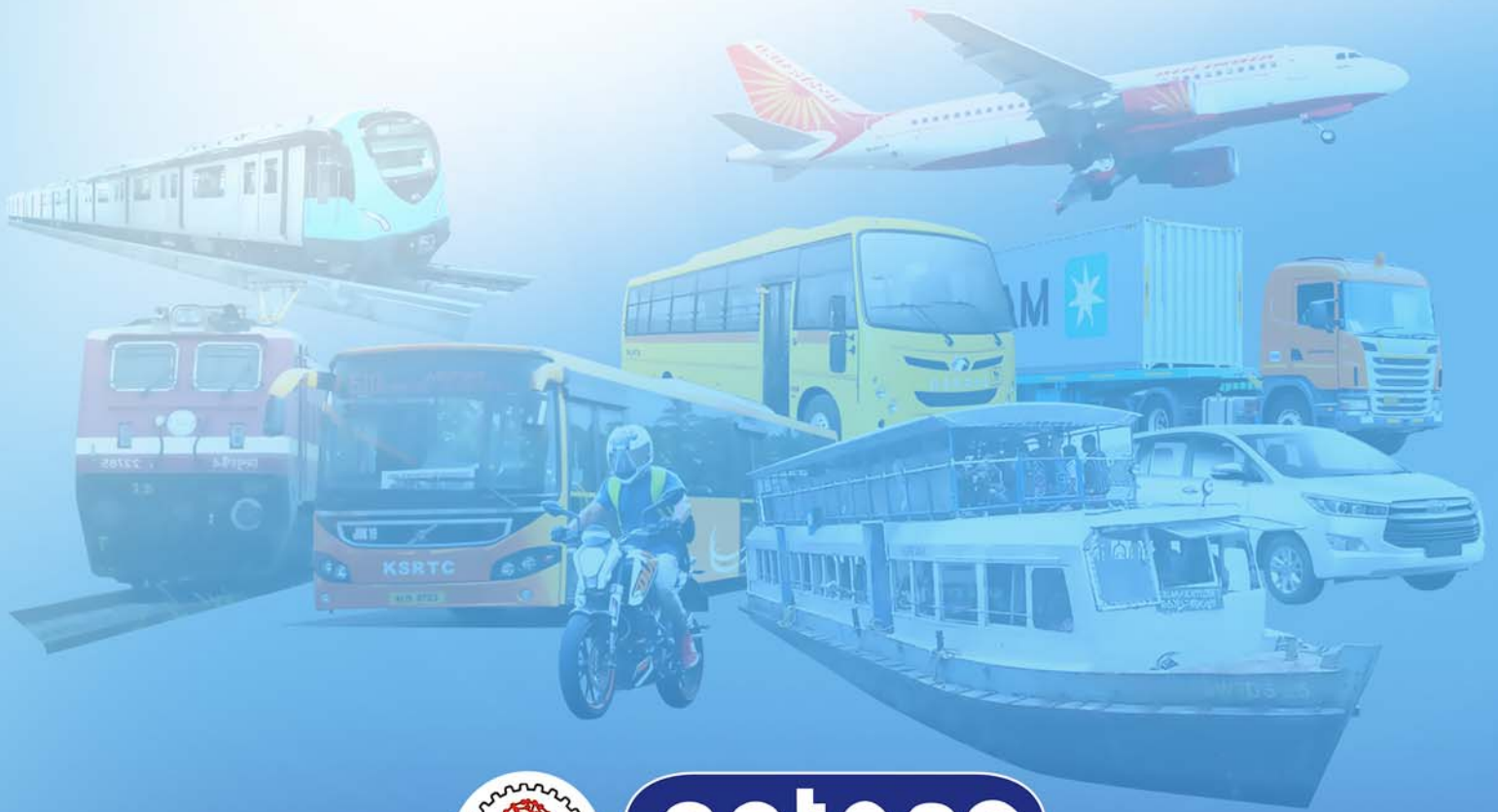# ANNUAL REPORT
## 2021- '22

**natpac**

**KSCSTE - NATPAC**

के एस सी एस टी इ – राष्ट्रीय परिवहन योजना एवं अनुसंधान केंद्र

**KSCSTE - NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE**

കെ എസ് സി എസ് ടി ഇ – ദേശീയ ഗതാഗത ആസൂത്രണ ഗവേഷണ കേന്ദ്രം

(An Institution of Kerala State Council for Science, Technology and Environment)

**K. Karunakaran Transpark, Aakkulam, Thuruvikkal P.O, Thiruvananthapuram - 695011**

# ANNUAL REPORT
# 2021- '22

**natpac**

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# ANNUAL REPORT
# 2021-'22

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**KSCSTE-NATPAC**
**KSCSTE - National Transportation Planning and Research Centre**
(An Institution of Kerala State Council for Science, Technology and Environment)
K Karunakaran Transpark, Aakkulam, Thuruvikkal P.O, Thiruvananthapuram - 695 011
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**natpac**
KSCSTE - NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE

# Contents

natpac — KSCSTE - NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE

# *Director's Desk*

*Greetings from NATPAC!*

***KSCSTE - National Transportation Planning and Research Centre (KSCSTE-NATPAC)*** *is a premier R & D institution in the country which functions related to multi – modal system of transportation covering road, rail, water, air etc. and involved in research, consultancy, and training programs in different fields of transportation engineering. The Centre acts in advisory role and assists other institutions and government agencies for scientific study of the problems concerning transportation and related areas and to come out with implementable solutions. I have immense pleasure to share this Annual Report of the Centre for the financial year 2021-'22.  This year has been exciting on many fronts. Even though the world passed through unprecedented change after the pandemic situation, we managed to deliver our unique expertise in the field of Traffic and Transportation Engineering for the service of the State and the general public, even with accelerated enthusiasm.*

*During this year, the Scientists of the center were involved in 25 plan projects including need-based studies initiated as per the demand from State Government and other departments and taken up 15 consultancy projects worth Rs. 1091.85 lakhs. Twenty-five research reports and eight book chapters were produced by the scientists of the centre. Apart from this, 33 papers were presented in various national and international seminars/conferences. Fourteen invited talks/media interactions were conducted by the scientists of the center. NATPAC scientists were also members of various committees like Technical committee of KRSA, Nodal Officer, Directorate of Environment & Climate Change (DOECC), GoK for State Action Plan for Climate Change (SAPCC), review Committee of KSRTC, Technical Committee of Integrated Digital Traffic Enforcement System for Kerala Police, Traffic Advisory Committee, Thiruvananthapuram city etc.*

*NATPAC in association with KSCSTE and Mar Ivanios College, Thiruvananthapuram conducted the 34th Kerala Science Congress in hybrid mode during 10th to 12th February 2022. NATPAC observed 'Road Safety Month – 2022' by organizing a series of activities from 18th January 2022 to 17th February 2022. The Centre produced two awareness short films on road safety for the general public entitled "Hands free is not risk free" and "Distraction is Extraction", which were shortlisted in the Global Road Safety Film Festival organised by the Laser International Foundation (LIFE), in collaboration with the UN Road Safety Fund (UNRSF) and the United Nations Economic Commission for Europe (UNECE).  NATPAC was accorded sanction to for conducting 'Training Course for Drivers of Vehicles Carrying Dangerous and Hazardous Goods' by Government of Kerala in 2015 and seven programs were conducted in 2021-22 under this program.*

*As part of plan projects, an integrated land use transport model for Thiruvananthapuram was developed under the expertise of the Centre.  Our research team came to the State's service at the time of great Calamity.  The recent flood in Kerala had a devastating effect on hilly regions like Munnar.  NATPAC did the risk and vulnerability analysis of the Munnar region in Idukki district of Kerala by using Remote Sensing and Geographic Information Systems (GIS) as tools. NATPAC also conducted a study on the enhancement of public transport services in Thiruvananthapuram city.*

Our Scientists developed a Road Asset Management System for the selected network of roads including National Highways, State Highways and Major District Roads. The Centre is investigating the impact of integrated feeder service for the public transport patronage. A study on the periodic updation of price indices for Intermediate Public Transport (IPT) Services in Kerala was also covered, which helped the Government to take appropriate decisions whenever fare revision matters are taken up.

As part of Intelligent Transportation Systems (ITS) Cell, driving rating cum travel assist system is being developed by NATPAC. Our Traffic Safety initiatives aimed at reducing fatalities and severe injuries from motor vehicle crashes. The Centre is continuously monitoring the crash scenario in Kerala by regularly undertaking the on-the-spot investigations of accidents in the State and thereby suggesting crash counter measures. Our Scientists are studying the overtaking characteristics followed by different types of vehicles. An android based mobile app for collecting road related data is being developed by the Centre. The Centre is in the process of creating a Web GIS-based road crash information system using Geospatial tools for Kerala.

The performance of the pavement with respect to variation in aggregate properties, binder types and fillers is being assessed by the Centre. NATPAC proposed a rehabilitation design methodology for the low-volume roads in Kerala, based on the obtained DCPT values and the laboratory results of pavement layer parameters. Data produced by our Highway Engineering Division – 'Resource Mapping of Road Construction Materials in Kerala' helps to identify and classify potential construction aggregate resources and fill materials for infrastructure development.

Inland Water Transport is a viable, sustainable alternative in addition to road and rail transport. Though environmentally friendly and the most economical mode of inland transport, it remains largely under-exploited. The travel behavior of the commuters in Kochi Water Metro is being studied as a part of new plan project initiated to evaluate the proposed traffic operation. Our Water Transport Division prepared a DPR for the development of an inland waterway between Kovalam – Akkulam section of West Cost canal. Our Scientists suggested a maintenance and management system for Parvathy Puthanar.

The Library of KSCSTE-NATPAC is a specialized one that caters to the scientific community of the institute and extends its services to the scientists and research students of various other research institutions and universities. The Library is maintaining a blog natpaclibrary1.blogspot.in to make users abreast of the latest developments in the library. Web OPAC extension of KSCSTE-NATPAC Library is available in https://natpac.libsoft.org/.

We provide facilities and guidance to several students to accomplish their project work and training. Several students from reputed academic institutions carried out their project work for B.Tech/M.Tech programmes during this period.

The constant support and encouragement received from the Hon'ble Chief Minister of Kerala, Hon'ble Minister for Transport and Hon'ble Minister for Public Works are thankfully acknowledged. The continuous support obtained from the Executive Vice President of KSCSTE, Research Council and Management Committee of KSCSTE-NATPAC has helped to discharge our duties for the benefit of the Society. Our team is our strength. I must thank my scientific, technical and administrative colleagues for their excellent work.

**Prof. (Dr.) SAMSON MATHEW**
**DIRECTOR**

# Institutional Overview

**Genesis**

KSCSTE-National Transportation Planning and Research Centre (KSCSTE-NATPAC) was established in 1976 as a unit of Kerala State Electronics Development Corporation (KELTRON), a Public Sector Enterprise. In 1982, it was reconstituted as an R&D Centre under the Department of Science & Technology, Government of Kerala. The Centre undertakes research, consultancy, and training programmes in the fields of traffic engineering and transportation planning, highway and pavement engineering, planning of rural roads, regional transportation, public transport system, alternate options for transport system, water transport, traffic safety, tourism planning, transport energy and environmental studies. NATPAC has contributed significantly to the transport development of the country in general and to the state of Kerala in particular.

The Centre is functioning in a five storied office campus 'K Karunakaran Transpark' located at Aakkulam, Kerala. The campus is spread over an area of about 2 acres with built up area of 16,000 sq ft. A regional office is functioning at a rented building in Kozhikode, another major city in Kerala State and has an area of 1,600 sq ft. KSCSTE-NATPAC has a staff strength of over 100 professionals working in different field of activities. There are currently 14 scientists headed by Prof. Dr. Samson Mathew, Director KSCSTE-NATPAC who are working in the allied fields of Transportation Engineering.

## Vision
*To shape and create an efficient, effective, safe and environment friendly transportation system in the State.*

## Mission
*To develop a Centre of excellence concerned with all areas of transportation planning and engineering, research and development, training and consultancy to meet the safe transportation needs of the people.*

**Growth of the Institution**

KSCSTE-National Transportation Planning and Research Centre (KSCSTE-NATPAC) works on multi-modal system of transportation covering road, rail, water and air. NATPAC has creatively contributed to the development of transport sector of the country both as a consultant and in an advisory role. NATPAC carried out several pioneer studies such as intermodal transport planning

studies, coastal area development studies, planning, implementing and monitoring the traffic circulation and parking system studies, employment potential studies in Inland Waterways, preparation of short and medium term traffic improvement measures for several medium sized cities and towns in various parts of the country, comprehensive traffic and transportation studies in Kerala, environment impact studies, DPR studies etc. In response to the achievements and contributions made, NATPAC was converted as an autonomous research centre in the field of traffic and transportation and was brought under the umbrella of the Department of Science, Technology and Environment, Government of Kerala in 1982. NATPAC's efforts helped to bring in more central funds to the State and financial aids by international financial institutions such as Asian Development Bank and World Bank for road development in the State.

The Centre is undertaking various need-based studies as directed by the State Government from time to time. The expertise of this Centre has been utilized by many User Departments which include Transport, PWD, Tourism, LSGD, KIIFB, KRFB, PMGSY, KSRTC, KMRL, KRSA, KSTP, KMTA, IWAI, NHAI etc. NATPAC has also been providing technical reports and proposals to national and international agencies in specialized fields of transportation.

**Collaboration with other Institutes**

KSCSTE-NATPAC has MoUs with academic and research organizations such as National Institute of Technology Calicut, National Institute of Technology Thiruchirapally, College of Engineering Trivandrum, LBS Institute of Technology for Women, Rajiv Gandhi Institute of Technology, Kottayam etc. IIT Palakkad has recognized KSCSTE-NATPAC as a Research Centre to enable employees for external PhD registration to promote professional upgradation of Scientists/Technical staff. KSCSTE-NATPAC is also partnering with APJAKTU in their "Industry Projects Single Window Facilitation scheme". KSCSTE-NATPAC plays a vital role in organizing Kerala Science Congress along with KSCSTE every year. NATPAC has been hosting an exhibition stall relating to road safety as part of the event every year. NATPAC has been creatively contributing to the transportation related programmes of the State.

**Dissemination of Knowledge**

KSCSTE-NATPAC has many social outreach programs for imparting knowledge to public and students from academic institutions. The centre provides extension services such as Internship and Projects for PhD/M.Tech/B.Tech, M.Sc, M.Phil students, Technical lectures to colleges and government agencies, etc. The findings of NATPAC in the form of title of the studies are being published regularly on the website of NATPAC. Scientists from the Centre are invited by media for various discussions. Scientists are also involved in outreach programmes conducted by various government and non-government agencies, academic institutions, etc. NATPAC scientists are regularly invited for delivering lectures and presentations in academic institutions, technical workshops, seminars, and symposia.

In the area of road safety, NATPAC has been playing a vital role in providing road safety education, awareness and training programs, organising extension programs for children and teachers in schools, police officials, student police cadets, drivers of vehicles transporting hazardous goods, drivers of auto, taxi, trucks and KSRTC bus etc. The Centre is involved in preparation of road safety materials for various target groups, road safety inspection and preparation of short-term immediate improvement measures for selected crash black spots, impact assessment, engineering measures to ensure road safety and training to departmental engineers, etc. KSCSTE-NATPAC has a MoU with MoRTH and IRC for imparting training on "Road Safety and Safety Audit".

**Regional Office at Kozhikode**

KSCSTE - NATPAC has its Regional Centre in Kozhikode located in a rented guest house inside CWRDM campus, Kunnamangalam. The Centre has carried out various research and sponsored studies in coordination with Head Office, Thiruvananthapuram with focus to the seven districts in northern part of Kerala. The Centre has involved in organizing various outreach activities comprising of workshops, awareness, training, and capacity building programs in the region. The Centre has also imparted internship, project and thesis guidance to B.Tech/M.Tech/M.Sc students from various colleges across the country.

# Advisory Council
## (Research Council and Management Committee)

KSCSTE - National Transportation Planning and Research Centre (KSCSTE - NATPAC) is an institution of Kerala State Council for Science, Technology and Environment, which is fully supported and funded by Government of Kerala.

## I. KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY AND ENVIRONMENT

### i. *The Members of the State Council consist of the following:*

| | | | |
|---|---|---|---|
| 1. | Chief Minister of Kerala | - | President |
| 2. | Minister for Industries, Govt. of Kerala | - | Vice President |
| 3. | Minister for Finance, Govt. of Kerala | - | Vice President |
| 4. | Minister for Agriculture, Govt. of Kerala | - | Vice President |
| 5. | Minister for Health & Family Welfare, Govt. of Kerala | - | Vice President |
| 6. | Minister for Education, Govt. of Kerala | - | Vice President |
| 7. | Minister for Forest, Govt. of Kerala | - | Vice President |
| 8. | Minister for Water Resources, Govt. of Kerala | - | Vice President |
| 9. | Vice Chairman, State Planning Board, Kerala | - | Vice President |
| 10. | The Chief Secretary to Government of Kerala | - | Vice President |
| 11. | The Executive Vice President, KSCSTE | - | Member |
| 12. | The Secretary, Department of Science and Technology, Government of India | - | Member |
| 13. | The Secretary to Government, Finance Department, Govt. of Kerala | - | Member |
| 14. | The Secretary, Planning and Economic Affairs Department, Govt. of Kerala | - | Member |
| 15. | The Vice Chancellor, Cochin University of Science and Technology | - | Member |
| 16. | The Vice Chancellor, Kerala Agricultural University | - | Member |
| 17. | The Director, Vikram Sarabai Space Centre, Thiruvananthapuram | - | Member |
| 18. | The Director, NIIST, Thiruvananthapuram | - | Member |
| 19. | The Director, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram | - | Member |
| 20. | The Member Secretary , KSCSTE (nominated by Government) | - | Member |
| 21. | Director, JNTBGRI, Palode, Thiruvananthapuram | - | Member |
| 22. | Director, NATPAC, Thiruvananthapuram | - | Member |

Five eminent persons nationally known for their expertise in S&T, Industry and Environment (nominated by Government).

