



1. **Name** : Prof(Dr). Ravindra Kumar, PhD., Post Doc.,
2. **Designation and complete address including email id.:** : Head ,
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3. **Areas of Interest** : Development of road and transportation, noise impact safety, guideline for Mass housing society, Application of GIS/GPS technologies in urban and rural transportation, driving cycle, travel behaviour, rural and urban road network planning, sustainable transportation, vehicular emission and idling emission mitigation measures, impact(traffic and pollution) assessment due to infrastructure
4. **Educational Qualification – starting from the highest degree**
 - TRI, Edinburgh Napier University, United Kingdom Civil Engineering Post Doc 2014
 - Edinburgh Napier University United Kingdom Civil Engineering Ph.D. 2009
 - University of Roorkee (IIT Roorkee) Roorkee, UP Civil Engineering M.E. 1997
 - Ranchi University (RIT Jamshedpur) Jamshedpur Civil Engineering, B.Sc(Engg.)1995
5. **Professional Experience - in reverse chronological order**
 - **Head, Transportation Planning and Environment Division**, Central Road Research Institute Central Road Research Institute, New Delhi, 1 May 2018 -Till date,
 - **Senior Principal Scientist**, Central Road Research Institute, New Delhi, Principal Scientist 1 January 2016- till date
 - **Principal Scientist**, Central Road Research Institute, New Delhi, , 1 January 2011-1 January 2016
 - **Post-Doctoral Research Fellow** Transport Research Institute, Edinburgh Napier University, United Kingdom, Road user travel behaviour 8 Month. ,
 - **Senior Scientist**, Central Road Research Institute, New Delhi, India, January 2007- December 2010,
 - **Research Student**, Edinburgh Napier University, Edinburgh, UK, August 2006- October 2009,
 - **Scientist C**, Central Road Research Institute, New Delhi, 1 January 2002-December 2006
 - **Assistant Executive Engineer** : Boarder Road Organization 1999, September to November 1999- (MORTH)
 - **Scientist B**, August 1997- December 2001, Central Road Research Institute, New Delhi, India
6. **Membership to Professional Bodies**
 - Reviewer of IAME 2014 International Scientific Steering Committee, US
 - Advisory Panel for 3rd Edition of Sustainable Smart Cities India
 - Expert member on Urban Transport Planning tool kit 2013 of IUT
 - Member of “Sub-group of planning commission’ ’Adopting GIS Architecture in Rural Roads including R&D and Environment. Planning Commission of India
 - Member of GIS Consortium
 - Member of DHI and DST Consortium on Electric Vehicle
 - Empower Committee, NRRDA, Govt of India
 - Member of CILT UK
 - Life Member of IRC
 - Life Member of IUT
 - Member in NITI Ayog
7. **Achievements**
 - a. **Honours and Awards**
 - Received **Best Divisional Display Award 2019*** from CRRRI
 - Received **Best Hindi Working Scientist Award 2019*** from CRRRI
 - Received **Fellowship** for 1 week leadership training programme 2019, HRDC, Govt of India Ghaziabad , 18-22 February 2019

- Received **SKOCH Order of Merit Award 2019*** as gold for top ranking mobility Project GIS based integrated Road Asset Management for RCD, Govt of Bihar
- **Invited as Panellist** on E Vehicle Policy, CNBC18 TV network 2019
- Received **Young Scientist Fellowship of CSIR and CRRI in 2019 to visit Dubai, UAE** to make presentation in **6th Annual Conference** of The ACSE. Vehicle Usage Controlling Policies and their Effect on Pollution
- External **examiner for PhD** at IIT BHU, 2018
- Received **Fellowship from AICTE** 2017 for 15 days training programme on big data and deep learning at SKIT Jaipur
- Received **Young Scientist Fellowship of CSIR and CRRI in 2016 to visit Sanghai China** to make presentation in 14th World Conference on Transportation Research (WCTR), Shanghai, China. On Does connectivity index of transport network have impact on delay for driver?
- Received **Highly Commended Paper Award Emerald Literati Awards for Excellence** by Emerald Literati Network 2015-2016 for the paper entitled “Effect of type of lead vehicle on following headway behaviour in mixed traffic” in the journal “World Journal of Science, Technology and Sustainable Development”.
- **Copy right** along with the team on driving cycle and its methodology (CF-3719/2014), 14 March 2014
- Received **Scotland Government Post-Doctoral Individual Fellowship** Award of value 30,000 British Pound -2013
- Received **Edinburgh University Fellowship**, 1000 British Pound for Lothian Corps 15 days Training on driving cycle and implementation of Aqua solution for increasing fuel efficiency in Lothian Buses-2011
- Received **Young Scientist Award 2011** from CSIR-CRRI for his outstanding performance*
- Received fellowship for 2 Days -**National level from Venture Centre** Pune to attend the workshop at NCL Pune 2011
- Published **20** out of **30** Technical report, Papers (**60** out of **113 papers**, **3** SCI out of six), **17** out of **35** Technical Reports and Guided **13** out of **22** Phd/M.Tech/ B. Tech Students for their dissertations in the last 5 years
- Completed **Two International Projects** (Travel Behaviour Study of Tabuk City and Accident Analysis frame work for Saudi Arabia.) as **Research Fellow 2013-14**
- **Course Coordinator** ACSIR Course No ENG (CRRI) 2-460 Transport Logistics and Operations 2010
- **Course Coordinator** application of GPS and GIS technology for CRRI training programme, 2011
- Received **National Overseas Scholarship and Common wealth Fellowship 2006-2009** through, Govt. of India for research studies from July 2009 -2009 October to complete PhD*
- Received **fellowship from Aerosol Society, United Kingdom** 2009 for presenting Onboard Emission Measurement of Motorcycles in Air Quality Management Area of Edinburgh. In: The Impact of the Global Financial Crisis on the Environment, Energy and Sustainable Development WASD Seventh International Conference, Ahlia University. Kingdom of Bahrain
- Received **Royal Academy of Engineering United Kingdom 2007** for presenting the research findings on driving cycle in 6thPublic Health and Environment Conference held at Brisbane 23rd~28thJuly, 2005
- Recipient of **GATE (Graduate Aptitude Test in Engineering) Scholarship** during 1995 to 1997 for pursuing M. Tech Course at IIT Roorkee
- **Member** EMPOWERED Committee NRRDA, 2006- 2013
- As **Head of the Division (HOD)**, managed the Transportation Planning and Environment Division of CSIR-CRRI for last one years from 2018-2019, instrumental in increasing research output in terms of the publications especially in SCI Journals and achieved ECF about 10 crores from externally funded projects
- Member of **Doctoral Research Committee(DRC)** at Delhi Technical University Delhi, 2019 and Member of **Doctoral Advisory Committee(DAC)** at CSIR-CRRI for AcSIR for monitoring and guiding PhD Students

b. Research Projects (Consultancy/Grant in Aid/Sponsored/Mission Mode/Advisory/Research)

1. Traffic System Analysis of Alaknanda Community Complex, DDA October 2019-January 2019 as Project Leader cost 20 Lakh.

The objective of the study is to estimate the Destined Traffic as well as the generated traffic in respect of Community Centre Alaknanda as the road from and of Shivalik Apartments to Sudharshan Munjal Marg is not available.

2. Design guidelines/specification for road system during- and after- construction of mass housing schemes including traffic impact analysis and noise pollution under Development of Fast, Durable and Energy Efficient Mass Housing Scheme” under Mission Mode Project of CSIR(Sponsored by Department Expenditure, GOI as part of the CSIR Mission mode project, Cost 99.5 Lakh): April, 2018- March 2020 As a Nodal Scientist (Project Leader)

Mass Housing is major agenda of Government of India as part of Pradhan Mantri Awas Yojan housing for all. Mass housing segments likely to grow at faster pace than industry at above 30% over medium term following increased focus by government. Affordable housing renewed focus from Government that has allocated 39% higher funds under Pradhan Mantri Awas Yojana. And extending the credit linked subsidy scheme linked to loan value up to 12 Lakh to cover middle income group. 60 million housing units are needed across the country to fulfil need of masses. But the road and transportation infrastructure has been never a part of planning process neither taken into any guideline in support to Mass Housing Society and its neighbourhood roads. The road and transport system cannot be ignored so, there is need to plan for eco-friendly road and transport to see from safety and noise point of view which is major concerns of many of mass housing society in cities. Share of accident at gated society is 3 to 4%, which also impact GDP wastage. Many of these societies have severe problem of noise and vibration. Also use of eco-friendly material for road construction for durable mass housing there is no such guideline available for developer. The safety of road user is also a major concern towards achievement of sustainability. Considering these issues, the objectives of the present study have been conceived under road design module include, integrated mass transportation system and sustainable non-motorized system, design of noise mitigation measures and evaluate the road users in terms of road safety for internal roads. The following guideline will be prepared

(i) Design Guideline for Traffic Impact Assessment in Mass Housing Society

(ii) Design Guideline for road safety measures in housing society

iii) Design guideline for noise mitigation

(iv) Design Guideline for Road Construction in Mass Housing Society

(iv) Design Guideline for Integration of NMT in Mass Housing Society

Significance of Outcome:

- ❖ Guidelines to Traffic Impact assessment of mass housing society
- ❖ Development of traffic calming technique for safety measures in mass housing society
- ❖ Development of 4 eco-friendly technology leads at different TRL.
- ❖ Noise barrier design and mitigation before and after
- ❖ Design Guideline for Integration of NMT in Mass Housing Society

3. Quantification of the reduction of air pollution level due to bypassing vehicular traffic on Eastern Peripheral Expressway”(sponsored by Department of Environment, Cost 46 Lakh Govt of Delhi.: October, 2018 –Mar 2019 As a Project Leader

One of the major concerns in Delhi is the hazardous level of pollution. Vehicular pollution is being a major source of this pollution, different policies and strategies has been applied to decongest and de-pollution Delhi region. With the same objective, EPE was constructed to reduce vehicular congestion and pollution by diverting vehicles passing from Delhi to EPE.

