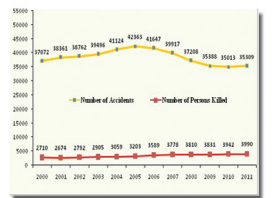
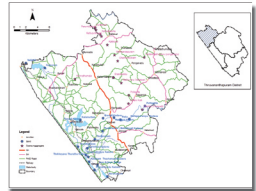
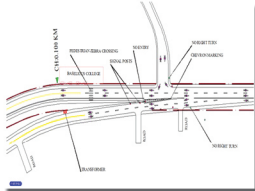
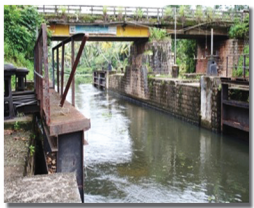


# Annual Report 2011- '12



**natpac**

**National Transportation Planning and Research Centre**

Sasthra Bhavan, Pattom Palace P.O,  
Thiruvananthapuram - 695 004

# **ANNUAL REPORT**

## **2011-'12**



**National Transportation Planning and Research Centre**

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

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## CONTENTS

Sl. No.	Title	Page No.
<b>I</b>	<b>TRAFFIC AND TRANSPORTATION</b>	
1	<i>Accuracy of Traffic Forecasts and Travel Demand Estimation in Cities of Kerala</i>	1
2	<i>Streamlining of Pedestrian Facilities in Central Business Area of Thiruvananthapuram City</i>	3
3	<i>Transport Infrastructure Development Plan for Harippad Town in Kerala</i>	6
4	<i>Integration of Public Transport - A Case Study of Thiruvananthapuram City</i>	8
5	<i>Price Index for Stage Carriage Operations in Kerala</i>	10
6	<i>Traffic Improvement Plan for Kottayam Town</i>	12
7	<i>Role of IPT Modes in Medium Size City of Kerala - Case Study of Kozhikode City</i>	15
8	<i>Gender Issues of Mobility of Working Women</i>	17
<b>II</b>	<b>HIGHWAY ENGINEERING</b>	
9	<i>Widening, Strengthening and Extension of Existing Tippu Sultan Road in Coastal Region of North Kerala</i>	18
10	<i>Pre-feasibility Study for Constructing A Green-field Highway between Nedumbassery and Vytilla in Kochi Region</i>	19
11	<i>Use of Geotextiles in Road Construction</i>	21
12	<i>Resource Mapping of Road Construction Materials in Kerala - A Case Study of Thiruvananthapuram District</i>	24
13	<i>Use of Waste Plastics for Road Construction</i>	27
14	<i>Performance of Highways Developed under Kerala State Transport Project</i>	30
15	<i>Measurement of Air Quality and Noise Level at Proposed IISER Campus, in Thiruvananthapuram District</i>	33
<b>III</b>	<b>REGIONAL TRANSPORTATION</b>	
16	<i>Road Development Plan for An Emerging Town – Case Study of Kottarakkara in Kollam District, Kerala</i>	35
17	<i>Mobility Plan for West Kallada Grama Panchayath in Kollam District</i>	37

<b>Sl. No.</b>	<b>Title</b>	<b>Page No.</b>
18	<i>Preparation of Computerized Inventory of Roads for Payyannur and Kalliassery Block Panchayaths in Kannur District</i>	39
19	<i>Restructuring of the Jurisdiction of Road Network of Kerala Public Works Department based on Assembly Constituencies</i>	41
20	<i>Shortest Path Analysis and Service Area Allocation for Ambulance Services in Thiruvananthapuram City - A GIS approach</i>	43
<b>IV</b>	<b>ROAD SAFETY</b>	
21	<i>Travel Protection Strategies</i>	45
22	<i>Analysis of Road Accident Causative Factors</i>	47
23	<i>Identification of Accident Prone Locations and Improvements in Northern Kerala</i>	49
24	<i>Safety of Public Transport System in Kerala</i>	51
<b>V</b>	<b>WATER TRANSPORT</b>	
25	<i>Constraints in Developing West Coast Canal in Kerala - Case Study of National Waterway - III</i>	53
26	<i>Route Network Planning of IWT System in Kerala – A Case Study of Central Kerala</i>	56
27	<i>Details of Existing Cross Structures along National Waterway - III in Kerala</i>	58
28	<i>Extension of National Waterway No.III to Kasargod in the North and Trivandrum (Kovalam) in the South</i>	59
<b>VI</b>	<b>EXTENSION SERVICES</b>	
1	<i>User Interaction Meet</i>	60
2	<i>Safe Road to School</i>	63
3	<i>Road Safety Week - 2012</i>	64
4	<i>Training</i>	67
5	<i>Exhibitions</i>	68
6	<i>Participation in Workshops, Seminars/Conferences and Other Training Programmes</i>	69
7	<i>Guidance to Students' Project Work and Thesis</i>	70



<b>Sl. No.</b>	<b>Title</b>	<b>Page No.</b>
8	<i>Presentation of Papers in Seminar/Workshops</i>	71
9	<i>Invited Talks/Media Interactions</i>	72
10	<i>Nominations to Technical Committees/ Advisory Bodies</i>	74
11	<i>Road Safety Education Materials</i>	76
<b>VII INFRASTRUCTURE</b>		
1	<i>New Campus for NATPAC at Aakkulam, Thiruvananthapuram</i>	78
2	<i>Testing Facilities and Equipments</i>	79
3	<i>Library and Information Services</i>	82
<b>VIII ORGANISATION</b>		
	<i>Plan Studies Undertaken During 2011-'12</i>	90
	<i>Consultancy/Sponsored Projects in 2011-'12</i>	92
	<i>Income and Expenditure Account</i>	94
	<i>Balance Sheet</i>	95
	<i>Organisation Chart</i>	96

## LIST OF TABLES

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
1	<i>Updation of Price Index for Stage Carriage Operation (PISCO) as on December, 2011 prices</i>	11
2	<i>Growth of Population and IPT modes in Kozhikode city</i>	15
3	<i>Estimation of future demand of Autos and Taxis in Kozhikode City</i>	16
4	<i>Constraints faced by working women while travelling in bus</i>	17
5	<i>Comparison Analysis of Green Field Alignment Options</i>	20
6	<i>Properties of Soil A</i>	21
7	<i>Comparison of OMC &amp; MDD values of Soil A</i>	22
8	<i>Comparison of CBR Values of Soil A</i>	22
9	<i>Properties of Soil B</i>	22
10	<i>Comparison of CBR Values of Soil B</i>	23
11	<i>Summary of Results of Tests on Coarse Aggregates from Chirayankil Taluk in Thiruvananthapuram District</i>	26
12	<i>Summary of Results of Tests on Fine Aggregates from Chirayankil Taluk in Thiruvananthapuram District</i>	26
13	<i>Details of Stretches on Study Roads</i>	30
14	<i>Subgrade Soil properties on Vettu Road – Pothencode Road</i>	31
15	<i>Pavement Evaluation Data on Vettu Road – Pothencode Road</i>	31
16	<i>Weightage Values of Grama Panchayath Roads</i>	38
17	<i>District wise accident details of Kerala - 2011</i>	47
18	<i>Rating of Accident Components</i>	49
19	<i>Major Accident Locations along NH - 213</i>	50
20	<i>Accidents involving buses in Kerala</i>	51
21	<i>Safety condition of buses in Thiruvananthapuram District, 2011</i>	52

## LIST OF FIGURES

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
1	<i>Study Area in Thiruvananthapuram City</i>	4
2	<i>Proposed route of Skywalk Facility between Thampanoor and East Fort in Thiruvananthapuram City</i>	5
3	<i>Traffic Improvement Plan for Harippad Town in Kerala State</i>	7
4	<i>Proposed Conceptual Plan of Manorama Junction Area</i>	14
5	<i>Proposed Bus Route Plan for Kottayam Town</i>	14
6	<i>Alignment of Proposed Coastal road between Ponnani and Francis Road</i>	18
7	<i>Map of the Study Area</i>	24
8	<i>Map of West Kallada Grama Panchayath</i>	37
9	<i>Road Network Map of Ezhome Grama Panchayath in Kalliassery Block</i>	40
10	<i>Constituency-wise Rearrangement of Jurisdiction of Manjeswar Section</i>	42
11	<i>Constituency-wise Rearrangement of Jurisdiction of Vattiyoorkavu Section</i>	42
12	<i>Closest Ambulance Facility from site of Accident in Thiruvananthapuram Corporation</i>	44
13	<i>Shortest path for Ambulance to reach spot of Accident and to Hospital</i>	44
14	<i>Trend of Road Accidents and fatalities in Kerala (2000 – 2011)</i>	48
15	<i>Map Showing the Waterway Network in Alappuzha District</i>	57

## LIST OF PLATES

<b>Plate No.</b>	<b>Title</b>	<b>Page No.</b>
1(a) & (b)	<i>Difficulties faced by women while using Public Transport</i>	17
2	<i>Coir matting mesh –half inch size</i>	23
3	<i>Coir matting- Panama Weave</i>	23
4	<i>Plastic Shredding Machine</i>	29
5	<i>Resurfacing using modified mix with PCA</i>	29
6	<i>Skid Resistance Test</i>	31
7	<i>Texture Depth Test (Sand Patch)</i>	31
8(a) & (b)	<i>Benkelman Beam Deflection Studies</i>	32
9	<i>Respirable Dust Sampler (APM 460BL)</i>	34
10	<i>Thanneermukkom Lock on NW-3</i>	54
11	<i>Thrikkunnappuzha Lock on NW-3</i>	54
12	<i>Kaniyampuzha Pipeline Bridge –on Champakara Canal</i>	58
13	<i>Kottappuram Bridge across NW-3</i>	59
14	<i>View of Canal near Mathilakam Bridge (Ch.14.90 Km) Kottappuram-Chettuva</i>	59
15	<i>Smt.B.G.Sreedevi, Director, NATPAC welcoming the participants at the inaugural session of the User Agencies Interaction Meet</i>	60
16	<i>Inauguration of the User Agencies Interaction Meet by Hon'ble Minister for Water Resources, Govt. of Kerala</i>	60
17	<i>Releasing of the book “A decade of Road Accident Scenario in Kerala”</i>	60
18	<i>Dr.G.C.Gopala Pillai, Chairman, RIAB moderating the User Interaction Meet session</i>	61
19(a) & (f)	<i>Presentations by Director and Division Heads, NATPAC at User Agencies Interaction Meet</i>	61
20	<i>View of the participants</i>	62
21	<i>Inauguration of the SRS Programme by Shri.M.A.Vahid</i>	63
22	<i>Students listening to class on ‘Road Safety’</i>	63
23	<i>Quiz Competition</i>	64



<b>Plate No.</b>	<b>Title</b>	<b>Page No.</b>
24	<i>Class on 'Safe Road to School'</i>	64
25(a)	<i>Shri.M.N.Prasad giving his opening remarks, in the panel discussion on 'Safer Roads for Kerala'</i>	64
25(b)	<i>Panel discussion in progress</i>	64
25(c)	<i>Shri.Gopinath, IPS expressing his views at the panel discussion</i>	65
26(a)	<i>Smt.B.G.Sreedevi, Director, NATPAC welcoming the participants at the inaugural session of RSYLP</i>	65
26(b)	<i>Inauguration of RSYLP by Hon'ble Minister for Transport &amp; Devaswom, Govt. of Kerala</i>	65
26(c)	<i>Class on 'Youth leadership in Road Safety' by Dr.Mahesh Chand, Scientist-G and Head, Traffic Safety Division, NATPAC</i>	65
27	<i>Demonstration Class on 'Road Safety' for students at Seva Mandir Higher Secondary School, Ramanattukara</i>	66
28	<i>Some of the hand out cards prepared by NATPAC</i>	66

### ***From Director's Desk.....***



*National Transportation Planning and Research Centre (NATPAC) has a mandate to promote and develop the transport sector and is entrusted with the task of formulating policies for Transport and Traffic Safety with a view to increase the efficiency of the transport system in the State. The period under report was another highly productive year for NATPAC. The Hon'ble Chief Minister of Kerala, Sri.Oommen Chandy inaugurated the new campus of NATPAC at Aakkulam on 1<sup>st</sup> July 2011. The new campus has been named after the former Chief Minister of Kerala, Sri.K.Karunakaran as 'K Karunakaran Transpark'. This new campus aimed at giving a fresh impetus to the organisation's research activities. This annual report gives an overview of the activities of NATPAC from April 2011 to*

*March 2012. I hope this report is both informative and will give greater understanding of the work done by the Centre.*

*During the year, the Scientists of the Centre handled 21 R & D Projects and an equal number of sponsored studies.*

*NATPAC prepared Transport Infrastructure Development Plans to augment the traffic and transportation facilities to cater to the needs of increasing traffic in various towns of Kerala. The Centre developed a methodology for optimizing the public transport services by providing effective coordination for transfer of passengers arriving by trains, to reach their destination in and around the city of Trivandrum. A scientific spatial database for rural roads by involving the Grama Panchayaths was prepared.*

*NATPAC has been assessing the ambient air quality and noise levels in and around the proposed IISER construction site as part of the Environmental Impact Assessment (EIA) study. Studies for evolving new construction materials continued as one of the thrust areas. Use of coir geotextiles have been found useful to increase the strength of the subgrade and capacity of pavement to carry more traffic/loads, reduces fatigue, cracking, amount of ruts and thus increase the life of pavements in weak subgrades and resulted in improved performance for different soil conditions. The Centre also took active role in resource mapping of road construction materials in Kerala. Another innovative programme on use of waste plastic in road construction proved to be a step towards providing input for evolving guidelines/specifications for the use of waste plastic materials in road construction thereby reducing a serious community menace.*

*NATPAC suggested necessary measures for enhancing Inland Water Transportation, an energy efficient and cheaper mode of transport for bulk commodities. It supports the Inland Waterways Authority of India to develop the waterways of the State.*

*Our focus on 'Road Safety' now takes head on critical issues facing the State. NATPAC collects, compiles and analyses road accident statistics and takes steps for developing a Road Safety*

*Culture by involving public and organizing various awareness programmes. The Road Safety Week - 2012 was observed by organizing a series of programmes to create awareness among school/college students, drivers and all other road users. The programmes were conducted as a measure to sensitize the road users and to create greater awareness regarding road safety aspects. A 'User Department Interaction Meet' was organised which resulted in an impactful interaction with people interested in the field of transportation and allied areas. The Research Council met twice during the year and reviewed the institute's research and development programmes.*

*The Library of NATPAC is well equipped and is providing assistance to the Scientists, researchers and students on their scientific and academic activities related to traffic and transportation. Guidance to students for Project/Thesis works was given a boost during the year with 48 students on the rolls. The Scientists were encouraged to attend conferences at national and state levels.*

*The constant support and encouragement received from the Hon'ble Chief Minister of Kerala, Hon'ble Minister for Transport and Hon'ble Minister for Works are thankfully acknowledged. The continuous support obtained from the Executive Vice President of KSCSTE, Research Council and Management Committee of NATPAC has helped us to discharge our duties for the benefit of the Society. We look forward to an even better performance in the coming years. The support provided by the Scientists and Staff of the institute to the research activities need special mention. As we reflect on the past year, we also look to the future and the many opportunities that will come our way.*

**B.G. SREEDEVI**

## ***1. Accuracy of Traffic Forecasts and Travel Demand Estimation in Cities of Kerala***

Decision makers use traffic forecasts to select projects and to decide whether to invest in a particular project or not. The demand forecasts for a specific project is the main variable influencing its realization. Evaluation of proposed projects and their subsequent performance depends on the demand forecasts made in support of these projects, ahead of its implementation. The high cost of transportation projects, availability of limited resources, irreversibility of such decisions and associated inefficiencies make it essential to understand and eliminate the causes of forecast inaccuracy.

Traffic and transportation studies were carried out by different agencies for various towns in Kerala during the last three decades. There is a wealth of information and traffic database available in the State. NATPAC proposed to analyse the temporal variation and predictive accuracy of identified variables for selected cities in Kerala and a case study of Thiruvananthapuram and Kochi Urban area were selected.

Data from 19 transport studies of Thiruvananthapuram and Kochi cities undertaken between 1981 and 2011 were used to analyse their predictive accuracy. The results of seven forecast items, showed a universal underestimation of every item. On an average, demographic variables (population and employment) in Thiruvananthapuram and Kochi cities were overestimated up to 24% for a forecasting period of 10 years. Almost all forecasts for land use pattern were overestimated by an average of 39 % in case of Thiruvananthapuram city, whereas for Kochi city, the forecasts were underestimated by 17 %. Vehicle population and traffic flow on selected corridors were heavily underestimated for both cities by 13 to 94 %.

It was suggested that the overriding factor affecting the accuracy of trip forecasts was over-prediction of the growth in variables such as population, employment and under-prediction of travel costs, household income and economic growth. If this were so, then errors of prediction could outweigh the errors of measurement and model specification. There was also evidence that transport models used in the studies contained errors of specification, particularly in their



projection of vehicle population and traffic volume. The possible effect of specification errors was obscured by the dominating effect of the errors in the planning input variables.

Further analysis of the data showed that an assumption of zero variation from base year situation produced mixed response. Such an assumption would have produced smaller errors for socio-economic variables like population and employment in case of Thiruvananthapuram City and larger errors in case of Kochi City. Assumption of zero variation would have produced larger errors for traffic parameters.

Although the results were necessarily based on studies that started between 1981 and 2000, to allow sufficient time to have elapsed to test their predictive accuracy, many of the modeling methods used in those studies is still in common use. However, no evidence could be found to suggest that the more recent studies or the more sophisticated models performed better than the others. Lack of sufficient data and forecasting procedures in the reports posed difficulty in proper analysis of the accuracy of the forecast.

## ***2. Streamlining of Pedestrian Facilities in Central Business Area of Thiruvananthapuram City***

Pedestrian safety has become a serious concern with increasing trend of pedestrian accidents in central area of cities. There is a need for streamlining of pedestrian movements to ensure safe and orderly movement of pedestrians and vehicles. Pedestrians are in sharp conflict with vehicular traffic in majority of road intersections and near bus stops due to absence of footpath or pedestrians invade carriageway space thereby putting their lives at risk. All these locations need controlled crossing facilities. **Figure 1** shows the study area selected.

Various proposals for pedestrian facilities have been worked out for the study area. These included:

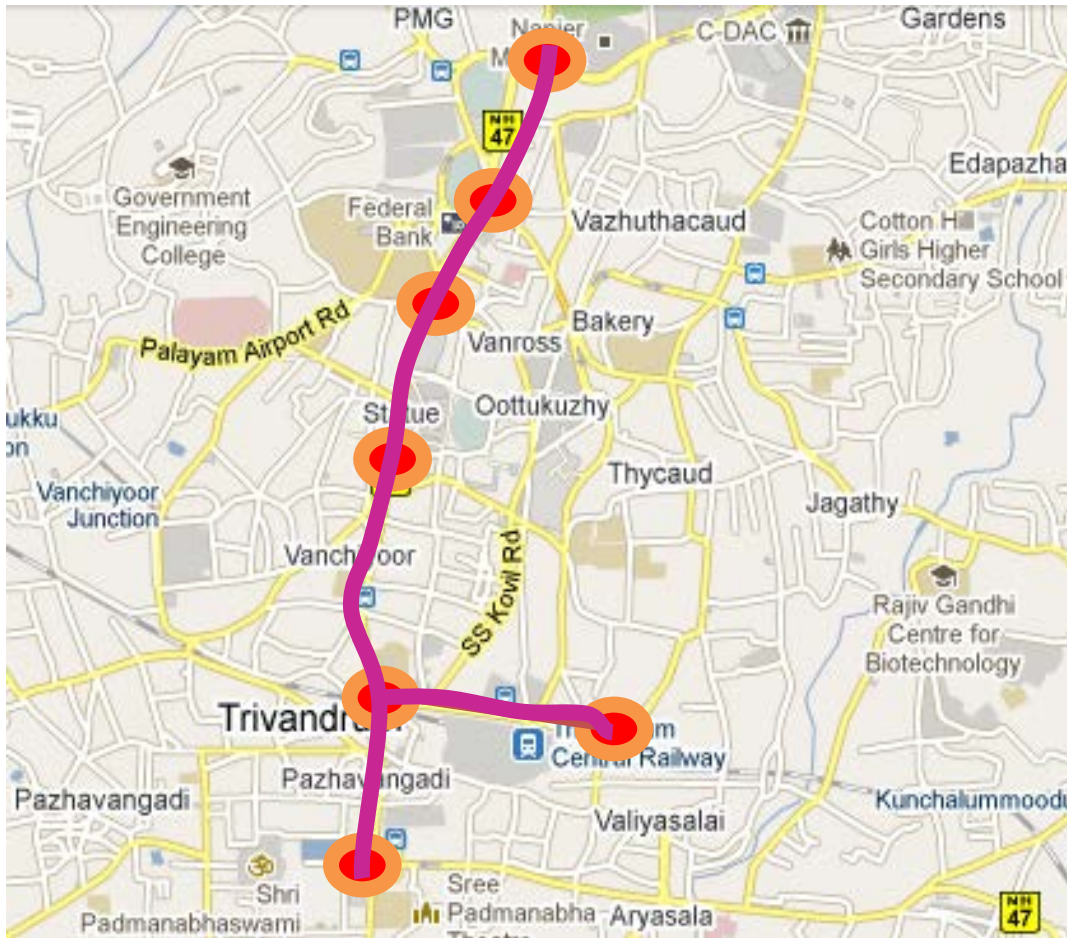
- i. At - grade pedestrian facilities*
- ii. Grade separated facilities*

At - grade pedestrian facilities include zebra crossing, pelican crossing, and provision of footpath and pedestrian streets. At - grade zebra crossing has been proposed for places like Over Bridge junction, Pazhavangadi junction, Statue, East Fort and Thampanoor Bus Stand area.