### ii. *Executive Committee of KSCSTE*

| | | | |
|---|---|---|---|
| 1. | Executive Vice President (Ex-officio) | - | Chairman |
| 2. | Secretary, Department of Science & Technology, Government of India or his/her nominee (Ex-officio) | - | Member |
| 3. | Secretary, Planning & Economic Affairs, Government of Kerala (Ex-officio) | - | Member |
| 4. | Secretary to Government, Finance, Government of Kerala (Ex-officio) | - | Member |
| 5. | Director, JNTBGRI, Palode, Thiruvananthapuram | - | Member |
| 6. | Director, NATPAC, Akkulam, Thiruvananthapuram | - | Member |
| 7. | One representative each of Science and Technology, Industry and Environment Departments nominated to the Council by Government of Kerala | - | Member |
| 8. | Member Secretary, KSCSTE | - | Member |

### iii. *Research Council of NATPAC*

| | | | |
|---|---|---|---|
| 1. | Dr. A U Ravi Shankar, Professor Department of Civil Engineering, NIT, Karnataka Surathkal, Mangalore | - | Chairman |
| 2. | Dr. M V L R Anjaneyulu, Professor Department of Civil Engineering, NIT Calicut | - | Member |
| 3. | Dr.P K Sarkar, Professor (Rtd.) Dept. of Transport Planning, School of Planning & Architecture IP Estate, New Delhi | - | Member |
| 4. | Dr. K V Jayakumar, Professor & Head Water & Environment Division Dept. of Civil Engineering, NIT-Warangal | - | Member |
| 5. | Director, Technical Education Department Government of Kerala | - | Member |
| 6. | Principal Secretary to Government Transport Department, Government of Kerala | - | Member |
| 7. | Director, NATPAC | - | Ex-Officio Convener |

### iv. *Management Committee of NATPAC*

| | | | |
|---|---|---|---|
| 1. | Director, NATPAC | - | Chairman |
| 2. | Executive Director, CWRDM | - | Member |
| 3. | Chief Scientist – NATPAC | - | Member |
| 4. | Member Secretary, KSCSTE | - | Member |
| 5. | Additional Secretary, S&T Department | - | Member |
| 6. | Registrar, NATPAC | - | Convener |

### v. *Information Officers as per the Right to Information Act*

Public Information Officer (Scientific &Technical)      -    Shri. Subin B, Senior Scientist

Public Information Officer (Administration)      -    Shri. D. Shaju, Section Officer

Asst. Public Information Officer      -    Smt. Arya S K, Assistant

Appellate Authority, RTI Act      -    Director

### vi. *Internal Committees*
#### a. *Library Committee*

| | | |
|---|---|---|
| Shri. V S Sanjay Kumar, Principal Scientist | - | Chairman |
| Smt. Salini P N, Senior Scientist | - | Member |
| Shri. Wilson K C, Senior Scientist | - | Member |
| Shri. M S Saran, Scientist | - | Member |
| Smt. K S Veena, Jr. Scientist | - | Member |
| Shri. Sanjai R J, Technical Officer-2 | - | Member |

#### b. *Purchase Committee*

| | | |
|---|---|---|
| Shri. S Shaheem, Principal Scientist | - | Chairman |
| Shri. V S Sanjay Kumar, Principal Scientist | - | Member |
| Shri. George Koshy K, Registrar | - | Convener |
| Dy. Registrar (A) | - | Member |

#### c. *Complaint Committee to prevent sexual harassment of working women at work place of KSCSTE-NATPAC*

| | | |
|---|---|---|
| Smt.P N Salini, Sr.Scientist | - | Presiding Officer |
| Shri.Wilson K C, Sr.Scientist | - | Member |
| Smt. Bindu S R, Asst. Registrar (Accounts) | - | Member |
| Smt. Arya S K, Assistant - II | - | Member |
| Adv. Rajeswari R K | - | External Member |

#### d. *Editorial Board*

| | |
|---|---|
| Shri.Subin B, Senior Scientist | |
| Smt.Veena K S, Scientist | - |
| Shri. R Chandra Prathap, Scientist | |
| Shri. Jegan Bharath Kumar, Scientist | |
| Shri.B Anish Kini, Scientist | |
| Smt. Deepa Radhakrishnan, TO – Grade 1 | |

### General Administration

### Research Council Meeting

The Research Council met on 22$^{nd}$ and 23$^{rd}$ October 2021 (25$^{th}$ RC) through online under the chairmanship of Dr. A U Ravi Shankar.

### Management Committee Meeting

The Management Committee was held on 29$^{th}$ April 2021 (36$^{th}$ MC) at KSCSTE-NATPAC under the chairmanship of Director, NATPAC.

# PERFORMANCE INDICATORS

# Publications in 2021-22
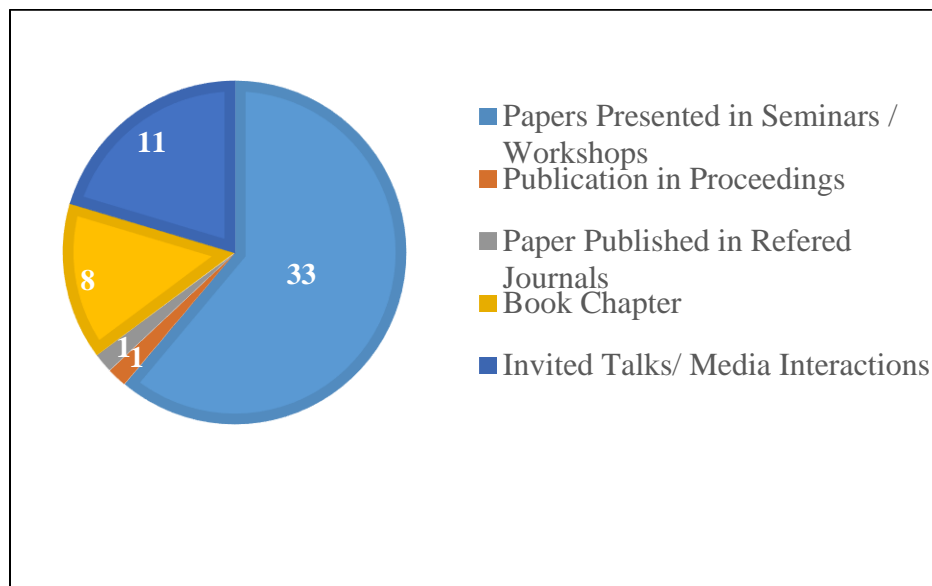


# Participation of Scientists in Workshops, Seminars and other Training Programmes
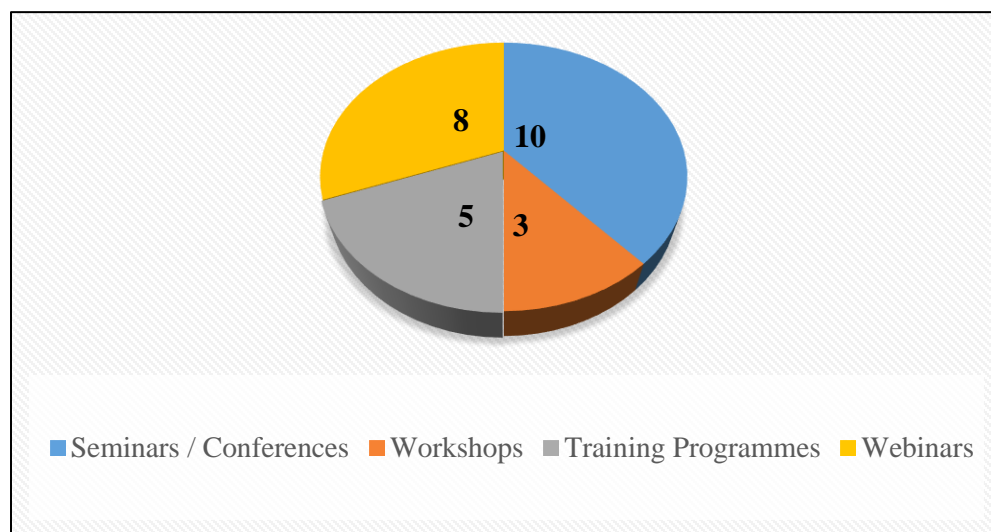
# Staff Strength in 2021-22



Pie chart legend:
- Scientists: 15
- Technical: 5
- Administration: 19
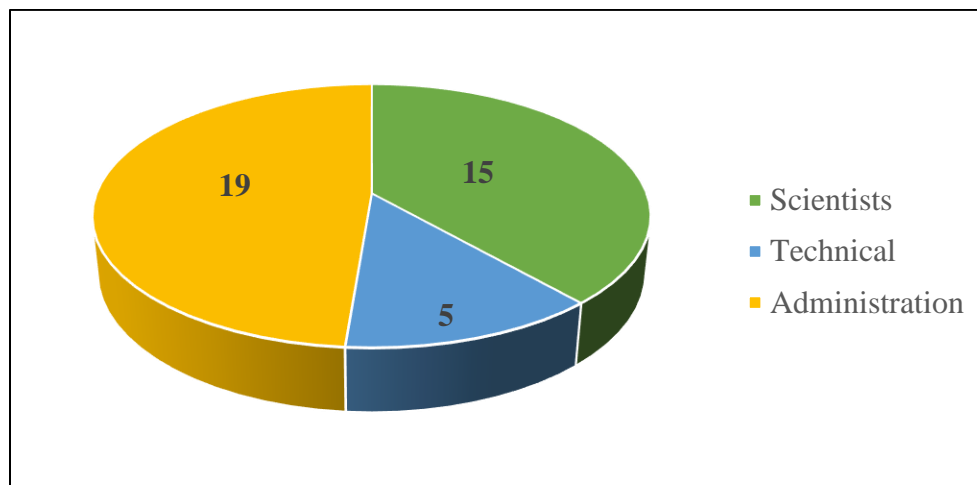
# Projects Undertaken in 2021-22



| Year | Research Studies | Consultancy/Sponsored Projects |
|---|---|---|
| 2016-17 | 32 | 20 |
| 2017-18 | 34 | 26 |
| 2018-19 | 29 | 6 |
| 2019-20 | 30 | 19 |
| 2020-21 | 36 | 12 |
| 2021-22 | 25 | 15 |

■ Research Studies  ■ Consultancy/Sponsored Projects

natpac KSCSTE - NATPAC    KSCSTE - NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE
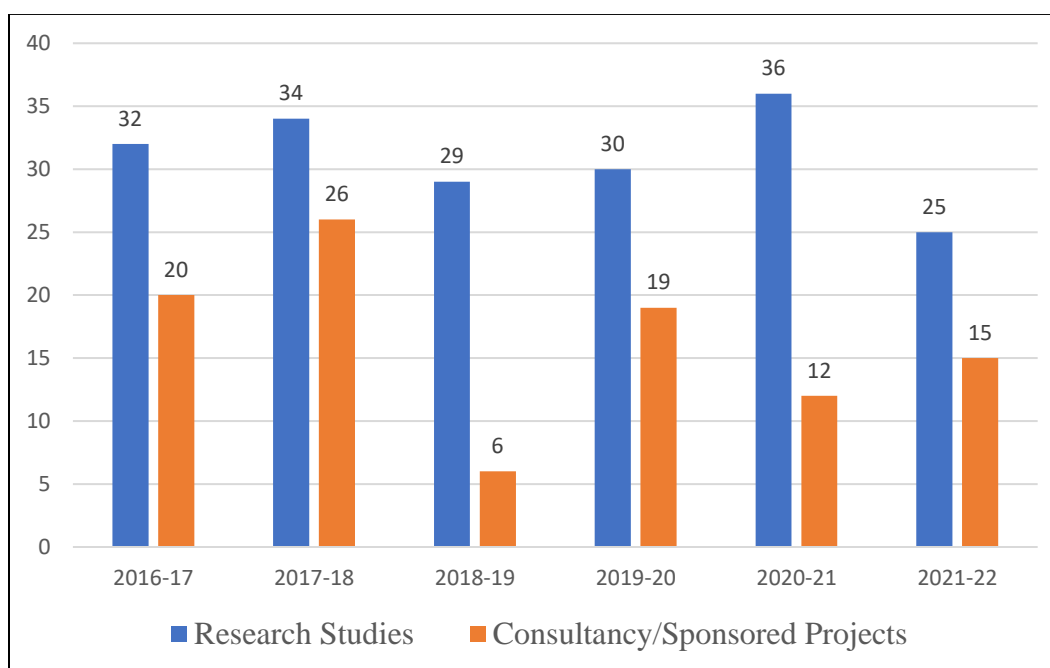
# RESEARCH & DEVELOPMENT PROGRAMMES

# TRANSPORTATION PLANNING AND MANAGEMENT

## 1. *Development of Integrated Land Use Transport Model for Thiruvananthapuram*

At present world is facing the problem of rapid urbanization and managing the urban areas has become one of the most important development challenges of 21st century. The urban structure determines travel demand and that influences travel pattern whereas the location and major transport infrastructure are key elements for land use allocation. This continues as a vicious circle.

The parameters like population and population density are taken as demographic parameter, since population and land use relation are inevitable while considering land use change. In Thiruvananthapuram corporation the wards Palayam, Thycaud, Valiyasala, Chalai, Manacaud, Thampanoor and Vanchiyoor were grouped together to form the Central Business District (CBD). The centroid of other wards was identified and calculated the Euclidean distance from that centroid to the centroid of the CBD. Under Socio- Economic parameters land price and employment opportunity are considered. Land Price varies depending on the economic, geographic and political aspects of a particular location. A Land Price survey has been conducted to assess site specific Land Price data and assess the variation. Areas with more employment opportunities, the major land use found will be residential to minimize the travel cost. Also,

Employment data is not readily available as secondary data. So, to identify the employment opportunity of an area, a survey has been conducted for collecting the details regarding establishment, employment and trip attraction. Using the above parameters, a land use model is developed using land use land cover data from BHUVAN in ANN method of MOLUSCE, a plugin in QGIS, after the comparison with logistic regression in MOLUSCE and markovian transition matrix. And it is seen that major urbanization is in Kazhakootam, Pallithura and Kattayikonam, the reason for the same is the influence of Technopark and KINFRA Park. The other is on the Vizhinjam area and it can be due to the influence of the upcoming Port. Lastly, major urbanization is also seen along the new NH bypass. These inferences are going in hand with on ground realities, so the parameters identified can be finalized. But for the land use transport integration, the classification should be according to Urban and Regional Development Plan formulation and Implementation (URDPFI) guidelines, so using these finalized parameters the land use model has to be developed with land use maps on URDPFI classification.

The road network database of Thiruvananthapuram Corporation is developed using the NATPAC's mobile application GETMAP. In the application Road inventory details of the track such as pavement type, shoulder type, speed limit and land use and road

cross sectional details such as name of the road, number of lanes, width of shoulder, carriage way and median can be entered. The road network of Thiruvananthapuram corporation consists of one National Highway, NH66, spanning from Kazhakootam ward to Mulloor ward, two State Highway, SH1, spanning from Mannanthala ward to Kesavadasapuram ward and SH2, spanning from Thuruthumoola ward to Thampanoor ward.

The output from this study reveals that these identified data can be used in development of Land Use Model for Thiruvananthapuram Corporation and need to be integrated with the transportation plan.

## 2. *Planning for Resilient Transport Infrastructure in a Disaster Prone area - a case study of Munnar Region*

NATPAC did the risk and vulnerability analysis of the Munnar region in Idukki district of Kerala by using Remote Sensing and Geographic Information Systems (GIS) as the tools. Adopting the Analytic Hierarchy Process (AHP) for a Weighted Linear Combination (WLC) approach, eleven evaluation parameters were selected. The results were validated using a historic landslide database and field verifications. Moreover, the landslide risk map of the area was also developed, based on the LS delineation, considering additionally the anthropogenic exposure and overall vulnerability of the area.

Alternate routes with potential for up gradation are recommended, geo referenced mapping of potential evacuation centres within and outskirts of Munnar town along with the access roads are prepared, prospects of alternate modes of transport – ropeways are explored. Risk and vulnerability analysis were done using Analytical Hierarchical Process of Multi Criteria Decision Making. Risk Assessment Maps were prepared for the region. Risk Exposure Index was also estimated.

Munnar being one of the worst affected areas every year, needs a robust and resilient transportation network which remain resilient to such situations. Using the GIS tools based on Multi Criteria Decision Analysis (MCDA) and AHP, risk and vulnerability analysis of the region is done. Risk assessment maps are prepared and Risk Index is estimated for the road network of the region. Proposals for upgradation of the existing road network, which can function as alternate routes in times of emergency is brought by the study. Potential evacuation centres and their access roads are plotted in geo-referenced platform. Risk and vulnerability assessment of the region will help the executing agencies in prioritising their intervention strategies.

The rational methodology evolved for risk assessment shall be replicated for other regions too which are likely to have natural disasters.

### 3. *Study on the Indo-HCM Adjustment Factors for Capacity Analysis of Intersections in Kerala*

Traffic congestion is one of the most constraining problems in many urban areas. Urban road intersections are the major critical points in the safety, capacity, delay and efficiency point of view. Therefore, both from the safety perspective and the level of service perspective, the study of intersections is very important for the traffic engineers especially in the case of urban scenario. Indian Highway Capacity Manual (Indo-HCM) put forth adjustment factors for bus blockage, exclusive right turns and initial surge. Bus stop activity is very common at signalized intersections in Kerala which is likely to affect the saturation flow and capacity of signalized intersections. Hence better estimations of adjustment factors for the effect of bus blockage will lead to more precise estimations of saturation flow.

For the study, various intersections were identified in Thiruvananthapuram and Kollam Districts in Kerala State. Field measurement of saturation flow is carried out as provided in Indo HCM for signalized intersections. To further improve the accuracy of the field measurement of saturation flow, usage of dynamic PCU was opted for the study. The dynamic PCU calculation methods like time headway method [Method 1] and area occupancy method [Method 2] were identified from literature based on the practical easiness of data collected required for the PCU estimation. The better method suitable for the study was selected after comparison with the dynamic PCU range provided in Indo HCM. The effect of vehicle type and its composition on the saturation flow was also studied. A regression equation is developed for estimation of dynamic PCU at signalized intersections. Expression for modified adjustment factor for bus blockage is also developed based on regression on field measured values.

The field measurement of saturation flow using dynamic PCU showed much better results than static PCU. In the comparison between Method 1 and Method 2, it was observed that the percentage difference between field measured and calculated saturation flow was much lesser when Method 1 was used. In the case of Method 2, the percentage difference was same as that obtained when static PCU provided in Indo HCM for signalized intersections was used. In this study, Method 1 was further used for dynamic PCU estimation as it was going in better conformity with the range of values given in Indo HCM.

Strong correlation was observed between vehicle composition and saturation flow. Two-wheelers, cars and auto rickshaw percentage composition were found to be significant. Heavy vehicles were

5

neglected due to very less percentage composition. Vehicle type and its composition were found to be a significant factor in saturation flow estimation. Saturation flow was observed to be directly proportional to the percentage composition of two-wheelers. Inverse proportionality was observed between saturation flow and percentage composition of cars. For auto rickshaw, inverse proportionality was observed between its percentage composition and saturation flow.

Further studies are being conducted to develop the modified adjustment factors to account for the effect of presence of other typical factors affecting saturation flow at signalized intersections.

