



Central Road Research Institute
केंद्रीय सड़क अनुसंधान संस्थान

CSIR CRRI Newsletter

सीएसआईआर-सीआरआरआई समाचार पत्रिका



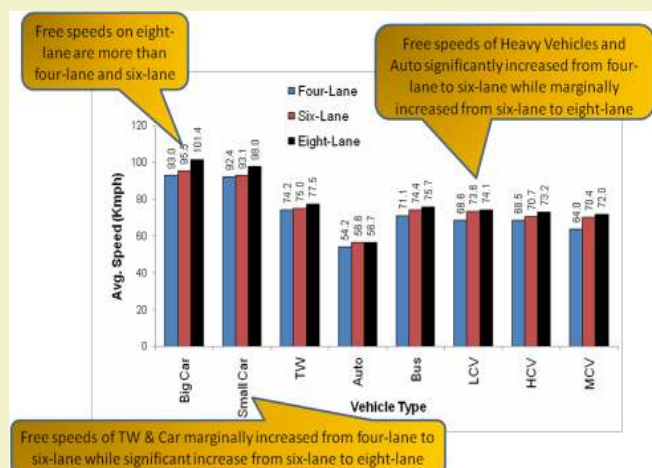
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❖❖ MAJOR R&D STUDIES

Development of Microscopic Traffic Simulation Model using VISSIM and PARAMICS to Develop Speed-Flow Equations and Roadway Capacity for High Speed Corridors

An attempt has been made for the first time in the country to explicitly study the free speed profiles and speed-flow characteristics on various types of multi-lane highways covering four-lane, six-lane and eight-lane divided carriageways in plain terrain. In order to assess these characteristics, extensive data on Time Mean Speed (TMS) and Space Mean Speed (SMS) under free flow conditions coupled with traffic flow data was collected on sites spread over different regions of India. Figure 1 shows the free speed characteristics of multi-lane highways ranging from four to eight lanes divided carriageways. From the data collected, free speed profiles of different vehicle types and speed - flow equations on high speed corridors have been developed using traditional and microscopic simulation models. Towards this end, microscopic traffic simulation softwares namely VISSIM and PARAMICS have been utilized. The road network



TW : Two Wheelers
HCV : Heavy Commercial Vehicles
LCV : Light Commercial Vehicles
MAV : Multi-axle Commercial Vehicles

Fig. 1: Free speed characteristics of multi-lane highway



Fig. 2: Simulation of vehicles in VISSIM on four-lane divided carriageway

developed in VISSIM software environment is shown in Fig. 2. The simulation model is able to reduce significantly the error (from 3 ~ 34% to 0.1 ~ 18%) as compared to traditional method, as can be seen in Fig. 3. Further, capacity norms developed for these high speed corridors were also evolved from the speed-flow equations as shown in Fig. 4., As can be seen, the estimated roadway capacity is 5574, 7733 and 9796 PCU/Hr/Direction