In school zones, where platoon-type movement of pedestrians take place during school timings, Pelican crossings have been recommended.

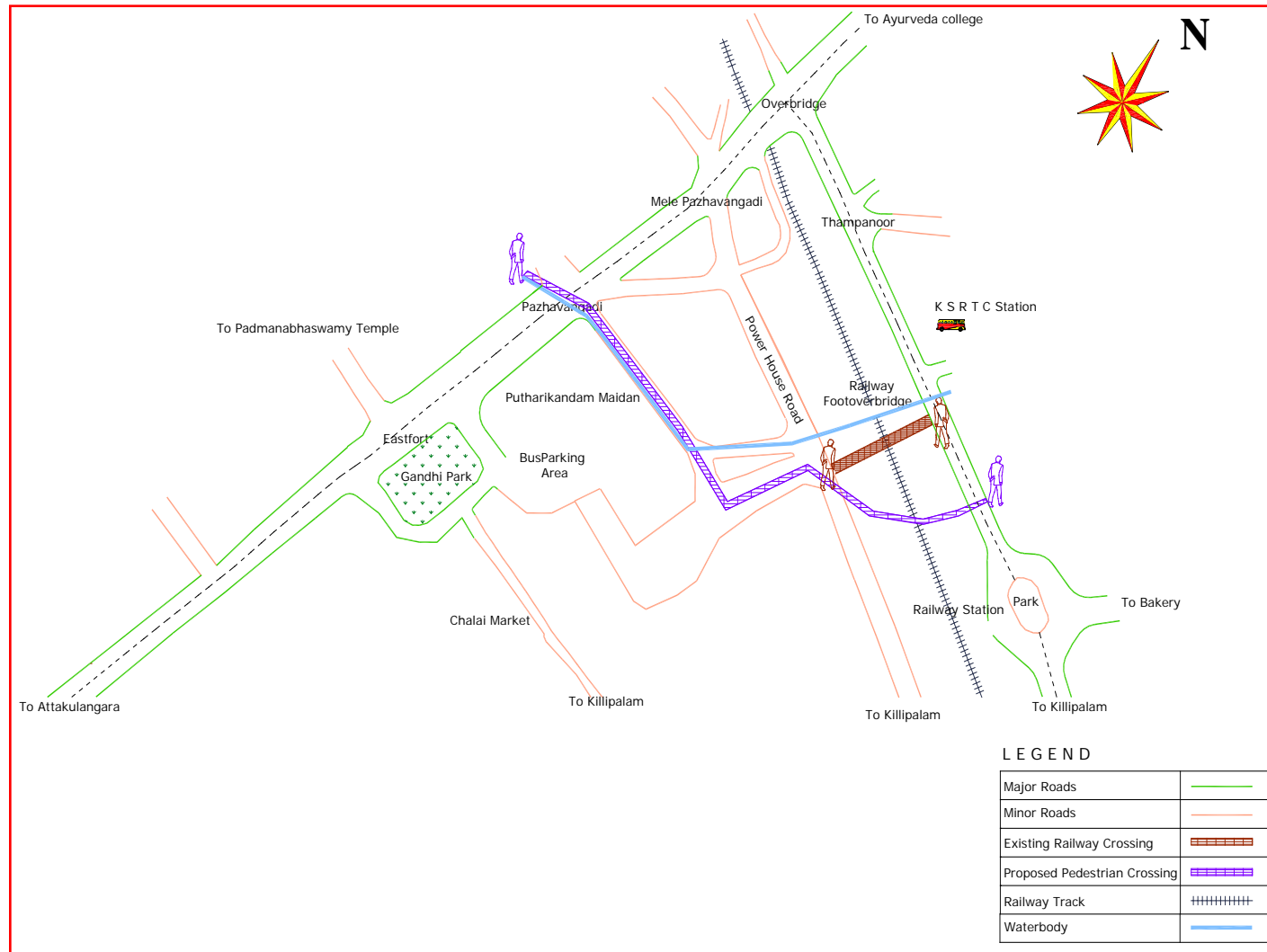
Allowing vehicles in a commercial street like Chalai Bazar where there is heavy pedestrian traffic is dangerous. In order to ensure safety of pedestrians such streets can be made as pedestrian streets.

Grade separated facilities are necessary at those places where pedestrian crossing pose a serious threat to vehicular movement. Pedestrian foot bridges are recommended at East Fort area and Palayam Market road. Similarly, pedestrian subways are proposed at Statue, Medical College junction and Thampanoor area.



**Figure 1: Study Area in Thiruvananthapuram City**

As part of grade-separated pedestrian facility, skywalks connecting Thampanoor Railway station to East fort, and Thampanoor - Statue have been recommended (**Figure 2**). Walking on integrated skywalks will reduce the travel time and also attract people using private vehicles to divert to this mode. The skywalks would also act as foot over bridge for crossing the roadway.



**Figure 2: Proposed Route of Skywalk Facility between Thampanoor and East Fort in Thiruvananthapuram City**



### **3. *Transport Infrastructure Development Plan for Harippad Town in Kerala***

To streamline the traffic movement and also to augment the traffic and transportation facilities to cater to the needs of increasing traffic in Harippad, NATPAC prepared a Transport Infrastructure Development Plan for Harippad Town in Kerala. NATPAC identified shortcomings in the existing road system. Detailed engineering surveys were carried out for selected locations and prepared improvement proposals. The base line data contains evaluation of transport network in the study area, volume and capacity utilization on major roads, parking demand and pedestrian traffic. Projection of traffic on major roads has been carried out for various horizon years considering the growth potentials of the study area.

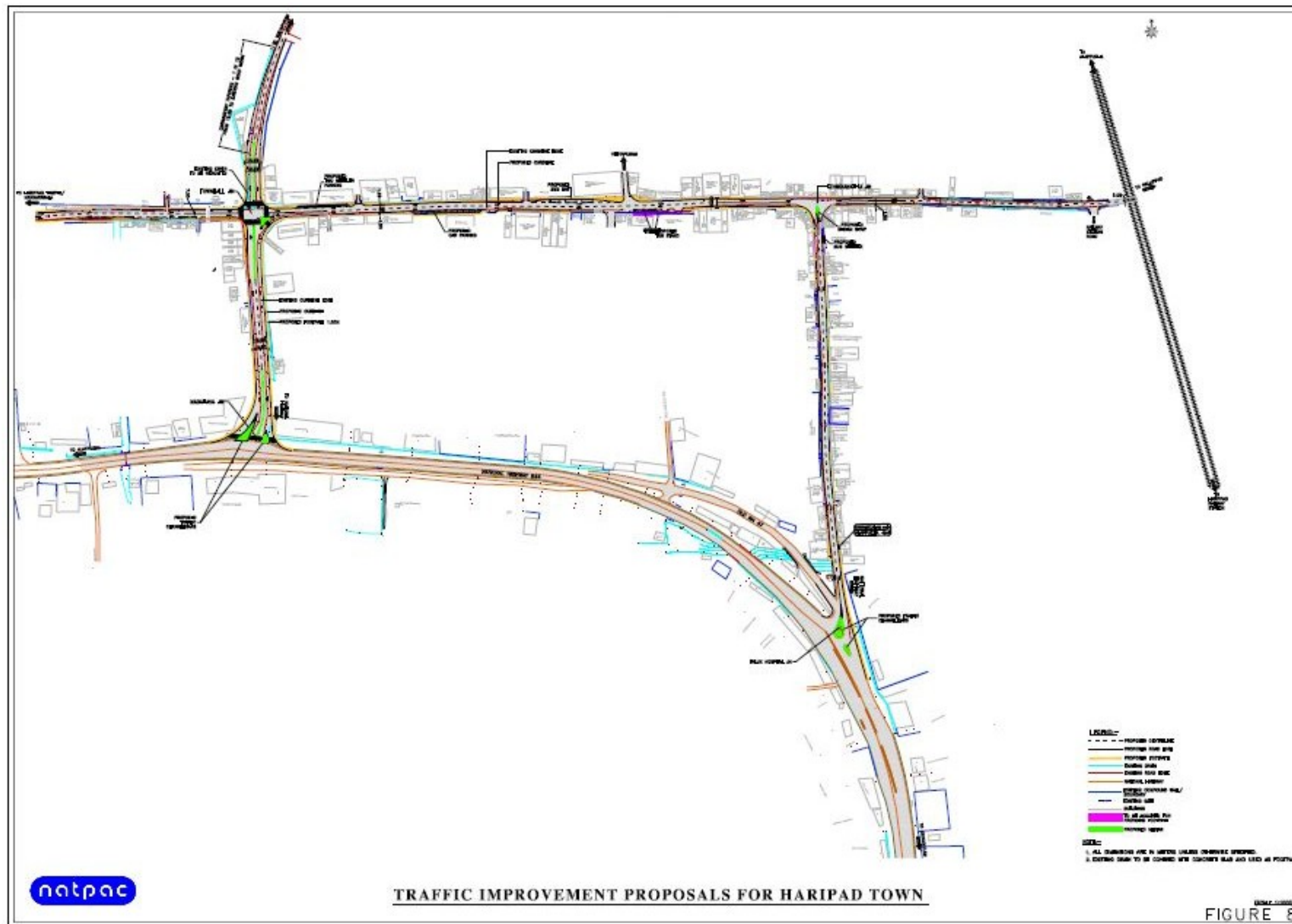
Improvement proposals are suggested in two stages namely:

- i) *Short-term traffic improvements and*
- ii) *Long-term transport development*

Short-term measures are those schemes that involve no land acquisition which could easily be implemented in the next six months to one year period. Long-term schemes are those that are essentially required to meet the anticipated traffic demand for the next 10 - 20 years period.

An implementation plan for taking up the short-term and long-term developments of the town has been proposed. Estimated cost for implementing short-term and long-term development schemes work out to nearly Rs.16.0 crores. **Figure 3** shows some of the proposals suggested for the town.

Early implementation of short-term improvement schemes would reduce the traffic congestion and ensure safe and orderly movement of traffic on the existing road system. A phased implementation of long-term development has been suggested as per the priority fixed by the local people through public participation programme. Implementation of long-term Transport Development Plan would bring a better level of service and qualitative improvement in traffic and transportation system of Harippad town. It will also trigger in transforming the region into a major Agro based Trading Centre cum Religious Cluster of the State.



### Figure 3: Traffic Improvement Plan for Harippad Town in Kerala State

#### ***4. Integration of Public Transport - A Case Study of Thiruvananthapuram City***

The public transport services provided by State transport undertakings and private operators are seldom coordinated, causing hardships to travellers and regular commuters. Although it is possible to coordinate the transfer of passengers from one mode of public transport to the other, a holistic attempt has not been made to integrate public transport services through optimum utilization of available infrastructure and services.

NATPAC developed a methodology for optimizing the public transport services by providing effective coordination for transfer of passengers arriving by trains, to reach their destination in and around the City of Thiruvananthapuram. From the traffic survey conducted at Thiruvananthapuram Central Railway Station, the general trend of arrival of passengers during different hours of the day was found. It was found that the peak hours of travel were 6-8 hrs, 9-12 hrs, and 19-20 hrs, which contributed to 43% of the total passenger arrivals.

The optimum frequency of buses along each sub route was computed using a non-linear optimization model implemented using Solver in Microsoft Excel. The optimum frequency of buses was derived using the model for different routes and during different hours of day. It was observed that travel demand and the optimum frequency to meet the demand were different during different hours. Accordingly, the frequencies should be changed based on the demand rather than following a fixed schedule throughout the day. It was also found that the user cost and operator cost involved could be minimized by changing the frequency of buses operating along that sub-route. The analysis conducted proved that the bus-trips could be curtailed or diverted when the number of passengers along any route is below the specified limits. Optimization was done for all the three sub-routes of each route and the savings obtained when frequency of buses operating along the sub-routes is varied.

The optimization carried for Route 1 indicated that the average load factor at peak, mid-peak, and off-peak hours were found to be 0.857, 0.700, and 0.650 respectively, which were found to be within the operating load-factor constraints. Similarly, the optimization carried for Route 2

indicated that the average load factor at peak, mid-peak, and off-peak hours were found to be between 0.50 and 0.70 which lies within the operating load-factor constraints, and that for Route 3 indicated that the average load factor at peak, mid-peak, and off-peak hours were found to be between 0.54 and 0.650 which also lies within the operating load-factor constraints.

Sensitivity analyses were done to study the influence of changes in the frequency of buses on user cost and operator cost. The variations in the waiting time of passengers user cost involved for unit passenger when different frequencies of buses are operating is computed. The changes are computed in terms of waiting time for passengers.

- It was observed from the sensitivity analysis of Route 1 that when the bus-trips were reduced by unity from the optimum frequency, the total cost of waiting time increased by 2167. Also, when the bus-trips were increased by unity from the optimum frequency, the total cost of waiting time reduced by 1850.
- It was observed that the savings in total cost of waiting time showed a gradual decrease as the frequency of buses operating along the route was increased.
- Also the operator cost was found to increase linearly as the frequency of buses operating along the route was increased.
- The sensitivity analyses of Route 2 showed that when the bus-trips were reduced by unity from the optimum frequency, the total cost of waiting time increased by 805. Also, when the bus-trips were increased by unity from the optimum frequency, the total cost of waiting time reduced by 687.
- The sensitivity analyses of Route 3 indicated that when the bus-trips were reduced by unity from the optimum frequency, the total cost of waiting time increased by 504. Also, when the bus-trips were increased by unity from the optimum frequency, the total cost of waiting time reduced by 366.



### **5. Price Index for Stage Carriage Operations in Kerala**

In Kerala, both KSRTC and private operators provide bus transport services. As per the present Motor Vehicle Rule, the State Government fixes the fare rate and structure for stage carriages and other public transport such as taxis and autos from time to time. The last comprehensive fare revision for stage carriages was implemented in March 2010. There is no scientific data to assess the impact of fare revision and profitability of operation of the private stage carriages. The major objectives of the study were to compute a Price Index for Stage Carriage Operations (PISCO) for understanding the periodical movement of prices of vehicle operating cost and other inputs for different types of stage carriage operations and to determine the fare structure of various categories of services of stage carriages and establish unit operating cost of various types of services.

National Transportation Planning and Research Centre (NATPAC) brought out PISCO in Kerala State based on limited field studies conducted in 1998 on private bus operations in Kerala State. The index compares the movement of prices of operating components for any base year with current year. The index was revised based on Cost Table approach in 2005.

The PISCO index was updated with changed base of September, 2011 to December, 2011 price level. In this approach the relative share of weights of major variables and components has been retained as such and only changes in prices were noted. It is noted that there were no major price changes in cost inputs between September, 2011 and December, 2011. Hence the percentage changes observed in Whole Sale Price Index and Consumer Price Index during the period have been used to update prices of materials and labour respectively between the two periods.

The updated PISCO with changed base and prices as on December, 2011 is given in **Table 1**. The PISCO index marginally increased from 100 in September, 2011 to 101.10 in December, 2011.

**Table 1**  
**Updation of Price Index for Stage Carriage Operation (PISCO) as on December, 2011 Prices**

Items	Components	Quantity (Q)	Price (P) Sep.2011	Value (QxP) Sep.2011	Price (P) Dec.2011	Value (QxP) Dec.2011
Fuel	Diesel	0.285522	44.55	12.72	44.55	12.72
Lubricants	Engine oil	0.002244	197.4	0.4429	197.4	0.4429
Tyre	Average for MRF 900-20 & 1000-20	4.61E-05	14450	0.666	14450	0.666
Engine system	Piston set BS2 Henoi engine (Leyland)	1.84E-05	10505	0.193	10623	0.1951738
Fuel injection	Fuel injector pipe kit	1.72E-05	1489	0.0256	1506	0.0258883
Exhaust	Hybrid silensor	3.63E-06	3331	0.0121	3369	0.0122363
Electrical	Battery cable unit	1.91E-05	5161	0.09839	5219	0.0994982
Clutch	Clutch disc	2.77E-05	3166	0.0877	3202	0.0886878
Gear box	Pinion bearing	3.07E-05	1683	0.0517	1702	0.0522823
Propellor shaft	Centre bearing housing	5.55E-05	3570	0.1982	3610	0.2004323
Housing system	Crown & pinion set	9.96E-06	8839	0.088	8939	0.0889912
Break system	Break lining 6'F1 Std (4 items)	2.64E-05	8408	0.2221	8503	0.2246015
Body & frames	Bumbers	0.00039	300	0.117	303	0.1183178
Steering system	Catridge assembly	7.79E-06	3400	0.0265	3438	0.0267985
Suspension system	Tapper roller bearing	0.000187	2040	0.3813	2063	0.3855946
Sub total				15.33049		15.347403
Labour	Labour cost per hour	0.005142	250	1.2856	257	1.3224553
Crew	Crew cost per day	0.014545	500	7.2727	514	7.4811922
<b>Grand Total</b>				<b>23.88879</b>		<b>24.15105</b>
<b>PISCO index</b>				<b>Base=100</b>		<b>101.09784</b>

## Findings

- As per the cost model, the fixed cost of operation is estimated as ₹ 2.78 per pass. km and the variable cost are estimated as ₹ 0.54 per pass. km. Thus the total fare rate for a distance of 5 km is found to be ₹ 5.50.
- It is recommended that a minimum fare of ₹ 7.00 can be fixed for fast services and ₹10.00 for express services.
- The PISCO index value of 23.89 was used to update the new index for December, 2011.
- Average student load /trip are found to be 6.29 and the General Passenger load /trip are 30.04, as per the survey.

## **6. Traffic Improvement Plan for Kottayam Town**

To find out a solution to reduce the heavy traffic congestion in Kottayam Town, NATPAC proposed a traffic improvement plan for Kottayam town. The study aimed at arriving the possibility of one way system along the major/minor roads, redesigning of signal timing at Manorama junction, redesigning of Seematti Rotary, identification of on-street and off-street parking lots, installation of destination sign boards outside the town area, construction of by-passes for the town and utilization of Old MC Road.

The methodology adopted for the study consisted of quick survey to assess the problems and to suggest suitable remedial measures.

Based on the field survey and analysis, the following suggestions in traffic circulation have been recommended for Kottayam town.

- Converting two lane streets to one way road at:
 

1. MC Road from Hotel Aida to Nagampadom	-	Towards North
2. YMCA Road from Seematti round to Central	-	Towards South
3. TB Road from Central to Hotel Aida	-	Towards South
4. ML Road from Market junction to Kozhichanda	-	Towards South
5. Post Office Road from Temple junction to Seematti Round	-	Towards North
- Redesigning of signal timing
  - Presently, there are two automatic traffic signals operated in Kottayam town, namely at - i) Manorama junction and ii) BCM College (Pedestrian crossing). It is suggested that the signal at Manorama junction may be dispensed with.
- Redesigning of Seematti Rotary island
- Identification of on-street and off-street parking lots in selected road sections, viz.
  - i. *Sasthri Road*
  - ii. *Nagampadom* Municipal ground
  - iii. *M G Road* for heavy vehicles
  - iv. *Old East Police Station* area
  - v. Vacant area near *MD Seminary*
  - vi. Private lands in central area to be developed as Pay and Park facilities.
- Installation of destination sign boards

➤ Utilization of Old MC Road

- Two sections of the Old MC road:
  - From Choottuveli to Kumaranalloor - Section (i) : Along the western side of the MC road. The major problem - Level cross at Kumaranalloor.
  - From Samkranthi to Ettumanoor - Section (ii) : Along the eastern side of the MC road. The major problem - Vilakkambalam temple at Samkranthi

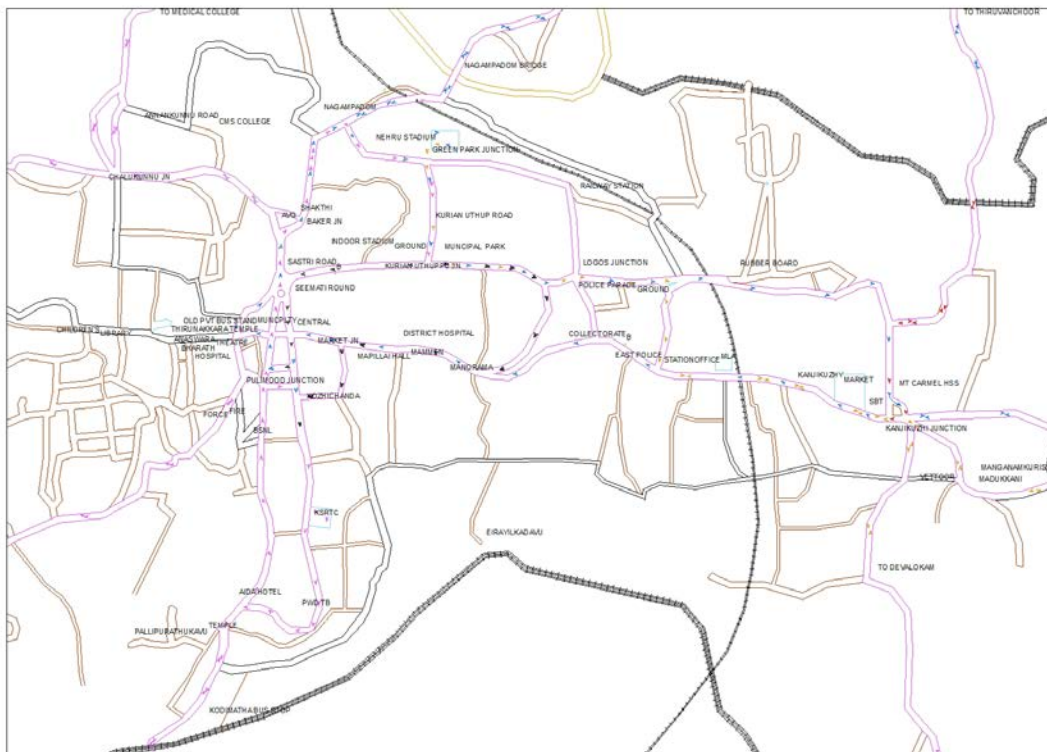
In a long term perspective, the bus transport services to be operated from 4 operating stations, along with the existing KSRTC depot. There are parallel roads existing to almost all the major roads in the town area. All these roads are poorly maintained and also have narrow width to cater to movement of vehicles. If proper maintenance is given, some of the roads may be made motorable for light passenger vehicles.