## 4. *Periodic Updation of Price Indices for IPT Services in Kerala - a Study on Taxi Mode*

NATPAC has been conducting studies on intermediate public transportation, such as taxis and autos, in order to determine the cost of operating in the state. This study aids the government in making decisions when it comes to fare revisions. The cost table approach, generated from an extensive investigation of the life cycle performance of practically all key vehicle components, is being used to compute the cost of vehicles' operations with optimal capacity utilisation. A price index is also calculated at the entry-level conditions for two time periods in order to assess and compare price movement over time. The index provides a scientific foundation for choices like fare modifications for different public and freight transportation operations in the state. This is also helpful in offering insight into the general condition of the Kerala taxi industry.

The current research is limited to taxi operations in Kerala. Varied types of taxis and their routes operated in different terrain conditions, such as plain, rolling, hilly regions and urban, semi-urban, and rural locations, were adequately represented in the sample. Thiruvananthapuram, Kollam, Ernakulam, Idukki, Thrissur, and Kannur were the districts chosen for the study. The taxi industry's operational parameters, revenue collection, and socio-economic aspects were among the variables evaluated during the operators' survey. According to the operators' study results, the pandemic has had a significant negative impact on the taxi industry, and drivers are still trying to make ends meet even after the post-lockdown circumstances.
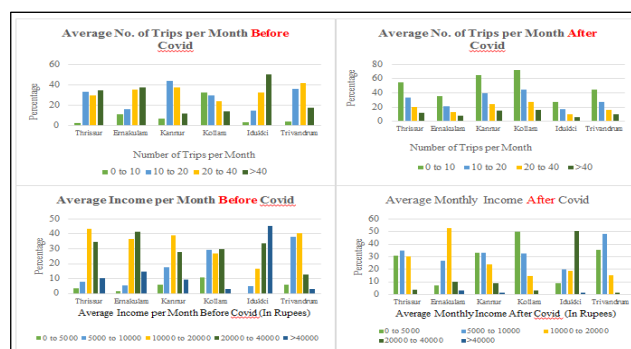


The current research and findings are based on a survey of operators. After the remaining data collection of the parameters affecting the

performance and cost of operations is completed, the remaining work can be continued. The study's future objectives include the creation of a pricing index based on standard cost principles, which would provide a precise scientific technique for making fare revision decisions for taxi services.

## 5. *Enhancement of Public Transport Services in Thiruvananthapuram City*

An efficient public transport system is an on-going need for the unhindered mobility of commuters in Thiruvananthapuram City. There has not been much studies conducted regarding the public transport system in Thiruvananthapuram city. The ridership in public transport can be gradually surged only through implementation of effective policies. In this context, NATPAC conducted a study on the enhancement of public transport services in Thiruvananthapuram city.

The broad objectives are to study the characteristics of existing public transport system operating in a medium sized city as well as to identify significant factors and latent variables influencing the mode choice behaviour of working population in Thiruvananthapuram city. The study proposed policies for improving public transport patronage in Thiruvananthapuram city and estimated modal shift from personalized vehicles to public transport mode by modelling of proposed policies and strategies. The scope of the present study is confined to the employees working within the precincts of Thiruvananthapuram city.

Exploratory factor analysis using varimax rotation was conducted on the data collected using opinion survey and the major latent variables influencing the attitude of commuters towards public transport were identified separately for the government employees, private employees and the combined data of all the employees. Confirmatory Factor Analysis was also performed to analyse the relation between observed attributes and their underlying latent factors. Mode choice decision of employees working in Thiruvananthapuram city was studied by using multinomial regression analysis. Structural Equation model was developed using Smart-PLS software. Model choice models was also developed using ANN and fuzzy logic techniques. Economic impact was also done to study the mode shift of commuters from private vehicles to public transport buses with the implementation of policies.

In case of government employees, the major latent factors identified were Reliability, Convenience, Safety and Security, Comfort and Affinity. The major latent factors influencing the attitude to public transport of the private employees as well as the combined dataset of all the employees were found out to be Convenience, Comfort, Safety and Reliability. Moreover, latent variable integrated

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mode choice model is found to have a relevant role in the mode choice decisions made by the commuter. The recommendations provided by the present study include reducing travel time of buses by introducing a greater number of limited stop buses for intra city commuters as well as providing exclusive bus services for employees from their home to workplace at subsidised fare rates.

The present study offers valuable insights into the mode choice behaviour of employees working in a medium-sized city of a rapidly developing country. The models developed as part of the study will help transport planners and policy makers to develop policies and recommendations for improving public transport patronage in Thiruvananthapuram city.

## 6. *Synthesis of Rich Origin-Destination Matrices using Fusion of Multiple Sparse Data Sources*

Kerala is known for its linearly extending geography with a rural-urban continuum. Urban transport planning in such regions falls short as the inter urban movement is not taken into consideration. Trip Length distribution studies conducted in various local bodies around the state of Kerala as part of various projects revealed that a major proportion of the trip lengths extended beyond the boundaries of the local body. Regional Travel Demand Model can form a frame work for

efficient planning of various transportation projects on a regional scale.

However, a household survey for the region as a whole is time consuming and tedious. Moreover, household level trip details are not available in the Indian scenario unlike countries abroad. This calls for clustering Traffic Analysis Zones (TAZs) based on demographic details and then conducting trip generation/ OD survey for fetching the relevant details.

In addition, there are a number of newly emerging data sources – Cellular, GPS, ANPR, ETM data etc. – which can be utilised to understand the trip origin/ destination without depending upon conventional surveys. Therefore, the main objective of the present study is to develop a Regional Travel Demand Model for the state of Kerala with clustered zonal data, followed by fine-tuning the model with GPS, ANPR and Cellular data finally resulting in establishing a reliable Regional Travel Demand Model from multiple data sources.

The boundaries of the zones have been finalized throughout Kerala and the zonal demographic details have been entered. The revision of the road network is being carried out. Once the regional model is functional, it could be used for regional transportation planning including infrastructural priority, long distance bus route identification and

scheduling etc. The regional model could also be used by the urban level planners as cues for urban transport planning.

## 7. *Impact of Integrated Feeder Services for Encouraging Public Transport Patronage*

A proper public transport system increases the participation of commuters'/passengers in society and helps them to travel to their desired places. In recent days public transport systems are developed with various infrastructure facilities to connect various points. The development of the public transport system includes different classes of facilities like metro system, bus rapid transit system, high-speed rail system, etc. Likewise, the study area (Kochi) also witnessed (existing and future) major infrastructural developments like metro system, railway service, boat jetty service, water metro system, silver line project, and bus service as a public transport facility for connecting different destinations.

It has been observed that majority of the public transport services are not being utilised to its efficiency or capacity for which they are designed. Less utilisation of public transport services is due to poor operational efficiency, increased travel time, inadequate accessibility and slow operating speed. High level of investments in public transport infrastructure without enhancing the quality and accessibility of public

transport leads to more usage of private modes. The private mode usage has certain negative externalities like increased congestion, increased travel time, more road fatalities, loss of economic productivity, air pollution and consequent health issues. To reduce the negative externalities and to increase the public transport utilisation, integration of public transport has received particular attention in recent years. Integration of public transport can be achieved by providing first mile and last mile connectivity by means of feeder service. The present study is to investigate the impact of integrated feeder service for the public transport patronage. This study also focuses on the mode choice selection of commuters for their first mile and last mile connectivity.

The preference of the commuters for the feeder service mode choice was identified. The majority of the commuters prefer Auto and E-Bikes for their First mile and last mile connectivity. The factors influencing the selection of a particular feeder mode choice for the access and egress trips were identified based on the logistic model. Based on the analysis result, the policy interventions are yet to frame for increasing the usage of public transport facilities.

# TRAFFIC SAFETY

# 1. *WebGIS based Road Crash Information System*

Data relevant to road safety, especially road accident are collected every day, but for these data to be useful for informing road safety practice, they must be properly coded and visualized, processed and analysed in a systematic way. A web application named *Road Crash Information System* (RCIS) is developed as an information system for managing road crash information in Kerala. The web application is developed using the programming languages HTML, JavaScript, CSS and PHP with the help of Visual Studio Code software and MySQL for database along with WAMP server.Two tables were created in the database in which one table is used to store the details of accident spots and other is used to store the login information of the user. The spatial data and attribute data collected about the accident spots all over Kerala are inserted into the tables of database.

The web application mainly consists of two web pages – Login page and Home page. Authorized persons with valid user name and password will be allowed to access the system. The web application displays the location of accident hot spots on a customized Leaflet OSM map and CanvasJS displays the corresponding charts. The web application initially displays the map of the whole study area which is the Kerala state. A GeoJSON layer of Kerala state with district borders is added over the OSM map. The control panel on the left side of the map consists of different options to filter the result from the database. A responsive HTML5 Charting Library named CanvasJS is used in the web application to visualize the data as charts. Accident spots are displayed as markers on the map with two different colours indicating the priority order. On clicking the marker, a pop-up window consists of information such as Name of Location, Name of Landmark and Accident Severity Index is displayed. Users with administrative privilege can view the details of accident hot spots as a tabular column and can insert the details of new accident hot spots into the database.

In the next phase, RCIS needs to be modified as an advanced road crash information system by incorporating the following broad features:

- Overall crash information - World, India, Kerala with official sources;
- Crash Data Analysis - Police Station/Police District/District;
- The Web GIS map should be overlay using Drone/High Resolution Satellite Imageries or Google Maps APIs/Open-Source Maps/base map and the location/data collected from the field should be displayed on the said maps;

- GIS toolbar for Spatial Data Management (Pan, Zoom, Scale, Measurement – Distance/Area, Identify/Information Window, Search, display mouse/cursor position in terms of latitude, longitude);

- Query Builder interface for execution and generation of attribute (geo-spatial queries) on area of interest along with generation of information on sidebar for each query) for Decision Support.

- Generation of Map based reports at the user end.

## 2. *Study on Overtaking Behaviour – a Case Study on Selected Roads in Kerala*

About 75% of roads in India are two-way two-lane roads. Overtaking is a common maneuver in traffic, with significant impacts on safety as well as on system performance. Unsafe overtaking accounts for 18.7% of road accidents in 2017 and 20.9% in 2018 (as per MoRTH Report). In mixed traffic conditions, a speed differential exists between fast- and slow-moving vehicles, hence overtaking maneuvers are inevitable. The infrastructure and traffic related variables may influence the occurrence and consequences of overtaking maneuver and in certain circumstances the overtaking accidents as well. Hence this needs to be studied in detail.

Straight stretches on National Highway-66 Alummoodu – Mangalapuram and Mangalapuram - Thonnakkal were taken for initial studies. Mainly the overtaking characteristics of four different categories of vehicles were studied like cars, two wheelers, light commercial vehicles and heavy vehicles.

The types of overtaking prevalent on study road stretches were analyzed and found that mainly three types of overtaking occur like flying, accelerative and multiple overtaking maneuvers. Accelerative overtaking is predominant in case of all vehicle types. Mean overtaking time for Heavy Commercial Vehicles (HCV) is higher compared to other categories of vehicles like two-wheelers, cars and Light Commercial Vehicles (LCV). Mean value of passing gap accepted by two-wheelers were smaller compared to other categories of vehicles like cars, LCV and HCV. It is also found that smaller passing gaps are associated with higher speeds of overtaking vehicles. The relation between different parameters involved in overtaking maneuvering is arrived at and used for formulation of models.

During overtaking maneuvers, drivers tend to complete the maneuvers by increasing their speed to reduce the risk of accidents with the vehicles moving in opposing direction. Drivers tend to spend more time on the opposing lanes if the time gap with the opposing vehicles were longer and a

positive correlation is observed between passing gap and duration of overtaking. It was also found that time taken for overtaking increases as the speed difference increases. Formulation of models is done based on the relations derived between different variables involved in overtaking maneuvering.

A detailed analysis and understanding of overtaking characteristics help to resolve the related road safety issues to a great extent. The parameters related to overtaking operations can be used to develop prediction models to predict safe overtaking opportunities which can be of use to road users.

### 3. *Crash Prediction Modelling for Two-Lane Two Way Roads: a Case Study of Critical Road Stretches in Kerala*

The study focused to develop a crash prediction model for NH-66 road stretch connecting Cherthala and Kazhakoottam. This model will be developed based on the crash data and other traffic and road data collected from the road stretch. Only a few studies have been conducted so far in the stretch. Crash prediction models will be an effective tool for reducing accident rates by predicting crashes beforehand. Several recent types of research were conducted focusing on nonlinear regression, fuzzy logic and ANN models and other machine learning algorithms for establishing a nonlinear relationship between

accident occurrence and factors causing accidents. So, our study adopted nonlinear regression and Artificial neural network for modelling. The major independent variables considered for crash modelling were carriageway width, shoulder width and condition, degree of curvature, vertical gradient, traffic volume and speed, number of access roads, number of junctions, pedestrian crossings, percentage of truck etc. Homogenous sections were used for developing crash prediction model to get reliable results.

The selected study stretch is Thiruvananthapuram-Alappuzha Road (NH 66), which is 90 km long. Road stretch under consideration was segmented into homogenous sections. The database consisted of details regarding roadway geometry and condition, crash data and traffic data. The data collected for model development includes crash data, traffic data and road data. Three years crash data (2018, 2019 and 2020) were considered for model development and the details were obtained from FIR records of police station. The crash data collected includes place, date and time of occurrence, type of vehicle and the type of injury. Traffic volume and spot speed were collected by adopting video-graphic method. Latitudes and longitudes of the points were obtained from Google earth.

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A crash prediction model will be developed using SPSS for traditional modelling and Google Keras for soft computing techniques using the data collected from the study stretch. The developed models are Nonlinear Regression model and Artificial Neural Network. Then the models can be validated using well recognized statistics such as Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) etc. Developed model is validated with 20% of the collected data. Based on these statistics, the best model can be identified.

Based on the study carried out along the stretch the following inferences were made:

- The major factors which contribute to road crashes are human behavioural factors, vehicle factors, traffic factors, roadway, environmental factors and time;

- From the analysis of crash data, grievous injuries were occurred in higher percentage, two– wheelers contributed to higher percentage of crashes, majority of crashes were due to vehicle-to-vehicle collision by head on collision;

- Spearman's rho and Pearson's correlation coefficient was computed using SPSS and found that crashes are significantly correlated to segment length, number of curves, number of bus stops, number of Zebra crossings, number of access roads, number of intersections, 85th percentile speed of two-wheeler, 85th percentile speed of car, average daily traffic and maximum radius of curvature;

- The nonlinear regression method performed well for homogenous sections;

- The major factors contributing crashes are found to be segment length, number of zebra crossing, average daily traffic, 85th percentile speed of both car and two-wheeler, number of access roads, number of curves and maximum radius of curvature;

- Model validation was done by MAPE, PRMSE and MAE statistics and when compared to the criteria, it was found that model has acceptable fit;

- Artificial neural network was developed for homogenous road sections using Google Collab in python code. The obtained model found to be satisfactory with R square value of 0.699 and MAE value;

- The most impacted features on crash prediction according to ANN results are segment length, truck percentage, Average daily traffic (ADT) etc.;

- Sensitivity analysis done for number of pedestrian crossings and 85th percentile speed.

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## 4. *Application of Surrogate Safety Measures at Unsignalized Intersections*

The safety analysis of roads using crash data is a reactive approach and is hampered by data inaccuracies. The crash data may be of limited sample size due to overlooking minor accidents or may be inaccurate/insufficient/incomplete crash data to support accurate diagnosis and intervention. These limitations can be overcome with the help of proactive approach to road safety. Surrogate Safety Measure (SSM) is one of the most widely used proactive methods for identifying future threats and analysing safety performance of road facilities. The present study aims to analyse the traffic conflict for the selected unsignalized intersections in Kerala with the help of micro simulation model and Surrogate Safety Assessment Model (SSAM) model.

According to crash data of 2018-2020 periods, in Kerala 36% of crashes occur at intersections and among intersections, 85% of crashes occur at uncontrolled intersections. Among uncontrolled intersections, 57% of crashes occur at T intersections, followed by Y intersection (20%) and four arm intersection (13%). Unsignalized T intersections on National Highway 66 and State Highway 1 were identified with help of GIS, Google Maps and subsequent field visit. The selected intersections were prioritized with the help of crash data. Video feeds were collected from Kozha intersection of SH 1, where the visibility was ideal for performing the video analytics. As first phase of the study, vehicle to vehicle traffic conflict analysis was considered in the Kozha intersection. Kozha intersection, an uncontrolled T intersection with channelizing island, has a peak hour traffic volume of 1188 veh/hr. Traffic composition comprises of 44% of cars followed by two wheelers (33%) and Auto rickshaw (10%), truck and buses possess a lesser percentage of traffic.

Micro simulation parameters and surrogate parameters required for the conflict analysis were extracted using AI based video analytics. Intersection was then modelled with the help of micro simulation software to extract required vehicle trajectories. The base model of the intersections was developed with the help of collected geometric parameters and traffic parameters. Initial calibration of the model was done by adjusting the traffic characteristics, link characteristics and driver characteristics in accordance with the data extracted and site conditions. The trajectories extracted from micro simulation model was then analysed using SSAM model to arrive at various surrogate safety measures. Analysis using surrogate safety measures will help in overcoming the limitations faced while using crash data. It will also aid in safety analysis of new schemes before it is actually implemented and assist to test and evaluate different safety improvements without the need for implementation.

# ROAD CONSTRUCTION MATERIALS AND PAVEMENT EVALUATION STUDIES

# 1. *Pavement Rehabilitation Design Using Dynamic Cone Penetrometer Test*

Urbanization of a particular location is evaluated on the basis of its infrastructure development, mainly in terms of its connectivity. Connectivity in terms of roads and rail networks in India is excessively perplexing as the same complexity in its topography. In India, the vast majority of the road network is reinforced with the flexible pavement, despite the fact that this pattern is moving to more sustainable pavements in near future. The necessity of examining the existing flexible pavements with non-destructive methods have greater importance by considering the economic aspect. In India, road pavement failure is a very sensitive and serious issue, particularly in territories having a high-water table. Climatic conditions of Indian terrain always disrupt the construction of conventional flexible pavement.