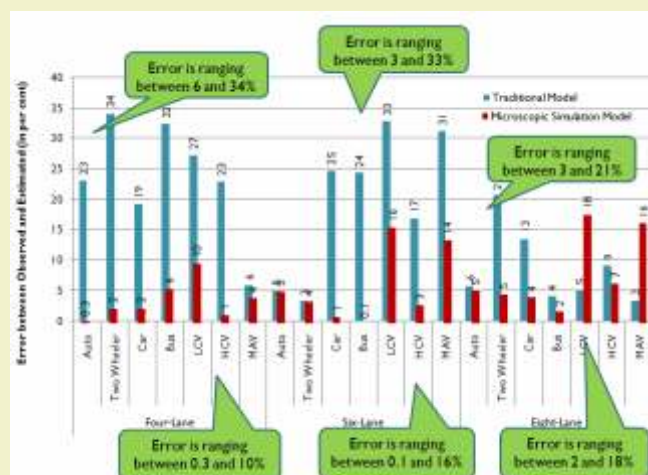


Fig. 3: Validation of microscopic traffic simulation model

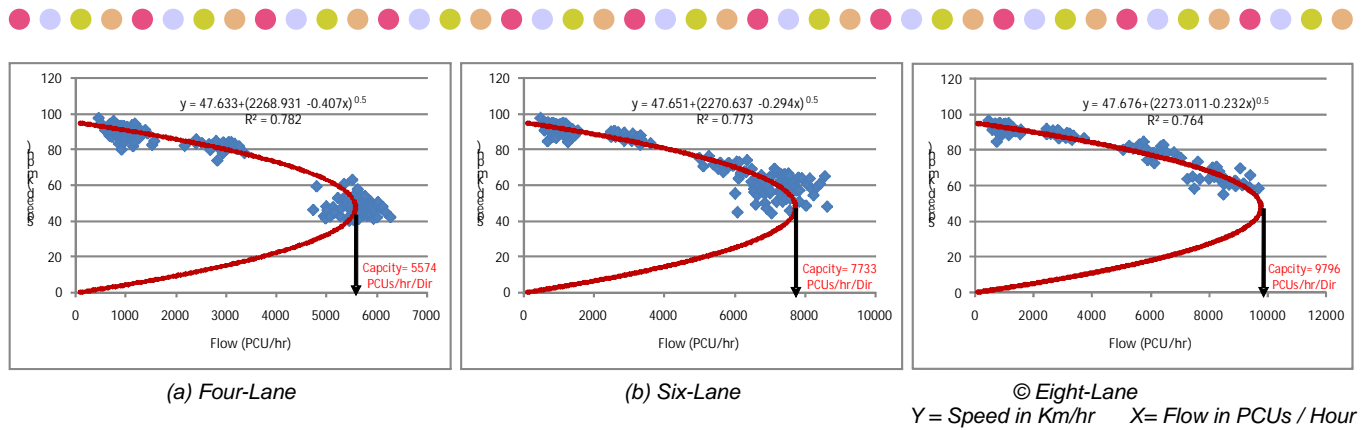


Fig. 4: Speed flow equations and roadway capacity for multi-lane highways

for four, six and eight-lanes divided carriageways respectively.

The impact of typical Indian driving behavior, for example how the lane change behavior affects roadway capacity on multi-lane highways has also been assessed through microscopic simulation approach. It has been estimated that there is a reduction of 3 to 9% in the estimated capacity as shown in Fig. 5. On a eight-lane divided urban

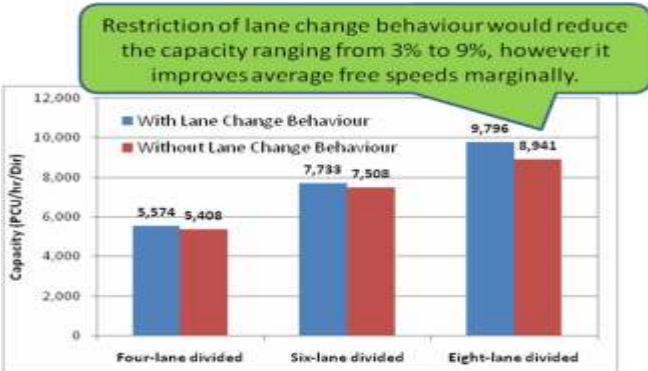


Fig. 5: Impact of lane change behaviour on roadway capacity

expressway, PARAMICS software has been used to model vehicular behavior such as virtual lanes etc. The speed-flow equations developed and the estimated roadway capacity of eight-lane divided urban expressway is presented in Fig. 6. Further,

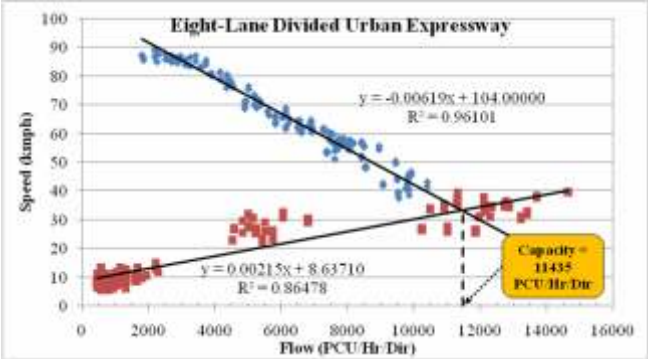


Fig. 6: Roadway capacity on eight-lane divided urban expressway

the impact of virtual lanes and lane change on capacity is assessed using developed simulation model. It is found that there is a 15% and 9% reduction in capacity due to the restriction of virtual lane and restriction of lane respectively, as

shown in Fig. 7. It can also be seen that free speeds are increasing only marginally. Finally, the Design