To quantify the impact of EPE in terms of traffic diversion from highways, travel time savings, reduction in pollution in Delhi region, need of a detailed study is realised. Nominee was instrumental in developing the project and executing the activity such as Estimation of vehicular traffic bypassing Delhi after the construction of Eastern Peripheral Expressway (EPE), Estimation of contribution of different categories of vehicles towards total vehicular emission load and identification of vehicle category contributing the most due to bypassing of traffic to EPE, and quantify the reduction of air pollution level due to avoidance of vehicular traffic on EPE

Vehicle category wise emission from EPE were estimated based on age profile, traffic flowing and emission factor data. The share of emission contribution is given in the table.

Reduction on pollution load on NCT Delhi network was estimated. The emission was compared with IIT Kanpur study 2016 and it was found that there was 7% reduction in NO_x and 2.5% reduction in CO, 0.9% reduction in PM_{2.5}. There was also reduction in toll taxes and some of the section Delhi destined at Narela and Singhu Boarder and other boarder.

4. Low cost road asset management system sponsored by CSIR-CRRI, New Delhi.: October, 2016 – August 2018 **As a Project Leader**

Approximating the current rate for work contract for surveying road inventory and condition data in India to Rupees 2000 per kilometers (single lane). Approximate Survey cost is Rs106.432 Crore Every year spent if done routinely. Essential requirement of information of road inventory, road condition, bridge inventory and bridge condition along with large number of road side asset to maintain, upgrade these roads. Numbers of road asset management systems are available which is a state of art equipment (i.e. Network Survey vehicle, Road Survey vehicle etc. used by various road agencies. Some limitation of these equipment are that they are quite expensive and also requires special skills to maintain and operate and they are not suitable for rural roads. The project deals with development of a low cost, easy to operate and maintain system for collection of road inventory and pavement condition data suitable for rural roads.

Significance of Outcome:

- ❖ The system developed is low cost and the basic model is catering road inventory and condition information from field.
- ❖ This system is very much useful in rural roads and street road with lower budget and flexible enough to be replicated and instrumented into any other vehicles.
- ❖ Due to some limitation of constant speed, slow speed etc., roughness measurement could not be included in BRAM.
- ❖ Electric rickshaw and other vehicular options are explored to include the roughness measurement in future.

5. Safe Road Connectivity for Tripura State of North East Region of India sponsored by National Mission of Himalayan Studies (NIMHS), New Delhi.: October, 2016 – August 2018 **As a CO PI**

Road connectivity in North-East region of India is limited and safety on these roads are challenging due to hilly terrain. In 2015, there were 9291 crashes happened in north-East states resulting in 3106 deaths and 10,152 injuries. Also, during the year 2015, the highest accident severity (road accident deaths per 100 accidents) was reported in one of the North-East states i.e. Mizoram (102.9 per cent). Road Connectivity and Safety jointly serves the society better and therefore a systematic approach for prioritizing road connectivity and safety improvement is very much essential. It is a key component of overall development of any settlement area (habitat, village and city). Various schemes of government towards improving road connectivity in North-East States are in-place (PMGSY, SHARDP-NE). This project focuses on two aspects of connectivity. First, road network connectivity and second, safety on roads. Focusing on these two aspects, study has been divided into five major tasks covering various activities: (i) reviewing existing data base (maps and data) and preparing an upgraded GIS database covering road network, settlement locations, crash data and census data (ii) assessment of various settlements will be carried out based on the self sufficiency of a settlement area (iii) computing the Road Connectivity Index (RCI) (iv) calculating Road Connectivity Index (RCI) to be further supported by Road Safety Index (RSI) and (v) Overall combined score of RCI which will be able to help in better decision making towards prioritization new construction of roads as well as improvement of existing roads. Nominee has been advising on technical and methodological aspect.

6. Noise & Vibration study for Pune Metro Rail Project (Phase/Stage-1 Sponsoring Organization, Maharashtra Metro Rail Corporation Limited 2018 as Traffic Expert

Pune where roads do not have adequate width and which cater to mixed traffic conditions comprising slow and fast moving vehicles, road transport can optimally carry 8,000 persons per hour per direction (phpdt). When traffic density increases beyond this level, average speed of vehicles comes down, journey time increases, air pollution goes up and commuters are put to increased level, of inconvenience. Thus when on a corridor, traffic density during peak hours crosses this figure, provision of rail-based mass transport, i.e. Metro system should be considered. But as metro was announced for about 30 Kms in the city noise and vibration becomes as essential component. Nominee has analyzed the model shift and future traffic projection to carry out the noise modeling which is one of the important contribution.

7. Study of Switching off behaviour & Awareness campaign at 100 intersections of Delhi sponsored by Petroleum Conservation Research Association **As a member**

Transport performs a key role in achieving fast economic growth. Road Transport is the dominant consumer of the petroleum products. The usage is high due to the alarming increase in travel demand and growth of vehicles. The vehicle owners have to overcome congestion and delay on roads. There is considerable loss of fuel due to idling of vehicles at the traffic intersections which results in increase of operating cost and wastage of precious fuel. It can be seen that in Delhi, with over 466 signalized intersections, 3,21,432 litres of Petrol and 1,01,312 litres of Diesel are being burnt every day due to the idling of vehicles. Converting these figures into monetary terms the total losses, at the 1996 prevailing price of fuel, works out to be Rs. 82.00 lakhs per day for Delhi.. RS 245.00 crores per annum. Nominee has been involved in this project since execution of pilot and developing the methodology with PL.

8. Development of Automatic Vehicle counting and Classification Software using Deep Learning Technique sponsored by CRRI as member

Traffic Analysis has been a problem that city planners have dealt with for years. Smarter ways are being developed to analyze traffic and streamline the process. Analysis of traffic may account for the number of vehicles in an area per some arbitrary time period and the class of vehicle. Delhi traffic scenario is recorded and YOLO algorithm has been used to count and classify the traffic data.

9. Noise & Vibration Study for Delhi-Meerut RRTS Corridor For (Stage-I)

Sponsoring Organization National Capital Region Transport Corporation Rs 1.4 Crore Ltd as a member

To create an optimized hi-speed high quality transport system having predominantly seated accommodation and good comfort level for passengers The operating pattern may include both non-stop and stopping at all stations• journeys. The non-stop journey between Delhi and Meerut to be in the order of 45-50 minutes for the rapid rail transit -RRTS corridor. The Delhi terminus may be located for interchange with the existing Delhi Metro network or any other separate continuing link with other alignments in the RRTS Interchange with other MRTS corridors including the development of feeder systems to other MRTS. But the first time speed of train will be 160kmph which will have impact on noise and vibration. The study has been done to estimate the modal share and split due to introduction of RRT

10. Acoustic and Light proofing study for lot 4/Package 4-Haryana-Rajasthan Border to kota as per WII Manual for Compliance of MoEFCC ToR point No.A (ii) for preparation of DPR for the project of development of Economic Corridors, Inter Corridors and Routes **Sponsoring NHAI** as a member

11. Impact of Road Condition on Fuel Consumption of Vehicles sponsored by Petroleum

Conservation Research Associate (PCRA), Govt. of India, 25 LAKH From March 2017 to March 2019 as **Project Leader**

Road roughness also indicator of its conditions are increasing over period of time and seldom maintained in many cases due to lack of funding, Although road is a basic need, there is a continue demand for good quality road infrastructure. Impact of road condition is severe in terms of fuels loss. Nominee has developed relation between roughness and fuel consumption by measurement of data and developing their relationship with statistical tools.

In this study, five roads in NCR were selected to quantify the fuel consumed per km for typical small car with petrol fuel, big car(SUV) with diesel fuel, and diesel truck in loaded and unloaded conditions. Fuel consumption test were conducted on good, fair and bad condition of roads to find the fuel consumed by these vehicles for different road conditions at three steady speed 20, 50 and 70 kmph for the test section length of 1100 km with fuel sensor installed and road condition measured in term of IRI(International Roughness Index). Section is defined based on IRC guideline(Good fair and poor).

For simple basic calculation there is fuel consumption is calculated based on vehicles km travelled (VKT). On assumption of 10km per day per vehicles, there will be 210 crores vehicles km travelled (VKT) per day. But if we need to make more realistic then normally commercial vehicles travel 100 km per day and personnel travels 10 km per day. With this estimates total vehicle total estimated VKT is 372 crores per day. In study area, 30 % of roads are found in bad conditions and there are a saving of 0.5 Rs per vehicle. In scenario of improving, road surface from bad to fair, there is saving 55.8 crores per day and yearly Rs 20367 crores per annum. Although estimate is kept at lower side with reference to our current results that cost of Rs1 per km for long term, that can saves non-renewable fuel such as petrol and diesel. Apart from the VKT, many other factors such as traffic flow factor delay, congestion and real world driving, driver related factors, and vehicles related factors influences that are not taken in this study.