When the road surface condition becomes poor or defective, rehabilitation or resurfacing work is needed to restore the pavement surface to the required level of service. The surface course may become damaged over time due to heavy traffic, aging and weathering. In the rehabilitation study of the existing pavement, the performance of the existing subgrade is assessed by structural and functional evaluation. The performance of a pavement depends to a large extent on the strength and stiffness of the subgrade. The existing methods for determining of the strength of

pavement like the effective thickness method and deflection method are costly, time consuming and demand significant effort. Dynamic Cone Penetrometer Test (DCPT) which has evolved as the most versatile, rapid, in situ evaluation method currently available for use in determining subgrade properties is the best suited alternative method. Though this method has been widely adopted in foreign countries, it is not yet common in India. It is a Non-Destructive testing method for evaluation of the structural strength of pavement layers. The DCPT is a quick test to set up, run, and evaluate on site. Due to its economy and simplicity, adopting the DCPT method can reduce efforts and costs for the evaluation of pavement and subgrade soils. Correlations of the DCPT index to California Bearing Ratio (CBR) and its use in the performance evaluation of pavement layers make it an attractive alternative to more expensive and time-consuming procedures.

This study proposed a rehabilitation design methodology for the low-volume roads in Kerala, based on the obtained DCPT values and the laboratory results of pavement layer parameters. Tests like in situ density, California bearing ratio, in situ Moisture Content and Dynamic cone penetration test were carried out. Regression models were developed using SPSS software with a good coefficient of determination (R2) and low standard error of the estimate.

## 2. *Road Asset Management for National Highways and State Highways in Kerala*

An efficient road network is essential for the growth of economy of a country and to ensure cost effective movement of goods and people. Road Asset Management (RAM) is the process of application of engineering, financial and management practices to optimize the level of service outcome in return for the most cost-effective financial input. RAMS aims at continuous monitoring of the road network and performing the necessary maintenance and repair works as and when required ensuring the reduction of huge economic burden of rehabilitation and reconstruction works.

The study road network has been selected as Thrissur, which includes a National Highway NH 66, starting from Kottappuram and ending at Andathodu, 3 State Highways - SH 75 (Vadanapally-Thrissur), SH 51 (Kodakara-Kodungalloor) and SH 61 (Potta-Moonupeedika) and two MDRs Cherpu-Thriprayar road and Peringotukara-Kaanjany-Chavakkadu.

Homogenisation of road network was done on the basis of Pavement Condition Index (PCI), International Roughness Index (IRI) and traffic volume and finally a total of 29 test sections each 1km length were obtained. The pavement condition of the road network was assessed in terms of PCI, IRI and road deflection using the Benkelman beam deflection study. The road roughness survey helps to evaluate the roughness value of the pavement. Benkelman beam deflection survey was carried out to evaluate the structural adequacy of the pavement. Traffic volume survey was also conducted. Pavement condition models were developed which essentially forecast the pavement deterioration. The in-built Pavement deterioration model in HDM-4 software has been calibrated to suit the road environment. Optimum maintenance strategy has been found out from HDM-4, which suggests performing 40mm BC overlay along with the routine crack sealing and patchwork. This will ensure the long life of pavements. Condition responsive and scheduled maintenance comparison had been conducted for the NH in road network. It was found out that a condition responsive maintenance, based on roughness progression is more cost effective and yield maximum benefits than the maintenance scheduled in every three years. Along with these studies, a Bridge Information Management System (BIMS) was also developed. The GIS database of the Bridge Information Management System was updated with the new pavement condition data.

### 3. *Evaluation of Moisture Susceptibility of Asphalt Mix Using Admixtures*

Moisture susceptibility is the loss of strength in bituminous mixtures due to the presence of excess moisture content. Any bituminous mix is composed of bitumen, aggregate and air voids. Moisture damage to the mix may occur in two ways. First, moisture content may decrease the bonding between binder and aggregate and next, the presence of moisture may modify the rheological properties of the binder thereby weakening the bituminous mix. The major objective of this study is to investigate the moisture susceptibility behaviour of the Hot Mix Asphalt (HMA) as a function of compaction conditions such as compaction level and compaction temperature. The specimen was fabricated at three different compaction temperature and five different compaction levels. The volumetric properties, mix characteristics, compressive strength, indirect tensile strength, rut test and cantabro abrasion loss properties of the mixtures were measured for evaluating the moisture susceptibility of the designed mix. Based on Indirect Tensile Strength (ITS) test results an ANN model is developed, which can be successfully used in the estimation of measured Tensile Strength Ratio (TSR) (%) of HMA using Gn, BD, Va, VMA, VFA, Sdry, Swet, fldry, flwet, and Gmb with excellent accuracy. Garson's algorithm test of the ANN model revealed that the Sdry is the maximum influencing parameter for the ANN model.

### 4. *Resource Mapping of Road Construction Materials in Kerala – Phase II*

The mining of aggregates is increasing with increasing demand leading to the resource exploitation. This necessitates having a proper planning system by mapping the distribution of aggregate sources using software like QGIS and ArcGIS. The primary objective of the study is to check the suitability of aggregates obtained from licensed quarries of Kerala in different pavement layers with MoRTH and MoRD. The secondary objective is to project the quarry details and aggregate properties into geo-referenced maps in GIS platform and attach attributes. The present work focused on aggregates from Thiruvananthapuram (2019), Kottayam and Thrissur (2020-21) and Ernakulam and Idukki (2021-22) quarries. The study conducted aggregate tests to determine the suitability of aggregate in pavement layers including BC, DBM, BM, WBM, and WMM as per MoRTH and MoRD criteria and mapped these properties using QGIS. The higher proportion as per the applied criteria are contributed by Kottayam and lowest by Idukki quarry samples. The combined elongation and flakiness index exceed the specified limit for many quarries and this is the reason why many quarries are not suitable in all

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pavement layers as per MoRTH and MoRD. Some of the reasons include the age and type of crusher regarding the Ernakulam quarry samples. More research is required to conclude their suitability in pavement layers concerning Idukki quarry samples. The study will help road agencies to choose the appropriate samples for the pavement construction.
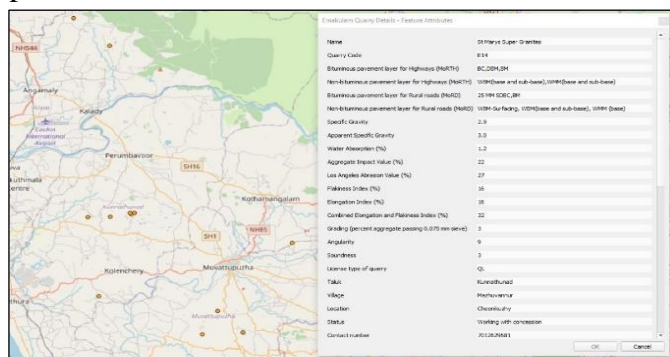


*Shape file created in QGIS after mapping of Ernakulam quarry samples*

## 5. *Study on the Influence of Different Types of Aggregates, Filler and Bitumen on Bituminous Mixture Performance and Properties*

The availability of good long-lasting roads plays an important role in the development of the state and nation. Providing durable roads has always been a problem for a state like Kerala with varied climate, terrain conditions, and rainfall intensities. Since flexible pavements are widely used in India, steps must be taken to increase the life of bituminous pavements. In general, road pavement distresses are related to the binder (bitumen) and asphalt mixture properties. Rutting is one of the major distresses that lead to permanent failure of the pavement surface. In recent years Kerala has witnessed an increase in the annual rainfall intensity and as a result pavement deterioration is happening at a faster rate. So necessary measures must be taken to improve the life of flexible pavements. In this study, an attempt is made to suggest a climate resilient pavement surface course for Kerala.

This study is done to assess the performance of the pavement with respect to variation in aggregate properties, binder types and fillers. The material property has a significant influence on the mix performance. This study is mainly limited to pavement surface layers only namely, Bituminous Concrete and Stone Mastic Asphalt. The conventional fillers viz., quarry dust, cement and lime are used for preparing BC and SMA mixes as per MORTH recommendations. Partial replacement of quarry dust with lime and cement has an influence on the performance of the pavement. To study the properties of the mix, property tests were carried out on VG 30, VG 40 and NRMB 70 grades of bitumen. Marshall tests were carried out on samples using VG 30, VG 40 and NRMB 70 grades of bitumen and using dust, cement and lime as fillers. Rut Resistance, Retained Marshall Stability test and Indirect tensile strength test were carried out on the samples. The study clearly indicated that SMA mixes showed better results as compared to BC

mixes and the performance of the mixes prepared with NRMB 70 is superior to other mixes.

## 6. *Characterization of Flowable Fills Incorporating Industrial Byproducts*

Granular fills are widely used as backfill material behind retaining walls and for other filling applications like filling of underground mines and shafts and as a bedding layer for pipelines. One of the main requirements of the granular fills is that they have to be properly compacted to the required unit weight at appropriate moisture content to achieve the desired engineering properties. In situations where it is difficult to obtain the required properties for the fill material due to inaccessibility of compacting equipment, flowable fills or Controlled Low Strength Materials (CLSM) can be used as an effective alternative for the fill material. The properties of flowable fills lie in between that of natural soil and concrete. In addition to the advantages mentioned above, CLSM offers a reliable technique for secure industrial waste disposal. Quarry dust, fly ash and cement were mixed in various proportions to prepare CLSM mixes and their suitability to engineering applications were decided based on flowability, bleeding and unconfined compressive strength tests. The results showed that the flowability of the mix decreased initially and then increased as the quantity of fly ash in the mix increased. Bleeding

values obtained were found to decrease with an increase in the fly ash in the mix. It was discovered that substituting fly ash with 50% of the quarry dust in the CLSM mix produced positive results and was acceptable for engineering application.



*Flowability Measurement from the spread diameter*

## 7. *Laboratory Investigation of Bituminous Porous Mix*

Traditionally pavements are designed to be impermeable, and rainwater flows over the pavement surface and drain along the side of the roads. Porous asphalt pavements are an alternative technology that differs from conventional asphalt pavement designs in that the structure permits fluids to pass freely through it, reducing or controlling the amount of run-off from the surrounding area. Porous asphalt shows excellent performance in both noise reduction and water drainage. This study aims to determinate the

performance (permeability and clogging potential) and internal pore structure characteristic of porous asphalt mixes made using Polymer Modified Bitumen and to compare the mix performances with two different gradations and compaction levels. By considering the parameters such as air voids, drain down value, abrasion losses, and voids in mineral aggregate, the optimum binder content of porous asphalt mix with one type of gradation was evaluated. The initial permeability of the porous mix for compaction level found to be higher than the minimum requirement of 100 m/day. While considering the clogging behaviour of the mixes, three types of clogging materials (A, B, C) have been used in this study. Type A clogging material will not contribute to clogged condition (terminal clogged permeability of 8.7 m/day) during the lifetime of pavement as the particle size is too small which would be drained along with rainwater during service life. The clogging potential of Type B is moderate which could be conveniently restored to good permeability if de-clogging operations were performed at regular intervals. Type C material could cause the clogged condition (terminal clogged permeability of 8.7 m/day) if regular de-clogging maintenance program is not carried out.

## 8. *Experimental Investigation of Cold Mix Asphalt using Different Fillers*

Highway industry is in the path of implementing new measures to reduce the carbon footprint. Cold mix technology in one among them. The idea of cold mix evolved many decades ago. The factors or disadvantages of hot mix asphalt in terms of environmental pollution, health effects, and highway budget led to the concept of cold mix. Even though it is favored in environmental point of view, it suffers weakness in terms of strength and durability. The present study tries to improve the performance characteristics of the cold mix to use as the binder layer of the pavement. The primary objective is to analyze the different factors such as pre and post compaction curing, optimum water content at compaction, temperature of curing, evaporation rate and compaction level in the volumetric properties and performance characteristics of the cold mix prepared as per MS-14. The secondary objective is to try different active fillers (cement, lime) to improve the moisture resistance. The current study followed MS-14 procedure in determining the optimum residual asphalt content. Out of the different mix parameters (like pre mixing water content, temperature, curing before and after compaction), the curing after compaction was found to be the most sensitive parameter affecting the Marshall and volumetric properties. The study will also determine the best filler or filler

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combination among cement, lime and wood charcoal filler using Marshall Stability, Indirect tensile strength, stripping and rut tests. The cold mix will help in environmental and health aspects particularly in India with poor air quality index. It will save energy and related costs.



| 1.Dry aggregate | 2.Water mixing | 3.Immediate |

| 4.20 minutes | 5.40 minutes | 6.60 minutes |
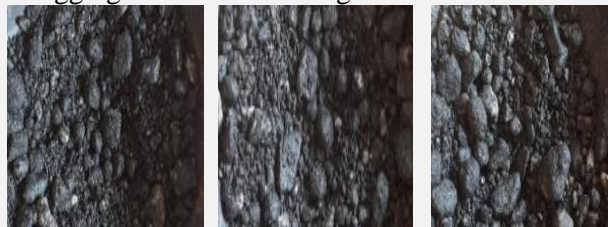
*The coating test assessment as per MS-14 showing breaking of emulsion at 60 minutes*

*Note: The coating test is necessary to determine the curing time before compaction of the coldbituminous emulsion mixture*

# INLAND WATER TRANSPORT SYSTEM AND COASTAL SHIPPING

# 1. *Performance Evaluation of Kochi Water Metro*

The Kochi Water Metro proposed to have 15 routes connecting 38 jetties across ten island communities in a 76 km route network. Of the 38 jetties, 18 are proposed to be developed as major jetties or main boat hubs while the remaining 20 jetties shall be developed as minor jetties for water transit services. The entire water transport project is proposed to be fully operational by 2019, but only a part of the first route (Vyttila-Kakkanad) of Kochi Water Metro was inaugurated in February 2021 and the boat operation is yet to start.

The objectives of the study were to study the travel behaviour of the commuters in the study area by developing a mode choice model, assess the possible mode shift to the proposed waterway by developing a response model, conduct water quality analysis, conduct an economic analysis of waterway operations and to identify the risks involved in waterway operation and suggest remedies. The literature review related to mode shift analysis, water quality analysis, and economic analysis is completed. Detailed methodology for mode choice modelling is prepared.

A reconnaissance survey was conducted and visited proposed 15 routes and terminals of the Kochi water metro project. After the survey, the water sample collection locations are identified

and collected water samples from 20 locations. Passenger details before and after the Covid scenario was collected from the Kerala State Water Transport Department (SWTD). Water quality index was prepared after analysis of water quality data. Mode choice questionnaire was prepared after extensive literature review. Out of 15 proposed routes of the Kochi water metro project, Vypin to High court, Vytilla to Kakkanad, and High court to South Chittoor routes were considered for the survey. A pilot survey was conducted in all the three routes to verify the questionnaire. Questionnaire survey was conducted and data was collected from Vytilla to Kakkanad, Vypin to High court, and High court to South Chittoor routes. Data cleaning of the collected data is completed and data analysis is in progress.

# INNOVATIVE PROJECTS

# 1. *Intelligent Transportation Systems (ITS) Cell*

As part of ITS cell, driver rating cum travel assist system was envisaged for development with the following objectives:

- Study existing sensor technologies used in the automobiles for driving behavior evaluation and travel assistance systems;
- Develop a driver rating system based on in-vehicle driving behavior, violations committed and clearances maintained;
- Develop a travel assist system that can display the relative position of the vehicle with respect to its surroundings even in inclement weather.

This was identified owing to the fact that:

1. Drivers after getting their licenses are seldom thoroughly checked for their driving skill and characteristics
2. Checking them manually is impossible as it would require an army of motor vehicle inspectors
3. Only FIRs for crashes and the fines for traffic violations penalize the drivers for erroneous driving which is inadequate
4. Rear view mirror becomes redundant in inclement weather conditions.

With these in mind, a system architecture was developed for using Advanced Driver Assistance System (ADAS), Driver Monitoring System (DMS) and Digital Video Recorder (DVR) along with electronics components like Radar, Lidar, Camera, GPS, IMU, blood pressure and heart rate sensor etc. for capturing the driving behavior with respect to road safety i.e., braking, overtaking, speeding maneuvers, violations, clearances maintained etc. These attributes would be used to develop a rating system through which each driving trip could be classified as good, average, poor with respect to road safety. The data flow is shown in figure below.
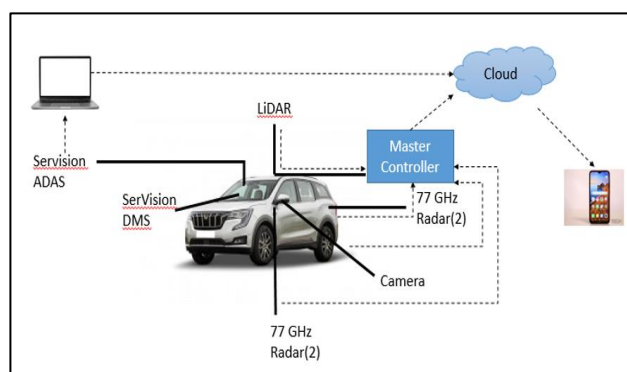


*Data flow diagram*

The travel assist system is proposed to be developed as a digital display to provide real time information about the vehicles/ obstacles in the vicinity of the subject vehicle, even in inclement weather so as to take corrective measures if required, thereby assisting the driver and enabling safety for all during all weather conditions.

# 2. *Development of Mobile App for Road Data Collection*

An android-based application named GetMap was developed for the plan project titled 'Utilization of Geoinformatics Tools for Development of

Comprehensive Road Network for Kerala State' to install at the user side for recording the travel path of the user. The app is developed using the software android studio and the app uses osmdroid Android library that provides Tools / Views to interact with OpenStreetMap. Location drivers in the smartphones allow the app to publish updates to the device's physical location through the Android location services. The app automatically checks the user location from time to time and plots the results on the real-time OSM maps.

Public users can download and install the app in their smartphones once it is made available in the app stores. The app consists of two screens – welcome screen and map screen. The major functions that can be performed using the GetMap app includes record track, add road inventory details to the track, record road cross sectional data and add points on the map along with the photos. The app shows the track as a colored line and provides different colors for different tracks. Road inventory details of the track such as pavement type, shoulder type, speed limit and land use etc., can be entered using the app. The user can enter the road cross sectional details such as name of the road, number of lanes, width of shoulder, carriage way and median etc. User can also record points such as bus stops, bridges, and junctions in the travel path while they are travelling by simply long pressing at the point in

the map. Also, an optional field for uploading up to five photos related to the point is also provided. All the data entered through the app will be automatically generated as an excel file with three worksheets for storing details of points, road inventory and road cross section.

Development of basic app to collect road related data and save it as both KML and Excel file in the local memory of the phone is completed. The KML files saved in the smartphone can be simply transferred into a computer and view the tracks and details using Google Earth software. This KML files can be imported as vector layers in QGIS and can be converted into shape files using ArcGIS software. After a satisfactory level of development is completed for the mobile app, moved to test on the physical devices for more real-life scenarios-based testing. The app was handed over to other projects in NATPAC and tested based on the different test cases by travelling different types of roads in the Trivandrum City. The app satisfied all the test cases and necessary changes are made for the perfective maintenance of the app.