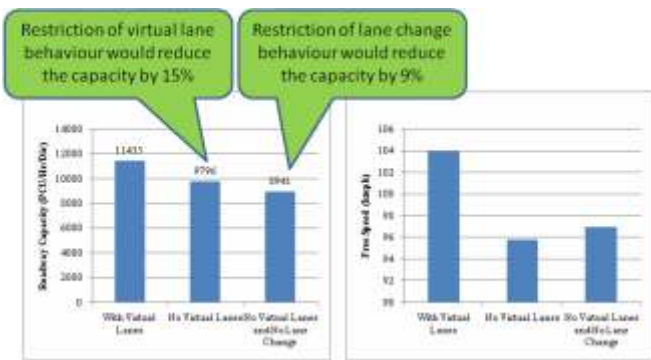


Fig. 7: Impact of virtual lane and lane change on roadway capacity on a eight-lane divided urban expressway

Service Volume (DSV) for various multi-lane highways under the prevailing heterogeneous traffic conditions has been evolved with reasonable degree of confidence. The outcome from this study is expected to form an important input for developing Road User Cost (RUC) models, exclusively for multi-lane highways.

GIS Based National Highways Information System

CRRI had undertaken the task of developing GIS based National Highways Information System (NHIS) in 2006 under the sponsorship from Ministry of Road Transport and Highways, Government of India. The study aims to develop comprehensive database for about 50,000 kms of National Highways (except the roads under NHDP Phase I & II) in GIS environment, which is to be achieved through collection and collation of one time road related data both from primary and secondary sources. The major objective of the project is to develop GIS based software through which data management system can be established. The developed software will also provide the data input requirements to perform



various analysis under pavement maintenance management system.

The software developed under this study includes variety of information under different sub-modules viz., (i) Locational Referencing, (ii) Pavement Construction and Maintenance History, (iii) Pavement Inventory, (iv) Pavement Condition (v) Pavement Geometry, (vi) Pavement Crust and Strength details (vii) Environmental Condition, (viii) Traffic and Vehicle Information, (ix) Cross-Drainage details, and (x) Integration with HDM-4 software. The software has been developed within a specific GIS environment with diversified multi-tasking operations. It is a web-based as well as desk top based application tool to serve spatial data on the internet/intranet.

There are three categories of users who can have access to the Web based NHIS application viz., Administrators, Engineers and Ordinary users. Desktop based NHIS application helps user to have control over the database. Since he will also be able to perform modifications as required over the existing database.

The database has been created by generating a unique NHID for each segment, which is Km based. To provide temporal view of the system, digital maps in 1:1 million scale have been prepared, where all major roads and cities are identified. Km wise spatial data was incorporated using DGPS data collected through Network Survey Vehicle (NSV). NSV also collects various primary data such as road geometric, pavement condition, and distance which are also synchronized with the DGPS data. The software also has the facility to enter and upload other data, as required in various modules.

About 35000 kms of DGPS spatial data along with the primary data, collected using NSV, has already been incorporated in the software and provided to the Ministry. Twenty officials of Ministry have also been given hands-on training on the operation of software. The database is currently being integrated to enable export and import of data sets to HDM-4 software for conducting series of analysis, as needed. Some of the photograph given below depicts the system operation.



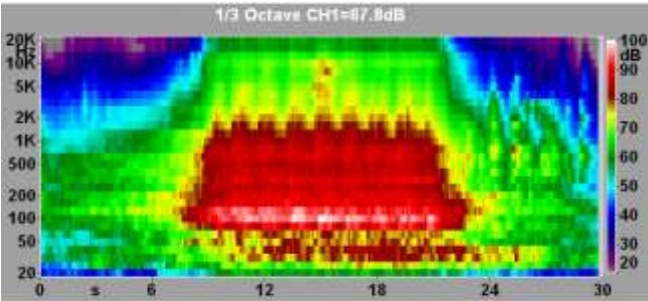
Noise and Vibration Study along Metro Railway Corridor, at Tapan Sinha Memorial Hospital, Chanditala, Kolkata

Noise and vibration assessments are the key elements in an environmental impact assessment process, especially for mass transit projects. Kolkata enjoys the rare distinction of being the first city in India to operate a high speed mass transit system. The first phase of Kolkata metro runs through the densely populated areas and operates mostly underground. Now, the second phase of Kolkata Metro, which is an elevated corridor, is also operational. In some areas, it runs very close to the sensitive land use such as schools, hospital and parks. A nine-storied multi specialty hospital (Tapan Sinha Memorial Hospital) at Chanditala is currently under construction abutting the metro corridor.



A study has been carried out to observe the noise and vibration levels being generated due to metro rail operation and on the basis of observed values the counter measures are suggested.

