLAN
Ms. Ching Lydia, B.Sc., MLISc.
Mr. Satyajit Nayak, B.Sc, MLIscc., MPhil.

**S&T and Supporting Staffs**
Sh. Des Raj

**Quality Management Division (QMD)**
Sh. A. K. Jain, M.E. (Transportation Engg.) Hons.

**AcSIR-CRRI**
Dr. Ch. Ravi Sekhar, M.E. (Transportation Engineering), Ph.D. (Coordinator)
Manpower Position (as on 31.03.2020)

Maharani Bagh Staff Quarters (MBSQ)

Head
Sh. A. K. Tripathi, B.E. (civil)

Coordinating Officer
Dr. Rajeev Goel, M.E.(Structural Engineering), Ph.D.

Technical Officers/Technical Assistants
Sh. Jitendra Gir, B.E. (civil)
Sh. Sunil Grover, M.E.(Building Engg. and management)
Sh. D.V. Singh, M.Sc.
Sh. Muni Raj Meena, B. Tech (Electrical)
Sh. Tara Chand, M.E.(Building Engg. and management)
Sh. Rohan Prakash Jha, M.E.
Sh. Ratan Vishwash Diploma in civil engg.

S&T and Supporting Staffs
Sh. Amit kumar, ITI(Electrician)
Sh. Prem Chand, Non-Matric
Sh. Abhijeet kumar, ITI(COPA)
Sh. Vimal Kushwaha, ITI ( Carpenter)
Sh. Raja Lal Manjhi, Non-Matric

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

Administration
Controller of Administration
Sh. Anjum Sharma, BA, DBA, PGD Eco. & Env., M.B.A( H.R.M)

Sh. Vijay Kumar, H.Sc.
Sh. Ram Singh, Non Matric
Sh. Yoginder Mehto, Non-Matric
Sh. Suresh Prasad Thakur, Matric

Sh. Karam Sing, Matric
Sh. Dharam Singh, Matric
Ms. Priti Sachdeva, B.A. (Hons.) & Dip. in Secretarial Practices (Receptionist)
Sh. Ravi Kumar, Non Matric
Sh. Om Prakash, Non Matric

Establishment-I

Section Officers
Sh. Anil Kumar, B.Com, Diploma in HR

Sh. Chander Kant, M.A.
Ms. Satinder Kaur, B.A.
Sh. Manoj Kumar, Non-Matric
Sh. Bhajan Singh, B.A.
Ms. Parul Jain, B.Com (P)
Sh. Anirudh, (Resigned from CRRI on 30-09-2019)
Sh. Sri Ram Mahto, Matric

Establishment-II

Section Officers
Ms. Vandana D Singh, M.A.

Ms. K.B. Verghese, Senior Secondary
Sh. Anil Kumar, B.A.
Sh. V.K. Bhambota, Matric
Sh. Sumit Paul, B.Com., M.Com., M.Ed, MBA,
Sh. Niranjan Kumar Srivastav, B.A.
Sh. Sachin Kumar, M.Com.
Sh. Dinesh Kumar, Non-Matric
Sh. Desh Raj, Matric
Sh. Mohan Lal, Non-Matric
Sh. Bhawesh Paswan, Matric (Retired on 30-11-2019)
Sh. Umesh Kumar, Diploma (I.T), B.C.A

Personnel Cell

Section Officers
Sh. Rajan Tirkey, B.A. (Hons.)
Manpower Position (as on 31.03.2020)

Ms. Parveen Bhatia, B.A., Cert. in Lib. Science
(Retired on 31-01-2020)
Sh. Nimish Mishra, B.Com (Hons.)
Ms. Nidhi Gautam, B.Com (Hons.)
Sh. Dharam Pal, Non-Matric
Sh. Murari Lal Meena, B.A.

Rajbhasha Unit
Hindi Officer
Ms. Anupama Sharma, MA, PG Dip. in Translation
(Resigned in November 2019)

Vigilance Cell
Section Officer
Smt. Santosh Khuttan, B.A

Sh. Meesam Zaidi, B.Com(Hons.), M.A.
(Pub. Adm.), UGC-NET
Sh. Sanjai Singh, B.A.
Sh. Karam Singh, Matric

Store & Purchase Section
SPO
Sh. R D Chinchulkar, B.Sc., Diploma in Material Management
Section Officer
Sh. Sumer Singh Chhachhia, B.A

Ms. Veena Verma, B.A. (Retired on 30/11/2019)
Sh. Rajeev Chopra, Sr. Sec.
Sh. K. Bairagi, Sr. Sec.
Sh. Virender Kumar Dussya, B.A., PGDAPP
Ms. Rachna Kumari, BA
Sh. Vijender Kumar, Matric (Retired on 30/04/2019)
Sh. Kartik, B.Sc
Ms. Sumitra Devi, Non Matric

Finance & Account Section
F&AO
Sh. Avanish Kumar, B.Sc., LLB
Section Officer
Mrs. Sumit Panwar, MA, B.Ed
Sh. Bishan Dass Sharma, B.A.

Sh. Vikas Negi, B.A.
Sh. Meesam Zaidi, B.Com (Hons.)
Ms. Deepa Rawat, M.Com (Pro)
Sh. Aman Malik, B, Com (Pro)
Sh. Ankit Kumar, B. Com (Hons)
Sh. Jagdish Singh Negi, Matric
Sh. Shiv Narayan, Non-Matric

Guest House (Wing I & II)
Manager
Sh. Jitender Kumar Yadav, Dipl. in Hotel Mgt.
Catering & Nutrition, B.A., MBA in Hospitality Management

Sh. Rohit, B.A. (Hons. Spanish)
Sh. Rajbir Singh, Non-Matric
Sh. Keshav Ram Acharya, Non-Matric
Sh. Rajesh Bariya, Non-Matric
Sh. Chet Narayan, Non-Matric
Sh. Rajpat Singh, Non-Matric
Sh. Ram Sahai, Non-Matric

Canteen
Manager
Sh. Braham Prakash, Matric

Ms. Kamlesh Kumari, M.A.
Sh. Ramesh Badola, H. Sc.
Sh. Bhawar Singh, Non-Matric
Sh. Rajinder Singh, Non-Matric
CSIR-Central Road Research Institute, New Delhi
Annual Report
2019-20

Chief Editor
Prof. Satish Chandra
Director, CSIR-Central Road Research Institute

Compilation, Editing, Design and Production
Information, Liaison & Training Division

Editorial Committee
Dr. Neelam J Gupta, Principal Scientist & Head, ILT
Dr. H. Lokeshwor Singh, Senior Technical Officer
Smt. Kamla Masih, Senior Technical Officer
Sh. Vijay Kaushal, Technical Officer

Overall Supervision
Dr. Neelam J Gupta
Head, Information, Liaison & Training Division

Published by:
Prof. Satish Chandra
Director, CSIR-Central Road Research Institute
New Delhi – 110025, India
E-mail: director.crri@nic.in

Designed by:
Pushpak Press Pvt. Ltd.
Okhla Industrial Area, Phase-1, New Delhi-110020