In the final phase of the app development, works are on-going to integrate the app with a cloud

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server. For the development purpose, a free plan-based Firebase Cloud server which is the default cloud server for android is integrated with the app. Firebase offers several services including Authentication, Realtime database, Cloud Firestore database and Cloud storage to help developers. The user who collects data from the field can simultaneously upload the data including KML files, excel files and photos to the cloud server. So, all the data collected from the field will be automatically updated to the server. A web-based admin portal needs to be developed to manage the data and the various levels of authorized users. The roles and their access levels will be configurable by an administrative user of the system. The officials associated with the survey can verify the live data from the office using this web application. So, all the manual data entry from the data collection sites can be eliminated by using this app. Security auditing and testing of the app need to be done by an external test engineer. And finally converting the app to a signed APK for uploading to Google Play Store is to be done. GetMap will be a promising tool to all the persons and agencies who are engaged in the road related data collection and research.
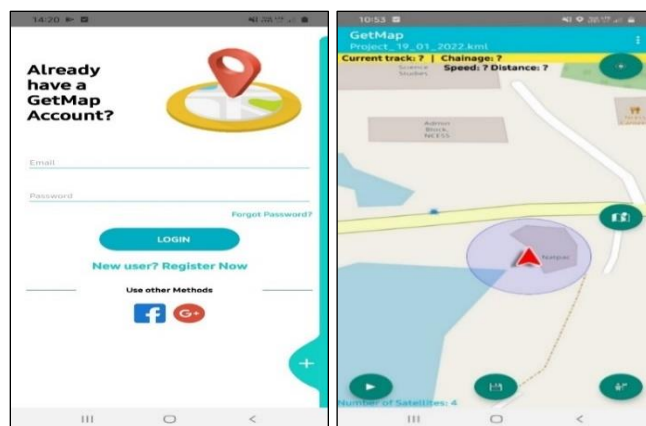


### 3. *Periodic Updation of GIS – based Road and Traffic Database for Kerala*

Road authorities put great effort and expense into collecting large quantities of data related to road assets. Management of collected data is a severe problem due to scattered data sets and information among different agencies. Reliable and detailed data help road practitioners accurately identify problems, risk factors and priority areas, and to formulate strategy, set targets and monitor performance. The present study aims to develop and periodically update the traffic, road inventory, and crash and road network database for the roads in Kerala.This study also aims to develop tools for data collection, analysis and data management. The proposed platform will have interoperability feature and allows easy integration with existing systems of departments/user agencies.

The scope of the study is limited to compilation of road and traffic data from the studies conducted byNATPAC and various other agencies in Kerala during the current year. The objective of the study

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is to develop and maintain digital database platform for effective monitoring, management, analysis and database updating of road inventory, traffic data, crash data and road network data.

The road inventory data, traffic data and crash data were collected compiled and standardized. Periodic Primary traffic surveys were conducted at selected locations in Kollam, Kottayam, Thrissur, Wayanad and Kozhikode districts for data collection.

A requirement analysis was carried out in order to determine the functional and non-functional requirements of the KTDMS (Kerala Transport Database Management System) software that is in the process of development. The software requirement specification document was prepared for conveying the needs of KSCSTE-NATPAC regarding the software and provides a general idea of the same. The Expression of Interest document was prepared for inviting proposals from various agencies.

It is envisaged to conduct periodic update of GIS database comprising of traffic, road network, transportation network, pavement characteristics and crash spots. The web-based system/software, namely KTDMS will be developed in different phases for the storing and management of database which will be hosted in the public domain.

**4. *Application of ITS in Enhancing Safety at Critical Locations and Black Spots: A Study on the utilization of Pelican Signals on Urban Roads in Kerala for enhancing Pedestrian Safety***

A Pelican crossing is a type of pedestrian crossing, which is activated using push buttons by pedestrians themselves. It comprises of signals for both pedestrians and vehicular traffic. When a pedestrian activates the push button, the green signal for vehicular traffic turns yellow and then red. At the same time, the signal for pedestrian turns green for a fixed duration of time. Installation of Pelican signals is costly and if their utilization is less, it would be a waste of public money. The study was intended to analyse the extent of utilization of pelican signals which were already installed in Kochi city. Finding the critical parameters which affect the utilization of Pelican signals was also an essential need. The inferences derived from the study would be a guide for policy makers who are planning to introduce novel ITS solutions for making urban transportation more sustainable.

The study sites selected where the four mid-block points within Kochi city where the Pelican signal was already installed.Data was collected using questionnaire survey method. Before preparing the questionnaire form, extensive literature review was done and various probable factors

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which influence the behaviour of pedestrians and vehicle drivers were considered. Theory of Planned Behaviour (TPB) was selected as the basis of formulating questions related to the behaviour of pedestrians. Separate questionnaires were prepared for pedestrians as well as motorists. The internal consistency of the questionnaire was tested by conducting an online pilot survey and analysing the Cronbach's alpha value of the sample obtained. The on-field data collection was done in the month of February 2022. During the survey period, awareness about pelican signals was also given to common public and Student Police Cadet (SPC) volunteers.

Based on Analysis of Variance (ANOVA) testing, it was found that there was considerable difference in traffic behaviour and violation between Genders. Males were more prone to conformity behaviour and traffic violations. Behavioural tendencies like risky crossing for convenience, conformity behaviour with other pedestrians etc. did not change much with increase in educational qualification. Pedestrians mostly agreed about the lack of effectiveness of authorities and the importance of instruction boards and signal timers. Irrespective of Gender, educational qualification etc., respondents considered Pelican signals more useful than grade separated road crossing facilities. Drivers were generally dissatisfied about the behaviour of pedestrians on urban roads.

Using exploratory factor analysis on pedestrian survey data, factors which mainly affect the utilization of pelican signals were derived: - External influences on Pedestrian Behaviour, awareness about Pelican signals, impact of improvements like timers, influence of authority surveillance and behavioural control of pedestrians. Similarly, for motorists, the factors which affect their decision to stop at a Pelican signal were: - Influence of delay to drivers due to stopping at Pelican signals, general attitude of drivers towards pedestrians, influence of surveillance by authorities and their awareness about Pelican signals. The relationships between each of these underlying factors were found out using Path analysis in Structural Equation Modelling (SEM) using SPSS AMOS software. It was found that utility of Pelican signals was mainly influenced by proper awareness about Pelican Signals and improvements related to the facility such as signal timer, instruction boards, selection of suitable location etc. Study found significant relationship between the influence of friends, ingrained habits and conformity behaviour on the Behavioural control of Pedestrians. Influence of awareness spreading and surveillance by Police and other responsible officials is recommended as the basic necessity for improving the utilization of pelican signals.

# EXTENSION SERVICES

## 1. 34th Kerala Science Congress

KSCSTE-National Transportation Planning and Research Centre (KSCSTE-NATPAC) in association with KSCSTE and Mar Ivanios College, Thiruvananthapuram conducted the 34th Kerala Science Congress in hybrid mode during 10- 12 February 2022. Shri.Pinarayi Vijayan, Hon'ble Chief Minister, Kerala inaugurated the 34th Kerala Science Congress on 10th February 2022 at Mar Ivanios College. Shri.K.P.Sudheer, Executive Vice President, KSCSTE presided over the inaugural function. Prof. (Dr.) Samson Mathew, Director, NATPAC welcomed the gathering. The Chief Minister's gold medal for young scientists were presented on the occasion. Cardinal Cleemis, Head, Syro-Malankara catholic church; Shri.M.C.Dethan, Executive Committee Member, KSCSTE and Mentor (Science), Govt. of Kerala and Dr.Saji Gopinath, Vice Chancellor, Kerala University of Digital Sciences, Innovation and Technology, Thiruvananthapuram, also spoke on the occasion.



## 2. Road Safety Month – 2022

Road Safety Week is a campaign initiated by the Ministry of Road Transport & Highways, which is normally observed in the second week of January every year. For the year 2021, it was directed to observe national road safety month instead of national road safety week. It provides road safety information for road users to reduce the number of people killed and injured on our roads every year.

KSCSTE-NATPAC observed 'Road Safety Month – 2022' by organizing a series of activities from 18th January 2022 to 17th February 2022. As part of this, various road safety contests were conducted on identified broad themes through which the students can contribute in road safety

related things and could produce new ideas of improving the road safety. Due to the Covid-19 pandemic, events were conducted through online platform.

Around 830 contestants, from all 14 districts of Kerala as well as from other States participated in various contests in the identified broad themes. 93 participants won the cash prizes and certificate of achievement at various levels and contests. Certificates of participation are awarded to all participants who successfully completed the primary screening process.



The Centre produced two awareness short films on road safety for the general public entitled "*Hands free is not risk free*" and "*Distraction is Extraction*". The films have been widely circulated through social media platforms and various Schools/Colleges, NGOs and Social Service Organizations in the State. These two road safety films were shortlisted in the *Global Road Safety Film Festival* organised by the Laser International Foundation (LIFE), in collaboration with the

UN Road Safety Fund (UNRSF) and the United Nations Economic Commission for Europe (UNECE) on 21st and 22nd February 2022 at the Palais de Nation, in the heart of Geneva.



## 3. Training Course for Drivers of Vehicles Carrying Dangerous and Hazardous Goods

Government of Kerala accorded sanction to KSCSTE-NATPAC for conducting 'Training Course for Drivers of Vehicles Carrying Dangerous and Hazardous Goods' vide G.O. (Rt) No.138/2015/Tran., dated 17th March 2015.

During the year 2021 – 22, seven programmes were conducted at the KSCSTE-NATPAC office, *K Karunakaran Transpark*, Aakkulam, Thiruvananthapuram. Two hundred and six drivers got benefitted from the course and are successfully endorsed to operate vehicles carrying dangerous and hazardous goods.

| Date | Number of drivers Participated |
|------|-------------------------------|
| 14/07/2021 - 16/07/2021 | 20 |
| 10/08/2021 - 12/08/2021 | 22 |
| 27/10/2021 - 29/10/2021 | 31 |
| 17/11/2021 - 19/11/2021 | 29 |
| 08/12/2021 - 10/12/2021 | 35 |
| 12/01/2022 - 14/01/2022 | 32 |
| 16/03/2022 - 17/03/2022 | 37 |
| **Total** | **206** |

## 4. Training Programmes Conducted

### a) In-house Training/Invited Expert Talk

| Sl. No. | Details of Training | Date |
|---|---|---|
| i. | Training for 'Open Roads Software for Pavement Design' for the Scientists of NATPAC | 02.08.2021-03.08.2021 |
| ii. | Training cum demonstration about the equipment Dynamic Shear Rheometers (DSR), organised by Anton Paar India Pvt. Ltd. for the Scientists and Technical Officers of NATPAC | 16.11.2021 17.11.2021 19.11.2021 |
| iii. | A three-day training program on "Surveying Concepts: Topographical survey using ElectronicTotal Station along with demonstration and field exercise", given to 23 students from Government ITI, Kazakuttom | 08.12.2021 – 12.12.2021 |
| iv. | Road safety awareness and training program for the trainees of State Excise Academy and Research Centre, Thrissur through online mode | 19.01.2022 |

### b) Road Safety Training for Various Target Groups

| Sl. No. | Details of Training | Date |
|---|---|---|
| i. | Half-day session on "Handling the Emergencies during accidents to vehicles carrying dangerous and hazardous goods", conducted for Kerala State Fire Force Department | 27.11.2021 |
| ii. | One day Training on safe driving practices for Ambulance drivers at Travancore Medical college Hospital Auditorium, Kollam. 54 participants | 22.12.2021 |
| iii. | One Day Training on Road Safety for Teachers for establishment of Traffic Safety Cells at NATPAC office, Aakkulam. 36 participants | 06.01.2022 |
| iv. | One day Training on safe driving practices for Ambulance drivers at CWRDM, Kozhikode. 40 participants | 24.03.2022 |
| v. | One day Training on Safe driving practices for Driving Instructors at CWRDM, Kozhikode. 18 participants | 25.03.2022 |



*One day Training on safe driving practices for Ambulance drivers on 22/12/2021*
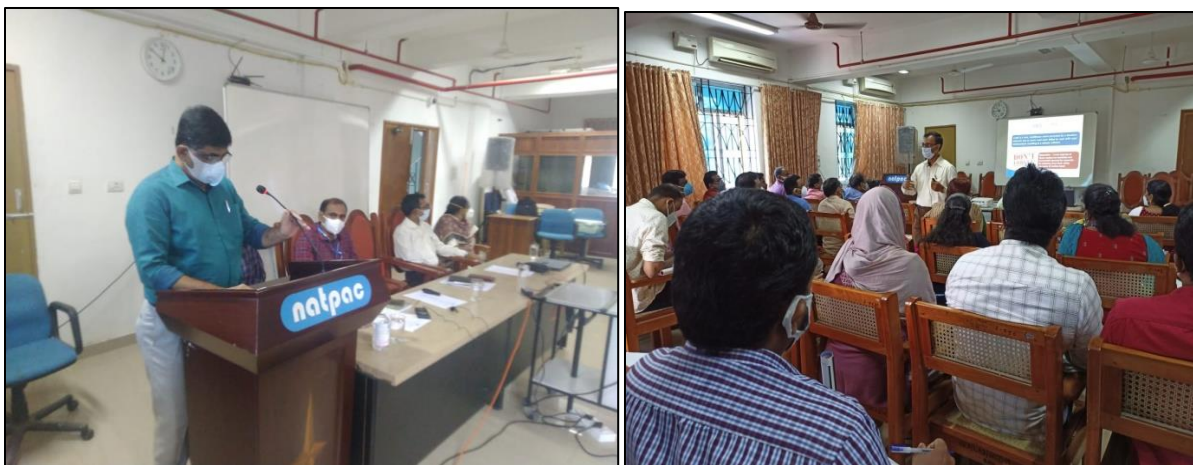
*One Day Training on Road Safety for Teachers on 06/01/2022*

## 5.     75th Independence Day Celebrations

As part of the 75th Independence Day celebrations, NATPAC conducted a Road Safety Pledge and a Road Safety Quiz competition. Due to the Covid-19 pandemic, events were conducted through online platform. The main aim of these activities was to create awareness among all types of road users for using roads safely by themselves and at the same time consider the other road users also by giving way to them too. It is highly beneficial to develop a road safety culture to all road users which can reduce the number of road crashes. The publicity of the activities was given through social media such as Whatsapp, Facebook and LinkedIn.

Around 1000 people participated in the Road Safety Pledge. Participants were from all over the world, including those from Kerala and other states such as Maharashtra, Tamil Nadu, Bihar,



Karnataka, Andhra Pradesh, Goa, Uttar Pradesh, Uttarakhand, Odisha, Telangana, Rajasthan, Jharkhand, Jammu and Kashmir, Madhya Pradesh, Bihar, Rajasthan, Gujarat and West Bengal, other UTs such as Delhi, Lakshadweep, Pondicherry and Andaman Nicobar and other countries such as United Kingdom, United Arab Emirates, China, Philippines and Canada. There were 517 applications for quiz competition from 14 districts in Kerala, as well as other states such as Nagaland, Andhra Pradesh, Tamil Nadu, Gujarat, Maharashtra, Uttar Pradesh, Uttarakhand, Rajasthan, Bihar, Telangana, and Jharkhand. Participation was also reported from UTs such as Delhi, as well as

other countries such as the United Arab Emirates and the United Kingdom. Out of total, 142 participated in the quiz competition and 15 won the competition. The winners were awarded with cash prize and certificate of appreciation in different age.

## 6. *Participation in Workshops, Seminars/Conferences and other Training Programmes*

| Name of Programme | Organized by | Date(s) & Mode | Participant(s) |
|---|---|---|---|
| *Seminars/Conferences* | | | |
| Indian Society of Geomatics (ISG) Earth Day Seminar – "Restore the Earth" | Indian Society of Geomatics (ISG) | 22.04.2021, Online | M S Saran |
| Role of Infrastructure Design in achieving Sustainable Road Safety | Department of Civil and Environmental Engineering, College of Engineering, National University of Science and Technology, Sultanate of Oman | 05.05.2021, Online | K C Wilson |
| New Design Approach for Gabion Walls | Maccaferri | 21.07.2021, Online | K C Wilson |
| 2021 ESRI India User Conference – 'Building Geospatial Infrastructure for the Nation' | ESRI India | 28.07.2021 - 29.07.2021, Online | M S Saran |
| 8th International Conference on Transportation Systems Engineering and Management (CTSEM 2021) | National Institute of Technology (NIT) Calicut | 26.08.2021- 27.08.2021, Online | Scientists of NATPAC |
| CIDC Digital Conference – 2nd Edition "Smart Cities the Future Growth Drivers" | | 29.09.2021- 30.09.2021, Online | M S Saran |
| CTCS 2021 | N.M.A.M. Institute of Technology, NITTE | 19.11.2021- 20.11.2021, Online | V S Sanjay Kumar Ebin Sam |
| 6thConference of the Transportation Research Group of India (CTRG 2021) | National Institute of Technology – Tiruchirappalli and TRG India | 14.12.2021- 17.12.2021, Offline | Scientists of NATPAC |
| ISG-ISRS Annual Conventions and National Symposium on - i-GEOMATICS: An Integrated Technology to Empower Citizens towards Self Reliant Nation | Ludhiana Chapters of ISG | 15.12.2021 – 17.12.2021, Online | M S Saran |
| Indian Geotechnical Conference 2021 | NIT Trichy | 16.12.2021, Online | Jegan Bharath Kumar A |

| Workshops | | | |
|---|---|---|---|
| Startup Procurement Workshop | Kerala Startup Mission | 08.07.2021, Online | M S Saran |
| International Online Workshop on Pavement Engineering and Road Safety−Theory to Practice (PEARS) | Transportation Engineering Division, Department of Civil Engineering, IIT Madras | 31.08.2021, Online | K C Wilson |
| Workshop on "Essentials of Road Safety Engineering" | World Bank Group, Bloomberg Philanthropies and Global Road Safety Facility (GRSF) | September 2021, Online | B Anish Kini |
| | | | Subin B |
| **Training Programmes** | | | |
| 2nd Online Short-Term Training Programme (STTP) on "Tools for Transportation Data Analysis & Modelling" (TTDAM-2021) | Centre for Transportation Research (CTR), NIT Calicut | 27.05.2021- 01.06.2021, Online | K C Wilson |
| 5 Days FDP on Trailblazing Practices in Geotechnical Engineering | Meenakshi Sundarajan Engineering College, Chennai | 07.06.2021 – 11.06.2021, Online | Dr.Salini U |
| Advances in Physical and Numerical Modelling in Geotechnical and Geo environmental Engineering | Musaliar College of Engineering & Technology, Pathanamthitta | 21.06.2021- 25.06.2021, Online | Dr.Salini U |
| ArcGIS for Real Time Situational Awareness | ESRI India | 18.08.2021, Online | M S Saran |
| Essentials of road safety engineering | Global Road Safety Facility – BIGRS programme | 20.09.2021 22.09.2021 27.09.2021 29.09.2021 04.10.2021 06.10.2021 11.10.2021, Online | B Anish Kini, Salini P N, Arun Chandran |
| **Webinars** | | | |
| International Webinar on "Road Tunnel: Recent Trends, Innovations and Way Forward" | Indian Roads Congress | 05.05.2021- 06.05.2021, Online | K C Wilson |
| Road Safety Management | IRF India Chapter | 18.05.2021, Online | M S Saran |
| Rethinking Public Engagement for Safer Streets | Indian Road safety Campaign | 30.05.2021, Online | M S Saran |
| Engineering Measures & Funding for Road Safety | International Road Federation India Chapter | 01.06.2021, Online | M S Saran |
| Importance of Vehicle Recalls Towards Road Safety | Indian Road Safety Campaign | 02.07.2021, Online | M S Saran |
| Approaches for Transitioning from Geometric Network to Utility Network | ESRI India | 25.08.2021, Online | M S Saran |
| Road Safety Challenges in India and Preparation of an Action Plan | International Road Federation India Chapter | 22.09.2021, Online | M S Saran |
| Advance your Spatial Analysis with R-ArcGIS Bridge within Python API | ESRI India | 29.09.2021, Online | M S Saran |