The observed noise level of the train is 95.6 dB(A), while vibration level is very high i.e 128 VdB in Y direction and 125 VdB in Z direction. These values are very high at the pier of hospital as well as at the pier of metro structure, as per US norms, since it crosses the threshold limit of 65 VdB. On the other hand British Standard and ISO Standard follow the acceleration. Conversion of VdB in acceleration mode comes out to be 3.2m/s² and 3.9m/s² respectively. Therefore, it is a serious concern in case of hospital. Continuous exposure time due to metro operation is 2.04 hours out of the total metro operation schedule of 18 hours.



There are no Indian guidelines available for vibration; hence, CRRRI has used the European Union / USA Guideline. EU guideline focuses on impact of vibration on human in building i.e x,y & z directional vibration, and thus it is monitored in terms of acceleration (m/s²), while USA guideline says that it will be in VdB.

The various sources of noise/vibration found at/near Tapan Sinha Memorial Hospital are Metro Railways corridor passing in the middle of hospital, High Speed of Metro Train at turning point (55km/h), Vehicular traffic at the entrance, Generator for battery back-up, various medical instruments & huge crowd (public) etc.

| HVMA Position 1 | | | | | |
|------------------|----------------|-------------------------|--------------------|-----------------------|--|
| X _{ch1} | W _h | a _{hw,eq} dB | Σ dB | a _{hw,eq} dB | |
| a _{hw} | dB | 95.0 | | 100.1 | |
| | | a _{hw,peak} dB | a _{hw} dB | CF(1) | |
| | | 125.0 | 81.7 | 2.0 | |
| Y _{ch2} | W _h | a _{hw,eq} dB | | | |
| a _{hw} | dB | 96.9 | | | |
| | | a _{hw,peak} dB | | | |
| | | 128.9 | | | |
| Z _{ch3} | W _h | a _{hw,eq} dB | | | |
| a _{hw} | dB | 93.3 | | | |
| | | a _{hw,peak} dB | | | |
| | | 125.4 | | | |

100

39.62

10

3.16

1

0.32

0.1

OV

OV

OV

UD

UD

UD

Σ

Noise and Vibration due to metro railways are found to be very high due to the old technology being used for metro operation and track. At present, no measures are being taken to stop / minimise the noise and vibration.

Air born vibration and ground born vibration is very high at this site (which is 150m in length). In addition. due to sharp turning, poor maintenance, old structural design and higher length of metro trains (eight numbers of coaches), secondary air born noise and vibration are also very high at this site.

When measured / Calculated Values are compared with Daily exposure graph, Nomogram for A8, exposure point and VdB (Vibration in decibel) and Acceleration at 3m (which is 3.2 m/s² in z direction), it is found that site is at extremely uncomfortable level.

Following measures have been recommended.

A) Recommendations at Source

- Complete loop of polycarbonate sheet of 8mm is required at the parapet wall upto a length of 150m for stopping the noise to 15 dBA level and stopping the vibration to 15 VdB level.
- Rail pads may be used to cover-up the opening near the track to prevent vibration at the hospital.
- Upto 2m height of parapet wall, absorptive noise barrier may be used along with polycarbonate sheet, in the length of 150m on either sides.
- A 9" thick brick wall will be provided around the circular pillars which will absorb ground borne vibration up to 10 VdB.

B) Recommendations at Receiver End

- At ground level and upto 1m below the depth of structure, Rubber pad insulator is required along the structure (3 side vibrations) for prevention of vibration upto 10 VdB.
- The open space between pillar to Hospital filling of river sand in about 1m depth from the





- Hospital will be used. In this way, vibration can be brought down to the level of 12 VdB.

 - Window, opening in front and in two sides of structure (except the door) will be firmly fixed and air conditioned.
- On both sides of window, 6mm perforated glass sheet at 300mm interval may be provided to maintain Air born vibration to the level of 10-12 VdB and noise to the level of 15 dBA noise.
 - Elevation of hospital may be slightly changed, is possible/ feasible

❖❖ WORKSHOPS/MEETINGS/EVENTS

Workshop-cum-Training on NHAI's Sponsored Project entitled “Consultancy Services for Conducting Road Safety Audit for PPP Projects on DBFO Basis”

National Highways Authority of India (NHAI) has awarded consultancy service to CRRI for conducting Road Safety Audit for PPP Projects on DBFO Basis. As part of this project, a workshop was organized by CRRI at National Botanical Research Institute (NBRI), Lucknow on 22-23 April, 2011 with the following major objectives.