12. Development and Application of Technologies for Sustainable Transportation(Sponsored by Planning Commission, GOI as part of the 12th Five Year Plan CSIR project): April, 2012- March 2017As a Work Package Leader 8.

Indian cities are spending a huge budget to improve transport but hardly any sustainable way of doing such an act. To ease decision-making in that direction, the measurement of sustainability levels become essential. Quantification of sustainability based on engineering, public and expert opinions, covering environmental and social need appropriate ground observations are required. Proposed research work on developing a Software of Transport

Sustainability Index (TSI) involves the automation for analysis of Transportation Sustainability Index with advanced solutions which generate many layers of policy scenario to improve transportation sustainability. Primarily TSI can be used for measurement of the level sustainable indicator for public transport and non-motorized transport facilities in an area and help to determine the saving in the socio-economic and environmental parameters, tested under different transport policy scenarios. The policy/ decision makers and development authorities are handicapped in the absence of accurate tools to evaluate the transport policies. The present product will enable them to do the same so that the policies can be implemented quickly, effectively and efficiently

The objectives of the project were to identify the sustainability indicators, and develop the Transport Sustainability Index (TSI) taking account of environment, social and economic indicators. Total 17 parameters were identified (6 from Environment, 6 from Economic and 5 from Social). A methodology based on Analytical Hierarchy Process and Damspter (DS) theory was developed to formulate Transportation Sustainability Index. User friendly software were developed based on Visual Studio to generate the Transportation Sustainability Index based on combined approach of AHP and DS theory. Data from field were collected at 4 different location in SUSTRAN based study area (Nehru place, Okhla Mandi, Kailash Colony and ISCON temple Marg). Results shows that it was difficult to get sustainability score above 40 and there is still lot of scope to improve the public transportation system to equally get 33.3% share in each environment, economic, and social aspect. The developed front end tools of the software are given below

13. Comprehensive Mobility Plan (CMP) for Ahmedabad City (Client: Ahmadabad Police) 2019- As Team Member

National Urban Transport Policy (NUTP) and other funding agency which is driven by the principle of moving people not vehicles), requires Comprehensive Mobility Plan .Ahmedabad Police has assigned work to CRRI to develop the Comprehensive Mobility Plan (CMP) for Ahmedabad City. The project is ongoing

14. Traffic Studies for Identified Intersections Improvements at Vadodara City

Client: Vadodara Municipal Corporation) 2018-2019- As Team Member

Vadodadra Municipal Corporation is facing significant delay in city so current at grade intersection has become saturated. But there was need felt to provide the scientific traffic study to cope the situation. Nomine as team member contributed for field study, report preparing and providing recommendation as per IRC guideline to shift from intersection to fly over.

15. Noise Mapping of Trivandrum City, (Client: Kerala Pollution Control Board,PWD, New Delhi) 2015 - As CO-Project Leader

In this project noise levels mapping across the entire Corporation area of Trivandrum. are completed. The decision came after it was found that noise levels in the city have increased manifold over the past decade. This is the first time mapping done on a large scale in a city in India. Undersigned was involved from initiation to bring the project to CRRI by attending several question answer meeting with Kerala pollution control board, GIS mapping of study area, conducting traffic survey 19 intersection, traffic flow assignment of main and link node comprises of 120 nodes and link, metro scenario generation and developing traffic demand model using various concept based transport demand elasticity approach on GDP growth rate, secondary traffic data from NATPAC, and vehicles registration data. Growth rate was determined based on finally which yielded highest growth factor. In this case vehicle registration and there growth factor were found suitable and travel demand modeling was done for next 20 year , 2030 with model split taking account of metro scenario at major corridor starting from Konchiravilla Temple to Mancaud to Kesavadasapuram near Ulloor intersection, covering a distance of 8.0 km for noise mapping with metro scenario. Junction improvement plan were suggested based on IRC guideline. 8 out of 19 junction/road (almost 50% of junction/roads) were found to be critically reaching to their capacity level and need immediate intervention. The name of junction is described below. (1) Statue Junction, (2) Near Kerala University Gate, (3) Near Sasthanamanglam Junction, (4)On Thycaud Flyover (5)Ulloor Memorial Library (Near DPI Junction), (6) Attakulangara Junction, (7) Karamana Junction, (8) Kazhakuttom Junction. Entire traffic flow model were integrated to noise mapping and modelling for further detail mapping and finding critical zone

and remedial measures such noise barrier, junction improvement plan, improvement of public transportation system were suggested for further implementation in Trivandrum city.

16. Noise Vibration and Privacy Issue along JJ Flyover Mumbai (Client: MSRDC, Mumbai) 2015 - 2017As Traffic Expert

In this project Noise Vibration and Privacy Issue along JJ Flyover Mumbai has been studied. With the increase in traffic and proximity of flyovers to the buildings, citizens have been demanding the installation of sound barriers to reduce noise levels. They have also complained of intrusion into their privacy. J J Flyover was the noisiest in Mumbai with a level of 105 dB. Also, areas riddled with traffic such as Sion, JJ Junction, and Saki Naka possess a high level of noise pollution. To understand the effected area and corridor traffic count, house hold survey, and noise monitoring were carried out. This was given as input for traffic forecasting to noise modelling & noise mapping). Report were discussed with the client.

17. Transportation and Traffic Study in Karwar (Client: Indian Navy, 2016 - As Traffic Expert

INS Kadamba is an Indian Navy base located near Karwar in Karnataka. The first phase of construction of the base, code-named Project Seabird, was completed in 2005 and the base was commissioned on 31 May 2005. Development of Phase II commenced in 2011. INS Kadamba is currently the third largest Indian naval base, and is expected to become the largest naval base in the eastern hemisphere after completion of expansion Phase IIB. Due to expansion, there is likely increase of travel demand and parking demand. Since there is constrains of road width then under such situations, the traffic problems are faced by staff both outside and inside campus of INS Kadamba in terms of congestion, parking and road safety. In the present project, the traffic conditions on road network has been assessed by collecting traffic and volume counts at different entry and exit gate, journey speed survey, parking surveys etc. Travel characteristics of commuter's office commuting and de-boarding the big ship like INS Vikrant have been estimated by collecting data from household travel surveys, OD surveys at outer cordons, PT and IPT surveys and Goods Vehicle surveys. In study traffic circulation plans have been devised using VISSIM software along with other measures namely parking facilities, cycle tracks, foot paths etc. The geometric designs for different intersections have been done in AutoCAD which would improve traffic operations. Total trips have been estimated by developing four-stage travel demand model for base year and horizon years. Accordingly, the network upgradations and new transportation systems have been recommended.

18. Noise mitigation measures and design of noise barrier at NOIDA sector 61-62

(Client: Noida Metro Rail Corporation 2017-18)- **As Traffic Expert** 6.6-km Noida City Centre to Noida Sector 62 stretch, an extension of the Blue Line, is set to begin. Scheduled to be completed by 2020, the line will touch NH-24, making commuting easy not only for people in Noida, but also for those in Ghaziabad. The proposed metro network within the Noida and Greater Noida has been studied. Modal shift traffic has been examined due to introduction of metro in current and horizon year scenario. After model shift analysis noise modelling were carried out by noise expert to provide the noise mitigation plan. Noise mitigation plans are also proposed after estimating the future traffic conditions.

18. Noise mitigation measures and design of noise barrier at BPCL Colony (Client: BPCL, Mumbai) 2018-19 - As Traffic Expert

BPCL Colony is facing severe noise problem due to commencement of expressway in front of colony. Traffic survey, effected household survey and noise monitoring data were collected to assess the impact. Major traffic flow is between Chembur to Wadala and Wadala to Chembur. The traffic data were segregated for slow and fast moving traffic. Impact was assessed due to introduction of expressway. Model shift analysis was carried out for long trip traffic using the expressway. Future traffic demand was assessed. Noise modelling were done to suggest mitigation measures.

19. Consulting Services for Developing Thematic GIS database for Integrating Road

Management System of RCD, Government of Bihar, funded by World Bank DFID grant 18,6648 USD (1.4crore), Govt of Bihar as Project Leader Year 2015

Massive road data base is prepared for the development of road network in Bihar which has been integrated with intelligent thematic GIS Data base to convey information about a single topic or theme, such as road length, road condition, road inventory, traffic data etc for planning and appraisal purpose at regional and local level for engineer to build maintain and operate these roads in effective manner. The total length of road network of Bihar in the State is around 141435 Kms. In that al SH, MDR and NH roads covering around 20000km were digitised. Original design structures for Thematic GIS Data base for RCD with the aim to integrate the data with Road Management System (RMS) in Bihar include 11 thematic layers (such as Block Map, district map, bridges/structures, railways, rivers/streams, settlement area (1:4000 scale), village points, forest, road condition (1:4000 scale for roads), road inventory, and road traffic in database taking help of satellite imageries and toposheets and field data collected on a roads, bridges and traffic has been prepared. Thematic mapping covers

district wise total no of blocks and villages, type of carriageway (bridges), roughness, type of bridges, span or bridges, pavement, shoulder condition, side drain condition, and road traffic. Thematic layers are useful tools for engineer planner and research to investigate on problem faced due to deficiency of road infrastructure and transport (See Figure). The thematic tools can provide immediate information and action plan for current and future planning, budgeting and maintenance and rehabilitation needs to sustain the transportation needs of entire state. Training to more than 120 engineers were imparted at Patna.