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## 7. *Guidance to Students' Internships/Project Work and Thesis*

Students from various National Institutes and reputed Professional Colleges have undertaken their Internships /Project Works/Thesis under the guidance of KSCSTE-NATPAC Scientists. The list of guidance provided by the Scientists is given below:

### 7.1. *M.Tech/M.Plan/M.Sc.*

| Sl. No. | Name of the Institution | Course | Guide | No. of Students | Topic |
|---|---|---|---|---|---|
| 1 | Jyothi Engineering College, Thrissur | M.Tech Thesis (Tptn.) | V S Sanjay Kumar | 1 | Pavement condition assessment using fussy logic |
| 2 | College of Engineering Thiruvananthapuram | M.Tech Thesis (Tptn.) | | 1 | GIS based road asset management for selected roads in Kerala |
| 3 | Indian Institute of Information Technology and Management, Thiruvananthapuram | M.Sc | | 2 | • Land use modelling for Thiruvananthapuram Corporation<br>• Web GIS based Bridge Information Management System |
| 4 | Rajiv Gandhi Institute of Technology, Kottayam | M.Tech (Tptn) | Salini P N | 1 | Performance Analysis of Urban Signalised Intersection: A Comparative Study |
| 5 | Jyothi Engineering College | M.Tech | Subin B | 1 | Safety Evaluation of Two-Lane, Two-Way Road Stretches in Kerala |
| 6 | RIT Kottayam | | | 1 | Development Of Crash Prediction Model for NH.66; A Case Study of Thiruvananthapuram to Alappuzha Stretch |
| 6 | Indian Institute of Information Technology and Management-Kerala | M Sc Thesis (Geoinformatics) | M S Saran | 2 | • Accident black spot analysis and Accident prediction using Machine Learning<br>• Landslide susceptibility mapping using weighted overlay method in GIS |
| 7 | Jyothi Engineering College, Cheruthuruthy | M.Tech | Sabitha N M | 1 | Kochi Water Metro: Mode Choice Analysis |
| 8 | Rajiv Gandhi Institute of Technology, Kottayam | M Tech | Wilson K C | 1 | Study on the effect of coconut shell ash in bituminous concrete mix |
| 9 | Jyothi Engineering College,Cheruthuruthy | | | 2 | • Traffic prediction modelling for major highways in Kerala |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | • Traffic Impact assessment of a proposed shopping mall in a medium sized town |
| 10 | NIT Tiruchirappally | | | 1 | Effect of binder content on moisture susceptibility of bituminous mixtures at different test conditions |
| 11 | Jyothi College of Engineering, Thrissur | M Tech | ArunChandran | 1 | Parking demand and supply estimation |
| 12 | NIT Trichy | M. Tech | | 1 | Intersection Safety Analysis using Surrogate Measures |
| 13 | Jyothi Engineering College | M. Tech | | 1 | Assessment of Crash Risk for State Highway in Kerala |
| 14 | Rajiv Gandhi Institute of Technology, Kottayam | M. Tech | | 1 | Blackspot Management Using PTV Visum Safety 2 |
| 15 | NIT-K Suartkal | M.Tech | Ebin Sam | 2 | • Macroscopic Analysis of Road Crashes in Kerala – 2020 & Pre-processing and Validation of Crash Data • Requirement Analysis and Design for the Development of Data Analysis Platform |
| 16 | NIT Calicut | M.Plan | | 1 | Algorithm for Road Accident Blackspot Identification |
| 17 | SPA, Bhopal | M.Plan | | 1 | Multimodal integration of Bus Stop near Polytechnic, Lucknow |
| 18 | Bharathidasan University, Tiruchirappalli | M.Tech | | 1 | Development of Mobile and Web GIS Based Application for the Transportation Data Management |
| 19 | IIITM-K | M Sc | | 1 | Development of Crash Analytical Module |
| 20 | Rajiv Gandhi Institute of Technology, Kottayam | M.Tech | R Chandra Prathap | 1 | Resource mapping of aggregate sources and analyzing its physical properties using petrography |
| 21 | CET Anna University | | | 1 | Experimental Investigation of Open Graded Friction Course MIx |
| 22 | NIT Calicut | | Jegan Bharath Kumar A | 1 | Finite Element Analysis of Porous Asphalt Mixtures |
| 23 | NIT Trichy | M. Tech | | 1 | Analysis of Internal Pore Structure of Porous Asphalt using X-Ray Tomography |
| 24 | Jyothi College of Engineering, Thrissur | | | 1 | Study on Clogging Behaviour of Porous Asphalt Mix |

| 25 | MVJ College of Engineering, Bengaluru | M. Tech | | 1 | Sustainable Flexible Pavement Design for Low Volume Roads |
| 26 | National Institute of Technology Tiruchirappalli | M. Tech | Dr.Salini U | 1 | Investigation on the performance of warm mix asphalt mixture with reclaimed asphalt pavement |
| 27 | School of Engineering, CUSAT, | M. Tech (GE) | | 1 | Effect of Suction on Slope Stability: A Case Study of Slope Failure in Muvattupuzha |
| 28 | National Institute of Technology Tiruchirappalli | M.Tech | | 1 | Evaluation of Autonomous Vehicles in Mixed Traffic conditions at intersections |
| 29 | TKM College of Engineering | M.Tech (Mini Project) | B Anish Kini | 1 | Effect of vehicular composition on performance measures of Enchakkal junction – An analysis using PTV Vistro software |
| 30 | Jyothi College of Engineering, Thrissur | M. Tech | | 1 | Development of travel time functions for road types |

## 7.2. B. Tech

| Sl. No. | Name of the Institution | Course | Guide | No. of Students | Topic |
|---|---|---|---|---|---|
| 1 | Saintgits College of Engineering, Kottayam | B.Tech Thesis | V S Sanjay Kumar | 8 | Traffic studies for skywalk facilities in Kottayam |
| 2 | Viswajyothi College of Engg and Technology, Vazhakulam | B.Tech | Salini P N | 8 | • Studies on Capacity Analysis of Signallised Intersection<br>• Studies on Signal Control Efficacy at Intersection |
| 3 | Saintgits College of Engineering, Kottayam | B.Tech | Sabitha N M | 4 | Mode Shift Analysis of Kochi Water Metro |
| 4 | Mar Baselios College of Engineering and Technology, Thiruvananthapuram | B.Tech | Ebin Sam | 4 | Impact Study of Kanjikuzhy flyover |
| 5 | LBSITW, Tvm | | | 4 | A Case Study on Prioritizing Accident Blackspot in Thiruvananthapuram City |
| 6 | PSG Tech in Coimbatore | | | 2 | Preparation of Software Requirement Analysis document for GIS Based Data Analysis Platform |
| 7 | Vellore Institute of Technology | B.Tech | R Chandra Prathap, Dr. Salini U | 1 | Mapping of Aggregate Resources in Thrissur District of Kerala |
| 8 | SRM Valliammai Engineering College | B.Tech | Jegan Bharath Kumar A | 4 | Modeling of Travel Characteristics of an Urban Area-Thrissur |

| 9 | Sri Sivasubramaniya Nadar College of Engineering, Chennai, Tamil Nadu | | | 4 | Prediction of Canal discharge using Machine Learning |
|---|---|---|---|---|---|
| 10 | VIT Chennai | B.Tech | Dr.Salini U | 1 | Mapping of aggregate resources in Thrissur district of Kerala |
| 11 | Marian Engineering College | | | 4 | Mix design of stone mastic asphalt using Recron-3S fiber |
| 12 | Trinity College of Engineering | | | 4 | Effect of warm mix additive-Evotherm on BC mix |
| 13 | Marian Engineering College | | B Anish Kini Shaheem S | 4 | Evaluation of short-term traffic management schemes for Vytilla junction |
| 14 | Saintgits College of Engineering | | B Anish Kini | 4 | Traffic impact assessment for a mixed-use development in Kozhikode |

## 7.3. *M. Tech (Internship)*

| Sl. No. | Name of the Institution | No. of Students |
|---|---|---|
| 1 | NIT Trichy | 14 |
| 2 | NIT Calicut | 5 |
| 3 | School of Planning and Architecture, Bhopal | 2 |
| 4 | NIT, Surathkal | 6 |
| 5 | Jyothi College of Engineering, Thrissur | 2 |
| 6 | MVJ College of Engineering, Bengaluru | 1 |
| 7 | TKM College of Engineering | 1 |

## 7.3. *B. Tech (Internship)*

| Sl. No. | Name of the Institution | No. of Students |
|---|---|---|
| 1 | College of Engineering, Trivandrum | 2 |
| 2 | Government Engineering College, Barton hill | 5 |

# 8. *Publications and Presentations*

## 8.1 *Papers Published in Referred Journals*

- Tawar, S., Shaheem, S., & S, Ebin. S. (2021). Identification of Crash Clusters and its Characteristics using GIS on National Highway 48 in Gurugram District. *Vidyabharati International Interdisciplinary Research Journal*, 1745-1751. ISSN 2319-4979.

## 8.2 *Book Chapter*

- Salini, P.N., Kini, B.A., Mohan, G. (2023). Comparison of Dynamic Passenger Car Values Estimated at Signalised Intersections Under Heterogeneous Traffic Conditions. *Recent Advances in Transportation Systems Engineering and Management.* Lecture Notes in Civil Engineering, vol 261, pp. 51-65. Springer. DOI: 10.1007/978-981-19-2273-2.

- Sanjay Kumar, V.S., Jinumol, K.R., Sam, E. (2022). An Appraisal of the Characteristics of Road Crashes Involving Vulnerable Road Users. *Recent Advances in Civil Engineering*. Lecture Notes in Civil Engineering, 256, 891-900. Springer, Singapore. https://doi.org/10.1007/978-981-19-1862-9_57

- Nanditha, A., Sanjay Kumar, V.S. (2022). Development of Trip Attraction Models for the Core Area of Thiruvananthapuram City. *Recent Advances in Civil Engineering*. Lecture Notes in Civil Engineering, 256, 659-669. Springer, Singapore. https://doi.org/10.1007/978-981-19-1862-9_41

- Sanjay Kumar, V.S., Joseph, A. (2022). A Heuristic Method of Prioritizing Flexible Pavement Sections. *Proceedings of the Fifth International Conference of Transportation Research Group of India.*, Lecture Notes in Civil Engineering, vol 218, 51-65.

- Sanjay Kumar, V.S., Anjaneyulu, M.V.L.R. (2022). A Purpose Based Trip Distribution Gravity Model for an Indian City. *Proceedings of the Fifth International Conference of Transportation Research Group of India.*, Lecture Notes in Civil Engineering, vol 218, 211-221.

- Sabitha, N.M., Athulya, A.S., Sreedevi, B.G., Kumar, V.S.S. (2022). Development of Risk Assessment Model for Waterway Safety. *Proceedings of the Fifth International Conference of Transportation Research Group of India.*, Lecture Notes in Civil Engineering, vol 220, 163-179.

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- Jegan Bharath Kumar, A., Vijayan, A.T. (2022). Effect of Compaction Levels on Moisture Susceptibility in Asphalt Mix. *Proceedings of the Fifth International Conference of Transportation Research Group of India.*, Lecture Notes in Civil Engineering, Vol. 218, 67-79.

- Salini P N., M S Saran., N M Sabitha., S S Sreeja., (2021). Planning for resilient transport infrastructure for disaster prone area – Case study of Munnar town. IOP conference series of Materials Science and Engineering, ICETEST – 2020. 1114. 012019.

## 8.3 *Publications in Conference Proceedings*

- Mohan, S. P., & Archana, S., S, Ebin. S., (2021). Safety Impact Analysis of Lane Conversion on Selected Highway Corridor., *AIJR Proceedings*, 488-493.

## 8.4 *Presentation of Papers in Seminars/Workshops*

| Sl. No. | Author(s) | Paper details | Date |
|---|---|---|---|
| i. | Sandra Kamar, Shaheem S, Vinayaka B, Samson Mathew | Factors affecting public bus ridership in a medium sized city. *5th International Conference on Advanced Research in Civil Engineering* – 2021, *REVA University, Bengaluru.* | 09.07.2021 – 10.07.2021 |
| ii. | Sangeetha Jayamohan, V S Sanjay Kumar, Sreelatha T | Pavement Management System as a Tool for Improving the Serviceability of Pavement Infrastructure. *AICTE Sponsored National Conference on Sustainability in Performance based Engineering design and Construction (NCSPEC-2021).* | 04.08.2021 – 06.08.2021 |
| iii. | Ardra V H, B Anish Kini, Dr Moses S Santhakumar | Impact of Implementing Two-wheeler boxes at Signalised T intersections under mixed traffic conditions. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 – 27.08.2021 |
| iv. | Salini P N, B Anish Kini, Gopika Mohan | Comparison of Dynamic Passenger Car values estimated at signalised intersections under heterogeneous traffic conditions. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode*. | 26.08.2021 – 27.08.2021 |
| v. | Sandra Kamar, Shaheem S, Vinayaka B, Samson Mathew | The Effectiveness of Passenger Attraction Policies: A Pre-Covid and Post-Lockdown Comparison. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 – 27.08.2021 |
| vi. | V S Sanjay Kumar, Shabana Yoonus, MVLR Anjaneyulu | Establishing an Optimum Maintenance Strategy for a National Highway Using HDM-4: A Case Study of NH 66 Section in Kerala, India. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 – 27.08.2021 |

| vii. | V S Sanjay Kumar, Shabana Yoonus, MVLR Anjaneyulu | An Appraisal of the impact of COVID-19 on Urban Transport Scenario. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
|---|---|---|---|---|
| viii. | Jegan Bharath Kumar A, Uthara | Assessment of Weather Impact on Traffic Characteristics- A Case Study in Thiruvananthapuram. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| ix. | Anjana Aji, R Chandra Prathap, Sreelatha Thankamma, Jyothish J P | Study on the Influence of Aggregate Mineral Composition on its Physical Properties. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| x. | Greeshma Gireesh, Salini U, Sreelatha T | Evaluation of WMA - RAP asphalt mixtures on moisture susceptibility. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xi. | Jayita V Mohan, Dr. Anil R, Wilson K C | Investigating the Impact of Pavement Factors on Road Accidents – A Case Study. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xii. | Neelu Mammen, K. C. Wilson, Vincy Verghese | Traffic Impact Assessment of a Proposed Shopping Mall in a Medium Sized Town. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xiii. | Sajeeha Salim, Wilson K C, Sreelatha T | Study on The Effect of Coconut Shell Ash in Bituminous Concrete Mix. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xiv. | Harsha Jasni T C, Dr. S. Moses Santhakumar, Ebin Sam S | Accident Prediction Modelling for Collision Types using Machine Learning Tools. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xv. | S A Krishnendu, Chandana Babu, Aparna Suresh, Abhirami K S, Ebin Sam, Praveen P S, Merlin R | Evaluation of various methods of prioritizing blackspots: A Case Study from Thiruvananthapuram city. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xvi. | Anagha Suresh, Wilson K C, Archana S | Traffic Prediction Modelling for Major highways in Kerala. *CTSEM 2021: 8th Online International Conference on Transportation Systems Engineering and Management, conducted by National Institute of Technology NIT Calicut, Kozhikode.* | 26.08.2021 27.08.2021 | – |
| xvii. | Sandra Kamar, Shaheem S, Samson Mathew | Mid-Covid Public Transport Passenger Attraction: A case Study of Thiruvananthapuram City. *Conference of Urban Mobility India (2021).* | 25.10.2021 | |

| xviii. | Nanditha A, V S Sanjay Kumar | Development of Trip Attraction Models for the Core Area of Thiruvananthapuram City. *3rd International Conference on Civil Engineering Trends and Challenges for Sustainability, organized by Department of Civil Engineering, NMAM Institute of Technology, NITTE Karnataka.* | 19.11.2021 – 20.11.2021 |
|---|---|---|---|
| xix. | V S Sanjay Kumar, Jinumol K R, Ebin Sam | An Appraisal of the Characteristics of Road Crashes involving Vulnerable Road Users. *3rd International Conference on Civil Engineering Trends and Challenges for Sustainability, organized by Department of Civil Engineering, NMAM Institute of Technology, NITTE Karnataka.* | 19.11.2021 – 20.11.2021 |
| xx. | Ebin Sam, Angel Maria Mathew, V S Sanjay Kumar | Impact of Covid-19 Travel Restrictions in the Crash and Mobility Patterns of Kerala. *3rd International Conference on Civil Engineering Trends and Challenges for Sustainability, organized by Department of Civil Engineering, NMAM Institute of Technology, NITTE Karnataka.* | 19.11.2021 – 20.11.2021 |
| xxi. | Nanditha A, V S Sanjay Kumar, Shabana Yoonus Athiappan K | An analysis of the Trip Attraction Pattern for an Urban area in a Developing Country'. *6th Conference of Transportation Research Group of India, held at Tiruchirappalli (Trichy), Tamil Nadu.* | 14.12.2021 – 17.12.2021 |
| xxii. | Jegan Bharath Kumar A, Mohit Singh Parihar, Murshida P, V Sunitha, Samson Mathew | Moisture damage prediction of hot mix asphalt using Artificial Neural Network. *6th Conference of Transportation Research Group of India, held at Tiruchirappalli (Trichy), Tamil Nadu.* | 14.12.2021 – 17.12.2021 |
| xxiii. | Raghav Tiwari, B Anish Kini, Dr.B K Bhavathrathan | Estimating regional travel demand from intraregional urban demand models. *6th Conference of Transportation Research Group of India, held at Tiruchirappalli (Trichy), Tamil Nadu.* | 14.12.2021 – 17.12.2021 |
| xxiv. | Anjana Aji, R Chandra Prathap | Development of statistical relationship between aggregate mineralogy and its physico-mechanical characteristics. *6th Conference of Transportation Research Group of India, held at Tiruchirappalli (Trichy), Tamil Nadu.* | 14.12.2021 – 17.12.2021 |
| xxv. | R Chandra Prathap, Devika Santhosh | Laboratory Investigation of Strength and Performance Characteristics of Bituminous Concrete Layer Subjected to Inundation. *6th Conference of Transportation Research Group of India, held at Tiruchirappalli (Trichy), Tamil Nadu.* | 14.12.2021 – 17.12.2021 |
| xxvi. | Salini U, Jegan Bharath Kumar A | Stabilization of Subgrade Soil Using Shredded Waste Plastic Bags. *Indian Geotechnical Conference 2021, organized by National Institute of Technology Tiruchirappalli.* | 16.12.2021- 18.12.2021 |
| xxvii. | V S Sanjay Kumar, Sangeetha Jayamohan | Calibration of HDM-4 Distress Models for a National Highway. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |
| xviii. | Jegan Bharath Kumar A, Murshida P | Development of Mobility in Attingal Town. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |
| xxix. | Ebin Sam, V S Sanjay Kumar, Angel Maria Mathew | Mobility Pattern Variations due to Covid 19 Travel Restrictions. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |
| xxx. | Feby Ann Varghese, Ponpriya M, B Anish Kini, Shaheem S | Traffic Operation Plan for Erode city. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |

| xxxi. | M S Saran,<br>Dr.Nisha Radhakrishnan,<br>Vishnu V P | GetMap App – A GIS Based Android Application for Road Data Collection. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, at Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |
|---|---|---|---|
| xxxii. | Salini P N,<br>Sreelakshmi T M,<br>Nandana Ramesan | Planning for Resilient Transport Infrastructure in a Disaster-Prone Area – a case Study of Munnar Region. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, at Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |
| xxiii. | Arun Chandran,<br>Vignesh D, Neetha Maria Aji | Assessing the role of feeder service for encouraging public transport patronage – a review. *34th Kerala Science Congress, Organized by Kerala State Council for Science, Technology & Environment in association with KSCSTE-NATPAC, at Mar Ivanios College, Thiruvananthapuram.* | 10.02.2022 – 12.02.2022 |