- To train Road Safety Audit Team, Project Directors and Independent Engineers on the whole spectrum of Road Safety Audit Process.
- To finalize the methodology to be adopted at development and construction stage audit.

The workshop was attended by forty two delegates which included officers from NHAI, Project Directors of the respective contract packages, Independent Engineers and CRRI audit team.

The inaugural session began with welcoming of the dignitaries which included Sh. P.C. Arya, GM, NHAI; Sh. Krishna Murari, DGM, Road Safety Cell, NHAI; and Dr S. M. Sarin, Former Director Grade Scientist of CRRI.



A view of the Inaugural session



Director, CRRI addressing the delegates

Dr. S. Gangopadhyay, Director, CRRI, addressed the delegates and explained the importance of this project including its timely completion as well as implementation. Dr Nishi Mittal, Head, Traffic Engineering and Safety Division, CRRI gave a brief about the project and also spoke about the objectives of the workshop.

The inaugural address was delivered by Shri Krishna Murari on behalf of NHAI (Road Safety Cell). Shri Murari explained about the various activities taken up by NHAI related to road safety all over India. Dr.S.M.Sarin addressed the delegates and highlighted various safety related issues and practical experiences in India and abroad. The inaugural session concluded with Vote of Thanks by Dr. K. Ravinder, Scientist CRRI.

National Technology Day

11th May is observed as National Technology Day every year all over India to commemorate the technological breakthrough made by India. CRRI also celebrated National Technology Day on May 11, 2011 by declaring it an open day for the general public who visited CRRI and interacted with the scientists of Institute.

Shri T. K. Amla, HOD, ILT gave a brief background of the National Technology Day celebrations. Dr S. Gangopadhyay, Director, CRRI delivered the welcome address. He urged CRRI scientists / technologists to develop new technologies which are economically viable for construction of roads. Prof. K. S. Rao, Department of Civil Engineering, Indian Institute of Technology, Delhi graced the occasion as Chief Guest and delivered a lecture on “Static and Dynamic Analyses of Chenab Bridge Abutments Using UNDEC & DEC”. The function



A view of National Technology Day Celebration



was concluded with the Vote of Thanks by Shri Sudhir Mathur, HOD, GTE. The programme was also attended by a large member of former employees of the Institute.

Training on VISSIM 5.30 and VISUM 11.0 Softwares

The Institute has recently procured VISSIM 5.30 and VISUM 11.0 softwares. A two day demonstration-cum-training was organised at the Institute from June 3-4, 2011. Lectures and hands on training were given by Mr Rishi Ahwa, Country Head, Sunovatech India, Indian Reseller for M/s PTV Vision. Twenty scientists attended this programme.

World Environment Day

The Institute celebrated the World Environment Day on June 6, 2011. As part of this function, Dr S. Gangopadhyay, Director, CRRI planted a tree in the CRRI lawn. In this context, a poster on



Dr. S. Gangopadhyay, Director CRRI planting a tree

“Reduce Your Carbon Footprints at Workplace” (prepared by Transport Planning and Environment Division of CRRI) was also released by him for wider circulation/dissemination amongst society at large.

Workshop on Communication and Presentation Skills

A workshop on Communication and Presentation Skill was organised by M/s Hero Mindmine Institute Limited, Gurgaon for CRRI scientists / Technical officers on June 13, 2011 at CRRI. About 25 scientists / Technical officers took part in the workshop and actively interacted with the faculty member on various issues involved.



A view of Workshop on Communication and Presentation skill

Workshop on “APTF-Benefits & Opportunities”

A Workshop on “Accelerated Pavement Testing Facility-Benefits and Opportunities” was organised on 24th June, 2011 at the Institute with the objective to bring all stakeholders on to one platform to discuss the various related issues.



A view of the Workshop on “APTF-Benefits & Opportunities

The Inaugural Session was chaired by Prof. D.V.Singh, Chairman, RC and Mentor-APTF. Dr S. Gangopadhyay, Director, CRRI gave the welcome address followed by addresses by Prof. D.V. Singh and inaugural address by Sh. D. P. Gupta, Retd. DG, MoRTH. The potentials and benefits were highlighted by both the speakers. A vote of thanks was given by Sh. M.N.Nagabhushana, Scientist and Nodal Officer(APT Group). The one day workshop comprised two technical sessions Technical Session-I: APTF Status, Benefits & Opportunities, Technical Session-II: On site Demonstration of APTF” which included presentations, floor interventions & live demonstrations of APTF and Panel Discussion-Business Attribute to APTF.