**Figure 4** shows the conceptual plan proposed for Manorama junction area and the proposed bus route plan for Kottayam Town is shown in **Figure 5**. Long term road development plan for Kottayam town is formulated which consists of the following important schemes.

- A river bank road parallel to Kodur river starting from Kodimatha and ending at Puthupalli via Erayilkadavu & Kalathilkadavu
- The above road may be extended in the Western direction to reach Kumarakom
- The Eranjal scheme to connect between Logos and Kalathipadi (bypass to Kanjikuzhy)
- Completion of Vattamoodu bridge
- River bank road connecting Railway Goods Yard and Eranjal
- The Old MC Road may be developed as a major arterial once an ROB at Kumaranalloor is completed and the Samkranthi junction is developed
- Inner Ring Road
  - Kodimatha – Thiruvathukkal – Kurissupally – Arthootty – Chalukunnu – Annankunnu Road – Nagampadom – Railway Station - Logos – Rubber Board – Kanjikuzhy - Vettoor junction – Muttambalam – Erayilkadavu - ML Road – MG Road – Kodimatha
- Outer Ring Road
  - Samkranthi junction – Plakkipadi - Moscow Junction - Manganankudi - Parakkalkadavu - Paruthampara - Pannimattom - Nattakom - Kottayam Port - Pathinanjil Kadavu - Illikkal - Alummoodu - Kummanam - Elamkavu - Kudamaloor - Medical College - Gandhi Nagar



**Figure 4: Proposed Conceptual Plan of Manorama Junction Area**



**Figure 5: Proposed Bus Route Plan for Kottayam Town**

## **7. Role of IPT Modes in Medium Size City of Kerala - Case Study of Kozhikode City**

Intermediate Public Transport (IPT) Modes like taxi cabs and auto rickshaws play a supplementary as well as complementary role with public transport systems in Kerala. A study on the role of IPT modes has been carried out for Kozhikode city. The study area covers the corporation area of Kozhikode which has nearly 4000 autos and 800 taxis in the city.

The study aimed at analyzing the role, growth and availability of IPT vehicles in the urban context and to study the socio-economic aspects of the runners of the system. The methodology adopted for the study consisted of data collection through primary and secondary sources including questionnaire and interview method, and city level traffic studies.

### *Requirement of IPTs in the City*

**Table 2** presents the growth trend of population and IPT modes in the city. Based on these available statistics a growth trend can be discerned and futuristic requirement of auto rickshaws and taxis can be estimated by fitting a regression curve.

**Table 2: Growth of Population and IPT modes in Kozhikode city**

Sl. No.	Year	Population	Taxis	Auto rickshaws
1	2001	436000	444	1794
2	2005	453440	588	2715
3	2006	471580	649	2897
4	2007	490440	707	3081
5	2008	510060	745	3438
6	2009	530462	792	3692
7	2010	551680	820	4087

The equations below was fitted to time series data and a high degree of correlation was also found viz.;

For taxis the coefficient of correlation was:  $R = 0.96$  and for auto rickshaws the coefficient of correlation was:  $R = 0.97$ .

The regression equation for Taxis was found as:  $Y = -460.12 + 2.35 X$

While, the regression for auto rickshaws was found as:  $Y = -3683.27 + 13.98 X$

Accordingly the required number of IPT vehicles based on growth of population was estimated as shown in **Table 3**.

**Table 3: Estimation of future demand of Autos and Taxis in Kozhikode City**

<b>Sl. No.</b>	<b>Year</b>	<b>Population</b>	<b>Taxis</b>	<b>Auto rickshaws</b>
1	2011	668000	1110	5655
2	2012	694720	1173	6029
3	2013	722509	1238	6417
4	2014	751409	1306	6822
5	2015	781465	1376	7242
6	2016	812723	1450	7679
7	2017	845232	1526	8133
8	2018	879041	1606	8606
9	2019	914204	1688	9097
10	2020	950772	1774	9609

It has been inferred that the population of the city will increase from 5.52 lakhs in 2010 to 9.5 lakhs by 2020. The growth of population is expected to be 72% for the next 10 years. Autorickshaws would increase by 2.35 folds and taxis would grow by 2.15 times in the next 10 years in the city. Adequate parking area for taxis and on-street parking space for auto rickshaws need to be created to facilitate their operation in the city.



## 8. Gender Issues of Mobility of Working Women

Kerala boasts of high literacy rate among women, and the share of working women population is very high compared to other States. Traveling women face problems that are in several respects unique, from those faced by men. When it comes to mobility, women face several problems, both physical and social compared to men folks. The study aimed at understanding the mobility levels of working women and to compare with non-working women and to suggest policies to improve the mobility aspects of working women.

The methodology adopted for the study consisted of primary surveys in institutions and households with questionnaire to elicit their socio - economic characteristics, and mobility pattern and issues, case studies on selected cross sections and through personal interviews. Travel characteristics like Origin - Destination, travel time, travel cost, purpose and frequency of trips, occupational status and problems, if any, during the previous trips were collected from the commuters and from women's hostel.

**Table 4**

**Constraints faced by working women while travelling in bus**

Problems highlighted by women include - long waiting time for buses especially during late evening hours, long distance to bus stops from

Sl. No.	Problems	% of commuters reporting
1	Foot board not comfortable	17
2	Improper support to hold on	26
3	Less stoppage time at bus stop	32
4	Over speed	25
Total		100

residence, non-availability of transportation in time, crowded buses, frequent cancellation of buses, lack of safety at bus stops and in buses etc. Major problems associated with mobility of women are shown in **Table 4**.



*Plate 1 (a)*



*Plate 1 (b)*

*Difficulties faced by women while using Public Transport*

## 9. *Widening, Strengthening and Extension of Existing Tippu Sultan Road in Coastal Region of North Kerala*

The transportation system in the state of Kerala is now facing much challenges and the present traffic volume is higher than the available road capacity even in the arterial road stretches resulting in traffic conflicts and accidents. The Government of Kerala intends to provide the much needed connectivity to the Malabar region especially along the coastal belt. The coastal belt of Ponnani - Vengalam region in Malabar mostly depends on the existing Tippu Sultan road (**Figure 6**) for connection to the hinterland. This road was constructed centuries ago and does not meet the required standards and also not well-maintained.

Roads and Bridges Development Corporation, Kerala (RBDCK) has been authorised by the Govt. of Kerala to improve the road connectivity to the region. RBDCK has initiated several studies to improve the Tippu Sultan Road. A physical survey was carried out by RITES in 2000 and a new coastal road alignment between Ponnani and Vengalam was proposed. At the request of RBDCK, NATPAC evaluated various options to improve the connectivity to the region.



**Figure 6: Alignment of proposed coastal road between Ponnani and Francis Road**

NATPAC technically evaluated the alignments suggested by RITES and KITCO. The existing land use and traffic demand were also analysed and suggested a most feasible alignment for constructing 4- lane road from Ponnani to Francis Road Junction in Kozhikode. It is proved beyond doubt that the new coastal highway between Ponnani and Vengalam in Malabar region will go a long way for the overall economic development of the State.

### ***10. Pre-feasibility Study for Constructing A Green-field Highway between Nedumbassery and Vytilla in Kochi Region***

Kochi, the industrial capital of Kerala, is a major port on the West Coast of India. Although Kochi is well connected to other regions with rail, road and air network, the quality of transport infrastructure and mobility standards leaves much to be desired.

At the instance of Kochi Metro Rail Ltd, NATPAC carried out a pre-feasibility study of constructing a new Bypass for Kochi city entirely on a new Green-field alignment. The new bypass is thought of between Kundannur and Athani connecting the Nedumbassery International Air port and Vytilla Hub.

NATPAC assessed the existing and projected traffic situation in Kochi and adjoining regions and explored the scope for constructing a new Bypass between Kundannur and Athani along NH - 47 connecting the Nedumbassery International Air Port and Vytilla Transport Hub entirely on a Green-field alignment. The Centre also carried out necessary techno-economic evaluation for selecting the most feasible alignment for the Green-field road.

#### ***Findings***

From the preliminary ground surveys, four alignment options were found out and analyzed (**Table 5**). The Economic Internal Rate of Return (EIRR) is found to be 22.3% for alignment option IV, 20.55% for alignment option III, 12.2% for alignment option II, and 18.8% for the alignment option I. However, the alignment option IV has the minimum negative economic impacts as compared to the other three options. It is recommended that alignment option IV may be adopted for the construction of the Greenfield road between Vytilla and Nedumbassery.

**Table 5**  
**Comparison Analysis of Green field Alignment Options**

Features		Option I	Option II	Option III	Option IV
Length (km)		23.915km	24.54km	21.755km	27.6km
Proposed ROW		60/45m	60/45m	60/45m	60/45m
Design speed(kmph)		80-100	65-100	100	80-100
No. of Culverts		104	109	95	126
Total Land to be Acquired	ROW-45m	104.78Ha	106.36Ha	95.31Ha	124.20Ha
	ROW-60m	139.71Ha	141.81Ha	127.08Ha	165.60Ha
No. of Structures Affected (Nos)	ROW-45m	238	408	673	346
	ROW-60m	385	512	835	414
Underpass		1	2	1	1
Overpasses/Flyover		6 (min. 2225m span)	6 (min.3400m span)	7 (min.3380m span)	8 (min.2025m span)
Bridges		1-major & 2-minor	1-major & 1-minor	2 minor	3 ( 1-major & 2 –minor)
Total cost in crores	ROW-45m	1715	1879	2085	2830
	ROW-60m	2166	2287.5	2597	3454
EIRR (%)		18.80	12.20	20.55	22.30

## 11. Use of Geotextiles in Road Construction

Evolving new construction material to suit various traffic conditions and climatic regions leading to economic and safe design have always been a challenging task in pavement construction. Use of coir geotextiles have been found useful to increase the strength of the subgrade and capacity of pavement to carry more traffic/loads, reduces fatigue, cracking, amount of ruts and thus increase the life of pavements in weak subgrades and resulted in improved performance for different soil conditions.

As per IRC: 37-2001 the strength of sub-grade soil expressed in terms of CBR (California Bearing Ratio) should have a minimum of 2 %. Weak soil having very low CBR value could be reinforced using geo-textiles. Laboratory experiments are conducted on weak soil using natural geotextiles like coir mattings with different mesh size (half inch and one inch), panama weave (commercial name given by manufacturer) and also polymeric geotextile like High Density Poly Ethylene (HDPE). The soil properties such as Optimum Moisture Content (OMC), Maximum Dry Density (MDD) and soaked CBR were found out as per current Bureau of Indian Standard specifications.

### Findings

**Table 6**  
**Properties of Soil A**

Test Results on Soil A is given in **Table 6**.

Property	Soil A
Dry density (gm/cc)	1.335
OMC (%)	28.0
Specific gravity	2.2
Plasticity index	13.73
Unified soil classification	SC
CBR (%)	4.7

Weak clayey soil collected from Akkulam was used for the study. The OMC and dry density test results on clayey soil with different fibre content indicates that the maximum dry density decreases gradually with increase in the fibre content, which is due to lower density of fibre than the soil particles. The change in OMC was quite marginal. **Table 7** gives the comparison of the optimum moisture content and maximum dry density values of soil A in different combinations of clay soil and coir fibre.

**Table 7**  
**Comparison of OMC & MDD values of Soil A**

Particulars (proportion of clay and coir)	Optimum Moisture Content (%)	Maximum Dry Density (gm/cc)
Clay alone	28.00	1.335
Clay + 0.5% coir fibre	29.50	1.360
Clay + 1.0% coir fibre	30.50	1.350
Clay + 1.5% coir fibre	31.50	1.300
Clay + 2.0% coir fibre	34.50	1.250
Clay + 2.5% coir fibre	34.50	1.275
Clay + 3.0% coir fibre	32.00	1.26

**Table 8**  
**Comparison of CBR Values of Soil A**

The CBR tests were conducted on unreinforced soil and soil reinforced with coir fibre and also in soil reinforced with coir mattings. **Table 8** gives the comparison of the CBR values of soil A in different combinations of clay soil and coir fibre.

Particulars (proportion of clay and coir)	CBR (%)
Clay alone	4.7
Clay + 0.5% coir fibre	8.2
Clay + 1.0% coir fibre	9.5
Clay + 1.5% coir fibre	10.3
Clay + 2.0% coir fibre	11.5
Clay + 2.5% coir fibre	12.4
Clay + 3.0% coir fibre	13.2

*Test Results on Soil B is given in Table 9.*

**Table 9**  
**Properties of Soil B**

Weak clayey soil collected from the subgrade of a road at Kulashekharam was used for the study.

Property	Soil B
Dry density (gm/cc)	1.895
OMC (%)	15.2
Specific gravity	2.2
Plasticity index	14.05
Unified soil classification	SC
CBR (%)	2.9

**Table 10** gives the comparison of improved values of CBR of the soil with the use of different geo-textiles.



**Table 10**  
**Comparison of CBR Values of Soil B**

Particulars of Geo-textile used		CBR (%)
Coir mesh matting (mesh size – one inch)	at half height of specimen	7
	at one-third and two-third height	10
Coir mesh matting (mesh size - half inch)	at half height of specimen	7.9
	at one-third and two-third height	10.2
Panama weave	at half height of specimen	17.2
	at one-third and two-third height	19.2
HDPE	at half height of specimen	19
	at one-third and two-third height	25.4



*Plate 2*  
*Coir matting mesh –half inch size*



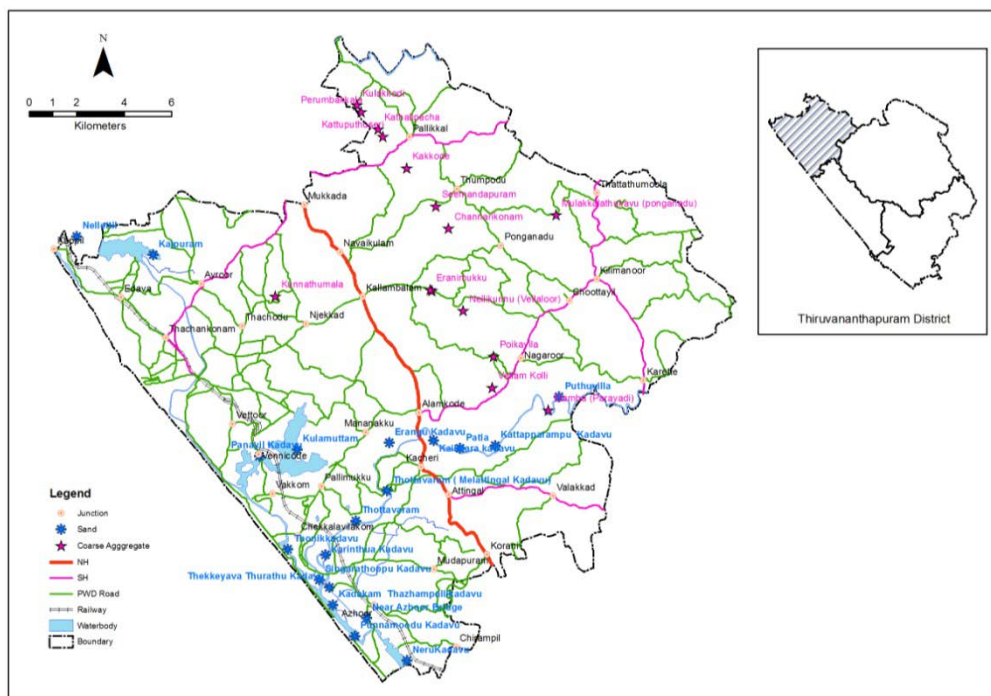
*Plate 3*  
*Coir matting –Panama Weave*

By providing geo-textiles the CBR value of weaker sub grades could be enhanced. Thereby, the pavement layer thickness can be considerably reduced and this facilitates the construction of roads in poor sub-grade soil areas.



## 12. Resource Mapping of Road Construction Materials in Kerala – A Case Study of Thiruvananthapuram District

Road construction materials are precious resources as the quantum of highway construction has been on the rise. For rate analysis and selection of construction materials, data like lead charges, and the quantum of materials available in a quarry are essential in formulating any detailed project reports. Mapping of the resource locations with its quantity and quality of materials available can be geo referenced and put in a GIS platform. This will help in identifying the quarry to be selected by choosing the optimum lead charges to a primary road network and availability of sufficient quantities of various construction materials and their engineering properties. During the year 2011-12, NATPAC studied the quarries of Chirayinkil Taluk of Thiruvananthapuram district (**Figure 7**).



**Figure 7: Map of the Study Area**

*The major objectives are:*

- Conduct inventory details of various quarries available.
- Assess the quantum of various construction materials such as coarse aggregate, fine aggregate, stone dust etc available in each quarry.
- Assess the engineering properties of various road construction materials.

- Project the digitized maps into geo referenced maps and attach attributes such as the lead distance, lead charges, quantum of materials and their properties.

## *Findings*

Various tests were conducted on the coarse aggregates collected from various quarries located in Chirayankil and Neyyattinkara taluks in Trivandrum district. The laboratory tests on the samples collected from the Nedumangadu taluk is in progress. The results of the laboratory tests conducted on the coarse aggregates and fine aggregates from Chirayankil Taluk are summarized in **Tables 11 & 12** respectively.

Various tests were conducted on the fine aggregates collected from 10 places. Sieve analysis was done on the samples collected to determine the gradation of the fine aggregate samples and the grading curves were plotted. The 10 samples taken are of poorly graded sand (SP). The fineness modulus of the 8 fine aggregate samples (i.e. 80% of tested sand samples) is well below the limiting value of 3.5 and hence they are suitable for satisfactory concrete works. Rest of the two samples (i.e. 20%) has got fineness modulus (FM) value slightly greater than 3.5 and hence in this perspective they are less desirable for satisfactory concrete works. The silt content of two samples (i.e. 20%) is greater than 3% and hence it is not suitable for satisfactory concrete works. Rest of the eight samples (i.e. 80%) has silt content values in the desired range and hence they are suitable for good concrete works. The bulk density values of almost all the samples are in the desired range of 1.6 to 1.7 g/cc. Percentage of maximum bulking is also found out for all the fine aggregate samples and the results obtained could be employed for correcting the volume of fine aggregates to be used for specific purposes.