## 9. *Invited Talks/Media Interactions*

### Media Interaction

| Name & designation of staff | Topic/Particulars | Venue/Event | Date |
|---|---|---|---|
| V S Sanjay Kumar,<br>Principal Scientist | *Road Safety activities of NATPAC* | Club FM | 17.01.2022 |

### Invited Talks

| Name & designation of staff | Topic/Particulars | Venue/Event | Date |
|---|---|---|---|
| Salini P N,<br>Senior Scientist | *Road Safety Auditing of Rural Roads* | For LSGD Engineers, organized by KILA | 07.05.2021 |
| Subin B,<br>Senior Scientist | *Road Engineering and Road Safety* | Kerala Police Academy | 31.07.2021, 04.08.2021 and 05.10.2021 |
| | *Transportation of Hazardous goods by road* | | |
| | *Handling the Emergencies during accidents to vehicles carrying dangerous and hazardous goods* | Kerala Fire Force Academy | 27.11.2021 |
| K C Wilson,<br>Senior Scientist | *Signalised intersections* | For B Tech students of Mar Baselios College of Engineering and Technology | 04.06.2021 |
| | *Highway design* | To the Technical Staff of the Project Appraisal Division, KIIFB | 01.10.2021 |

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|---|---|---|---|
| | *Fundamentals of road alignment* | 3-day online training course on Quality Improvement in Civil Works for overseers, organised jointly by PWD and IMG | 09.10.2021 – 10.10.2021 |
| | *Talk on road safety* | 3-day online training course on Quality Improvement in Civil Works for overseers, organised jointly by PWD and IMG | 09.10.2021 – 10.10.2021 |
| Jegan Bharath Kumar A, Scientist | *Flexible Pavement Design* | As part of Training on Highway design at KIIFB | 01.10.2021 |
| | *Vulnerable Road Users* | Department of Civil Engineering, School of Engineering and Technology, Central University of Haryana& Indian Road Safety Campaign as part of five days Faculty Development Program on Road Safety (via Online mode) in connection with Road Safety Week 2022 | 11.01.2022 – 15.01.2022 |
| Dr. Salini U, Scientist | *Unsaturated soil mechanics* | FDP on "Advances in Physical and Numerical Modelling in Geotechnical and Geoenvironmental Engineering" organized by Musaliar College of Engineering & Technology, Pathanamthitta | 22.06.2021 |
| | Handled the Industrial Elective Course '*Ground Modification techniques*' | 7th Semester B.Tech CE students of CUSAT | August – November 2021 Semester (25 hours) |
| B Anish Kini, Scientist | *Road Safety Audit* | Department of Civil Engineering, School of Engineering and Technology, Central University of Haryana& Indian Road Safety Campaign as part of five days Faculty Development Program on Road Safety (via Online mode) in connection with Road Safety Week 2022 | 14.01.2022 |

10. *Nominations to Technical Committees/Advisory Bodies/Membership of Professional Institutions*

**SHAHEEM S**

- Screening Committee Member, Recruitment of Scientist-B, KSCSTE
- Committee Member, Scrutiny of Assessment Promotion of Scientists, JNTBGRI
- Member, Sub-committee for review and monitoring of black spots in Kerala
- Member, DSIR Committee constituted by KSCSTE
- Member, H-1, G 7 and G 3 Committee, IRC
- Life Member, Indian Roads Congress, New Delhi
- Member, Institute of Engineers

**V S SANJAY KUMAR**

- Associate Member, Institution of Engineers, India (AM 099062-3)
- Life Member, Indian Roads Congress, New Delhi (Roll No. e-LM 100707)
- Member, Institute of Urban Transport (India) (Roll No: M-1415)
- Member, Technical Committee, Kerala Road Safety Authority
- Member, Technical Committee for the purchase of Total Station and Auto level for Project Management Unit, Rebuild Kerala Initiative, LSGD, Government of Kerala

**SUBIN B**

- Designate Officer for checking bills provided by contractor for the pre-fabricated construction of Institute of Advanced Virology (IAV), Thonnakkal
- Expert panel member for approving the civil works at JNTBGRI
- Expert panel member for extension and operation of 108 ambulance services in Kerala
- Expert member from NATPAC for looking into road safety issues in Alappuzha district
- Extending services as Public Information Officer (Technical) for KSCSTE-NATPAC
- Member of PIC of NATPAC

**K C WILSON**

- Life Member, Indian Roads Congress, New Delhi (Roll No. e-LM 100706)
- Member, Accident Prevention and Trauma Care Association (APTCA)
- Member, Institute of Urban Transport (IUT), India
- Member, Institute of Engineers (M-1609313)
- Technical committee member of KRSA up to August 2021

**ARUN CHANDRAN**

- Member to G-7 Committee: Intelligent Transportation Systems Committee of IRC for the years 2021-23
- City Level Nodal Officer from NATPAC for implementation of Integrated Command and Control Centre (ICCC) project in Thiruvananthapuram city as part of smart city project

**EBIN SAM**

- Additional nodal officer for implement of iRAD
- Member, Review Committee, KSRTC

**JEGAN BHARATH KUMAR A**

- Member, Technical Committee for conducting performance evaluation of usage of fuel additive "Glider" in KSRTC buses
- Nodal Officer – Directorate of Environment & Climate Change (DOECC), GoK for State Action Plan for Climate Change (SAPCC) -Transport sector
- Life member, Institute of Engineers (India) (M-1726980) from 2021

**B ANISH KINI**

- Member to G-7 Committee: Intelligent Transportation Systems Committee of IRC for the years 2021-23

- City Level Nodal Officer from NATPAC for implementation of Integrated Command and Control Centre (ICCC) project in Thiruvananthapuram city as part of smart city project

- Nominated as Data Coordinator from NATPAC for Smart City Thiruvananthapuram Limited

- Nominated to Review Committee of KSRTC for reviewing DIMTS consultancy services related to route rationalisation of long-distance services

- Represent NATPAC in Technical Committee of Integrated Digital Traffic Enforcement System for Kerala Police

- Represent NATPAC in Traffic Advisory Committee, Thiruvananthapuram city

- Member of Institution of Transportation Engineers (ITE), USA; IUT(India); IRC

## 11. *Road Safety Education Materials*

### *Films*
1. Savari, A Documentary Film on Road Safety   – For Auto rickshaw Drivers
2. Gathy, A Short Film on Two Wheeler Safety
3. IRC Film (English and Malayalam)   – For School Children
4. Right Step (English and Malayalam)   – For School Children
5. VIC Roads, Australia   – For School Children
6. A Picnic on Pedals   – For School Children
7. Vazhikkannumai   – On Pedestrian Safety
8. Sradhha   – Transportation of Goods Vehicles
9. Take care
10. A Film on Seatbelt
11. A film on Rash Driving
12. A Film on Pedestrian Crossing
13. Distraction is Extraction
14. Hands free is not Risk free

### *Booklets*
1. Safe Road to School (English & Malayalam)
2. Preventing Accidents
3. Two Wheeler Driving Manual
4. Road Safety Manual for Goods Vehicle
5. All about Lane Driving and Road Safety
6. Auto rickshaw Driving Manual (English & Malayalam)
7. Defensive Driving

8. Teacher's Manual (English & Malayalam)
9. Safe Community Programme for Panchayats (English & Malayalam)
10. Helping Road Accident Victims (English & Malayalam)
11. Rules of Road Regulations,1989
12. On Car and Safe Driving
13. Road Safety Slogan
14. Vehicle Upkeep and Safety
15. Alphabets of Road Language
16. Road Safety Quiz
17. Safe and Responsible Parking
18. Road Safety and Youth Leadership Programmes
19. Safety Rules for Railway Level Crossing and Around Tracks
20. Safe and Secure Travel by Train
21. Driver's Guide (Malayalam)
22. Formation and Activities of Road Safety Cell in Schools (Malayalam)
23. കാൽനടയാത്രക്കാർക്കുള്ളസുരക്ഷാമാർഗരേഖ
24. സ്കൂൾകുട്ടികൾക്കുള്ളറോഡ്സുരക്ഷാധിഷ്ഠിത

ബോധവത്കരണം
25. പപ്പു ഉറങ്ങുകയല്ല
26. സുരക്ഷിതമായസൈക്കിൾസവാരി
27. സുരക്ഷിത പാർക്കിംഗ്
28. റോഡിലെ ഭാഷയുടെ അക്ഷരമാല
29. റോഡ്സുരക്ഷാമുദ്രാവാക്യങ്ങൾ
30. റോഡ്ഗതാഗത നിയന്ത്രണ ചട്ടങ്ങൾ
31. ലെയിൻ അധിഷ്ഠിതഡ്രൈവിംഗും റോഡ്സുരക്ഷയും
32. പ്രതിരോധാത്മകഡ്രൈവിംഗ്
33. റോഡ്സുരക്ഷയുംയുവജന നേതൃത്വ പരിപാടികളും
34. ഇരുചക്ര വാഹനമോടിക്കുന്നവർക്ക്ഒരു കൈപുസ്തകം
35. ചരക്വാഹനങ്ങൾക്കുള്ളറോഡ് സുരക്ഷാസഹായി
36. പ്രതിരോധാത്മക ബസ്ഡ്രൈവിംഗും റോഡ്സുരക്ഷയും
37. റോഡപകടങ്ങൾ തടയുന്നതിനുള്ളമാർഗങ്ങൾ
38. വാഹനങ്ങളുടെ പരിപാലനവും സുരക്ഷയും

### *Leaflets*

1. Who is Walking on the Wrong Side
2. Police Hand signals
3. Safe and Correct Ways of Parking
4. Protect your Child from Injury
5. Spot the Hidden Dangers
6. Two Wheeler Driving
7. School Safety – A Checklist for Parents
8. Understanding Traffic Rules and Regulations (English & Malayalam)
9. Helmets (English & Malayalam)
10. Golden Rules for Defensive Driving (English & Malayalam)
11. Safe Travel by Bus
12. Safe Bus Driving
13. Safe Car Driving
14. Safety Precautions for Two-Wheeler Drivers
15. Safe and Responsible Parking
16. Traffic Control Devices
17. Trains of thought- Use Extreme caution when crossing
18. Trains of thought- Safety Slogans - Just Think
19. Trains of thought- Safety Slogans - Just Think over these
20. Railway level Crossings- Safety Tips for Vehicle Drivers
21. Safe Crossing of Railway Tracks- Tips for Pedestrians and Cyclists

22. Railway Level Crossing- Safety Tips for School Buses
23. Railway Level Crossing- Safety Tips for Truck drivers
24. സുരക്ഷിതഇരുചക്രവാഹന സവാരി
25. രാത്രികാലറോഡപകടങ്ങൾ എങ്ങനെ ഒഴിവാക്കാം
26. സുരക്ഷിതയാത്രയ്ക്കുള്ളമാർഗ നിർദ്ദേശങ്ങൾ
27. പ്രതിരോധാത്മകഡ്രൈവിംഗ്
28. റോഡ്‌സുരക്ഷയുംമുതിർന്നപൗരന്മാരും

29. അമിതവേഗതയും അപകടസാധ്യതകളും
30. സുരക്ഷിത പാർക്കിംഗ്
31. സുരക്ഷിത ബസ്‌യാത്ര
32. ബസ്‌യാത്രയിൽ/കാൽനടയാത്രക്കാർ
33. ഡ്രൈവർമാർ/അമിതവേഗത
34. സ്‌ക്കൂട്ടർ/മോട്ടോർ/ഹെൽമെറ്റ് ധരിക്കൂ
35. മൊബൈൽഫോൺ/സീറ്റ്‌ബെൽറ്റ്
36. ആട്ടോറിക്ഷയിൽ/മദ്യപിച്ച്
37. റോഡിൽ എങ്ങനെ സുരക്ഷിതരാകാം

### *Road Safety Posters*

1. പത്തിനും പതിനഞ്ചിനുംഇടയ്ക്ക് വയസ്സുള്ളകുട്ടികൾക്ക്‌വേ ീ രക്ഷിതാക്കൾക്ക്‌എന്തുചെയ്യാം -1
2. പത്തിനുംപതിനഞ്ചിനുംഇടയ്ക്ക് വയസ്സുള്ളകുട്ടികൾക്ക്‌വേ ീരക്ഷിതാ ക്കൾക്ക്‌എന്തുചെയ്യാം-2
3. അഞ്ചിനും പത്തിനുംഇടയ്ക്ക് വയസ്സുള്ളകുട്ടികൾക്ക്‌വേ ീരക്ഷി താക്കൾക്ക്‌എന്തുചെയ്യാം -1
4. അഞ്ചിനും പത്തിനുംഇടയ്ക്ക് വയസ്സുള്ളകുട്ടികൾക്ക്‌വേ ീ രക്ഷിതാക്കൾക്ക്‌എന്തുചെയ്യാം-2
5. അഞ്ചിനും പത്തിനുംഇടയ്ക്ക് വയസ്സുള്ളകുട്ടികൾക്ക്‌വേ ീരക്ഷി താക്കൾക്ക്‌എന്തു ചെയ്യാം-3
6. റോഡ്‌മുറിച്ചു കടക്കുമ്പോൾ1
7. റോഡ്‌മുറിച്ചു കടക്കുമ്പോൾ2
8. റോഡ്‌മുറിച്ചു കടക്കുമ്പോൾ3
9. ചിലറോഡ്‌സുരക്ഷാ പ്രവർത്തനങ്ങൾ1
10. ചിലറോഡ്‌സുരക്ഷാ പ്രവർത്തനങ്ങൾ2

11. ആട്ടോറിക്ഷയിൽസഞ്ചരിക്കുമ്പോൾ ശ്രദ്ധിക്കേ കാര്യങ്ങൾ 1
12. ആട്ടോറിക്ഷയിൽ സഞ്ചരിക്കു മ്പോൾ ശ്രദ്ധിക്കേ കാര്യങ്ങൾ2
13. റോഡ്‌സുരക്ഷയെകുറിച്ച്‌അറിഞ്ഞി രിക്കേ മറ്റ്‌കാര്യങ്ങൾ1
14. റോഡ്‌സുരക്ഷയെകുറിച്ച്‌അറിഞ്ഞി രിക്കേ മറ്റ്‌കാര്യങ്ങൾ2
15. നിങ്ങളുംറോഡ്‌സുരക്ഷിതത്വവും1
16. നിങ്ങളുംറോഡ്‌സുരക്ഷിതത്വവും2
17. ക്രോസിംഗ് ഡ്രിൽ 1
18. ക്രോസിംഗ് ഡ്രിൽ2
19. യാത്ര ചെയ്യുമ്പോൾ ശദ്ധിക്കേ കാര്യങ്ങൾ
20. സിഗ്‌നൽലൈറ്റുകൾ
21. സൈക്കിൾസവാരി ചെയ്യുമ്പോൾ
22. റോഡിൽ നടക്കുമ്പോൾ
23. Protect your life with seat belt and helmet
24. സുരക്ഷിതമായി ബസ്സിൽയാത്ര ചെയ്യുന്നതിന് ചില നിർദ്ദേശങ്ങൾ
25. സിഗ്‌നൽലൈറ്റുകൾ കാൽനടയാത്ര ക്കാരുടെ ശ്രദ്ധയ്ക്ക്

# INFRASTRUCTURE

## *1. Testing Facilities and Equipments*

NATPAC is well equipped with the state-of-the-art equipment's for testing of highway materials, pavement evaluation and mix design. There is also a Geotechnical Lab for soil testing with all the equipment's for routine testing of soil. The Traffic Engineering Lab of NATPAC is equipped with several software's used for traffic modelling and analysis.

The Environmental Lab services provide air quality monitoring, noise level measurement and measurement of meteorological parameters.

The following are the equipment's purchased during the period 2021-22:

### i.    Moisture Induced Stress Tester (MIST)

MiST – Tests the moisture damage susceptibility of asphalt mixtures. Determines the moisture susceptibility of bituminous mixes by simulating the stripping mechanisms those occur in H.M.A pavement.