20. Post Doctoral Research (2013 August 2013-June 2014) at Transport Research Institute

Edinburgh Napier University, UK: Main work responsibilities include data analysis, report writing on writing papers on the research project "Travel behavior of Tabuk city in Kingdom of Saudi Arabia" which was funded by University of Tabuk at Transport Research Institute, Edinburgh Napier University, UK.

The other lists of research are

- Investigation of impacts of driving behavior on emissions and fuel consumption by motorcyclist - Student name-Lorena Ocana an international intern from Ecuador (Kumar et al., 2013)
- Impact of ethanol blend on fuel and emission- Student name- Lawrence Wright, Edinburgh Napier University (Kumar et al., 2013)
- Gap acceptance behaviour at signalized T Junctions in Edinburgh- Ruggeriro, Phd student Politechnique De Bari, Italy (Saleh W , Kumar et al., 2014)
- Pedestrian behaviour modelling- Student- Alexandre Mayeaux, France (Saleh et al., 2014)
- Car following behaviour in mixed traffic- Joseph Appiah PhD student Edinburgh Napier University, UK
- Bus and Car following behaviour in mixed traffic lane- Anna Galevko, Russia

21. Evaluation of Economic Loss Due to Idling of Vehicles at Signalized Intersection a Mitigation Measures (ELSIM)-(CSIR-CRRI) 2012-17 Cost 10 Crore. CSIR Planning Commission Government of India.

Worked as package leader for mitigation measures for reducing emission at idling by intervention of infrastructure and other transport and behavior change measures. Study were carried out in 8 different city and location of signalised intersection. Estimation for their fuel consumption factor and times in idling were estimated along with emission.

22. Micro simulation based driving cycle in Delhi city for sustainable transport system. Prestigious scheme of Prime Minister called EMPOWER Schemes for young Scientist.

Position : Principal Investigator Year : 2010-12

Worked in capacity of Project Leader: Driving cycle is a speed-time sequence developed for certain type of vehicles in particular environment to represent the driving pattern. It is used for purpose of measuring and regulating exhaust gas emissions and monitoring fuel consumption. Micro simulation based driving cycle for various types of vehicle for Delhi city was studied. The objective of this study was two folds (i) to derive the driving cycle and compare it with existing regulatory driving cycle using micro-simulation and real world data (ii) to estimate the emission based on real world driving cycle for Delhi. Driving cycle can be used directly to emission control and it will reduce environmental impact. Real world driving has application in improving vehicle energy efficiency, fuel economy, improving vehicle performance. This can be also used in vehicle simulation on engine test bed for intelligent energy management and emission modelling in India. This is very useful for modifying our existing driving cycle European adopted Indian Driving Cycle in local condition which is purely based on European condition. The outcome of driving cycle can be used in traffic demand management and developing Indian Driving Cycle to reduce congestion.

23. Development and Application of Technologies for Sustainable Transportation” Under 12th FIVE YEAR PLAN of CSIR 2012-2017. Position : Package Leader Year: 2012-2017

Objectives: The objectives of the present study are formulated under two modules namely transportation module and road module as given below: To design a symbiotic sustainable public transportation (PT) system to mitigate negative effects on every part of the transportation system considering quality enhancement of PT system, feeder system, parking facilities at PT terminals and integration of mass transportation system with policy level sustainable strategies to restrict/ control usage of private vehicles

- To design sustainable Non-Motorised Transport (NMT) system and facilities to enhance road safety
- To design sustainable Intelligent Transport Systems (ITS) for prioritization of movement of PT, NMT and optimize the movement of private vehicles by communicating real-time travel information to all road users

Worked as Module Leader: Quality Enhancement of public transportation system

The city of Delhi and NCR regions would be considered as study area and develop a sustainable transport system conceptually considering every aspect. The developed sustainable transportation system would be considered to start as a Pilot Study in a small network of Delhi to demonstrate the benefits generated from the proposed sustainable system.

24. Evaluation of BRT corridor in Delhi- NCT Delhi via High Court Delhi 2012, 10 Million INR Worked in capacity of team member

Bus Rapid Transit (BRT) is very good concept for sustainable development. But if it is not implemented properly then it creates a lot of delay for passenger cars. Therefore the public litigation was filed by Non Government Organisation in High Court, Delhi to sort out the issue of severe delay and cut fuel wastage. In this regard CRRI conducted study to evaluate the corridor in terms of its performance of speed, delay time, fuel loss and passenger flow. Some simulation exercise was carried out apart from conducting performance measures and report was submitted to the court to court.

25. Modelling of driving cycle for road network development plan in urban area and suburban area applying GPS – A case study in NCR” Inhouse R&D. 2010-2012, Research Grant Rs-0.5 million INR

Worked in capacity of Project Leader: The aim of the study is “Modelling the driving cycles and to develop the efficiency of road network plan” by minimising the delays and congestion and find the effect of road geometry, traffic volume, speed-limit on driving cycle. The scope the work will be limited to Delhi NCR urban corridors (subzone) for cars only. The outcome of the study was used as an input parameters to develop the Indian Condition driving cycle for estimating accurate fuel consumption and emission. On pilot trial initially the study was carried out in Ghaziabad city in National Capital Region. Six routes were selected to represent overall driving cycle pattern and driving conditions of the city. Roads were selected in north- south and east- west side of the city covering entire set of differences in their characters. The total lengths of the selected routes are 29.4 km. The results show that perceived preferred speed by driver was higher than regulatory speeds which challenge the credibility of assigned speed limit. Even observed speeds on three roads were higher than regulatory speed limit, which were driven in different off peak and peak hours of morning and evening time. The data analysis of driving cycle characteristics and simulation based emissions was made.

26. Micro simulation based driving cycle in Delhi City for sustainable transport system under EMPOWER Scheme of CSIR OLP 504, R&D. 2010-2012, Research Grant: 1 Million INR

Worked in capacity of Project Leader: Driving cycle is a speed-time sequence developed for certain type of vehicles in particular environment to represent the driving pattern. It is used for purpose of measuring and regulating exhaust gas emissions and monitoring fuel consumption. Micro simulation based driving cycle for various types of vehicle for Delhi city was studied. The objective of this study was two folds (i) to derive the driving cycle and compare it with existing regulatory driving cycle using micro-simulation and real world data (ii) to estimate the emission based on real world driving cycle for Delhi. Driving cycle can be used directly to emission control and it will reduce environmental impact. Real world driving has application in improving vehicle energy efficiency, fuel economy, improving vehicle performance. This can be also used in vehicle simulation on engine test bed for intelligent energy management and emission modelling in India. This is very useful for modifying our existing driving cycle European adopted Indian Driving Cycle in local condition which is purely based on European condition. The outcome of driving cycle can be used in traffic demand management and developing Indian Driving Cycle to reduce congestion.

In this study the real world driving cycle is being carried out in selected seven routes in Delhi City. These routes represent different types of lane, connectivity, land-use pattern, etc. to capture the road and travel related parameters. It covered all most all part of the Delhi city with variations in route characteristics. The survey is being carried out using GPS based Performance Box, which is fitted in different type of vehicles. Questionnaires were designed to capture the driver related parameters. In first instance, on pilot base the survey was carried out in seven routes for car only. In addition, traffic volume data were also collected in selected locations (mid points) of these routes.

27. Modelling of driving cycle for motorcycle in Edinburgh (PhD): 2006-2009 Sponsored by Govt Of India

PhD Study: The main aim of this study was to calibrate real world driving cycles for motorcycles in Edinburgh (EMDC) and to investigate their impacts on emissions. To develop the driving cycle for motorcycles in Edinburgh for the urban and rural modes, measurement of instantaneous speed, acceleration, deceleration, distance travelled, and route tracking data were made. Onboard and laboratory emission and speed measurements were made using different motorcycles. Real-world driving cycles were derived using VISSIM and estimates of emissions were made for a suitable traffic corridor in Edinburgh. Results were compared and validated for the emissions obtained from real-world, laboratory and micro-simulation measurements methods. Results were discussed, analyzed and

concluded. From the results of the EMDC, the time spent in idling mode for the urban cycle was found greater than that of the rural cycle, time spent in cruising was found less than that of rural cycle. The average cycle speed and the average running speed of the rural sections were both higher than those of the urban roads.

28. Environmental Impact Assessment of third phase of Delhi Metro Rail Corporation (Consultancy Research CNP1609), 2009-2010. Research Grant 4 Million INR

Worked as Team Member, In process of development there has been intensive use of natural resources. Very often the process of development has adversely affected the environment leading to ecological imbalances. Therefore to assess the environmental impact assessment of 74.2 km length in third phase of DMRC, studies were undertaken. Undersigned was involved in assessing the bio environment, socio economic impact and rehabilitation and resettlement study. The reports were submitted to DMRC for further improvement of alignment.