**Table 11**  
**Summary of Results of Tests on Coarse Aggregates from Chirayankil Taluk in Thiruvananthapuram District**

Sl No.	Sample No	FI %	EI %	CI %	AIV %	Sp.gr	Water absorption %	Bulk density kg/l	% of voids	Abrasion value %
1	C-1	34.54	15.31	49.85	*	2.63	0.11	1.64	37.03	16.60
2	C-2	20.18	29.08	49.26	*	2.68	0.15	1.51	43.61	15.80
3	C-3	25.02	29.50	54.52	*	2.71	0.13	1.55	31.37	20.20
4	C-4	6.93	22.24	29.18	27.97	2.35	0.06	1.63	30.60	34.80
5	C-5A	5.39	43.85	49.23	26.49	2.61	0.25	1.62	37.88	32.00
6	C-5B	*	*	*	*	*	*	1.53	*	40.40
7	C-5C	2.60	17.8	20.41	4.29	2.66	0.24	1.55	41.66	32.00
8	C-6	24.53	35.40	59.93	29.01	2.60	0.35	1.62	37.60	31.20
9	C-6B	*	*	*	22.75	2.70	0.34	1.6	40.72	36.80
10	C-7A	*	*	*	27.47	2.55	0.72	1.59	37.88	54.80
11	C-7B	4.42	55.89	60.31	39.35	2.67	0.20	1.57	41.03	46.40
12	C-8	9.74	26.17	35.91	30.56	2.69	0.40	1.61	40.26	45.60
13	C-8B	31.60	39.33	70.93	*	2.61	0.15	1.44	44.93	26.40
14	C-9	8.36	56.93	65.29	40.11	2.76	0.51	1.59	42.49	34.00
15	C-9B	30.55	20.34	50.89	*	2.75	0.20	1.51	45.25	23.60
16	C-10	11.20	21.98	33.18	*	2.87	0.25	1.58	44.98	17.60
17	C-11A	25.50	18.02	43.52	*	2.84	0.08	1.53	45.97	18.20
18	C-11B	10.83	36.26	47.09	43.00	2.80	0.27	1.61	42.29	24.80
19	C-12A	24.11	24.14	48.24	25.66	2.65	0.29	1.65	37.88	24.80
20	C-12B	25.24	29.94	55.18	*	2.79	0.14	1.53	45.28	23.40
21	C-13	32.28	8.90	41.18	*	2.49	0.68	1.54	38.22	30.60
22	C-14B	32.20	22.26	54.46	*	2.71	0.22	1.44	46.85	21.60
23	C-14A	26.74	49.21	75.95	27.56	2.67	0.61	1.52	43.13	32.40
24	C-15A	4.60	29.02	33.62	46.07	2.76	0.36	1.63	41.02	32.40
25	C-15B	*	*	*	*	2.44	0.89	1.58	16.13	41.60
26	C-15C	4.60	29.02	33.62	37.64	2.76	0.36	1.63	41.02	32.40
27	C-16	5.69	22.60	28.29	24.77	2.67	0.64	1.62	39.32	26.80
28	C-16B	*	*	*	*	2.52	0.20	1.59	37.04	28.00
29	C-17A	1.76	31.53	33.29	33.10	2.72	0.54	1.59	41.41	46.00
30	C-17B	4.86	25.26	30.12	33.60	2.70	0.19	1.73	35.85	28.80
31	C-17C	*	*	*	*	2.57	0.30	1.60	37.83	37.20
32	C-18	30.51	31.71	62.23	*	2.66	0.14	1.61	39.55	19.40

(FI - Flakiness Index, EI - Elongation Index, CI - Combined Index, Sp.gr - Specific Gravity, AIV - Aggregate Impact Value,  
\* Required gradation was not available)

**Table 12**  
**Summary of Results of Tests on Fine Aggregates from Chirayankil Taluk in Thiruvananthapuram District**

Sl. No.	S&C	FS	MS	CS	SC	FM	Silt content	Bulk density	Moisture content at Max.Bulking	% of max. bulking	Remarks
1	0.9	33.5	59.6	5	SP	3.2	2.48	1.5	8.4	25	1)Silt content should not be more than 3% for uncrushed material(for use in concrete)
2	0.1	22.5	69.4	6.4	SP	3.7	1.56	1.6	6.8	54	
3	0.4	26.9	67.7	3.9	SP	3.4	1.64	1.6	9.2	43.5	
4	10.9	60.1	26.5	1.8	SP	1.8	3.6	1.5	11.8	34.5	2)The limiting value for bulk density is 1.6 to 1.7 kg/l
5	0.3	21.6	77.1	0.8	SP	3.5	0.52	1.7	6.2	46	
6	0.3	51.4	39.4	8	SP	2.6	0.84	1.7	12	45	
7	0.4	50.2	48.6	0.7	SP	2.5	0.40	1.4	8	68	3) A sand having a fineness modulus more than 3.5 will be unsuitable for making satisfactory concrete.
8	1.0	49.3	40.7	8.3	SP	2.7	4.24	1.6	8.4	54	
9	0.3	18.4	74.3	5.7	SP	3.8	0.72	1.7	10	51	
10	0.60	32.9	56.5	8.3	SP	3.4	2.24	1.8	7.8	73	4) The percentage of bulking so found out could be employed for correcting the volume of fine aggregate to be used for construction works.

(S&C Silt & Clay, FS - Fine Sand, MS - Medium Sand, CS - Coarse Sand, SC - Soil Classification, FM - Fineness Modules, SW - Well Graded Sand and SP - Poorly Graded Sand)

### ***13. Use of Waste Plastics for Road Construction***

NATPAC explored the possibility of usage of waste plastics in road construction on a large scale basis, carried out further research in the field and identified the data gap, developed methodology for processing the waste and conducted laboratory investigations (Mix design, Marshall stability etc.). The pilot roads already resurfaced in Thiruvananthapuram, Vadakara, Kozhikode and Thalassery are being evaluated periodically to study the performance. Another road Kokkalai to KSRTC Junction (700m) in Thrissur district was overlaid using modified mix with waste plastic in December 2010 (50mm BM + 20 mm PMC). Two more roads – Menamkulam road in Trivandrum district and GIDA road (in front of high court) in Ernakulam district were also resurfaced with modified mix having waste plastics in 2012.

All these proved to be a step towards providing input for evolving guidelines / specifications for the use of waste plastic materials in road construction and helped in its effective usage thereby reducing a serious community menace.

#### *Laboratory Studies*

Marshall studies were conducted to determine the strength characteristics of Bituminous Concrete (BC), Semi Dense Bituminous Concrete (SDBC) and Dense Bituminous Macadam (DBM) made using plastic coated aggregates and compared the results with that of ordinary mix. The constituent materials like aggregates and bitumen used for the study were tested in the laboratory to ensure that they confirm to the standard specifications. Stripping tests were also conducted on the bituminous mixes to evaluate their resistance to water soaking.

#### *Field Studies*

Four test roads were resurfaced in collaboration with local bodies. They are Municipal Town Hall – Our College Road in Vadakara Municipality (400m length), Stadium to Puthiyara road in Kozhikode (600m length), Logans Road in Thalassery (650m length) and Kokkalai to KSRTC Junction (700m length) in Thrissur district. A surface layer of 20mm Premix Chipping Carpet (PMC) with modified mix is laid on all these roads and a control stretch is maintained.

Periodical pavement evaluation studies were conducted to investigate the functional performance of all the study roads.

## *Findings*

### *Laboratory Studies*

- Increase in strength
  - For Bituminous Concrete (BC) and Semi Dense Bituminous Concrete (SDBC) mixes, the strength (stability) increased 1.5 times
  - For Dense Bituminous Macadam (DBM), the strength (stability) increased 1.2 times
- Reduction in binder content
  - For BC, the optimum binder content reduced from 5% to 4.5%
  - For SDBC, the optimum binder content reduced from 5% to 4.6%
  - For DBM, the optimum binder content reduced from 4.6% to 4%
- Reduction in voids
  - There is reduction in voids which shows better binding and this reduces moisture absorption and oxidation of bitumen by entrapped air. This will reduce the deterioration of roads.
- Reduction in stripping
  - Aggregates coated with plastic and bitumen showed zero stripping after 72 hours of soaking, whereas in the case of same aggregates without plastic coating showed about 2% stripping.

### *Field Performance Studies*

Reduced damage in terms of potholes and cracks were seen on the stretches which used plastic coated aggregates for surfacing than the control stretch. This will lead to:

- Increased service life of roads
- Reduced consumption of petroleum products because smooth surface reduces the vehicle operating costs

## *Other Advantages*

- Massive consumption of waste plastic can be effectively made without causing any damage to environment as in the case of burning or land filling
- Easy, cost effective and does not involve any complicated additional machinery
- There is predominant social benefit as it generates wealth from waste



*Plate 4*  
*Plastic Shredding Machine*



*Plate 5*  
*Resurfacing using Modified Mix with PCA*

## 14. Performance of Highways Developed under Kerala State Transport Project

Kerala state has embarked on a massive highway development programme through projects like Kerala State Transport Project (KSTP) which could enhance the comfort and level of mobility on the state highways. A critical appraisal of these highway development projects will be most befitting and significant as regard to the highway research in the state.

This study aimed at the critical appraisal of the highways developed under KSTP and to collect a comprehensive database on the structural and functional performance of the upcoming highways of the state thereby help in formulation of deterioration models for the state roads.

The scope of the study is limited to selected stretches of SH-1 developed under Kerala State Transport Project.

The methodology adopted for the study consisted of collection of baseline data, traffic studies, structural and functional evaluation of the pavements, Estimation of Vehicle Operating Cost (VOC) and capacity analysis.

The Study Area selected for the project is shown in **Table 13**

**Table 13**  
**Details of Stretches on Study Roads**

Road Name	No of Homogenous Sections	Road Category	Traffic	Inventory Details
Vettu Road - Pothencode	HS I	SH	968 veh/hour (peak traffic)	C/W – 7.5m ROW – 22 m Paved shoulder – 2.3 to 2.5m on either side Side drains - 0.9m
	HS II			
Mannanthala - Venjaramoodu	HS I	SH	1087 veh/hour (peak traffic)	C/W – 7 m ROW – 15 m Earthen shoulder – 1.5m Side drains – nil (lack of continuity)
	HS II			





*Plate 6*  
*Skid Resistance Test*



*Plate 7*  
*Texture Depth Test (Sand Patch)*

The data collected by pavement evaluation studies were analysed to obtain dataset I which gives an indication on the structural adequacy and functional performance of the study road (**Tables 14 & 15**).

**Table 14**  
**Subgrade Soil properties on Vettu Road – Pothencode Road**

Road Name	OMC (%)	MDD (g/cc)	LL (%)	PL (%)	PI	Soil Type (IS)	CBR (%)
Vettu Road - Pothencode	12.20	1.98	19.00	6.20	12.80	SC	12.2

**Table 15**  
**Pavement Evaluation Data on Vettu Road – Pothencode Road**

Road Name	Sections	Deflection (mm)	Texture depth (mm)	Skid Number
Vettu Road - Pothencode	HS I	0.62	0.402	55
	HS II	0.63	0.350	54

Study road (strengthened under KSTP) has good performance as indicated by lower deflection value and desirable skid resistance value.



*Plate 8(a)*



*Plate 8(b)*

*Benkelman Beam Deflection Studies*

The study brought out quantified results in figures and facts to substantiate the performance of State Highway strengthened through the Kerala State Transport Project.

### ***15. Measurement of Air Quality and Noise Level at Proposed IISER Campus, in Thiruvananthapuram District***

NATPAC assessed the ambient air quality and noise levels in and around the proposed IISER construction site as part of the Environmental Impact Assessment (EIA) study.

The study attempted to measure the concentration of air pollutants such as Particulate Matter (PM), Nitrogen dioxide (NO<sub>2</sub>), Lead (Pb), Carbon monoxide (CO) and Ammonia (NH<sub>3</sub>) at five locations at proposed IISER Campus as per Central Pollution Control Board (CPCB) guidelines in four seasons. Further it measured the noise level at five locations during four seasons in and around IISER Campus as per the guidelines of International Electro Technical Commission (IEC).

The objective of the study is to determine the existing quality of air, evaluation of the effectiveness of control programme and to identify areas in need of restoration and their prioritization. High Volume Sampler and CO analyzer was used to measure the concentration of pollutants. The noise level was measured at five locations using Sound Level Meter.

#### *Observations*

*i) SPM Levels*

The blasting of rocks and diesel generators are the major sources that caused the higher concentration of particulate matter at the site. But the average values at all the stations are found well within the threshold limits of Central Pollution Control Board (CPCB).

*ii) Respirable Suspended Particulate Matter (RSPM) Levels*

The RSPM levels recorded the maximum values due to drilling, blasting of rocks and vehicular movement. The 24 hour average value of RSPM levels in and around IISER campus is under prescribed limits of Central Pollution Control Board.

iii) *SO<sub>2</sub> Levels*

There were no exceedances of the SO<sub>2</sub> concentration with ambient air quality standards at any of the stations.

iv) *NO<sub>2</sub> Levels*

The measured NO<sub>2</sub> concentration levels are well within the CPCB standards.

v) *Lead Levels*

The overall average of Lead levels shows that it has been below the permissible limits of Central Pollution Control Board (CPCB).

vi) *Ammonia Levels*

There were no exceedances of Ammonia level with ambient air quality standards at any of the sampling stations.

vii) *Carbon monoxide Levels*

There were no exceedances of the CO ambient air quality standards at any of the stations. The highest value was recorded at a location where diesel generator as well as vehicular movement was sited.

viii) *Noise Levels*

The major sources of noise in the study area are: construction activities (cutting and blasting of rocks), transportation, power generators etc. The ambient air quality with respect to noise level at five locations was measured. The noise level at a particular site was slightly above the standard value due to blasting and drilling activities round the station. The observed noise levels at other stations showed values well within the permissible limits.



Plate 9  
*Respirable Dust Sampler (APM 460BL)*

## ***16. Road Development Plan for An Emerging Town – Case Study of Kottarakkara in Kollam District, Kerala***

A good network of transport infrastructure greatly influences the overall development of a region. It activates and fosters the process of development in all sectors of economy. It is an established fact that the quality of life in a city is judged by the efficiency of its transportation system. For a region to survive and develop, it should be connected with the service and market centres by adequate transportation modes.

The present study is a continuation of the project done by NATPAC in the year 2010-'11 and the scope of the study was limited to conducting household surveys in Kottarakkara coupled with Origin-Destination (O-D) surveys at the external cordon points.

The methodology adopted for the study consisted of household interviews, Origin-Destination survey, data analysis and interpretation and forecasting of transport demand for horizon year.

Transport development plan for Kottarakkara is prepared taking into account the existing traffic scenario and based on an evaluation of the future traffic on the base year network. Transport development schemes cover all the available modes of travel and are formulated so as to reduce the severe strain on the existing road network.

### ***Road Network***

All the existing as well as future traffic and transportation problems likely to arise has been taken into account while formulating the long term road development plan for the region. The various transport-related problems facing the town along with the development proposals made by various agencies have also been taken into account while formulating the long term development strategy for the city. Since the most important problem of Kottarakkara is chronic congestion in the central parts of the town with limited scope for road widening, emphasis is placed on developing an alternative link to divert the traffic passing through the central area. The development strategy lays special emphasis in relocating the major traffic generators like bus stand, truck terminal, wholesale markets, warehouses and godowns to the fringe areas of the town to decentralize the traffic attraction activities, thereby attempting to reduce the congestion

in the central area of Kottarakkara. Special emphasis is also given to improve the pedestrian facilities and in developing off-street parking lots.

A Road Development Plan consisting of two ring roads and a number of link roads are formulated for the town.

### *Rail Network*

The Kollam – Shenkotta railway line passing through Kottarakkara is currently not functional due to gauge conversion work in meter gauge section. Once the work is completed, the rail transport becomes an attractive mode of travel in the region. This will reduce the dependence of people on personal modes.

### *Transport Terminals*

- *Bus terminals*

It is recommended to have a new location for the KSRTC bus depot, so as to have an efficient flow of traffic in the CBD area.

- *Goods terminals*

At present, major activities for goods operation are taking place in the Market area, which is in very close proximity to the CBD area. It is proposed that the concentration of these activities may be shifted away from the CBD area.

### *Pedestrian Facilities*

The pedestrian facilities that need to be considered are:

- Sidewalks or walkways
- Marked crosswalks and enhancements
- Elevated pedestrian facilities at – Pulamon junction and Market road

### *Parking Facilities*

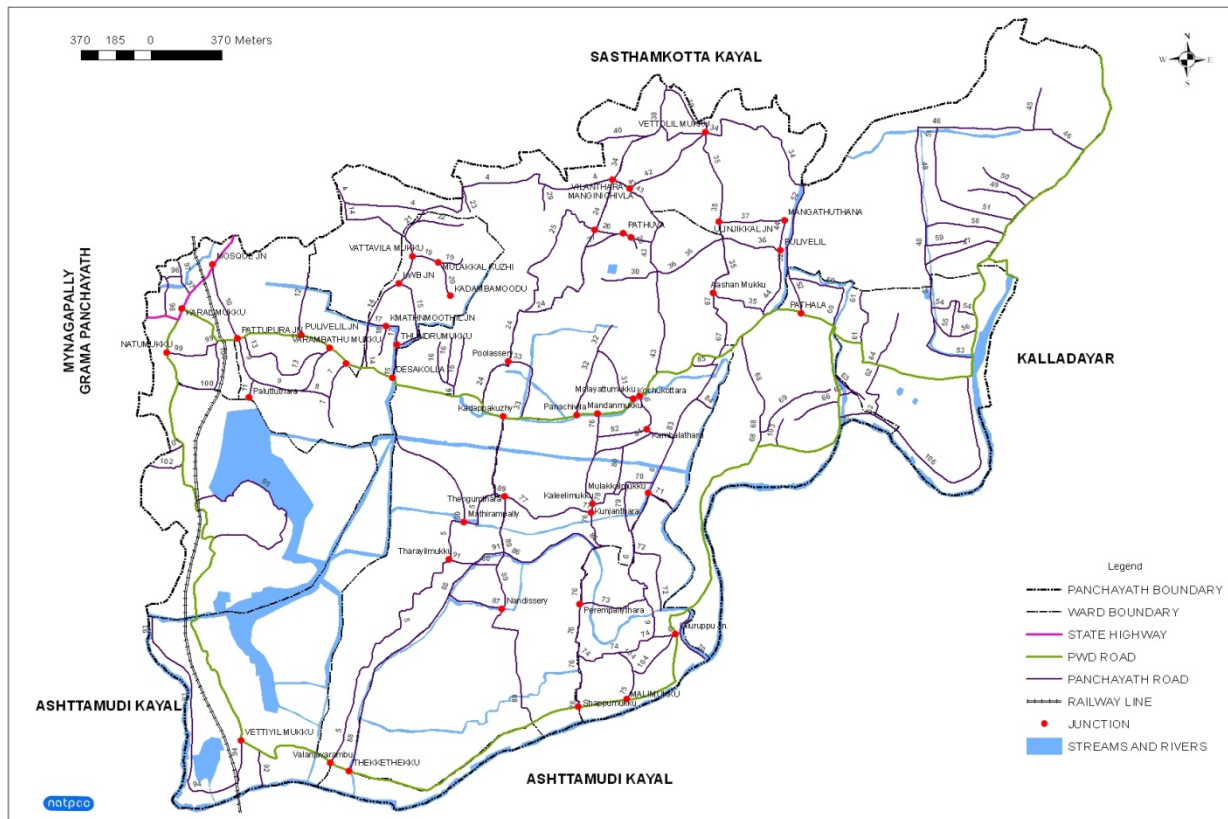
The central area of Kottarakkara town has no adequate space for off street parking, thus forcing the vehicles to occupy the busy commercial streets. This reduces the capacity of the roads, causing traffic congestion and delays. Once the bus terminal is shifted, there will be adequate space available for parking.



## 17. Mobility Plan for West Kallada Grama Panchayath in Kollam District

The scope of the study is limited to understand the quality and quantity of roads in the West Kallada Grama Panchayath in Kollam District and to develop mobility plan for the Panchayath and to improve the roads in the region to increase the overall connectivity and mobility of the people.

Based on discussions with the local representatives and the Panchayath authorities and data collection, NATPAC has prepared a mobility plan for West Kallada Grama Panchayath. **Figure 8** shows the map of the study area.



**Figure 8: Map of West Kallada Grama Panchayath**

The road network available in West Kallada Grama Panchayath of Kollam District was prioritized based on various geometric, social and economic indicators and a priority list of roads which are to be improved was prepared (**Table 16**).



**Table 16: Weightage Values of Grama Panchayath Roads**

Sl. No.	Name of road	Length (m)	Width (m)	Popln.	SC/ST Popln.	Weightage
S-1	Varambathumukku-Kottakkuzhy road	1150	6	3120	1197	70
S-2	Plathalamukku - Kayalvarambu-Vilanthara-Kakkathope road	4060	8	8600	2425	80
S-3	Kanjiram Joatmukku-Uparikunnam Ikkarazhikathumukku - Kayalvarambu Road	2000	6	3000	1000	40
S-4	Athikkattu-Vilanthara Jn.-Kochukottathara Jn. road	2800	6	5600	1425	70
S-5	Kaleelilmukku-Vettolilmukku road	1200	4	3600	375	25
S-6	Kadappakuzhy-Valanjavaramb road	2320	8	3650	560	55
S-7	Ullurup - Malayattoormukku Road	1450	7	3650	350	45
S-8	Mathirampally-Thekkathara-Thekkethkumukku-Kunnutharamukku Road	1500	4	2820	507	35
S-9	Mandanmukku-Shappumukku road	2400	4	5225	950	45
S-10	Puthethumukku - Thekkathekkamukku road	1270	4	3275	960	25
S-11	Thengumtharamukku-VKS Jn. road	1450	6	1575	600	50
S-12	Pallikkamukku-Kettidathilcharuvu road	1160	8	1500	56	20
S-13	Pattambalam-Virathoor road	1780	8	4000	600	35
S-14	Mandhirathilbhagam - Cheekaramukkathu Road	1620	4	1825	137	30

The list includes a total of 17 roads (38.61 km), including three PWD roads. Of this, immediate attention should be given to the PWD roads as they have been found to be damaged all along their length. Water logging is the main problem behind the damage of roads. The two District Panchayath roads also need to be improved at the earliest as they have got ample width and will serve a large population and other societal needs. Other roads listed may be improved in a phase wise manner, taking into consideration its weightage values. Roads with a width of six metres or above need to be given first priority. The advantage is that, once these roads get a width of eight metres, they could be improved under some of the Centrally sponsored schemes like Pradhan Mantri Gram Sadak Yojana (PMGSY).

### ***18. Preparation of Computerized Inventory of Roads for Payyannur and Kalliassery Block Panchayaths in Kannur District***

The State Government has initiated action to revise the existing Core Network Plans for the implementation of Central Schemes like PMGSY and Bharath Nirman. The Core Network Plan prepared earlier was found to be defective due to omission of many important existing links and roads identified for new connectivity/ improvement. Of the three models considered for the purpose (Rural Development Dept. / Town Planning Dept. / NATPAC), the model presented by NATPAC was selected for adoption for the purpose.

The study aimed to develop a scientific spatial database for rural roads by involving the Grama Panchayaths. The study area for this exercise was 15 Grama Panchayaths in two block Panchayaths viz., Payyannur and Kalliassery in Kannur District and has developed up-to-date and scientific data-base (digitized spatial maps in GIS format with inventory and settlement particulars) of roads under the control of various Grama Panchayaths.