Shri D.P. Gupta Former DG, MORTH delivering the inaugural address

At the end, the recommendations were summarised which mainly includes the coming together of industries & CRRI for effective utilisation of APTF, making a project proposal to



DST on utilisation industrial waste material in bituminous mix and formation of a 'Core Group' with members from all major agencies. The workshop concluded with vote of thanks.

❖❖ TRAINING PROGRAMMES

Customized

On the request of Rural Engineering Services, Uttar Pradesh, CRRI organised a customized training programme from May 18 to 23, 2011, on 'Flexible and Rigid Pavement for Rural Roads under PMGSY Scheme' for the 3rd Batch of Assistant Engineers, Executive Engineers and Superintending Engineers. Thirty participants attended this programme.



A view of the Training Session

Regular

- A Training programme on "Vibration and Noise Measurement Anyalysis" was conducted from June 6-9, 2011. Ten participants attended the programme.



A view of the Inaugural Session of the Training

- A Training programme on "Bridge Diagnostics, Performance Evaluation and Rehabilitation" was organised from June 20-24, 2011. Ten participants attended the programme.



A view of the Inaugural Session of the Training

❖❖ AWARDS/RECOGNITION

- Dr S. Velmurugan, Dr Errampalli Madhu, Dr K. Ravinder, Scientists and Dr S. Gangopadhyay, Director, CRRI received the best article award from Association of Road Transport Undertaking (ASRTU) for their paper entitled "Updation of Road User Cost for Economic Evaluation of Road Project", published in the Indian Journal of Traffic Management.
- Shri Sudhir Mathur, Scientist 'G' and HOD (GTE) was awarded the IGS Delhi Chapter Leadership Award 2009 for his outstanding contributions in the area of Geotechnical Engineering by Indian Geotechnical Society of India.



Dr. E. Madhu, Scientist receiving the Award

❖❖ VISITORS

- Dr Abel Gasper-Rosas, Technical & Export Sales Director, M/s TA Instrument — Thermal Analysis & Rheology made a technical presentation on May 23, 2011 on "Asphalt Rheometer Applications".



- A delegation from Netherland visited the Institute on April 1, 2011 and held discussions with the scientists of CRRI.
- Dr Colin Franco PE, Chief Engineer of Materials and Research, Rhode Island Department of Transportation, USA made a presentation on April 8, 2011 on "Eco Friendly Lasting Pavements".
- Shri C. Ramana Kumar, Sr. Manager, Sitech India North & East Tractor India Pvt. Ltd., Gurgaon made a presentation on April 15, 2011 on "Trimble Quantum Alignment Planning System for Roads".
- Prof. S. L. Dhingra, Emeritus Professor, IIT Mumbai, made a presentation on June 17,



- Dr Sundaram Logras & Mr Michael Tan, M/s Akzonobel made a presentation on June 20, 2011 on "Road Construction Technologies- Warm Mix Technology, Microsurfacing and Chip Seal Application".



STAFF NEWS

Promotion

Congrats

Shri B. M. Sharma, Sci. Gr. IV (5) has been promoted to Gr. IV (6) w.e.f. March 5, 2010.

Retirement

Following staff members were retired during April-June 2011. CRRI Staff Welfare Committee gave them warm farewell.

| | | |
|-------------------|------------|----------------|
| Dr. A. K. Mishra | Gr. IV (5) | June 30, 2011 |
| Shri Sat Pal Rana | Gr. II | April 30, 2011 |

Welcome on Joining CRRI

The following staff members have joined CRRI. The Institute welcomes all the newly joined staff members.

| | | |
|--------------------|--------------------------------|---------------|
| Shri Vijay Kumar | Section Officer | March 8, 2011 |
| Ms. Neha Dhiman | Technician I | April 1, 2011 |
| Ms. Lydia Ching | Technical Assistant Gr. III(1) | May 2, 2011 |
| Ms. Ashia | Technician I | May 2, 2011 |
| Shri Aniket Ranjan | Technician I | May 2, 2011 |
| Shri Subhash | Technician I | May 9, 2011 |
| Shri Vijay Kumar | Technician I | May 16, 2011 |
| Ms. Anshul Saxena | Technical Assistant Gr. III(1) | June 14, 2011 |

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