29. Noise vibration and privacy issue along Central secretariat to Badarpur Metro corridor DMRC 2012

•Main Project features: Noise control vibration control and privacy issues before and after installation
Positions held: Team Member

Activities performed:

•Vehicle counting before and after, Noise vibration and privacy issue along Central Secretariat to Badarpur.

•Videography before and after along corridor

30. GIS based National Highway Inventory System Sponsored: Ministry of Surface Transport, Government of India. Research Grant 4 Million INR Position: Team Leader Year: 2006-2011

The main objective of the project is to develop GIS based Highway Information System for 50,000 km of National Highways through inventorisation of road related data. The project has been divided in to four modules viz., (i) GIS database, (ii) traffic surveys, (iii) road inventorisation and (iv) maintenance strategies.

Undersigned prepared the draft proposal for Automatic Traffic Counting at 100 locations on National Highway and submitted proposal for the perusal of Chief Engineer and CRRI. Subsequently, the project was successfully awarded to CRRI. Undersigned was deputed as Team Leader to organise and manage the data collection using Network Survey Vehicle (NSV) of national highway in several part of the north east region of India.

31. Model Master Plan for Rural Roads for Nagoan (In house Research), Cost 0.15Million. 2003

•Worked in capacity of project leader. The objective of the project was to prepare a model master plan for rural roads of Nagaon District for Assam state of India. The optimal road network is proposed based on functional accessibility approach.

32. Project preparation of Rural Roads for 37 Districts of Bihar and 18 Districts of Jharkhand Using GIS tool Sponsored: Rural Engineering Organization, Secretary REO Bihar & Jharkhand. Position : Team Leader Year : 2003-2009

Worked as the team member. The objective of the project was to prepare the master plan for rural road project for implementation of PMGSY roads. The study was aimed to build the rural road in new technological low cost design. Training workshops were conducted at Patna and Ranchi for Engineers of Rural Engineering Organization (REO) of Bihar and Jharkhand state. Technical know-how on map preparation, data collection and data management for prioritization of rural roads was exercised in the workshops. The detailed discussion was held to sort out the problems coming in the map preparation due to unavailability of Survey of India Maps. Detailed road inventory, condition survey, primary data collection proforma was designed and scrutinized for 211 small blocks. Core network, were identified using the road index and habitation index criteria based on data available in district rural road plan to reduce the redundancy in the network.

33. Technical Assistance for Project preparation of Rural Roads for Three Pilot Districts inq Andhra Pradesh, Sponsored: World Bank Year :1997-98 Total cost of project :0.7 MillionINR

The aim of the project was to prepare the rural road project for three district in Andhra Pradesh. The scope of the project was to find the bottlenecks in rural road network and fixed up relative priorities for various types of deficiencies in rural road network.

Worked as the team leader for finding socio- economic- impact of road connectivity to the village conducting rural transport survey. Rural transport surveys were carried out by training schoolteacher and enumerator to fill the questionnaires at household and village level. Training were imparted to the middle school teachers in Adilabad and Karimnagar districts of Andhra Pradesh. The survey was carried in 22 villages. The household sample size was 220. The filled questionnaire was computerized. A computerized database was designed in MS Access Software to store surveyed sample. This database

was subsequently used to analyze and compare the socio economic differences between connected and unconnected village. A video recording was made to appraise lively issue related with rural transportation problems. A comparative study showed that connected villages have more per capita income, expenditure, vehicle ownership, and agriculture productivity than unconnected village.

A comprehensive document "Borrowers Project Implementation Plan" was prepared to appraise the financial estimate for World Bank project to build the rural roads for three pilot districts of Waranagal Karimnager and Adilabad of Andhra Pradesh State .

cost per thousand-served population and cost per km criteria were adopted to rank and optimize the project. The missing cross drainage and road link were identified. The cost estimates were reduced adopting different design standard based on population served and cost per km criteria. Total cost of the project for upgradation and construction of rural road network of three pilot districts was reduced to one third of the actual cost with systematic preparation of master plan and identification of core network among rural road nevertheless ensuring connectivity to all unconnected villages with all-weather road.

34. Economic Analysis of Rural Roads in Rajsthan by Rajsthan Government funded under ADP

World Bank, Position : Team Member Year : 2003-2004

The aim of the study was economic evaluation of 2200km of rural roads on sample basis. Roads were selected in highly developed(Kota),medium developed (Jodhpur),and less developed(Bharatpur) region of Rajasthan. In each area 10 villages were selected for assessment. The evaluation showed an average internal rate of return of 11.63%, 21.20 and 17.29% with overall 16.7% for whole region. Due to construction of rural roads.

35. Preparation of Master Plan for Rural Roads for 19 Districts in Andhra Pradesh Sponsored: Panchyati Raj Engineering Department (PRED), Engineer –in – Chief , Andhra Pradesh Year: 1998-99 Cost 2.2 Million INR

Worked as the Sub Project Leader. The roads were prioritized with cost effectiveness criteria population served per km. Organized a state level workshop at Hyderabad (state Capital) and nine regional workshops at different level for preparation of master plan and database of rural roads. The master plan was prepared based on local map, census and road data. The master planned network ensured connectivity to all the habitation by all weather roads. Entire road network was categorized into two categories (i) Major Road (ii) Link road. Around hundred thousand km of roads was identified including all categories of roads in master plan out of two hundred thousand kilometer.

36. Review of Design of Rural Roads under Andhra Pradesh Economic Restructuring Project Sponsored: Panchayat Raj Engineering Department, Engineer –in – Chief, and Andhra Pradesh, Year : 1999 Cost 1 Million INR

Worked as a team member. The aim of the study was to check of design of rural roads and check the design standard designed by consultant. The problem was to cut the cost of total project adopting a suitable design standard based on economic and engineering design. Design standard was modified for effective use of fund by reviewing 38 road packages. Availability of local material was also explored and local material such as gravel was recommended for surface course in rural roads. Economic analysis using World Bank model was carried out considering minimum economic rate of return 12% and the population served greater than 5000 was treated as qualifying criteria for road up gradation to black top standards.

37. Supervision Mission for Andhra Pradesh Economic Restructuring Project Sponsored: World Bank Year: 1999 Cost of project : 0.3 Million INR

Worked as a team member. Assisted supervision mission of World Bank for road inspection and policy decision to check the ambiguity between designs, implementation at field for Waranagal and Karimnagar Districts of Andhra Pradesh. The physical verification of constructed road were made on sample basis.

38. Title: Urban Road Traffic and Air Pollution in Major Cities

Sponsored: Ministry of Petroleum, CHT (Center of High Technology) Government of India Year: 2002 Cost: 34 Million INR

Worked as the team member. The mega prestigious project entitled "Urban Road Traffic and Air Pollution in Major Cities" to give database and scientific support to prepare the Auto Fuel Policy for Government of India .The main objective of project was to assess the present size and pattern of urban travel by road and associated air pollution load due to automobile exhausts in eight major cities called Delhi, Kolkata, Mumbai, Chennai, Bangalore, Hyderabad, Kanpur and Agra. The following data was collected at important locations (spread over the entire country).

- Classified traffic volume counts,
- Classified traffic volume counts including turning movements and stopped delays at selected intersection,

- Road side interview at outer cordon points and fuel station,
- Spot speed measurements at selected mid-points in the road network
- Air pollution monitoring on the road side both at selected mid blocks and intersections

Based on the analysis of the above data, mode wise and fuel type wise vehicle –kms traveled in each city were estimated. On the basis of classified traffic loads, the quantity of pollutants like CO, NOx, HC and PM were estimated as per the group (inter and intra-city) of travel using vintage of vehicles and proper emission and deterioration factors. The data generated enabled to understand the contribution to the air pollution from their exhausts from different vehicle types. Attempt was made to assess the impact of recommended road maps of Auto Fuel Policy Expert Committee up to 2010 A.D. by projecting future travel demands in these cities. The study showed that the improvement in current air quality was mainly due to various measures taken by the Government such as improvement in vehicle technology, fuel quality etc.

39. Technical Assistance for delivery and packaging of Pradhan Mantri Gramin Sadak Yojana (Rural Road project) Sponsored: Ministry of Rural Development, Government of India. Year: 2001 Cost : 7 Million INR

CRRRI has associated with Ministry of Rural development, Government of India as technical agency in implementing the PMGSY programme since its inception. CRRRI has undertaken several activities for implementation of PMGSY for rural road connectivity. During the assessment period the undersigned involved in the activity such as: (1) Preparation of Manual for Master Planning of Rural roads and prioritization of rural roads using Core Network Approach. (ii) IRC manual on rural roads(IRC: SP:20-2002), (iii) Project Preparation and 100% scrutiny of PMGSY project package, (iv) Empowered Committee (NRRDA/MORD) for clearing the project proposals and (iv) associated in dissemination of programme objective and implementation process.