The scope of the study is limited to rural roads coming under the rural local bodies comprising of Grama Panchayaths, Block Panchayaths and District Panchayath. Within the scope, the objectives of the study are:

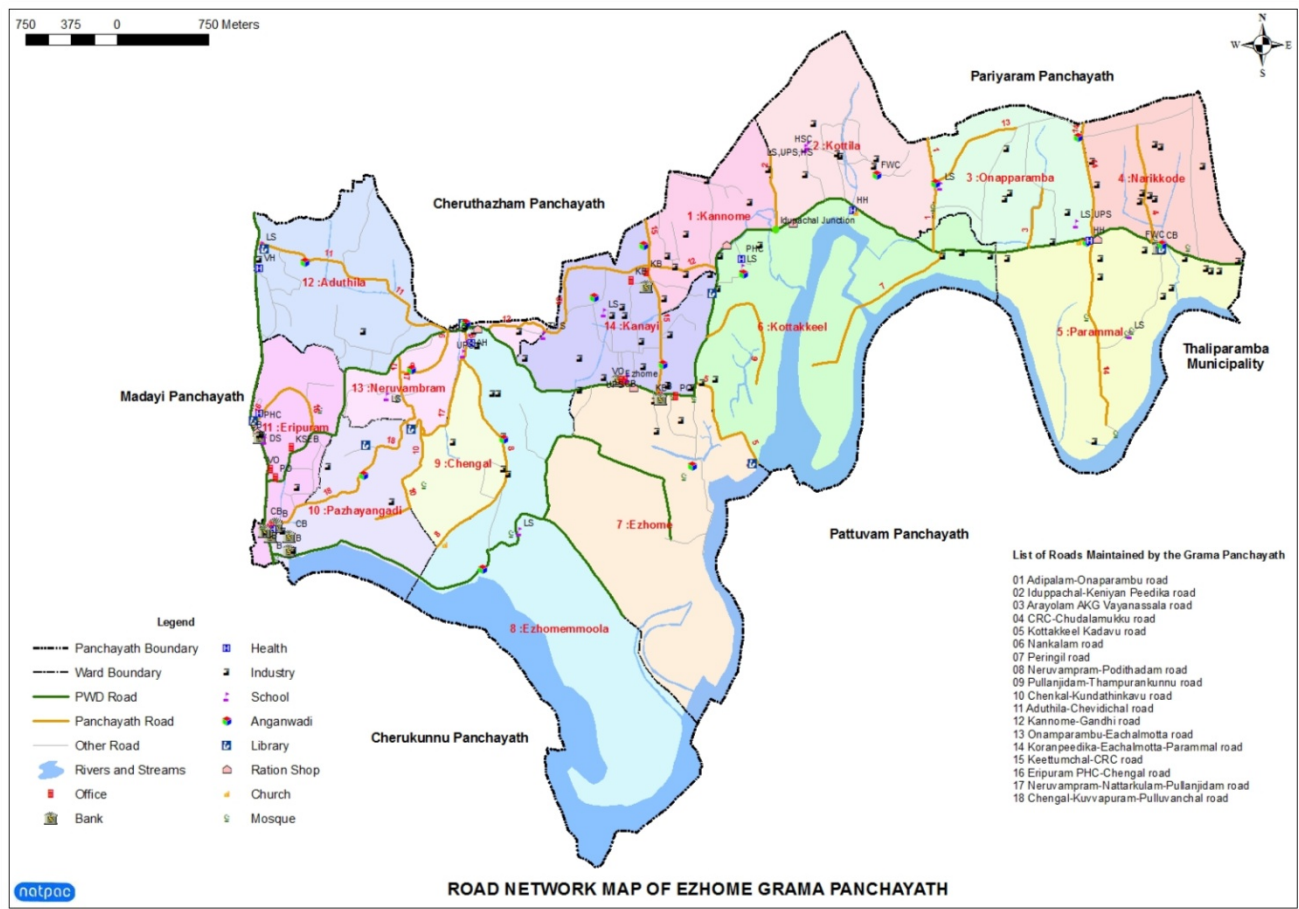
- Identification of all sub settlements (wards) within each Grama Panchayath in the study area;
- Listing of all roads passing through the settlements (all categories);
- Inventory of Grama Panchayath roads (roads having a minimum width of six metres that can be developed to motorable standards and a minimum length of 500 metres);
- Preparation of digitized road maps with supporting data for each Grama Panchayath in the GIS format

The following data were collected from various sources:

- *Settlement level data* - sub settlement (within each Panchayath) identification, road availability, location of facilities
- *Road level data* - connecting settlements, population benefited, facilities along the road

- *Road inventory* - length, width, surface type, settlements connected
- *Road mapping* - base maps (cadastral) provided by the Kerala State Land Use Board were further modified by Digitizing, mosaicing, Geo-referencing, Scaling using GIS and development of attribute tables.

The study developed an authentic spatial database on Grama Panchayath roads together with supporting information required for the development of plan documents and rural road management system in GIS platform. Updated road details along with settlement level data can be used for the preparation of Road Development Plan required for PMGSY, Bharath Nirman or NABARD funded road development schemes. A sample map generated in GIS Platform is shown in **Figure 9**.



**Figure 9: Road Network Map of Ezhome Grama Panchayath in Kalliassery Block**

### ***19. Restructuring of the Jurisdiction of Road Network of Kerala Public Works Department based on Assembly Constituencies***

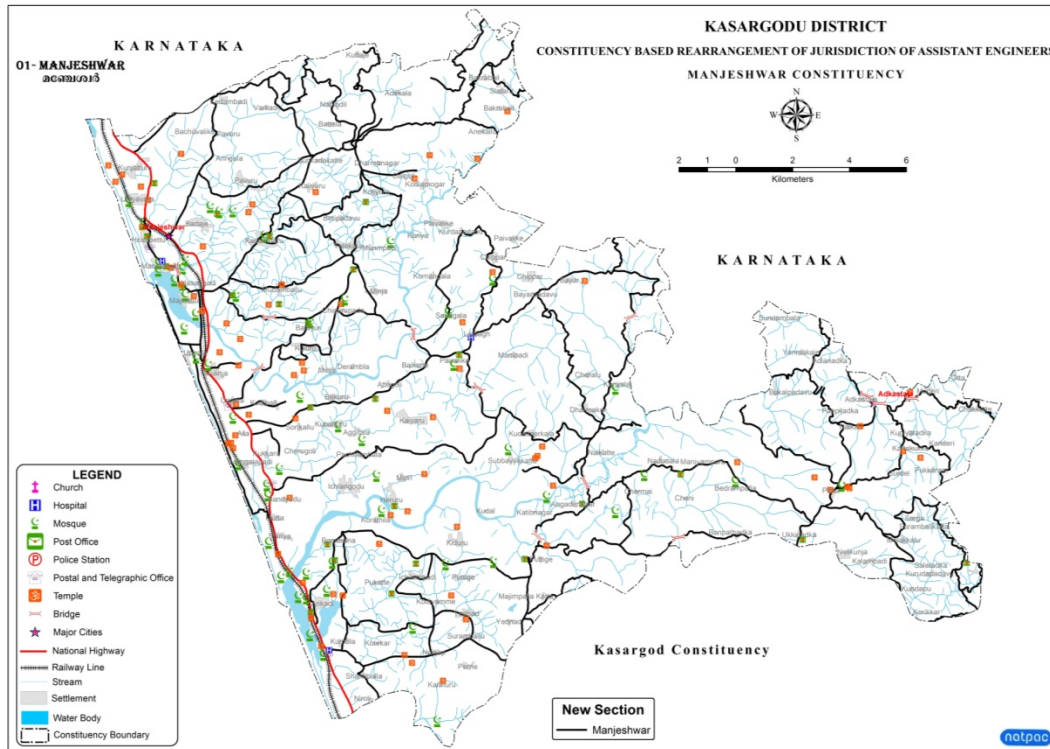
NATPAC was entrusted with the task of delineating the jurisdiction of Section Offices in Kerala by Public Works Department, Government of Kerala. NATPAC delineated the jurisdiction of the Assistant Engineers in Kerala with the help of GIS software and generated a framework for reallocation of the jurisdiction based on Assembly Constituency.

#### *Methodology adopted for the Study:*

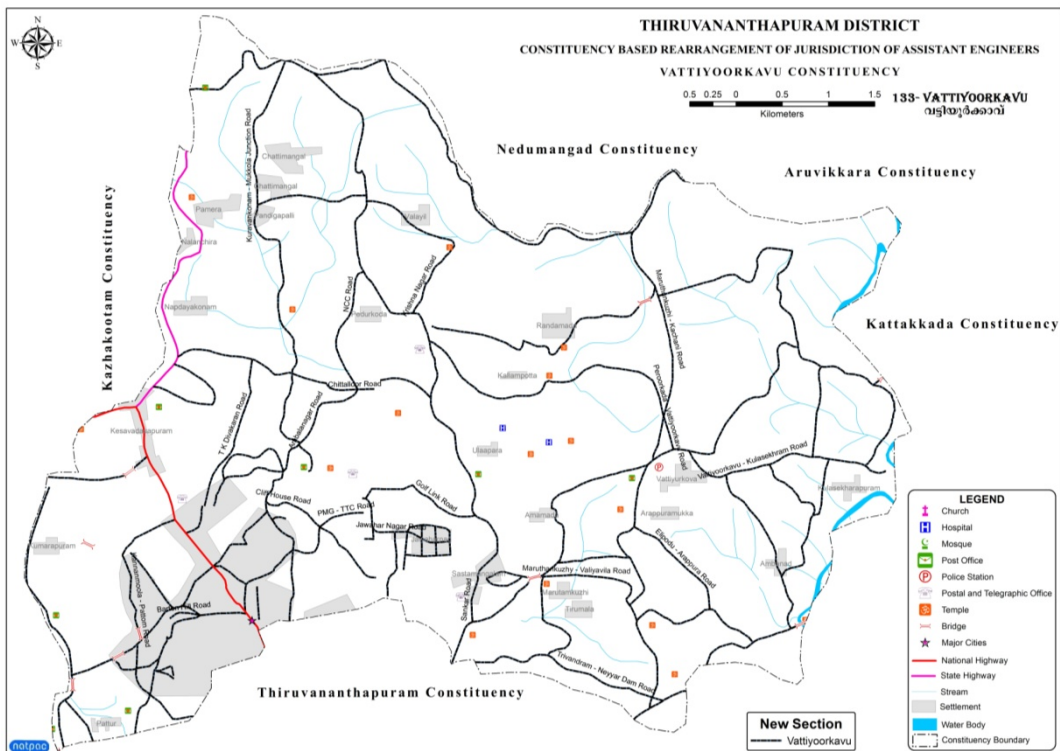
GIS Data Layers obtained from PWD was corrected for errors using Topology function in the software.

- With the help of 176 Assistant Engineers within the State of Kerala, the existing sections in PWD were demarcated with all the necessary attributes like road length, carriage way, construction materials used etc.
- Overlay analysis performed in GIS software to combine the constituency boundary with the sections.
- New sections generated based on constituency in GIS environment.
- Individual maps of Constituency along with Road Register generated.

This delineation will bring more clarity for the Assistant Engineer (AE) to control their designated area and will also help the elected members to understand the jurisdiction of the Assistant Engineer and if need arise, they can monitor the works in liaison with the Assistant Engineer. The Member of Legislature Assembly (MLA) will have a greater clarity with regard to the Assistant Engineer they have to approach to address any of their issues related to the road. The restructuring of Assistant Engineers section will help in efficient administration of each and every road section falling under the PWD (R&B). Sample maps generated are given in **(Figures 10 & 11)**.



**Figure 10: Constituency-wise Rearrangement of Jurisdiction of Manjeshwar Section**



**Figure 11: Constituency-wise Rearrangement of Jurisdiction of Vattiyoorkavu Section**



## ***20. Shortest Path Analysis and Service Area Allocation for Ambulance Services in Thiruvananthapuram City - A GIS approach***

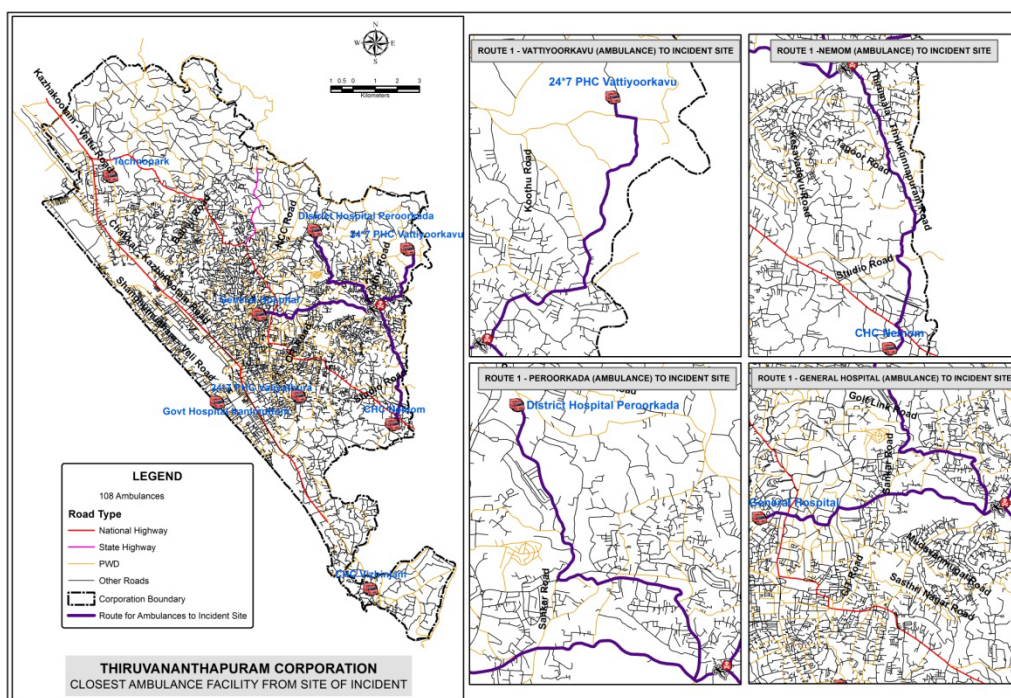
Geographical Information System (GIS) is a tool which has been employed for efficient planning and management of transportation infrastructure, taking into account parameters like travel time, speed, road resistance, turning movements, etc. In order to establish the use of GIS, the present study was undertaken.

*The purpose of the study is to:*

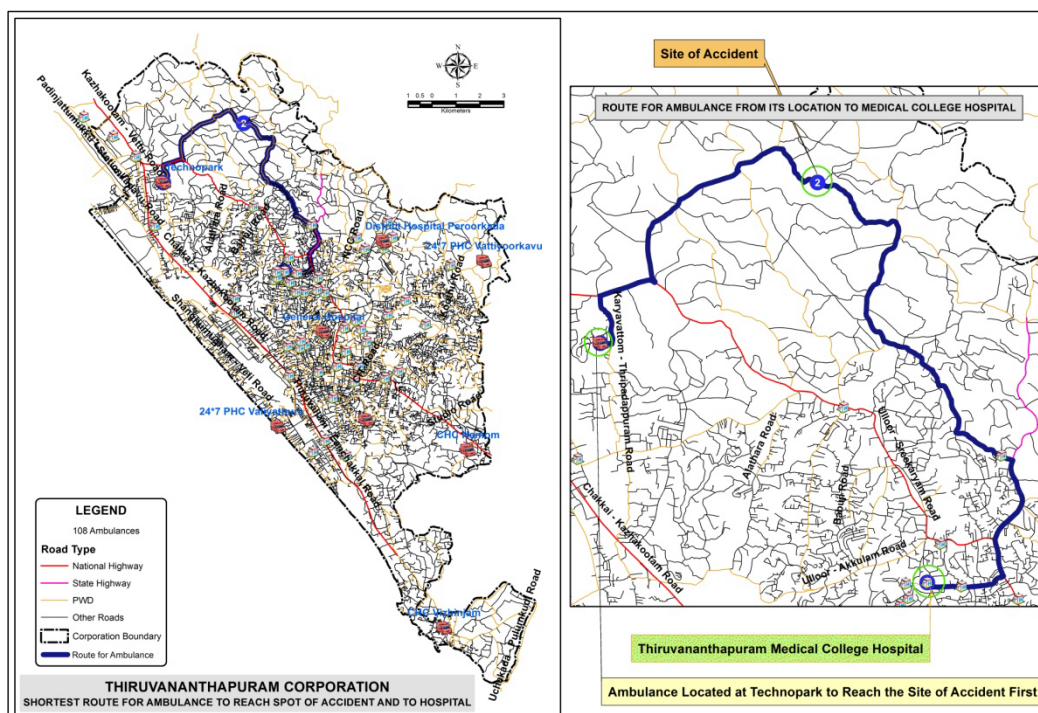
- understand the existing transport infrastructure facilities available in the study area.
- find the shortest path for the ambulance to reach the site of accident and back to hospital and demarcate the service area served by each ambulance.
- generate service area covered by a single ambulance, based on travel time (5 minutes or 10 minutes) and allocate ambulance in areas which are less served by them.

Data from secondary sources were collected and the features were updated using GPS. Thematic layers were created in ArcGIS 10 Desktop and analysed using the Network Analyst extension of ArcGIS.

The study generated a reliable and scientific data base of road network in Thiruvananthapuram City which will be beneficial for user agencies like PWD, Police and Health Department for planning and decision making. Shortest path for the ambulance to reach the spot of accident and back to hospital was computed, using the impedance factor and shortest travelling time. Judicial placement of ambulances in the areas where there is inadequacy of ambulances were suggested. NATPAC developed Standalone GIS based software for finding shortest path and service area of ambulances. Maps generated using GIS is given in **Figures 12 & 13**.



**Figure 12: Closest Ambulance Facility from Site of Accident in Thiruvananthapuram Corporation**



**Figure 13: Shortest Path for Ambulance to Reach Spot of Accident and to Hospital**



## 21. *Travel Protection Strategies*

NATPAC recognized the use of protective devices such as helmets and seatbelts, curbing use of mobile phone and drunken driving as an important strategy for reducing road accidents.

NATPAC conducted a study of the vehicle occupant protection measures and recommended strategies for the safety of vehicle users, with special focus on helmet and seat belt use, curb mobile phone use and drunken driving. The study covered all the 14 districts of Kerala.

### *Scope and Objectives*

- To study the compliance level of various rules related to the use of protective devices and to assess the level of seat belt / helmet usage
- To assess helmet / seat belt utilisation among different age groups, occupation categories etc. and to evaluate the regional variation in seat belt / helmet use
- To understand the motivating factor behind low compliance level and to prepare a strategy to improve the seat belt use / helmet use in Kerala
- To study the prevalence of drunken driving and the extent of mobile phone use while driving in Kerala

The existing characteristics and utilization pattern of helmet and seat belt were obtained. The characteristics of drivers who drive under the influence of alcohol and the use of mobile phone while driving was also analysed. The technique adopted for data collection was visual observation of users / non users and user response based on self reporting to a set of queries. Besides relevant data was collected from secondary sources.

The reasons for not wearing helmet as reported by vehicle users are respiratory problems, head ache and sweating, allergy, hair loss, burden of weight and audibility inhibition. The seat belt users and non users interviewed in each district were classified on the basis of various decisive factors such as age of driver, vehicle type, occupation etc. The number of seat belt users/ non – users and the percentage falling under each decisive factor was computed. Further the number and percentage of seat belt users to non users were computed.

The proportion of accidents under the influence of alcohol in the state is on the increase. Unfortunately, in spite of the great economic and social progress, alcohol-impaired driving remains a serious national problem that takes a toll of several lives annually.

Mobile phone use while driving has added a new dimension to safety on the roads. The task of driving requires faculties of various types, namely cognitive faculties, physical faculties such as visual, auditory, and skills associated with sharp reflex. The use of mobile phone also requires all the faculties which are required for driving. Therefore when the driver uses mobile phone while driving, his attention is divided between the two tasks.

## 22. Analysis of Road Accident Causative Factors

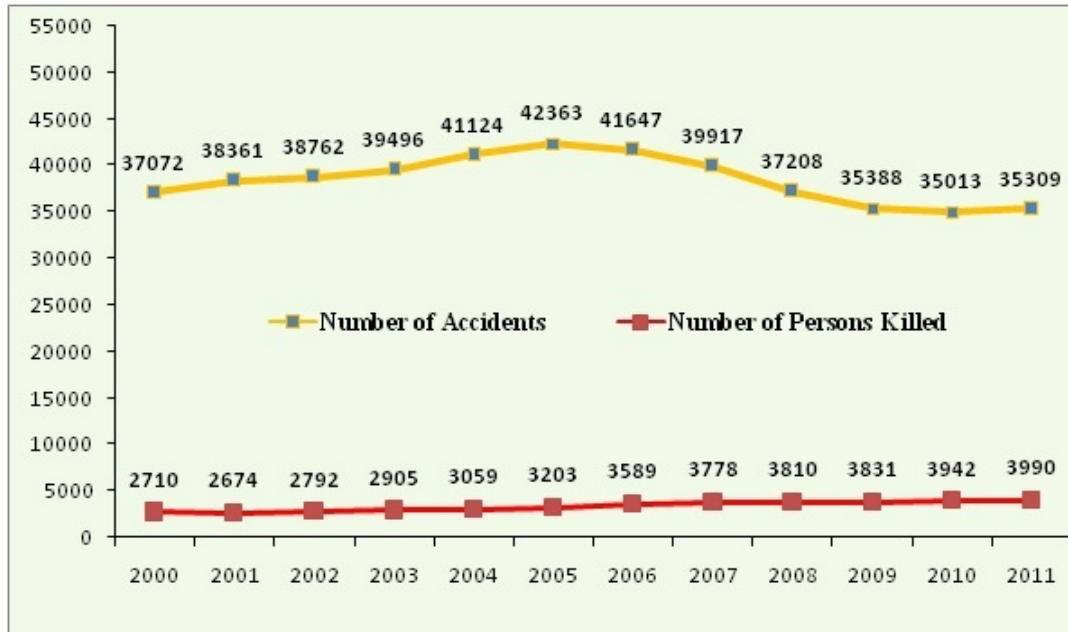
The accident situation in Kerala is relatively more serious due to rapid growth of vehicles and inadequacy of road infrastructure. Various districts in Kerala are exhibiting different pattern of accidents and this require region specific accident control measures.