### ii.   Dynamic Shear Rheometer

The Dynamic Shear Rheometer determines the rheological properties of specimen



In addition to above, NATPAC has all the basic test setup for tests on soil, aggregate and bitumen. Some of the major equipment's/software's available with NATPAC is given below:

### 1. Tests on Soil

- All basic equipments
- Standard and Modified Proctor Compaction test setup
- Automatic motorized universal compactor
- Hydraulic Ejector
- CBR test equipment
- Direct Shear Test Setup
- Triaxial Shear Test Setup
- Unconfined Compression Test Setup
- Consolidation Test Setup
- Combined pH, TDS and conductivity meter

### 2. Tests on Bitumen

- All basic equipment
- Brookefield viscometer

### 3. Tests on Aggregate

- All basic equipment

### 4. Tests on Mixes

- Digital Marshall stability and ITS test setup
- Motorized centrifuge extractor
- Automatic compactor
- Wheel rut tester and Shaper
- Corelok Device
- Bitumen mixer

**5. Field Testing**

- Field CBR
- Dynamic cone penetrometer test
- Core cutting machine - (100mm dia. core bit)-undisturbed sampling of bituminous pavement.
- Fifth Wheel Bump Integrator
- Benkelman Beam
- Skid resistance tester

**6. Traffic Engineering Laboratory**

- Noise level meter
- Speed Radar
- Inertial Measurement Unit (IMU) and laser sensors as add-on to Video VBox
- TIRTL

**7. Topographic Survey**

- DGPS
- Total stations-3 Nos.
- Automatic levels-2 Nos.
- High end plotters -2 Nos.
- Handheld GPS

**8. Environment Laboratory**

- CO Analyzer
- CO2Analyzer

- NO2Analyzer
- CH4Analyzer
- Respirable Dust Sampler (APM 460)-2 Nos.

**9. Water Transport Laboratory**

- Echo sounder
- Portable cantilever scale
- Flow Probe

**10. Application Softwares**

- MX ROAD
- AUTO CAD
- ARC GIS
- 3DS MAX
- TALLY
- STADD PRO
- HDM IV
- SPSS with AMOSS
- ERDAS
- OPEN ROADS DESIGNER
- OPEN ROADS CONCEPT STATION
- Bentley CUBE
- PTV Vissim, Viswalk, Vistro and Visum
- MATLAB
- TRANSCAD

## *2.     Library and Information Services*

The KSCSTE-NATPAC Library is endowed with the responsibility of providing assistance to the scientists, researchers and students in their scientific and academic activities. The Library continued to cater to the information needs of the institute and students. The Library has a vast collection of books on Transportation, Traffic Engineering, Transport Economics, Urban and Regional Planning, Water Transport, Environment, Management, Operations Research, Geography, Statistics and allied subjects. The Technical Reports prepared by KSCSTE-NATPAC are also available for reference purpose. The library has a good collection of the publications by Indian Roads Congress (IRC) and this collection is being updated regularly. A number of new journals, both National and International, have been added to the library during this year.

An in-house database of books, periodicals, bound volumes of journals, reports, etc., is being updated. The Library is maintaining a blog natpaclibrary1.blogspot.in to make users abreast of the latest developments in the library. NATPAC library is automated and managed using LIBSOFT. Bibliographic record of books available in the library can be accessed through https://natpac.libsoft.org/.

The major services rendered to users by the library are reference service and literature search. Clippings from newspapers, web resources, etc. are maintained in the library for the benefits of users. E-mail alerts are sent to scientists and technical staff for new arrival of books and publications. NATPAC has been extending academic support and other R&D facilities to Researchers as well as Professionals to carry out their research and project works. During this year many Research scholars / students from different institutions undertook project works using the facilities available in NATPAC library.

## *Other NEWS*

♦ NATPAC partnering with Kerala Technological University (KTU) on the Industry Projects Single Window Facilitation scheme of APJAKTU. EoIs were solicited from various Engineering Colleges affiliated with APJAKTU, from which ten Engineering Colleges were selected to participate in NATPAC's project "Preparation of DPR for Integrated Development of Coastal Highway with Cycle Track in Thiruvananthapuram, Kollam, and Alappuzha Districts" from September to October 2021.

♦ SevanaVaaram was observed in NATPAC Campus from 4th – 8th October 2021.

## NATPAC STAFF – AS ON 01.04.2022

| Sl.No | Name | | Designation |
|-------|------|---|-------------|
| | Prof.(Dr.) Samson Mathew | - | Director |
| *Scientific Staff* | | | |
| 1. | Shaheem S | - | Principal Scientist |
| 2. | V. S.Sanjay Kumar | - | Principal Scientist |
| 3. | B. Subin | - | Senior Scientist |
| 4. | P. N. Salini | - | Senior Scientist |
| 5. | M. S. Saran | - | Scientist |
| 6. | N. M. Sabitha | - | Senior Scientist |
| 7. | K. C. Wilson | - | Senior Scientist |
| 8. | Arun Chandran | - | Senior Scientist |
| 9. | Veena K.S. | - | Scientist |
| 10. | S. Ebin Sam | - | Scientist |
| 11. | A. Jegan Bharath Kumar | - | Scientist |
| 12. | R. Chandra Prathap | - | Scientist |
| 13. | Dr. Salini U | - | Scientist |
| 14. | B. Anish Kini | - | Scientist |
| *Technical Staff* | | | |
| 15. | V.G.Sasi | - | Technical Officer Grade -4 |
| 16. | M.S. Radhakrishnan | - | Technical Officer Grade -4 |
| 17. | E. P. Surendran Pillai | - | Technical Officer Grade -3 |
| 18. | R. J. Sanjai | - | Technical Officer Grade -2 |
| 19. | Deepa Radhakrishnan | - | Technical Officer Grade -1 |
| 20. | R.Radhakrishnan Thampi | - | Technical Assistant Grade-3 |
| 21. | Shyama C. | - | Jr.Library Assistant Grade-2 |
| *Administrative Staff* | | | |
| 22. | K George Koshy | - | Registrar Grade-2 |
| 23. | Reshmy R S | - | Assistant Registrar Grade-1 |
| 24. | Bindu S R | - | Assistant Registrar Grade-1 |
| 25. | Abey George | - | P.A. to Director Grade-4 |

| 26. | D. Shaju | - | Section Officer Grade-1 |
|-----|----------|---|-------------------------|
| 27. | R. Lekha | - | Typist cum Stenographer Grade-5 |
| 28. | Arya S.K. | - | Assistant Grade – 2 |
| 29. | Maya Devi M. | - | Assistant Grade – 2 |
| 30. | Veena S | - | Assistant Grade – 2 |
| 31. | Muhammed Naserudeen C | - | Assistant Grade – 2 |
| 32. | Sangeetha T.S. | - | Assistant Grade – 2 |
| 33. | Lajila K.B. | - | Stenographer Grade – 2 |
| 34. | A. Praveen Kumar | - | Clerical Assistant Grade -2 |
| 35. | G.Ragesh | - | Driver Grade - 3 |
| 36. | A.Somaraj | - | Driver Grade - 3 |
| 37. | Surendran Kulangara | - | Driver Grade – 3 |
| 38. | Shijil P. R. | - | Driver Grade – 2 |
| 39. | S.Jayakumar | - | Office Attendant Grade -5 |
| 40. | A. Anil Kumar | - | Office Attendant Grade -3 |
| 41. | Athira S.Kumar | - | Office Attendant Grade -2 |
| 42. | Bharat Menon | - | Office Attendant Grade - 1 |

## **RETIREMENTS**



***Shri.K George Koshy***
*Registrar Grade-2*
*Superannuated on*
*30<sup>th</sup>April 2021*



***Shri.V G Sasi***
*Technical Officer – IV*
*Superannuated on*
*31<sup>st</sup> May 2021*



***Shri.R Radhakrishnan Thampi***
*Technical Assistant-III*
*Superannuated on*
*31<sup>st</sup> May 2021*

## **OBITUARY**



***Shri. S Jayakumar***
*Office Attendant –V*

**RESEARCH STUDIES UNDERTAKEN DURING 2021-'22**

| Sl.No. | Code | Project |
|---|---|---|
| 1 | Plan-398 | Enhancement of Public Transport Services in Thiruvananthapuram City |
| 2 | Plan-399 | Road Asset Management for National Highways and State Highways in Kerala |
| 3 | Plan-400 | Development of Integrated Land Use Transport Model for Thiruvananthapuram |
| 4 | Plan-401 | Resilient Transportation Planning for Disaster prone areas – A case study of Munnar Town |
| 5 | Plan-402 | Field Evaluation of Indo-HCM for Intersections in Kerala |
| 6 | Plan-403 | Periodic Updation of GIS-based Road and Traffic Database for Kerala |
| 7 | Plan-404 | Periodic Updation of Price Indices for Different Public Transport & Freight Operations |
| 8 | Plan-405 | Pavement Rehabilitation Design Based On Dynamic Cone Penetrometer Test (DCPT) |
| 9 | Plan-406 | Study on the influence of different types of aggregate, filler and bitumen on mixture properties and performance |
| 10 | Plan-407 | Evaluation of Moisture Susceptibility of Asphalt Mix Using Admixtures |
| 11 | Plan-408 | Resource Mapping of road construction materials in Kerala -Phase II |
| 12 | Plan-409 | Crash Prediction Modelling of Undivided Two-Lane Two-Way Road Networks in Kerala |
| 13 | Plan-410 | Overtaking Behavior of Drivers – A Case Study on Selected Roads in Kerala |
| 14 | Plan-411 | Web-GIS based Road Crash Information System |
| 15 | Plan-412 | Utilization of Geo-informatics Tools for development of Comprehensive road network for Kerala State |
| 16 | Plan-413 | Synthesis of rich origin –destination matrics using fusion of multiple sparse data sources |
| 17 | Plan-414 | Impact of integrated feeder services for encouraging urban mass transport patronage in post-pandemic world |
| 18 | Plan-415 | Study on effectiveness of cold mix asphalt in Kerala roads |
| 19 | Plan-416 | Characterization of flowable fill incorporating industrial by-products |
| 20 | Plan-417 | Laboratory Investigation of Bituminous Porous Mix |
| 21 | Plan-418 | Application of Surrogate Safety Measures at Unsignalized Intersections |
| 22 | Plan-419 | Application of ITS for Enhancing Safety at Critical Locations and Blackspots |
| 23 | Plan-420 | Intelligent Transport System (ITS) Cell |
| 24 | Plan-421 | Performance evaluation of Kochi Water Metro |
| 25 | Plan-422 -1 | Traffic impact study for extension of buses from Goshree island to Ernakulam city |

## CONSULTANCY/SPONSORED PROJECTS IN 2021-22

| Sl. No | Code | Project | Sponsored by | Total Project Cost (in Lakhs) |
|---|---|---|---|---|
| 1 | C00121 | Traffic Impact assessment TCS Campus-Thiruvanathapuram | Environmental Engineers & Consultants | 2.52 |
| 2 | C00221 | Feasibility Study for Alternatives to Forest Routes for the Proposed Hill Highway Alignment at Selected Districts- | Kerala Road Fund Board (KRFB) | 16.88 |
| 3 | C00321 | Road safety Audit on NH 66 in Kerala State-IRF | International Road Federation | 16.46 |
| 4 | C00421 | DPR preparation -Coastal highway TVPM, Kollam and Alappuzha | Kerala Road Fund Board (KRFB) | 598.00 |
| 5 | C00521 | LSGD-Rebuild Kerala Initiative - Road works – Pavement Design | LSGD | 11.97 |
| 6 | C00621 | Identification & Rectification of Black spot-2021 (NEW) | Road Safety Commissioner- KRSA | 5.94 |
| 7 | C00721 | Construction of main road and entrance gate at Rajiv Gandhi Centre for Bio Technology, Akkulam, Trivandrum- Design of approach road | CPWD | 3.00 |
| 8 | C00821 | Identification & Mapping of Forest - Hill highway | Kerala Road Fund Board (KRFB) | 5.04 |
| 9 | C00921 | Road Safety Audit for PMGSY Roads | KSRRDA, LSGD | 22.13 |
| 10 | C01021 | Mitigation of Traffic Issues at Vytilla Junction in Ernakulum- KIIFB | KIIFB | 10.00 |
| 11 | C01121 | Functional Performance Evaluation of KIIFB funded roads | KIIFB | 4.62 |
| 12 | C01221 | Preparation of DPR for the alternate access to VSSC eastern campus, Thiruvananthapuram | VSSC | 11.00 |
| 13 | C01321 | Technical Review and Support Services to SPVs for the development of project execution documents in road projects | KIIFB | 359.73 |
| 14 | C01421 | Training for employees of Motor Vehicle Department | Transport Commissionrate | 20.91 |
| 15 | C01521 | Traffic Management Plan for Kunnamangalam Town | Kunnamangalam Grama Panchayath | 3.65 |

natpac KSCSTE - NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE

# KSCSTE – NATPAC – ORGANISATIONAL STRUCTURE

KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY & ENVIRONMENT

RESEARCH COUNCIL

MANAGEMENT COMMITTEE

DIRECTOR, NATPAC

SCIENTIFIC DIVISIONS

ADMINISTRATION

**TRANSPORTATION PLANNING & ENGINEERING DIVISION**
- Traffic & Transportation Studies
- Comprehensive Urban Mobility Plan Study
- Travel Demand Modeling & Demand Forecasting
- Public Transport System Performance Study
- Resilient Transport Infrastructure
- Disaster Evacuation Planning

**TRAFFIC ENGINEERING & SAFETY DIVISION**
- Traffic Situation Analysis
- Traffic Demand Management Study
- Traffic Impact Assessment
- Traffic Simulation Studies
- Non-Motorised Transport (NMT) studies
- Road Safety Audit
- Safety Assessment of Road Networks
- Crash Analysis

**HIGHWAYS & BRIDGES DIVISION**
- Pavement Evaluation
- Pavement Material Testing and Analysis
- Resource database on highway materials
- Reclaimed Asphalt Pavement
- Moisture susceptibility of pavements
- Sustainable Pavement Technology
- Landslide Monitoring and Prediction

**WATER TRANSPORT DIVISION & GIS**
- Inland Water Transport
- Hydrographic Survey
- Waterways and Canal Development
- Inter-Modal Transport
- Drainage System
- Safety of Waterways
- Database Creation
  - Transport Infrastructure
  - Traffic Demand and Supply
  - Accident Database

**INFORMATION, LIAISON & TRAINING DIVISION**
- Organise workshops, seminars and other training programmes
- Conduct certified training programmes
- Interaction with user agencies
- Digital Library with online access to referred journals
- Documentation and Central Database of the Centre

**GEN. ADMN & ACCOUNTS**
- Office Administration
- Personal Management
- Budgeting
- Project Accounts
- House Keeping
- Stores & Purchases
- Welfare Measures
- Financial & Legal Matters

National Transportation Planning And Research Centre
( A unit of Kerala State Council for Science, Technology & Environment. Govt. of Kerala )
Balance Sheet as at 31 March 2022

in (₹.)

| Liabilities | Sch No | As at 31 March 2022 | As at 31 March 2021 | Assets | Sch No | As at 31 March 2022 | As at 31 March 2021 |
|---|---|---|---|---|---|---|---|
| Reserves & Surplus | 5 | 7,79,56,746 | 8,35,67,258 | Property, Plant & Equipment | 2 | 7,79,56,746 | 8,35,67,258 |
| Building Fund Account | 6 | 2,66,79,019 | 2,66,79,019 | Work In Progress | 2 | 4,43,322 | 4,43,322 |
| Current Liabilities | 7 | 1,89,53,462 | 88,95,847 | Current Assets | 3 | 12,27,82,105 | 8,25,84,494 |
| Unspent balance | 8 | 6,34,50,421 | 3,15,29,803 | Loans & Advances | 4 | 2,62,18,246 | 2,39,37,614 |
| Corpus fund | 9 | 4,03,60,770 | 3,98,60,760 | | | | |
| Total | | 22,74,00,419 | 19,05,32,688 | Total | | 22,74,00,419 | 19,05,32,688 |

The accompanying notes form an integral part of the financial statements

For National Transportation Planning and Research Centre

In terms of our report attached.

For Mohan & Mohan Associates
Chartered Accountants
FRN:002092S

Deputy Registrar (Finance)

Registrar

Director

R Suresh Mohan
Partner
M.No.013398

Place : Thiruvananthapuram
Dated :01-11-2022

UDIN 22013398BD4LUR2662

Reg. No: 020925
TRIVANDRUM

National Transportation Planning And Research Centre
( A unit of Kerala State Council for Science, Technology & Environment, Govt. of Kerala )
Income & Expenditure Account for the year ended 31 March 2022

In (₹.)

| Expenditure | Sch No | Year ended 31 March 2022 | Year ended 31 March 2021 | Income | Sch No | Year ended 31 March 2022 | Year ended 31 March 2021 |
|---|---|---|---|---|---|---|---|
| To Infrastructure Strengthening (Plan) | 13 | 3,07,31,754 | 2,44,56,101 | By Grant from Government of Kerala | 10 | 8,57,23,180 | 6,71,52,579 |
| To Infrastructure Strengthening (Non Plan) | 14 | 43,14,930 | 26,50,344 | By Other Receipts | 11 | 29,05,199 | 53,51,422 |
| To Salaries and Allowances (Non Plan) | 15 | 5,25,81,685 | 4,53,97,556 | By Depreciation written back | 2 | 58,18,512 | 64,82,600 |
| To Depreciation | 2 | 58,18,512 | 64,82,600 | By Income from Consultancy Project | 12 | 1,57,04,187 | 69,65,848 |
| To Consultancy Project Expenses | 16 | 1,57,04,187 | 69,65,848 | | | | |
| Total | | 10,90,43,048 | 8,59,52,449 | Total | | 10,90,43,048 | 8,59,52,449 |

The accompanying notes form an integral part of the financial statements.
For National Transportation Planning and Research Centre

In terms of our audit report attached
For Mohan & Mohan Associates
Chartered Accountants
FRN:002092S

Deputy Registrar (Finance)

Place : Thiruvananthapuram
Dated :01-11-2022

Registrar

Director

R.Suresh Mohan
Partner
M.No:013398

UDN 22013398BDGLUR2662

Reg. No: 02092S
TRIVANDRUM

**KSCSTE - National Transportation Planning and Research Centre**

(An Institution of Kerala State Council for Science, Technology and Environment)

K. KARUNAKARAN TRANSPARK, Aakkulam,

Thuruvikkal P.O, Thiruvananthapuram, Pincode: 695011

Phone: 0471-2779200

E-mail: contactus.natpac@kerala.gov.in, Web: www.natpac.kerala.gov.in

KSCSTE-NATPAC Regional Centre,

CWRDM Campus, Kunnamangalam,

Kozhikode,

Pincode - 673 571

Phone: +91- 495 - 2963795

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KSCSTE - NATPAC

ANNUAL REPORT 2021- '22

**natpac**

**KSCSTE - NATPAC**