Worked as a member of Scrutinizing Committee. Scrutinize the proposal of road estimate package of various states of India for PMGSY to help the latest low cost design and specifications. Inspected the road constructed under PMGSY to make sure the quality work of road surface, side drainage, and shoulder. Visual inspection of geometry, quality control and project progress for the Udaipur Zone site was reported. A technology transfer training was provided to State Technical Agencies (Surat) for best use local specification and low-cost design.

c. Research Publications (in two parts, Papers in Journals and papers in Conferences) in the following format

a. Books

1. Kumar, Ravindra., Saleh, Wafaa., (2010) Motorcycle Emission - Effect of Driving Cycle in Urban and Rural Area Estimation of motorcycle emission factor using onboard and chassis dynamometer technique under different driving condition, VDM Publisher Germany, 2010.

b. Chapters/ Articles in Books

2. Rao M. A., Kumar, Ravindra., Jain, P. K. and Durai, B.K. (2005) "A Case of District Level Location Planning for Educational Facility based on Rural Accessibility Approach", Geo Spatial Technology for Development and Planning Edited Book : Allied Publishers Pvt. Ltd., New Delhi .
3. Kumar, R., Saleh, W. and Kirby, H. (2007) "Development of driving cycle for motorcycle for Edinburgh", World Association for Sustainable Development (WASD). In: 5th International Conference Managing Knowledge, Technology and Development in the Era of Information Revolution Griffith University. Australia, Volume 7, pp. 357-364. Publisher: WASD Outlook UK UK. ISBN (Print) 0-9551771-3-8.11.
4. Kumar, R., Saleh, W. and Boswell, C. (2009) Onboard Emission Measurement of Motorcycles in Air Quality Management Area of Edinburgh. In: The Impact of the Global Financial Crisis on the Environment, Energy and Sustainable Development WASD Seventh International Conference, Ahlia University. Kingdom of Bahrain. Publisher: WASD Outlook UK ISBN (Print) 978-907106-05-7.
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6. Kumar, Ravindra and Parida, Purnima (2013) Evaluation of following headway behaviour in mixed traffic condition in north east part of India. In: 2013 World Sustainable Development Outlook: Sustainable Development - New Multi-Disciplinary Approaches and Methodologies. World Association for Sustainable Development, London, pp. 365-390. ISBN 978-1907106149
7. Attiyah M. Al-Atawi, Ravindra Kumar and Wafaa Saleh, (2014) traffic accident reductions in Saudi Arabia: barriers and the way forward, world sustainable development outlook 2014 pp. 455-468

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9. Amit Dahiya, Ravindra Kumar, Dr. Errampalli Madhu and Sanjeev Sinha (2015) Comprehensive assessment of sustainability indicators for public transportation system including pedestrians and feeder services – a case study of Delhi, World sustainable development outlook 2015 pp, 1-12.
10. Dr. Ravindra Kumar, Dr. Errampalli Madhu, Anil Maan, Sanjeev Sinha (2015) Comprehensive Assessment Of Sustainability Indicators For Public Transportation System Including Pedestrians And Feeder Services – A Case Study Of Delhi, World sustainable development outlook 2015, 17-29.

c. List of Publications in SCI Journals (Total Impact Factor = 9.23), International and national Journal

11. Chandra, Satish., Kumar, Ravindra. (2001) "Headway Modeling under Mixed Traffic on Urban Roads" Journal of Road and Transport Research, Australia March 2001 Vol.10 No.1. P61-71. **SCI Impact Factor 0.6**
12. Prof. P. K. Sikadr, B.K.Durai and Kumar, Ravindra. (2002) "Revision of Indian Road Congress (IRC) manual: Associated in preparation of draft manual (Chapter -1 on planning of rural road) on rural roads (IRC: SP:20-2002)" published by Indian Road Congress, New Delhi.
13. Kumar, Ravindra, Jain, P.K. and Gupta, Kamini. (2003), "GIS based property and road information system", Journal of Building Road Congress, Volume 10 No. 3 pp-23-32.
14. Kumar, Ravindra., Singh, Bhagwan Singh., Chaudhary, Sanjya., (2005) "Bhartiya Yatayat Ke liye platoon Akar avam headway, Ek naveen dristikon" Bhartiya Audyogik Anusandhan Patrika (Journal of Scientific and Industrial Research Hindi), NISCAIR, Volume No 13. pp 91-97.
15. Saleh, W., Kumar, R. Kirby, Howard. and Kumar, P. (2009) "Real world driving cycle for motorcycles in Edinburgh". Transportation Research Part D. 14, pp. 326–333. doi:10.1016/j.trd.2009.03.003. **SCI Impact Factor 3.445**
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21. Kumar Ravindra, Kamini Gupta and B.K.Durai (2011) "Effect of Driving Cycle and emission and in BRT-Hindi, Sagar Bodh Volume 4 No 2011 by National Institute of Oceanography, Goa, pp 89-98, ISSN 2250-3277.
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23. Kumar Ravindra, Purnima Pardia, B.K. Durai, Saleh, W., (2013) "How real world driving differs in heterogeneous traffic condition World Journal of Science, Technology and Sustainable Development, Volume 10, Issue 1, Emerald Publisher 2013 .
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25. Al-Atawi, Attiyah M., Kumar, R., Saleh, W. (2014). A framework for accident reduction and risk identification and assessment in Saudi Arabia. World Journal of Science, Technology and Sustainable Development (WJSTSD), UK vol:11, iss:3, 2014 (J) pp.214 – 22, <http://dx.doi.org/10.1108/WJSTSD-06-2014-0008>
26. Kumar, R., Parida, P., Shukla, S., Saleh, W. MOVES model for idling emission of signalised junction in developing country. (2014), World Journal of Science, Technology and Sustainable Development (WJSTSD), UK vol:11, iss:4, 2014 (J)<http://dx.doi.org/10.1108/WJSTSD-06-2014-0009>
27. Neelima Chakrabarty, Kamini Gupta, Ravindra Kumar, Geetanjali Singh (2014), Effect of Extreme Weather Conditions on Speed Profiles of Drivers: A Case Study in Delhi, India, 2014, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 2 Issue XI, November 2014, ISSN: 2321-9653

28. Kumar, R., Parida, P., Saleh, W. (2014). Effect of type of lead vehicle on following Headway behaviour in mixed traffic, World Journal of Science, Technology and Sustainable Development, UK,11(1), <http://dx.doi.org/10.1108/WJSTSD-08-2013-0036> pp.28 - 43. (J)
29. Dr. Ravindra Kumar, Dr. Errampalli Madhu, Amit Dhayia, Sanjeev Sinha, (2015) Analytical Hierarchy Process for Assessing Sustainability Indicators of Public Transportation Systems, Pedestrians and Feeder Services in Developing country, World Journal of Science, Technology and Sustainable Development, UK, ISSN: 2042-5945.
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34. Attiyah M Al-Atawi, Ravindra Kumar & Wafaa Saleh (2015) Transportation sustainability index for Tabuk city in Saudi Arabia: an analytic hierarchy process, Transport, London, Transport 30(2015) Taylor & Francis doi, 10.3846/16484142.2015.105885, **SCI impact factor, 1.**
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38. Tushar R Bagul, Kiran Patil, Alka Kote, B.S.Balpgold, Ravindra Kumar, Rakesh Kumar, (2018), Analysis of Autorickshaw as an Intermediate Paratransit system, International Journal of Pure and Applied Mathematics, Volume 118 No. 24 ISSN: 1314-3395 (on-line version), url: [http://www.acadpubl.eu/hub/Special IssueSCI_IF0.23](http://www.acadpubl.eu/hub/Special%20IssueSCI_IF0.23).
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42. Kumar, Ravindra., Sinha, Anil. (2002) “Soil and Road Material Information System for Geo Engineer: A GIS Vision” Indian Geotechnical Conference Allahabad page 645-647.
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58. Kamini Gupta, Sekhar Ravi, Kumar Ravindra,& Durai B. K., (2011) "Provision of Sustainable Road Transport Infrastructure-Urban Corridor in Delhi", ICWES15 held in Adelaide Convention Centre, Australia during 19th-22nd July, **(I)**
59. Kumar Ravindra, Kamini Gupta , B.K. Durai, (2012) Real world driving cycle, emission and fuel economy for car- A case of East Delhi 8th International Symposium On Fuels And Lubricants March 5-7, 2012. **(I)**
60. Kumar Ravindra, Purnima Pardia, B.K. Durai, Saleh, W (2012) Real World Driving Cycle in Heterogeneous Traffic Condition in Delhi for Sustainable development, Abu Dhabi, United Arab Emirates 19th - 21st November 2012 **(I)**
61. Dr Ravindra Kumar (2012) Basic of Headway and Driving cycle modelling and its application in traffic engineering, Workshop on "Advances in Transportation Engineering"Civil Engineering Department of NIT Silchar during 16-18 April, 2012
62. Kumar Ravindra, Kamini Gupta , B.K. Durai, (2012) Real world driving cycle, emission and fuel economy for car, National Workshop on Understanding of real world Indian driving cycle and its impact was organized by CRRI 4th December 2012, New Delhi, India.
63. Kumar Ravindra, Purnima Pardia, Tiwari Devesh, Gangopadhyaya, S.(2013) " Idling emission at intersection and exploring suitable mitigation measures" 2nd International Conference on Traffic and logistic, Istanbul, 14-17 March 2013. **(I)**
64. Kumar, Ravindra and Parida, Purnima (2013) Evaluation of following headway behaviour in mixed traffic condition in north east part of India. In: 2013 World Sustainable Development Outlook: Sustainable Development - New Multi-Disciplinary Approaches and Methodologies. World Association for Sustainable Development, London, pp. 365-390. ISBN 978-1907106149 **(I)**
65. Saleh, W., Kumar, R., Ziolkowski, R., Ostrowski, K. (2013, August). -TDM and sustainability: international experiences. Paper presented at 6th International Symposium on Travel Demand Management, Dalian, China. **(I)**
66. Sinha, Sanjeev and Kumar, Ravindra (2013) Driving cycle pattern for cars in medium sized city of India. In: Proceedings of the Eastern Asia Society for Transportation Studies. Eastern Asia Society for Transportation Studies, Taipei, p. 224. **(I)**