A study has been undertaken by NATPAC at the state level to understand the accident causative factors in Kerala. Police records and information given in FIR were analysed to identify the causes of accident. Content analysis of accident reports published in local news papers was also undertaken. Accident investigation was conducted for selected major accidents that took place in Kerala to identify major, minor and contributory causes of accidents. This includes systematic study of traffic accidents and proper investigation of the cause of accident and proposed preventive measures in terms of design and control.

**Table 17** gives the district-wise accidents reported in the year 2011. It is of interest to note that maximum number of accidents were reported from Ernakulam district (5249) followed by Thiruvananthapuram district (4406). In the case of fatalities Ernakulam district reported the maximum (513) followed by Thrissur district (483). **Figure 14** shows the trend of accidents and fatalities in Kerala from 2000-2011.

**Table 17**  
**District wise accident details of Kerala -2011**

Districts	Total Accidents Reported	Number of persons Died	Districts	Total Accidents Reported	Number of persons Died
Thiruvananthapuram	4406	460	Palakkad	2174	377
Kollam	3056	427	Malappuram	2693	308
Pathanamthitta	1424	153	Kozhikode	2787	264
Alappuzha	3001	404	Wayanad	580	61
Kottayam	2456	223	Kannur	1648	159
Ernakulam	5249	513	Kasargod	774	89
Idukki	1029	69	<b>State</b>	<b>35309</b>	<b>3990</b>
Thrissur	4032	483			



**Figure 14**  
**Trend of Road Accidents and fatalities in Kerala (2000-2011)**

Road related factors are relatively constant over a shorter period of time. Vehicle related factors at macro level are also by and large stable. Environment related factor, though dynamic in nature; also have a fixed pattern over a short period. However, traffic and human related factors are quite dynamic and may change over time.

### 23. Identification of Accident Prone Locations and Improvements in Northern Kerala

The study aimed at collecting the accident details pertaining to the past two years and to analyze the accident causative factors for evolving a suitable methodology to identify accident prone locations. A micro-level analysis of the accident prone locations has been carried out to work out improvement measures for accident prone locations.

The data pertaining to accident frequency, type of accidents, geometric features of the road and traffic data were collected. The data was analysed using Quantum of Accident Method and Accident Risk Index (ARI) to identify the black spots. Rating of accident components is discussed in **Table 18**.

**Table 18**  
**Rating of Accident Components**

No.	Accident Components	Points
I	Consistency (max points 30)	
	One or more than one accident every year	30
	One or more than one accident for two year	20
	One or more than one accident for one year only	10
	No accident in three year	0
II	Tendency (max points 30)	
	Two times increase in three years	30
	One time increase in three years	20
	No increase	10
	No accident in three years	0
III	Level (max points 30)	
	Number of accidents in three years is 6 or more than 6	40
	Number of accidents in three years between 3 and 5	30
	Number of accidents in three years between 1 and 2	20
	No accidents in three years	0

Each section of the road were analysed by using the above three components. Total score of each section has been computed. Higher the total score, higher is the accident proneness, which varied between 0 and 100. Road sections having a score more than 90 were given priority in improvement. The list of major accident prone locations in NH-213 in Northern part of Kerala is given in **Table 19**.

**Table 19**  
**Major Accident Locations along NH-213**

Sl. No.	Location
1	Kondotty
2	Angadipuram
3	Kottappuram
4	Perinthalmanna
5	Valluvampuram
6	Thazhikode
7	Olavakodu
8	Aryambavu
9	Amminikadu
10	Kunnummal
12	Pulikkal
13	Kolathur
14	Kottapadi
15	Poriyani

*Improvement measures suggested for accident prone locations include:*

- Improvement of the sight distance by removing on- street parking
- Installation of signals at the side roads and control of traffic
- Relocation of bus stops and auto parking from the junction
- Improving the sight distance and vertical geometry at curves
- Control of speed of vehicles by traffic calming techniques
- Provision of signages, road markings and guard rails to guide the motorist during night time drive



## 24. Safety of Public Transport System in Kerala

NATPAC studied the causes and related factors of bus accidents in detail and prepared a status report on the safety of bus system in Kerala. The objectives of the study are:

- To study the accident trend in Kerala, in general, and bus related cases in particular
- To analyse the accidents pertaining to K.S.R.T.C., private, and institutional buses
- To study safety practices of different type of public transport buses
- To evaluate the safety consciousness of bus crew and the condition of buses with respect to safety of passengers.

The methodology involved safety auditing of bus stops, bus station, condition of bus, crew behaviour and analysis of the same. **Table 20** gives the trend of accidents involving buses in Kerala from 2001-2011.

**Table 20**  
**Accidents involving buses in Kerala**

Year	Total Number of accidents	Accidents involving KSRTC buses	Accidents involving other buses	Accidents involving buses (%)
2001	38361	1426	5024	16.81
2002	38762	1365	5206	16.95
2003	39496	1282	4926	15.72
2004	41124	1332	4880	15.11
2005	42363	1513	4447	14.07
2006	41647	1211	4239	13.09
2007	39917	1052	4503	13.92
2008	37208	1123	4258	14.46
2009	35388	1144	3980	14.48
2010	35013	1195	3885	14.51
2011	35309	1203	3705	13.90

The safety condition of buses in Thiruvananthapuram region has been analysed and salient features are presented in **Table 21**.

**Table 21**  
**Safety condition of buses in Thiruvananthapuram District, 2011**

Sl. No.	Item	Rating	Number of buses (%)
(i)	Condition of seats	Good	76.47
		Satisfactory	11.77
		Bad	11.77
(ii)	Condition of bus (Mechanical factors)	Good	23.53
		Satisfactory	61.77
		Bad	14.71
(iii)	Inside bus environment	Good	55.88
		Satisfactory	39.22
		Bad	4.9
<b>Notes:</b>	Factors considered in evaluating condition of seats:		
(i)	condition of cushion, rigidity of seat, and comfort level.		
(ii)	Factors considered for evaluating mechanical conditions: working of brakes, condition of tyres, smoothness of steering, condition of axle.		
(iii)	Factors considered in evaluating inside condition of bus: space for passengers, space for luggage, condition of reeling barriers.		

The analysis has revealed that young driver and new vehicles is not a safe combination. The major causative factors of accidents are driver fatigue and over speeding tendency. There existed some sort of 'vehicle fraternity', two vehicles of the same type normally do not collide with each other. It was found that more than fifty percentages of accident victims were pedestrians. According to police sources, fewer people died on the spot while more people succumbed to their injuries either on the way to or at the hospital.

## ***25. Constraints in Developing West Coast Canal in Kerala – Case Study of National Waterway III***

The importance of Inland Water Transport has declined with the expansion of road and rail transport. A study was taken up in order to gauge the actual status of development of NW-III and to suggest necessary measures for enhancing this mode of transport.

### *Objectives*

- Identify the extent of developments undertaken and compare with the proposal both with respect to physical and monetary units.
- Identify the problems encountered during development, if any.
- Study the present status of NW-III in terms of traffic achieved after development and suggest measures for improving the same.

On the basis of field studies and investigations, the factors which are responsible for retarding the growth of traffic on the NW - III was determined.

### *Constraints encountered in the development of NW - III*

The minimum 2.2m depth is not available in some of the stretches of NW-III. Insufficient horizontal and vertical clearances at the site of cross structures and locks also pose problems.

#### Technological factors:

Technological innovations taking place in other countries required to be adopted on the NW-III. A standing example is the containerization of goods traffic. China introduced small sized containers specifically designed for the inland waterway routes several years ago. This will help in standardizing and simplifying the process of goods handling and also in cutting down delays.

#### Non availability of sufficient cargo:

The availability of cargo depends on the state of the economy. An economy with a huge tertiary sector, at the same time nascent secondary and primary activities will not offer patronage to the waterways.

Local community issues such as bank encroachment, problems posed by fishermen etc., are assuming serious dimensions and constitute a major problem. People treat waterway mode as an old fashioned and slow mode of transport and there is shortage of trained manpower and vessels.

*Suggestions for improvement:*

The capital dredging work on NW-III needs to be completed. Removing fishing nets from the navigable channel of the waterways will help in making the channel free of obstructions. The locks at Thanneermukkom and Thrikkunnappuzha have to be widened to provide adequate horizontal clearance.

Development of feeder canals of NW-III will give a boost to water borne cargo movement. Containerization of goods on NW-III is another important step which has to be taken and it will also go a long way in encouraging the use of water way for transportation. Container handling facilities at terminals of IWAI has to be provided.

Conceptualization of cargo oriented projects linked to specific industrial units such as cement, fertilizers, food grain movement between the ware houses of the Food Corporation of India (FCI) located within the state, with guaranteed quantity of cargo for a specified time frame for



*Plate 10*  
*Thanneermukkom Lock on NW-3*



*Plate 11*  
*Thrikkunnappuzha Lock on NW-3*

movement by waterways is also recommended. The issue of shortage of man power in IWT sector needs to be addressed urgently.

Facilitating financing by the banks for construction of inland vessels is suggested. Development of logistics parks and container freight stations along the banks of waterways and delineation of revenue land along the waterways and rehabilitation of encroachers along the banks of the waterways will help in solving the waterway width constraint.

The Airports at Kochi and Trivandrum can be connected through waterways. Government should issue notification to prohibit construction of cross structures which does not provide specified minimum horizontal and vertical clearances. The integration of IWT with rail and road will help in improving connectivity.

## **26. Route Network Planning of IWT System in Kerala – A Case Study of Central Kerala**

Central Kerala including Ernakulam, Kottayam, Alappuzha and Kollam Districts has a wider network of feeder canals, well connected to NW-3. Even today, some of the habitats of Kuttanad region are not connected by roads. There are other locations which are connected by road, but closer to waterways. Congestion of roads due to increase in vehicle population is a major concern. Improving navigation across the canal system of central Kerala will therefore change the very socio- economic scenario of the region. A comprehensive planning of the water transport system will help in achieving an efficient and well integrated transport system for the region.

NATPAC aimed at assessing the utilization of the waterway network for transport and identifying new routes for boat trips so as to establish an efficient and integrated transportation system within Ernakulam, Kottayam, Alappuzha and Kollam districts.

### *Objectives*

- Assess the existing water transportation scenario in Central Kerala to obtain the details of the available waterways and its utility
- Find out the traffic pattern, demand and identify traffic potentials in terms of cargo movement, passenger and tourism
- Assess the adequacy of the existing water transportation facilities for the area and identify the constraints
- Evolve strategies for efficient utilization of the existing waterways for transport and to investigate the scope for integration with road and rail.

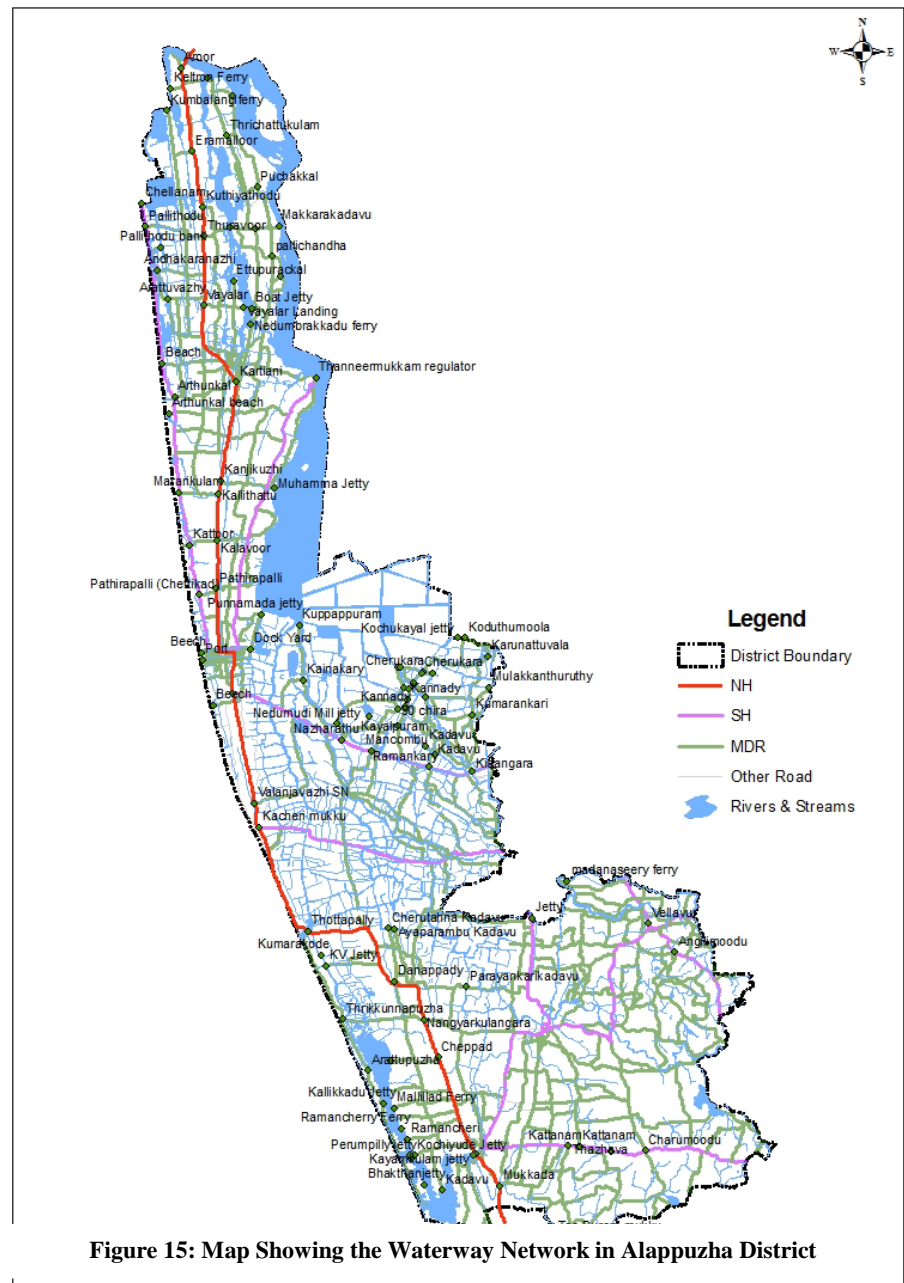
The methodology adopted for the study consisted of detailed survey of the waterways in Ernakulam, Kottayam, Alappuzha and Kollam Districts in order to take stock of the existing condition. **Figure 15** shows the waterway network in Alappuzha district.



An integrated transportation plan will be prepared for the area including suggestions to develop the waterways so as to make them suitable for navigation, by provision of navigational aids, jetties, landings and other infrastructure facilities. Proposals for integration of the waterways with other modes like road, rail etc. was worked out so as to make the transportation system more efficient. Tourism potential of the area was also studied.

The study aimed to create conditions for an integrated transport network system for Central Kerala with Alappuzha as the nucleus, which will help the

government as well as private vessel operators to efficiently plan their operations. Improved water transport network will enhance the connectivity as well as economy of the region as a whole and will also result in increased tourism revenue.



## 27. *Details of Existing Cross Structures along National Waterway – III in Kerala*

Water Transportation has several advantages over road. It is cost effective and an eco friendly mode of transportation, compared to roads. The traffic along National Waterway -III is not picking up over the years. Realizing that the identification of cross structures which are not within the acceptable standards, and preparation of a database of the existing cross structures, electric poles, telephone poles and water pipe lines across NW –III would go a long way in improving the traffic in NW - III, NATPAC provided various services under the sponsorship from Inland Waterways Authority of India (IWAI).

The section of the West Coast Canal (WCC) between Kollam and Kottapuram, along with Champakara and Eloor Canals, having length 205 Kms has been declared as National Waterway No.III by Government of India in 1993. Field studies were conducted for identifying the cross structures which fall below minimum standards prescribed by IWAI for



Plate 12 Kaniyampuzha Pipeline Bridge –on Champakara Canal

safe navigation. Modification of the cross structures were recommended wherever the structures fall below standards and the cost for modification of the cross structures was also estimated.

### *Findings of the Study*

Total number of electric lines to be replaced is 24, with an estimated expenditure of 24.9 crores. The total number of bridges to be reconstructed is 15 which involve an investment of Rs 258.4 crores. Two foot bridges were recommended for reconstruction at a cost of 1.25 crores. Reconstruction of railway bridge at an estimated cost of 139 crores, and reconstruction of locks at a cost of 105 crores was recommended. The overall expenditure is expected to be Rs.729 crores.

## **28. *Extension of National Waterway No.III to Kasargod in the North and Trivandrum (Kovalam) in the South***

For providing a continuous waterway corridor between Kovalam and Kasargod running parallel to the National Highway 47 and 17, the Inland Waterways Authority of India (IWAI) proposed to extend the National Waterway towards Kasargod in the north and Kovalam in the south.

NATPAC has been authorised by IWAI to frame proposals for upgrading the two identified waterway stretches to National Waterway standards.

Information on various parameters such as depth, width, cross structure details, existing bank protection methods adopted, bend radius details etc. were collected and the data was analysed on the basis of objective criterion as stipulated by the IWAI. Parameters which fall short of minimum standards were identified and the cost involved for making the necessary improvements was estimated.

The total quantity of various works to be taken up and the financial implications were worked out. The works to be taken up are dredging, widening the channels to 40m width, provision of bank protection measures, recommendation on location of terminals, provision of navigational aids and reconstruction of cross structures. The overall cost of the project is expected to be Rs. 5538.5 crores.



*Plate 13*  
*Kottappuram Bridge across NW-3*



*Plate 14*  
*View of Canal near Mathilakam Bridge*  
*(Ch.14.90 Km) Kottappuram - Chettuva*

## 1 User Interaction Meet

NATPAC organized a “User Agencies Interaction Meet” on 20<sup>th</sup> October 2011 at Thiruvananthapuram. The purpose of the meet was to familiarize the R&D works of NATPAC, its future work plans, and to obtain feedback from user departments which will help in formulating programmes as per the needs of the User Organizations. The programme was formally inaugurated by the Hon’ble Minister for Water Resources, Government of Kerala.



*Plate 15*  
*Smt.B.G.Sreedevi, Director, NATPAC welcoming the participants at the inaugural session of the User Agencies Interaction Meet*



*Plate 16*  
*Inauguration of the User Agencies Interaction Meet by Hon'ble Minister for Water Resources, Govt. of Kerala*

The User meet was attended by the Member of State Planning Board, Kerala, Transport Secretary, Chairman, RIAB, Kerala, Executive Vice President, KSCSTE, Transport Commissioner, Officers representing various user departments, PSUs and Directors of R&D Centres and Research Laboratories in the Region.

Hon’ble Minister for Water Resources also released NATPAC’s News letter- “*Safe Savari*”, “*Road Safety Diary*” and a book titled “*A decade of Road Accident Scenario in Kerala*”.



*Plate 17*  
*Releasing of the book “A decade of Road Accident Scenario in Kerala”*



In the technical session that followed presentations of R&D Projects and sponsored studies undertaken by NATPAC in the areas of Urban Transport, Road Safety, Rural Transport, Water Transport, Highway Engineering and Extension Services and Training were made. Dr. G.C. Gopala Pillai, Chairman, RIAB moderated the technical session.



*Plate 18*  
*Dr.G.C.Gopala Pillai, Chairman, RIAB moderating the User Interaction Meet session*



*Plate 19(a)*  
*Presentation by Smt.B G Sreedevi, Director*



*Plate 19(b)*  
*Presentation by Shri T Elangovan, Head, Traffic and Transportation Division*



*Plate 19(c)*  
*Presentation by Dr Mahesh Chand, Head Traffic Safety Division*



*Plate 19 (d)*  
*Presentation by Dr G Ravikumar, Head Extension Services Division*



*Plate 19 (e)*

*Presentation by Shri Tomy Cyriac, Head  
Water Transportation Division*



*Plate 19(f)*

*Presentation by Shri D Robinson, Head  
Regional Transportation Division*

On the whole nearly 100 participants representing the Departments of PWD, Transport, Tourism, Town Planning, LSGD Institutions, Police, Motor Vehicle Department, KSRTC, Water Transport, Rubber Board, Planning Board, Development Authorities, Road Fund Board etc., participated. Eminent persons who addressed the meet include: Shri.M.N.Prasad, Former Chairman, Railway Board; Shri.T.P.Senkumar, Transport Commissioner; Dr.N.P.Kurian, EVP (i/c) KSCSTE; Shri.K.R.Jothilal IAS, Transport Secretary; Dr. G.C. Gopala Pillai, Chairman, RIAB; Shri.S.Gopinath, IG (Traffic); Shri.T.Elangovan, Former Director, NATPAC and Dr. Mahesh Chand, Scientist G, NATPAC.



*Plate 20*

*View of the participants*

Posters depicting the achievements of NATPAC and its Publications on Road Safety were exhibited. The user interaction meet resulted in lively discussion on various issues related to parking, road safety, congestion, road development, water transport etc. Several important areas for research were identified. Development of walkways, improving pedestrian mobility, automatic signal systems in railways, inter modal integration, installing surveillance cameras at problematic road stretches and junctions were highlighted during the feedback session.