67. Kumar, Ravindra (2014) Sustainability indicators for sustainable transport infrastructure development. In: Soveniour on 'Infrastructure development in Bihar: Strength, opportunities and challenges'. NIT Patna and ICE Patna.
68. Saleh, W., Al-Atawi, A., Kumar, R. (2014, Novemeber 2014). Road users travel behaviour an sus tainable transport in Tabuk city of Kingdom of Saudi Arabia. International Conference On Sustainable Energy & Environmental Protection, Dubai. (I)
69. Kumar, R., Saleh, W., Ocana, L. (2014). Impact of motorcycle's driving behaviour on fuel consumption and emissions. Paper presented at 46th Annual UTSG Conference, New Castle University. (I)
70. Dr Ravindra Kumar (2014) Road network development plan in urban areas, Urban Transport organised by MOUD at Indian Institute of Public Administration Aug 20, 2014.
71. Atawi, Attyah M., Kumar, R., Saleh, W. (2014, August 2014). Traffic accidents reductions in Saudi Arabia: Barriers and the way forward. Paper presented at WASD 12th International Conference, Le Meridian Versailles - Montreal, Canada. (I)
72. Gupta, Kamini, Kumar, Ravindra and Tomar, S (2014) Multinomial logistic regression modelling for perception evaluation of commuters to work. In: Colloquium on Transportation System, Engineering and Management, May 2014, NIT, Calicut
73. Gupta, Kamini, Kumar, Ravindra and Tomar, S (2014) Quality parameters Public Transportation System in Delhi, WISE Conference.US 2014. (I)
74. Kumar, R., Parida, P., Shukla, S., Saleh, W. (2014, August 2014). Idling emission at signalised intersection- A case study in Delhi. Paper presented at WASD 2014 International Conference, Le Meridian Versailles - Montreal, Canada. (I)
75. A.V.A.Bharat Kumar , Ravindra Kumar , Purnima Parida , E. Madhu, Wafaa Saleh (2015) Ne work Connectivity Index and Delay Optimization, 7th International Symposium on Travel Demand Management in Tucson, Arizona April 13-15, 2015. (I)
76. A.V.A.Bharat Kumar , Ravindra Kumar , Purnima Parida , E. Madhu,(2015) Exploring Public Transport Connectivity Index and Delay in Delhi, CTRG Kolkatta 2015
77. Ravindra Kumar, Smart Transportation in Smart City, NISPANA. Bangalore .Sustainable Smart Cities India(SSCI) , 3-4 Sep 2015
78. Ravindra Kumar, Idling fuel loss and emission at intersection and their mitigation measures, TEQIP-II Sponsored Faculty Development Programme on Urban Environmental Challenges and Their Control Strategies (UECCS-2015) from 13th July-17th July, 2015
79. Ravindra Kumar , A.V.A.Bharat Kumar , Purnima Parida , E. Madhu(2016) Does connectivity index of transport network have impact on delay for driver? 14th World Conference on Transport Research, China 2016.(I)
80. Ravindra Kumar and Purnima Parida, Application of Geospatial technology in effective planning of PMGSY, National conference on 15 Years of PMGSY (FYPMGSY) 6-7th August 2016 IIT Roorkee
81. Tushar Bagul, Vilash Shingare, Parag Suryavanshi, Ravindra Kumar and Rakesh Kumar, Development of Three wheeler Autorickshaw Driving Cycle for Indian city, CTRG 2017, CTRG-2017 - Civil IITB - IIT Bombay
82. Ravindra Kumar Reducing emissions by capping number of vehicles on roads, Workshop on Vehicular Pollution and traffic management on Clean Air for Delhi Campaign 17th February, 2018, MOEF
83. Shivani Verma, Ravindra Kumar Prof. N. P. Melkania (2018), Alternate vehicle-usage controlling policies and their effect on air pollutants – Case study of Delhi, Recent Advances In Traffic Engineering (RATE) 11-12 August 2018, Sardar Vallabhbbhai National Institute of Technology, Surat
84. Dr. Ravindra Kumar Vehicular emission reduction by travel demand management 18 September, 2018 NISTAD, CSIR Workshop on Traffic Strategies for Management of Air Pollution over Delhi, NISTAD CDNISTAD
85. Dr. Ravindra Kumar Alternate Vehicle Usage Controlling Policies & Their Effect on Vehicular Pollution – Case Study of Delhi 11-12 August 2018 RECENT ADVANCES IN TRAFFIC ENGINEERING Sardar Vallabhbbhai National Institute of Technology, Surat CD, SVNNI
86. Ravindra Kumar, Neha Choudhary, P. Kumar, Satish Chandra Video image Processing based traffic counting and classification. 13-14 Aug 2018 Hindi , Technical Seminar Chennai SERC, and CSIR, Chennai Campus, CD ROM, CSIR Campus, Taramani,
87. Ravindra Kumar, Neha Choudhary, P. Kumar, Satish Chandra (2018) Video image processing based traffic counting and classification. Hindi Technical Seminar at CSIR Campus, Taramani, Chennai
88. Ravindra Kumar and Pritikana Das Critical Review Of Current E Vehicle Policy Of Government Of National Capital Territory Of Delhi 17–19,July, 2019 International Conference on Smart Cities (2019 ICSC), Seoul, Accepted Submitted December 2018(I)

89. Samarth Ghoslyaa, Mukti Advani, Ravindra Kumar, Integrated Transportation and Land Use Activities for Mass Housing to Increase Non-Motorized Trips 26-31 May 2019, World Conference on Transport Research - WCTR 2019 Mumbai CD Rom WCTR(I)
90. Gulnazbanu Saiyad, Minal, Ravindra Kumar, Trips Generated by Rickshaw Pullers and Trip Rate for Cycle Rickshaws: A Case Study of Delhi" 26-31 May 2019 World Conference on Transport Research - WCTR 2019 Mumbai, CD Rom WCTR, (I)
91. Janak Parmar, Pritikana das, Farhat Azad, Ravindra Kumar Evaluation of parking characteristic – A case study of Delhi 26-31 May 2019 World, Conference on Transport Research - WCTR 2019 Mumbai CD Rom, WCTR, (I)
92. Dr. Ravindra Kumar, The Effect on Vehicular Pollution on Vehicle-Usage Controlling Policies, 11-14 February 2019, The Asian Conference on Science and Technology, Dubai, CDACSE, (I)

MAJOR TECHNICAL REPORTS

Size of the R&D team managed for the last service years in man-years:

Several large teams (consisting of scientists and technical officers) within the Institute (CSIR-CRRI) and within CSIR have been formed and associated objectives/activities accomplished under the leadership (as a project leader) whose description is provided below. These included multidisciplinary teams as is clear from the list below contributing as project leader for **Man-years = 8** years (1760 Man days).

| Sr. no | Title project | Team members- | Status of project | Grant / Fee received Rs. (Lacs) |
|--------|---|--|---|---------------------------------|
| | | Mandays | | |
| 1 | Development of Fast, Durable, Eco-balanced and Energy Efficient Mass Housing Scheme, CSIR Mission Directorate | Project Leader, 20 Monday in year | Ongoing | 67.95 |
| 2 | Quantification of benefits due to avoidance of Eastern Peripheral Expressway, Delhi Pollution Control Board | Project Leader, 25 Man day | Ongoing | 42.5 |
| 3 | Impact of Road condition on fuel consumption, PCRA | Project Leader, 120 Man days in year | Completed the project in one year 2017-2018 | 25 |
| 4 | Development of low cost asset management system in-house | Project Leader, In house R&D, CRRI, 20 Man day in Year | Completed the project in one year 2016-2017 | 15 |
| 5 | Establishment of research network for reducing vehicular emission | Project Leader, 10 Man days for 5 month | Completed the project in 5 month 2016-February 2017 | 16.5 |
| 6 | Noise Mapping of Trivandrum City, Kerala Pollution Control Board, 2015-2016 | Subproject Leader, 30 Man days in year | Completed the project in 12 month 2015-2016 | 35 |
| 7 | Consulting Services for Developing Thematic GIS database for Integrating Road Management System of RCD, World Bank DFID, Govt of Bihar, 2015-16 | Project Leader, 90 Man days in year | Completed the project in 3 month 2015-2016 | 140 |
| 8 | Post Doctoral Research -Travel Behaviour and Accident-Transport Research Institute | Project Investigator | Completed the project in 10 month 2013-2014 | 100 |
| 9 | Development and Application of Technologies for Sustainable Transportation, Planning Commission through CSIR | Wok Project Leader, 40 Man-days in year*4 | Completed the project in 5 years month 2012-2017 | 2400 |
| 10 | Evaluation of Economic Loss Due to Idling of Vehicles at Signalized Intersection a Mitigation Measures, Planning Commission through CSIR | Worked as package leader, 40 Man-days for 3 years | Completed the project in 5 years month 2012-2017 | 300 |