## 2 Safe Road to School

NATPAC in association with Kerala Road Safety Authority organised one day programme on, 'Safe Road to School (SRS)' at Govt. High School, Sreekariyam, Thiruvananthapuram on 25<sup>th</sup> November 2011. The programme was inaugurated by Shri M.A. Vahid, MLA, and addressed by Shri.T.P.Senkumar, IPS, Transport Commissioner and Road Safety Commissioner, Government of Kerala.



*Plate 21*  
*Inauguration of the SRS Programme*  
*by Shri.M.A.Vahid*



*Plate 22*  
*Students listening to class on 'Road Safety'*

The programme included training session on various aspects of road safety, interactive sessions, and road safety quiz programme for school students.

The programme is aimed at creating road safety awareness among school children and also helps to sensitise the various components of road safety to the school children. Classes were conducted by experts on topics such as traffic rules, traffic signs, signals, road markings and pedestrian safety.

## 3 Road Safety Week - 2012

NATPAC observed 'Road Safety Week - 2012' by organizing a series of activities from January 1 – 7, 2012. The programme was sponsored by Kerala Road Safety Authority. Activities during the road safety week included:

- Screening of Audio-visual programmes on road safety and road safety exhibition for the public at Kanakakunnu Palace, Thiruvananthapuram.
- Painting, Quiz and Elocution Competitions for Students, at Sasthra Bhavan, Pattom, Thiruvananthapuram.



*Plate 23  
Quiz Competition*



*Plate 24  
Class on 'Safe Road to School', by Salini, P N,  
Scientist-B, NATPAC*

- Panel Discussion on "Safer Roads for Kerala" at Mascot Hotel, Thiruvananthapuram on 6<sup>th</sup> January 2012. The discussion was moderated by Shri.M.N.Prasad, Former Chairman, Railway Board & Member, Kerala Road Safety Authority. The main objective of the Panel Discussion was to formulate an action plan for Kerala by bringing together experts of experience to share their perspectives and actions needed for enhancing Road Safety in the State of Kerala.



*Plate 25 (a)  
Shri.M.N.Prasad giving his opening remarks  
in the panel discussion on 'Safer Roads for Kerala'*



*Plate 25 (b)  
Panel discussion in progress*



Plate 25(c)

*Shri.Gopinath, IPS expressing his views at the panel discussion*

- Road Safety Youth Leadership Program (RSYLP) – Inauguration of State Level programme. The programme was inaugurated by Shri V.S.Sivakumar, Hon'ble Minister for Transport & Devaswom, Government of Kerala on 7th January 2012 at Sasthra Bhavan, Pattom, Thiruvananthapuram. The Transport Minister had released books published by NATPAC entitled 'Safe Community Programme for Panchayats' (English and Malayalam), 'Helping Road Accident Victims', and the publications were received by Shri.T.P.Senkumar IPS, Road Safety Commissioner, Government of Kerala and Prof.V.N.Rajasekharan Pillai, Executive Vice President, Kerala State Council for Science Technology and Environment (KSCSTE) respectively.



Plate 26 (a)

*Smt.B.G.Sreedevi, Director, NATPAC welcoming the participants at the inaugural session of RSYLP*



Plate 26 (b)

*Inauguration of RSYLP by Hon'ble Minister for Transport & Devaswom, Govt. of Kerala*



Plate 26 (c)

*Class on 'Youth leadership in Road Safety' by Dr.Mahesh Chand, Scientist-G and Head, Traffic Safety Division, NATPAC*

- Road Safety Training Programme for public, students, and heavy vehicle drivers.

*NATPAC Regional Office, Kozhikode had organised the following programmes as part of Road Safety Week -2012:*

- No Honking Day on 1<sup>st</sup> January 2012 at NH 17 (Kadavu Toll Booth) & NH 213 (Ramanattukara, Kozhikode District)
- Road Safety Awareness Programme for Students on 2<sup>nd</sup> January 2012 at M.E.S College of Engineering Auditorium, Kuttippuram (Malappuram District)
- Distribution of road safety literature and hand out cards on 3<sup>rd</sup> January 2012 at Ramanattukara - Feroke Bus stand, Kozhikode District
- Demonstration Class on 'Basic Life Saving Techniques' on 4<sup>th</sup> January 2012 at Parammal School, NH-17 (Malappuram District)
- Road Safety Awareness Programme for Students and Public on 5<sup>th</sup> January 2012 at Seva Mandir Higher Secondary School, Ramanattukara, Kozhikode
- Distribution of road safety literature on 6-7<sup>th</sup> January 2012 at major transport terminals in Kozhikode city



*Plate 27*

*Demonstration Class on 'Road Safety' for students at Seva Mandir Higher Secondary School, Ramanattukara*



*Plate 28*

*Some of the hand out cards prepared by NATPAC*

NATPAC also organised screening of Road Safety Films prepared by the R&D Centre in Doordarshan and Malayalam Channels from 1<sup>st</sup> January 2012 to 8<sup>th</sup> January 2012 throughout the State.



## **4 Training**

### **a) In-house Training**

- Two days training on “ArcGIS -10” for Scientists on 12-13 October 2011.
- Training on “Statistical Package for Social Sciences (SPSS)” for Scientists and Technical Staff on 14<sup>th</sup> December 2011.
- Training on “Auto Cad 2012” for Scientists and Technical Staff on 9<sup>th</sup> January 2012.

### **b) Road Safety Training for Various target Groups**

NATPAC organised and conducted the following training programmes during the year.

- i. ‘Road Safety Training Programme’ for school children as part of Summer Vacation Camp at State Central Library, Thiruvananthapuram on 8<sup>th</sup> April 2011.
- ii. ‘Road Safety Training Programme’ for students of St.Joseph School, Thiruvananthapuram on 24<sup>th</sup> September 2011.
- iii. Training on Road Safety at M.G.College, Thiruvananthapuram on 2<sup>nd</sup> November 2011.
- iv. ‘Road Safety Training Programme’ to NCC students of St.Mary’s Higher Secondary School on 24<sup>th</sup> November 2011.
- v. Road Safety Awareness Training Programme for drivers of KSRTC, Thiruvananthapuram on 3<sup>rd</sup> December 2011.
- vi. Road Safety Training to Trainers of various Driving schools in Nedumangadu Taluk at Govt. UP School, Nedumangadu on 5<sup>th</sup> January 2012.
- vii. ‘Road Safety and Traffic Management’ Classes for Police Personnels at Police Training College, Thiruvananthapuram on June 2011, October 2011, November 2011 and January 2012.
- viii. ‘Road Safety Education and Training classes for High School students’ at Govt.High School, Kumarapuram in association with Medical College Police, as part of Road Safety Week -2012, on 6<sup>th</sup> January 2012.

- ix. Training on 'Road Safety' for Autorickshaw and Taxi drivers at Town Hall, Attingal on 16<sup>th</sup> February 2012.
- x. 'Road Safety Education Programme for Higher Secondary School Students' at Cotton Hill Higher Secondary School, Vazhuthacaud, Thiruvananthapuram on 17<sup>th</sup> February 2012.

## **5 Exhibitions**

- i. Conducted Road Safety Exhibition at Central School, Nedumkolam, Kollam on 24<sup>th</sup> -25<sup>th</sup> November 2011.
- ii. Road Safety Exhibition and audio-visual programmes in connection with "Road Safety Week 2012".
- iii. Road Safety Exhibition and audio-visual programmes in connection with 24<sup>th</sup> Kerala Science Congress, at Rubber Research Institute of India, Kottayam, 29<sup>th</sup> – 31<sup>st</sup> January 2012.
- iv. Conducted Road Safety Exhibition at Mar Athanasius College, Kothamangalam, 20<sup>th</sup> – 25<sup>th</sup> February 2012.



## 6 Participation in Workshops, Seminars/Conferences and Other Training Programmes

Name of Programme	Organised by	Date	Venue	Participants
<b>Workshops</b>				
“Workshop on Research Methodology”	Dept. of Mechanical Engineering, NIT, Calicut	04.04.2011 - 05.04.2011	National Institute of Technology, Calicut	V.S.Sanjay Kumar Sabitha N M
“Workshop on Digital Library”	KSCSTE	05.07.2011- 07.07.2011	Kerala Forest Research Institute (KFRI), Peechi	Subin B
“Workshop on Research Methodology, Writing Practices and Language Skills for Women Scientists”	KSCSTE	15.12.2011- 16.12.2011	Sasthrabhavan, Pattom, Thiruvananthapuram	Sabitha N M, Salini P N
UGC Sponsored “Workshop on Advanced GPS Surveying [WAGS]”	Dept. of Geography, Bharathidasan University, Trichy	03.02.2012 - 04.02.2012	Dept. of Geography, Bharathidasan University, Trichy	M.S.Saran
State Level Workshop on “Barrier Free Environment for disabled and access for all”		29.02.2012	Thiruvananthapuram	Satheish B Nair
<b>Seminars/Conferences</b>				
Kerala Environment Congress 2011	Centre for Environment & Development (CED)	25.08.2011 - 27.08.2011	Rajiv Gandhi Centre for Biotechnology (RGCB), Thiruvananthapuram	P Kalaiarasan
India R&D -2011 Industry-Academia Linkages Conference	Federation of Indian Chambers of Commerce and Industry & Dept. of Science & Technology, Govt. of India	02.11.2011- 03.11.2011	New Delhi	T.Elangovan
72 <sup>nd</sup> Annual Meeting of Indian Roads Congress	Govt. of Uttar Pradesh & IRC, New Delhi	03.11.2011- 06.11.2011	Lucknow	T.Elangovan
Panel discussion on “Preparation of Transport Policy for Kerala”	Kerala Sasthra Sahithya Parishath	12.11.2011	Thrissur	T.Elangovan
National Conference of Advances in Civil Engineering (NACE 2011)	Department of Civil Engineering, Mar Baselious College of Engineering and Technology, Thiruvananthapuram	03.12.2011	Mar Baselious College of Engineering and Technology, Thiruvananthapuram	P Kalaiarasan Salini P N Sabitha N M V.S.Sanjay Kumar
24 <sup>th</sup> Kerala Science Congress	Rubber Board, Kottayam and sponsored by KSCSTE	29.01.2012 - 31.01.2012	Rubber Research Institute, Kottayam	Sabitha N M Salini P N V.S.Sanjay Kumar
Investors Meeting for proposed PRT system in Trivandrum	Infrastructures Kerala Limited, Trivandrum	14.03.2012	Infrastructures Kerala Limited, Trivandrum	T. Elangovan

## 7 Guidance to Students' Project Work and Thesis

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

Name of the Institution	Course	No. of Students	Topic
<b>Traffic and Transportation Division</b>			
National Institute of Technology, Surathkal, Karnataka	M.Tech (Transp. Systems Engg)	4	Intermodal Transit Terminal for Thiruvananthapuram International Airport
Kalasalingam University, Tamil Nadu	B.Tech (Civil)	4	Streamlining Pedestrian flow in CBD area of Trivandrum
Saint Kits College of Engineering, Kottayam	B.Tech (Civil)	5	Personal Rapid Transit System for Trivandrum City
<b>Regional Transportation Division</b>			
Travancore Engineering College, Thiruvananthapuram (UOK)	B.Tech (Civil)	5	Traffic Studies for Kottayam Bypass
Travancore Engineering College, Thiruvananthapuram (UOK)	B.Tech (Civil)	5	Traffic Improvement Plan for Kazhakkootam Area
Carmel Engineering College, Pathanamthitta (MG Uni.)	B.Tech (Civil)	5	Topographic Survey and Pavement Design of Thiruvalla - Manarcadu Bypass
<b>Highway Engineering Division</b>			
Marian Engineering College, Thiruvananthapuram	B.Tech (Civil)	5	Study of ambient air quality in Pathanamthitta district
Marian Engineering College, Thiruvananthapuram	B.Tech	5	Resource Mapping of Road Construction Materials - Thiruvananthapuram District
<b>Water Transportation Division</b>			
Marian Engineering College, Thiruvananthapuram	B.Tech	5	Improvement of Kovalam – Akkulam Section of T S Canal in Thiruvananthapuram City for Inland navigation and Tourism

## 8 *Presentation of Papers in Seminar/Workshops*

1. **B G Sreedevi**, “*Transport Development*”. District Development Forum Seminar, organised by Solidarity Youth Movement, at Public Library Hall, Thiruvananthapuram, 3<sup>rd</sup> December 2011.
2. **B G Sreedevi, Salini P N**, “*A Comparative study on the characteristic properties of coarse aggregates available in Southern Kerala*”. 24<sup>th</sup> Kerala Science Congress, organised by Rubber Board, Kottayam and sponsored by KSCSTE, at Rubber Research Institute, Kottayam, 29<sup>th</sup> -31<sup>st</sup> January 2012. (Contest Paper for Young Scientist Award)
3. **Elangovan T**, “*Application of Intelligent Transport Systems in India*”. National Conference on Innovations in Civil Engineering (NCICE), at SCMS School of Engineering & Technology (SSET), Ernakulam, 19th March 2012.
4. **Elangovan T**, “*Sustainable Transportation Development in Kerala*”. Journal of Builders Vision, September 2011; Pages 15-18.
5. **Kalaiarasan P, B G Sreedevi**, “*Energy consumption in transport sector and its effect on climate*”. Kerala Environment Congress 2011, at Rajiv Gandhi Centre for Biotechnology (RGCN), Thiruvananthapuram, 25<sup>th</sup> -27<sup>th</sup> August 2011.
6. **Kalaiarasan P, B G Sreedevi**, “*Study on air quality and estimation of vehicular emission in South Kerala*”. National Conference of Advances in Civil Engineering (NACE 2011), organized by Department of Civil Engineering, Mar Baselious College of Engineering and Technology, Thiruvananthapuram, 3<sup>rd</sup> December 2011.
7. **Robinson D, M S Saran**, “*Air Pollution Monitoring in Central Business District (CBD) in Ernakulam City Using Geographical information System*”. National Seminar on Geospatial Solutions for Resource Conservation and Management, organised by Karnataka State Remote Sensing Application Centre (Department of IT, Bt and S&T, Govt. Of Karnataka), at JN Tata Auditorium, Indian Institute of Science, Bengaluru, 18<sup>th</sup> -19<sup>th</sup> January 2012.
8. **Robinson D, V S Sanjay Kumar**, “*Mobility Plan for West Kallada Grama Panchayath*”. 24<sup>th</sup> Kerala Science Congress, organised by Rubber Board, Kottayam and sponsored by KSCSTE, at Rubber Research Institute, Kottayam, 29<sup>th</sup> -31<sup>st</sup> January 2012.
9. **Robinson D, V S Sanjay Kumar**, “*Prioritisation of roads for enhancing market connectivity*”. National Conference of Advances in Civil Engineering (NACE 2011), organized by Department of Civil Engineering, Mar Baselious College of Engineering and Technology, Thiruvananthapuram, 3<sup>rd</sup> December 2011.

## **9 Invited Talks/Media Interactions**

### **B.G.Sreedevi**

#### Invited Talk

1. *'Safety on Roads'*. Training programme on Safety, at School of Engineering, Cochin University of Science and Technology (CUSAT), 7<sup>th</sup> April 2011.
2. *'Expressways - Challenges and Myths'*. Discussion at TKM College of Engineering, Kollam, 22<sup>nd</sup> September 2011.
3. *Key note address* at Institution of Engineers, Thiruvananthapuram on 'National Cycle Day', organized by Energy Conservation Society, 22<sup>nd</sup> September 2011.
4. Panelist - IEEE Seminar on 'Women achievers in Engineering', Kollam, 2<sup>nd</sup> December 2011.
5. Session Chairperson - 'National Conference of Advances in Civil Engineering', at Mar Baselios College of Engineering, Thiruvananthapuram, 3<sup>rd</sup> December 2011.
6. *'Design of safe roads'*. Talk delivered in the Panel Discussion on 'Safer Roads for Kerala', organised by NATPAC in connection with 'Road Safety Week -2012' at Mascot Hotel, Thiruvananthapuram, 6<sup>th</sup> January 2012.
7. *'Appropriate treatment of road features from becoming safety hazards'*. Talk delivered at the Seminar on "Modernization of Road Safety Initiatives in Public Works", 28<sup>th</sup> - 29<sup>th</sup> March 2012.

#### Media Interactions

1. *'Panel Discussion on Roads'*. Malayalam Communications, Kairali Channel on 14<sup>th</sup> July 2011.
2. *'Road Safety'*. Discussion in '*Nammal Thammil*' in Asianet on October 2011.
3. *'Panel Discussion on Road Safety'*. All India Radio on 8<sup>th</sup> December 2011.
4. *'Phone - in programme on Road Safety'*. Thiruvananthapuram Doordarsan on 11<sup>th</sup> January 2012.
5. *'Kazhakoottam Development'*. Discussion in '*Nattukoottam*' in Manorama News Channel on February 2012.
6. *'Discussion on Railway Budget'*. Amrita TV on 15<sup>th</sup> March 2012.

## **T.Elangovan**

### Invited Talk

1. *Key note speech* at one day Seminar on 'Managing the Mobility Chaos – A road to sustainable, safe and efficient mobility in Kerala', organised by Darsana, at Palakkad, 13<sup>th</sup> August 2011.
2. *'Integrated Transport Policy for Kerala'*. State level Panel Discussion, Trichur on 12<sup>th</sup> November 2011.
3. *'Transport Development Policy for Kerala'*. Key note speech delivered at seminar held at Chalakkudi, 27<sup>th</sup> November 2011.
4. *'Cochin Metro Rail – the way forward'*. Talk delivered at 'Metro Round Table Conference', organized by Kerala Chamber of Commerce and Industry, at Cochin, 6<sup>th</sup> January 2012.
5. *'Road Safety Engineering –Traffic Engineering Approach'*. Talk delivered at the 'State Level Youth Leadership Programme for promoting road safety', organized by NATPAC, at Sasthra Bhavan, Thiruvananthapuram, 7<sup>th</sup> January 2012.
6. *'Guidelines for preparation of Project Reports for external funding'*. Talk delivered at Centre for Educational Research & Development, College of Engineering, Thiruvananthapuram, 17<sup>th</sup> February 2012.
7. *'Development of Waterways and Inland Navigation System for Kerala - Policies and Legal issues'*. Talk delivered at the 'National Seminar on Infrastructure Law', organized by National University of Legal Studies, Cochin, 22<sup>nd</sup> - 24<sup>th</sup> March 2012.