| | | | | |
|----|---|--|--|---------|
| 11 | Micro simulation based driving cycle in Delhi City for sustainable transport system under EMPOWER Scheme | Project Leader, 100 Man-days in year | 2011-2012 | 10 |
| 12 | Driving Cycle and Emission Study, at Edinburgh Napier University | Principal Investigator, 740 Man day in 3 years | 2006-2009 | 70 |
| 13 | Modelling of driving cycle for road network development plan in urban area and suburban area applying GPS – A case study in NCR”, In-house R&D CRRI | Project Leader, 40 Man-days in year | Completed the project in 1 years month 2010-11 | 5 |
| 14 | Model Master Plan for Rural Roads for Nagoan (In house Research),In-house R&D CRRI | CSIR-CRRI, 40 Man-days in year | Completed the project in 1 years month 2003 | 1.5 |
| | Assuming 220 man-days in a year | Total 1760 Man-days as project leader, total 8 Man years | | 3228.45 |

d. Any Other information – whatever you feel should be displayed on the website (like courses conducted, lectures delivered outside, keynote speech, member of editorial boards, etc. etc.)

Software Skill

| Name of Training | Organized | Purpose | Duration |
|------------------|---|---------------------------------|----------|
| ArcGIS ESRI | ArcGIS, India | Application of GIS techniques | 1 Week |
| VISSIM 5.2 | PTV New Castle, UK | Application of micro-simulation | 1 Week |
| Paramics | Edinburgh-Napier University, UK | Application of micro-simulation | 2 Week |
| TNT Mips | MicroImage, USA | GIS | 3 days |
| S –Paramics | S Parmics, UK | Micro-Simulation | 2 days |
| ESB PDF | ESBPDF | Probability density Function | 1days |
| NLOGIT | Binary Semantics Ltd. | Logistic analysis | 1 days |
| VISSIM, | S-Paramic, TransCAD, Microsoft Office, REIDS, HDM-4 | | 1 days |
| ESRI City Engine | ESRI | City Model Development tools | 3 days |
| S-Paramic | S Paramic Asia | Simulation Model | 3 days |

Invited Lecture Keynote/Expert Lecture /Special Lecture

- Keynote Lecture Smart and sustainable Transportation, Manav Rachna University, February 2019
- Keynote Lecture Smart Transportation in Smart City, Sharda University, June 2018
- Keynote Lecture on Application of GIS in construction management “Current Practices In Road Construction” Under TEQIP Phase – II (March 3rd ,2017), MITS Gwalior.
- Expert Lecture/ keynote address Delivered special lecture Driving cycle and GIS application at SVNIT Surat, Under TEQIP on road planning design construction operation evaluation and rehabilitation. 10-13 May 2016
- Member of selection board for assessment and recruitment of S&T and administrative and project staff at CRRI, 2016-2018
- Invited key note speaker/ panel speaker, Smart Transportation in Smart City, NISPANA. Bangalore. Sustainable Smart Cities India(SSCI), 3-4 Sep 2015
- Delivered special lecture AHP based Evaluation of sustainable transportation system at NIT Patna, Sustainable Urban Transportation for Patna: A Curtain Raiser 27-28TH September 2016,
- Delivered special lecture on Transport Planning & Management, TEQIP-II Sponsored Faculty Development Programme on Urban Environmental Challenges and Their Control Strategies (UECCS-2015) from 13th July-17th July, 2015.Delhi Technical University
- Delivered special lecture Urban transportation Planning Indian Institute of Administration, 2014

Technical Event Organized

1. Organized Workshop at regional level in Karimnagar district for Rural Transport Survey 1997 under World Bank aid
2. Organized training Workshop at regional level in 8 district(more than 50 engineers in each districts) for Project Preparation of rural roads and master plan in 19 districts of Andhra Pradesh 1998-1999 for govt . of Andhra Pradesh

3. Organized Workshop at regional level in Patna and Ranchi for 55 districts of Bihar for Rural Road Master Plan to implement in PMGSY for Govt. of Bihar, 2001-2004
4. Organized project scrutiny of the proposal for PMGSY at CRRRI for different state in India 2000-2001
5. Organised National Workshop on Understanding of driving cycle in India 2012 as Organising and Technical Secretary
6. Course coordinator of transport logistics in ACSIR
7. Course coordinator of training programme on Application of Geospatial technology in road and transport sector 2012
8. Organised state level training Workshop for more than 120 engineers on Thematic GIS database for integrating road asset management system for RCD Govt. of Bihar 2015
9. Organised EARNOVER Workshop 2016 -2017 funded by Shakti Foundation
10. Organised PCRA funded workshop on dissemination of Impact of Road Condition on Fuel consumption 2018
11. Organised National Level Hindi Workshop on Role of Science and Technology on infrastructure Development: Challenges of 21st Century 2019.

Students and their Supervision

PH D/M. TECH/ B. TECH DISSERTATIONS GUIDED

| Name of Students | Degree | Title |
|--------------------------|---------|--|
| Menu Kathuriya 1999 | B. Tech | Corenetwork Rural Planning |
| Vedajit, 2002 | M.Tech | Model master plan of rural roads for Nagaon district |
| Abhishek Kumar 2012 | B. Tech | Driving cycle study in Delhi-Part1 |
| MontuGambhir , 2012 | B. Tech | Driving cycle study in Delhi-Part 2 |
| Shashi Rajak, 2012 | B. Tech | Driving cycle study in Delhi-Part 3 |
| Tushar R Bagul | PhD | Auto rickshaw driving cycle in Surat city |
| Surbhi Shukla | M.Tech | Idling emission using moves |
| S Lakshmi | M.Tech | Micro simulation based driving cycle using VISSIM |
| Joseph Appiah | PhD | Car following driving model |
| Amit Dahiya 2014 | M.Tech | AHP based Sustainability Indicator |
| Aman 2015 | B. Tech | GIS base database development on case study basis |
| Rubin Sharma, 2015 | B.Tech | GIS base database development on case study basis |
| Ashutosh Yadav, 2015 | M.Tech | GIS base database development on case study basis |
| A. Bharat Kumar 2015 | M.Tech | Relationship between connectivity and delay |
| Mayank Mishra 2015 | B.Tech | Stopped delay and switching off behaviour |
| AbhinavPokharva 2015 | B.Tech | Smart journey planning using GIS |
| Dharamdeep 2015 | B.Tech | Sustainability indicator identification and scenario development |
| Asif Hussain 2015-16 | M.Tech | Sustainability index using damspster safer theory |
| Shivani Verma 2017-18 | M.Tech | Alternate vehicle-usage controlling policies and their effect on air pollutants – Case study of Delhi |
| Aarushi Bhardwaj | B.Tech | Data analysis on Impact of road condition on fuel consumption |
| Priyanka C U 2018-19 | M. Tech | A case study of microsimulation modelling in mass housing” |
| Praveen Kumar, 2018-2019 | M.Tech | Traffic Impact Assessment on Existing Roadway Network & Site-Specific Variational Study of Carbon Monoxide with Traffic -A case study of Greater Noida |
| M. Sitanathan | PhD | Driving cycle, fuel and emission-On Going |
| Asif Hussain | PhD | Sustainable Transportation and Environment |

Technology development/translation/initiation

Over 22 years experience working on diverse topics in urban and rural transportation which includes application of methodologies, technologies and research development in impact assessment, mass housing guideline, Geographic Information Systems (GIS) applications, rural and urban road and transportation planning, travel behavior, vehicular driving cycle and application of technology in sustainable transportation for clients such as World Bank, State Government and central govt. ministry.

Summary of research output (papers, patents, technology development)

| Role in the Report | National/Laboratory Institute | International |
|--|---------------------------------------|-----------------------------|
| Total number of project | 20 | 7 |
| Project Category | SSP(3), CNP(11), OLP/ESC/GAP(8) | R&D (2) and Academic (5) |
| Role in PL/Team Leader/WP Leader | 10 | Research Investigator (2) |
| Role as Co PL | 2 | 5 |
| Role as member | 8 | |
| Total ECF | 540 Lakhs | |
| Total SCI Impact Factor | 9.5 | |
| Total Google Impact factor | 1.13 | |
| Number of paper in journal having Emerging source citation Index in Thomson Router | 4 | |
| Total number people for skilled development &HRD | 500 | |
| Number of Master Thesis | 5 | |
| No of Phd Thesis | 3 | |
| Number of International Fellowship | 7 | |
| Number journal as reviewer/Advisory | 7 | |
| Number of Cash Award | 5 | |

Language Skill

| Language Known | Read | Write | Understand |
|----------------|-----------|-----------|------------|
| English | Excellent | Excellent | Excellent |
| Hindi | Excellent | Excellent | Excellent |

Certification: It is certified that the information provided in the CV is best of my knowledge belief and truthful

(Dr Ravindra Kumar)

Senior Principal Scientist

Head of Department Transportation Planning and Environment