## ***10 Nominations to Technical Committees/ Advisory Bodies***

### **B G Sreedevi**

- Member, Working group on Climate Change Monitoring and Networking related to Science and Technology-KSCSTE
- Member, Kerala Road Safety Authority
- Member, Board of Studies in Environmental Studies, CUSAT (2011-'15)
- Member, Internal Assessment Committee of KSCSTE
- Member, 24<sup>th</sup> Kerala Science Congress Committee
- Member, State Level Working Group of National Transport Policy Committee
- Member, Technical Committee for Roads and Road safety, State Planning Board, Kerala
- Member, Technical Advisory Committee for Formulation of Development Schemes for Attukal and adjoining areas
- Member, State Executive Committee of Disaster Management, Govt. of Kerala
- Member, High Level Committee on Coastal Shipping, State Planning Board, Kerala
- Member, Director Board of Kerala State Road Transport Corporation (KSRTC)
- Expert Member, Trivandrum Development Authority (TRIDA)

### **T. Elangovan**

- Council Member of Indian Roads Congress for 2011-12, elected at the 72<sup>nd</sup> Annual Session of the IRC held at Lucknow.
- Director on the Board of Directors of Kerala Shipping & Inland Navigation Corporation – A Public Sector Undertaking under the Coastal Shipping & Inland Navigation Dept., Govt. of Kerala (since 2007)
- Member, Highway Research Board – Identification, Monitoring and Research Applications (IMRA) Committee, IRC, New Delhi
- Honorary Director, Working Group for Developing Modular Curricula on 'Air Transport Services' Central Institute of Vocational Education, Bhopal



- Member, Management Committee of NATPAC
- Academic Council Member, Noorul Islam University, Kumaracoil, Kanyakumari District, Tamil Nadu
- Member, Board of Studies for UG Programmes in Civil Engineering, Thiagarajar College of Engineering, Madurai
- Member, Expert Committee for 'Enactment of Unified Inland Navigation Act Kerala-2010' constituted by Government of Kerala
- Member, State Advisory Committee, Kerala State Electricity Regulatory Commission
- Member, State Level Expert Committee on "Preparation of Integrated District Development Plan and Local Area Development Plans in Kerala" constituted by LSG Department, Government of Kerala
- Member, Technical Committee on 'Fully Automated Services of Transport Department (FAST)' constituted by Transport Dept., Government of Kerala
- Member, Project Implementation Committee (PIC), Kerala School of Mathematics, Kozhikode
- Member, Expert Committee to 'Suggest specifications, guidelines and procedure for utilization of waste plastic with bitumen for road construction' constituted by PWD, Govt. of Kerala
- Member, Kerala Fare Regulatory Committee constituted by Govt. of Kerala
- Member, Educational Standing Committee, Institute of Town Planners (India), New Delhi
- Member, Expert Committee for 'Scrutinizing the Revised PWD Standard Data Book' constituted by Public Works Dept, Govt. of Kerala
- Member, Expert Committee on 'Preparation of Unified Bill for Kerala State by amalgamation of Travancore/Cochin/Madras Public Canals and Public Ferries Act' constituted by Law Department, Government of Kerala

## **Dr. G. Ravikumar**

- Life Member, Indian Economic Association
- Member, Indian Roads Congress
- State Nodal Officer for Draft Transport Policy for the State

## 11 Road Safety Education Materials

### Films

- |   |                            |
|---|----------------------------|
| 1. Savari, A Documentary Film on Road Safety                                    | – For Autorickshaw 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. Safe Cycle Use (English and Malayalam)                                       | – For School Children      |
| 7. Safe Use of School Bus (English and Malayalam)                               | – For School Children      |
| 8. On Pedestrian Safety   |                            |
| 9. On safe Transportation of Goods (Tankers, Trucks, Special Category Vehicles) |                            |

### Booklets

1. Safe Road to School (English & Malayalam)
2. Preventing Accidents
3. Two Wheeler Driving Manual (English)
4. Road Safety Manual for Goods Vehicle
5. All about Lane Driving
6. Safe Cycling
7. Autorickshaw Driving Manual (English & Malayalam)
8. ഗതാഗത വിദ്യാഭ്യാസവും റോഡ് സുരക്ഷയും, കുട്ടികൾക്കുവേണ്ടിയുള്ള ലഘുലേഖ
9. Defensive Driving
10. റോഡ് സുരക്ഷിതത്വ പാഠങ്ങൾ
11. റോഡപകടങ്ങൾ ഒഴിവാക്കാൻ സുരക്ഷാമാർഗ്ഗങ്ങൾ
12. Teachers Training Manual (Malayalam)
13. Traffic Safety Quiz –Test your Road Safety Knowledge
14. Safe Community Programme for Panchayats (English & Malayalam)
15. Helping Accident Victims (English & Malayalam)
16. Rules of the Road Regulation, 1989
17. On Car and Safe Driving

### Student Badges

1. Be Careful and Be Safe
2. Don't Be Safety Blinded Be Safety Minded
3. Follow Traffic Rules and Be Safe
4. You Can't Fix Your Brain at a Body Shop – Buckle Up!
5. While Driving Put off Mobile! Put on Seat Belt!
6. Better to Arrive Late Than Never
7. Courtesy and Common Sense Promote Road Safety
8. Road Safety is a Mission, Not an Intermission
9. Before Crossing Stop! Think! Then Act
10. Kindness is Giving the Right of Way
11. Look Carefully and Drive Safely
12. Be smart, think, then Start

13. Leave sooner, drive slower, live longer
14. Drive as if every child on the street were your own
15. Be careful and be safe
16. At work at play let safety lead the way
17. Safety is a simple ABC- Always Be Careful
18. Safety on road, Safe tea at home
19. The safe way is the best way
20. നിൽക്കൂ!ശ്രദ്ധിക്കൂ!റോഡ് മുറിച്ച് കടക്കൂ!
21. സൂക്ഷിച്ച് വാഹനമോടിക്കൂ, റോഡിലെ തിരക്കിൽ നിങ്ങളുടെ കുട്ടികളും ഉണ്ടായിരിക്കാം
22. വേഗതയിലല്ല സ്മാർട്ടാകേണ്ടത്, സുരക്ഷയിലാണ്
23. ശ്രദ്ധിച്ച് നോക്കൂ, സുരക്ഷിതമായി ഡ്രൈവ് ചെയ്യൂ
24. സുരക്ഷിതത്വം മഹത്വമാണ്
25. വീഥിയിലൂടെ വേഗത വേണ്ട
26. ശ്രദ്ധിക്കൂ സുരക്ഷിതരായിരിക്കൂ
27. അശ്രദ്ധ അപകടമാണ്
28. നേരത്തെ ഇറങ്ങൂ, നേരെ ഓടിക്കൂ, നേരായവിധം ജീവിക്കൂ
29. ശ്രദ്ധയുള്ളിടത്ത് സുരക്ഷ ഉണ്ട്
30. പാഞ്ഞു പോകരുത്, പ്രാണൻ എടുക്കരുത്
31. സുഗമമായ പാത നിങ്ങളുടെ മാത്രം സ്വന്തമല്ല

## Calenders

1. Steps to Use Bus safety
2. Safe Road to school – Crossing the Road Safely
3. Safe Road to School – Kerb Drill
4. Safe Road to school – Lessons from Animals
5. Road Signs

## 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. Follow this Simple Kerb Drill
8. School Safety – A Checklist for Parents
9. Understanding Traffic Rules and Regulations (English & Malayalam)
10. Don't Be Rash and End in Crash (English & Malayalam)
11. Helmets (English & Malayalam)
12. Golden Rules for Defensive Driving (English & Malayalam)
13. Untied Duppatta/Saree – Risks and Remedies (English & Malayalam)

## 1 New Campus for NATPAC at Akkulam, Thiruvananthapuram

The Hon'ble Chief Minister of Kerala, Sri. Oommen Chandy inaugurated the new campus of National Transportation Planning and Research Centre (NATPAC) at Aakkulam on 1<sup>st</sup> July 2011. Akkulam is about 10 km from Thiruvananthapuram city. The new campus of the premier transport research agency has been named after the former Chief Minister of Kerala, Sri.K.Karunakaran as "K.Karunakaran Transpark".

Kazhakkootam MLA Sri.M.A. Vahid presided over the function. Smt.Ramani P Nair, District Panchayath President and Sri.C.T.S Nair, Executive Vice President, KSCSTE graced the occasion. Three floors have been completed. The new campus at Aakkulam aims at giving a fresh impetus to the organization's research activities and scope for future development.



## 2 Testing Facilities and Equipments

Sl. No.	Item
<b>a) Highway Engineering Laboratory</b>	
<b>I. Soil Testing Equipments</b>	
1.	Soil sieves
2.	Mechanical sieve shaker(motorized)
3.	Liquid limit test apparatus
4.	Shrinkage limit test set
5.	Compaction test equipment-light & heavy
6.	Automatic motorized universal compactor
7.	Core cutter for field density test
8.	Sand pouring cylinder (10cm,15 cm&20 cm dia) for field density test
9.	CBR test equipment
10.	Rapid moisture content - Infrared moisture meter
11.	Rapid moisture content - Calcium carbide test apparatus
12.	Post hole auger
13.	Direct Shear Test
14.	Triaxial Shear Test
15.	Unconfined Compression Test
16.	Consolidation Test
17.	Permeability Test
<b>II. Aggregate Testing Equipments</b>	
18.	Aggregate sieves
19.	Aggregate Impact Value test equipment
20.	Los angles abrasion testing machine
21.	Stripping value test equipment
22.	Specific gravity test - Density basket
23.	Shape test - Thickness gauge & Length gauge, Angularity number test mould
<b>III. Bitumen &amp; Emulsion</b>	
24.	Penetration test equipment
25.	Flash & fire point Test apparatus
26.	Softening point test - Ring & ball apparatus
27.	Ductility testing machine
28.	Standard Tar Viscometer
29.	Specific gravity - Pycnometer
30.	Dean and Stark apparatus - water content
31.	Distillation test apparatus
32.	Wax content test apparatus
33.	Solubility test equipment

Sl. No.	Item
34.	Particle charge test apparatus - emulsion
35.	Residue on 600 micron sieve test apparatus - emulsion
36.	Coagulation test apparatus - emulsion
37.	Settlement test apparatus - emulsion
<b>IV. Tests on Mixes</b>	
38.	Marshall stability test equipment.
39.	Motorized centrifuge extractor
40.	Core cutting machine - (100mm dia. core bit)-undisturbed sampling of bituminous pavement.
<b>V. Test on Pavement and evaluation</b>	
41.	Fifth Wheel type Bump Integrator
42.	MERLIN - Machine for evaluating roughness using low cost instrumentation
43.	Benkelman beam test equipment
44.	Portable wheel weigh bridge/pad
45.	Portable Skid Resistance Tester
46.	Sand Patch method test set
<b>b) Traffic Engineering Laboratory</b>	
47.	Noise level meter
48.	Speed Radar
<b>c) Topographic Survey</b>	
49.	DGPS
50.	Single Frequency GPS-5 Nos.
51.	Total stations-3 Nos.
52.	Automatic levels-2 Nos.
53.	Theodolite
54.	High end plotters -2 Nos.
<b>d) Environment Laboratory</b>	
55.	CO Analyzer
56.	CO <sub>2</sub> Analyzer
57.	NO <sub>2</sub> Analyzer
58.	CH <sub>4</sub> Analyzer
59.	Cup Anemometer
60.	Wind vane
61.	Wind logger
62.	RH meter
63.	Thermo couple sensor
64.	Spectro photo meter
65.	Respirable Dust Sampler (APM 460)-2 Nos.
<b>e) Water Transport Laboratory</b>	
66.	Echo sounder
67.	Portable cantilever scale



Sl. No.	Item
68.	Distometer
<b>f) General Accessories for Laboratory</b>	
69.	Thermostatically controlled drying oven 0-150 <sup>0</sup> C
70.	Thermostatically controlled water bath
71.	Electronic balances – 200 g, 2 kg, 50 kg
72.	Soaking tank
73.	Heater
74.	Semiautomatic balance 10 kg – 2 nos.
75.	Traffic safety appurtenances
76.	Power generator- 2 nos.
77.	External car battery-3 nos.
78.	Digital Thermometer
<b>g) Application Softwares</b>	
79.	MX ROAD
80.	AUTO CAD
81.	ARC GIS
82.	3D MAX
83.	TALLY
84.	STAD PRO
85.	HDM IV
86.	SPSS

### **3    *Library and Information Services***

The NATPAC Library is entrusted with the responsibility of providing assistance to the scientists, researchers, and students in their scientific and academic activities. The Library has a vast collection of books on Transportation, Traffic Engineering, Transport Economics, Urban and Regional Planning, Environment, Management, Operations Research, Geography and allied subjects. In addition to this the Technical Reports prepared by NATPAC are also available for reference purpose. The library has a good collection of the publications by Indian Roads Congress (IRC). 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. For computerization of the Library, NATPAC uses LIBSOFT. Bibliographic records of books available in the library can be accessed through Online Public Access Catalogue (OPAC).

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.

National Transportation Planning and Research Centre (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, Govt. of Kerala   | - | Vice President |
| 6. Minister for Education, Govt. of Kerala  | - | Vice President |
| 7. Minister for Forests, 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,<br>Government of India               | - | Member         |
| 13. The Vice Chancellor, Cochin University<br>of Science and Technology                       | - | Member         |
| 14. The Vice Chancellor, Kerala Agricultural University                                       | - | Member         |
| 15. The Secretary to Government, Finance Department,<br>Govt. of Kerala                       | - | Member         |
| 16. The Secretary to Government, Planning and Economic<br>Affairs Department, Govt. of Kerala | - | Member         |

- |   |   |        |
|---|---|--------|
| 17. The Director, Vikram Sarabai Space Centre,<br>Thiruvananthapuram  | - | Member |
| 18. The Director, NIST, Formerly (RRL-T),<br>Thiruvananthapuram   | - | Member |
| 19. The Director, Sree Chitra Tirunal Institute<br>for Medical Sciences and Technology,<br>Thiruvananthapuram | - | Member |
| 20. The Member Secretary (nominated by Government)  | - | Member |
| 21. Director, TBGRI, Trivandrum   | - | Member |
| 22. Director, KFRI, Peechi, Thrissur  | - | Member |

The 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,<br>Government of India or his/her nominee (Ex-officio)  | - | Member    |
| 3. Secretary, Planning & Economic Affairs,<br>Government of Kerala (Ex-officio)   | - | Member    |
| 4. Additional Chief Secretary, Finance,<br>Government of Kerala (Ex-officio)  | - | Member    |
| 5. Director, TBGRI, Trivandrum  | - | Member    |
| 6. Director, KFRI, Peechi, Thrissur   | - | Member    |
| 7. One representative each of Science and Technology,<br>Industry and Environment Departments nominated to the Council<br>by Government of Kerala | - | Members   |
| 8. Member Secretary, KSCSTE   | - | Secretary |

### **iii. Research Council of NATPAC**

1. Dr. C. E. G Justo - Chairman  
334, 25<sup>th</sup> Cross, 14<sup>th</sup> Main,  
Banashankari 2<sup>nd</sup> Stage,  
Bangalore -560 070
2. Dr. P.K. Sarkar - Member  
Professor of Transport Planning  
School of Planning & Architecture  
4-Block-B, Indraprastha Estate  
New Delhi – 110 002
3. Dr. B. P. Chandrasekhar - Member  
Director (Technical),  
National Rural Roads Development Agency  
(Ministry of Rural Development, Govt. of India)  
New Delhi – 110 066
4. Sri.R.M.Nair - Member  
Formerly Member (Tech.) IWAI  
304/28, East End Apartments  
Mayoor Vihar, Phase – 1  
Extension, New Delhi – 110 096
5. Dr. Kuncheria P Issac - Member  
Member Secretary,  
AICTE, 7<sup>th</sup> Floor  
Chanderlok Building, Janpath  
New Delhi -110 001
6. The Secretary to Government - Member  
Public Works Department  
Govt. of Kerala
7. Member Secretary - Member  
KSCSTE
8. T.Elangovan - Permanent Invitee  
(Former Director), Scientist-G, NATPAC
9. Director, NATPAC - Member Convenor  
Thiruvananthapuram

**iv. Management Committee of NATPAC**

- |  |                   |
|--|-------------------|
| 1. Director, NATPAC  | - Chairman        |
| 2. Director, TBGRI<br>Palode, Thiruvananthapuram                     | - Member          |
| 3. Member Secretary<br>KSCSTE  | - Member          |
| 4. Special Secretary to Govt. Law Department<br>Government of Kerala | - Member          |
| 5. Shri. T. Elangovan<br>Scientist G, NATPAC                         | - Member          |
| 6. Registrar, NATPAC   | - Member Convenor |

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

Public Information Officers	:	Shri. D.Robinson, Scientist E-2 <i>(Scientific and Technical Matters)</i>
		Shri. P C. Sivadas Assistant Registrar (Administration) <i>(Administrative Matters)</i>
Asst. Public Information Officer	:	Smt.V.S.Manju Office Assistant
Appellate Authority, RTI Act	:	Smt.B.G.Sreedevi Director



## vi. Internal Committees

### a) Library Committee

Shri.G.C.Das Gupta Deputy Chief Project Coordinator	Chairman
Dr.G.Ravikumar Scientist F	Member
Shri.Tomy Cyriac Scientist E-2	Member
Shri.D.Sunder Scientist E-1	Member
Shri.K.Mohanakumar Assistant Registrar (Finance)	Member

### b) Capital Purchase Committee

Shri.T.Elangovan, Scientist G	Chairperson
Shri.D. Robinson, Scientist E-2	Member
Shri.V.S.Govindan Namboodiri, Registrar	Member
Shri.K.Mohanakumar, Assistant Registrar (Finance)	Member
Shri.P.C.Sivadas, Assistant Registrar (Admn.)	Convenor

## NATPAC Staff –as on 01.04.2012

Smt.B.G.Sreedevi

Director

### **Scientific Staff**

1	T. Elangovan	Scientist- G (Head, Traffic & Transportation Dn.)
2	Dr. Mahesh Chand	Scientist- G (Head, Traffic Safety Dn.)
3	Dr. G. Ravikumar	Scientist-F (Head, Extension Services Dn.)
4	G.C.Das Gupta	Dy.Chief Project Coordinator (Head, Central Support System Dn.)
5	N. Vijaya Kumar	Scientist-E2 (Head, Regional Office, Kozhikode)
6	Tomy Cyriac	Scientist-E2 (Head, Highway Engineering Dn.)
7	D. Robinson	Scientist-E2 (Head, Regional Transportation Dn.)
8	Satheish B. Nair	Scientist-E2 (Head, Water Transportation Dn.)
9	D. Sunder	Scientist-E1
10	S.Shaheem	Scientist-E1
11	V.S. Sanjay Kumar	Scientist-C
12	P.Kalaiarasan	Scientist-B
13	B.Subin	Scientist-B
14	P N Salini	Scientist-B
15	M S Saran	Scientist-B
16	N.M.Sabitha	Scientist-B
17	K.C.Wilson	Scientist-B
18	Arun Chandran	Scientist-B

### **Technical Staff**

19	K. M. Syed Mohammed	Principal Technical Officer
20	C. Anbalagan	Technical Officer Grade -5
21	S. Ramachandran	Technical Officer Grade -5
22	T. Ramakrishnan	Technical Officer Grade -5
23	C. Muraleedharan Pillai	Technical Officer Grade -4
24	V. Ajith Kumar	Technical Officer Grade -4
25	O. Sugatha	Technical Officer Grade -4
26	V. Jayawardhanan	Technical Officer Grade -3
27	K. Satheesan	Technical Officer Grade -3
28	V.G. Sasi	Technical Officer Grade -2
29	M.S. Radhakrishnan	Technical Officer Grade -2
30	K. Devadethan Nair	Technical Officer Grade -2
31	E. P. Surendran Pillai	Technical Officer Grade -2
32	T. Mohan	Technical Assistant Grade-2
33	S. Geetha	Technical Assistant Grade-2
34	R. Radhakrishnan Thampi	Technical Assistant Grade-2

## ***Administrative Staff***

35	K.George Koshy	Registrar (on LLP)
36	P.C. Sivasdas	Dy. Registrar (Admn.)
37	K. Mohanakumar	Dy. Registrar (Finance)
38	J.Krishnamoorthy	P.A. to Director Grade-4
39	T. Vijayan	P.A. to Registrar Grade-1
40	Abey George	P.A. to Director Grade-1
41	D. Shaju	Section Officer Grade-1
42	R. Lekha	Typist cum Stenographer Grade-4
43	A. Praveen Kumar	Clerical Assistant Grade -1
44	P. K. Rajan	Driver Grade -I
45	G.Ragesh	Driver Higher Grade
46	A.Somaraj	Driver Grade -I
47	Sukhdev Kolay	Jr. Assistant / Sr.Helper
48	C. Viswanathan	Jr. Assistant / Sr.Helper
49	P. X. Mathew	Sr.Helper /Jr. Assistant
50	S. Jayakumar	Helper Grade -4
51	G. Suresh Kumaran Nair	Helper Grade -2
52	A.Anil Kumar	Helper Grade -I
53	P. Lakshmi	Helper Grade -4
54	Athira S Kumar	Helper Grade -I
55	Surendran Kulangara	Driver Grade -I
56	Shijil P R	Driver Grade -I

## **New Recruitments**



*K C Wilson, Scientist B*



*S Shaheem, Scientist E1*



*Surendran Kulangara,  
Driver Grade I*



*P R Shijil,  
Driver Grade I*

## **Retirement**



*Sri. G C Das Gupta, Deputy Chief Project Coordinator  
Superannuated on 31<sup>st</sup> October 2011*

## **Obituary**



*Sri. P K Rajan, Driver (Higher Grade)  
Expired on 3<sup>rd</sup> September 2011*

**PLAN STUDIES UNDERTAKEN DURING 2011-'12**

<b>Sl. No.</b>	<b>Code</b>	<b>Project</b>
1	PR 101/2011-12	Resource Mapping of Road Construction Materials in Kerala -Thiruvananthapuram District
2	PR 102/2011-12	Demonstration Project on the use of PMB, NRMB, CRMB and Plastic Waste for road construction and study on its suitability to Kerala conditions
3	PR 103/2011-12	Use of Geo-synthetic materials in road construction and embankment works - a demonstration project
4	PR 104/2011-12	Preparation of inventory of roads for two block panchayaths in Kannur District
5	PR 105/2011-12	a) Road development for an emerging town - a case study of Kottarakkara b) Mobility Plan for West Kallada Project in Kollam c) Traffic Improvement Plan for Kottayam Town d) Transport Infrastructure Development Plan for Harippad Town
6	PR 106/2011-12	Constraints in developing West Coast Canal in Kerala - Phase II - Case Study of selected stretches in North Kerala (Kozhikode, Kannur and Kasargod Districts)
7	PR 107/2011-12	Constraints in developing West Coast Canal in Kerala -a Case Study of National Waterway III
8	PR 108/2011-12	Periodic Updation of Price Index for Stage Carriages Operation (PISCO) in Kerala
9	PR 109/2011-12	Study on the Performance of Highway Development Projects in Kerala
10	PR 110/2011-12	Safety Auditing of Public Transport System in Kerala
11	PR 111/2011-12	Shortest Path Analysis and Service Area Allocation for Ambulance Services in Thiruvananthapuram Corporation - a GIS Approach
12	PR 112/2011-12	Route Network Planning of Inland Water Transport System for Kerala - Phase I - Central Kerala

Sl. No.	Code	Project
13	PR 113/2011-12	Identification of Accident Prone Locations and Improvement Measures in National Highways 17 and 212 Segments in Kozhikode District
14	PR 114/2011-12	Role of IPT Modes in Medium Size City in Kerala - a Case Study of Kozhikode
15	PR 115/2011-12	Study on Gender Issues of Mobility of Working Women
16	PR 116/2011-12	Integration of Public Transport Services - a Case Study of Thiruvananthapuram City
17	PR 117/2011-12	Streamlining of pedestrian traffic in a CBD area - a Case Study of Thiruvananthapuram City
18	PR 118/2011-12	Predictive accuracy of urban transport studies in Kerala

**CONSULTANCY / SPONSORED PROJECTS IN 2011-'12**

<b>Sl. No.</b>	<b>Code</b>	<b>Project</b>	<b>Sponsored by</b>
1	RP 00311	R&D support on Road Safety Research and Training Programmes	Kerala Road Safety Authority (KRSA)
2	RP 01010	Tipper Lorry Drivers' Training Programme	Kerala Road Safety Authority (KRSA)
3	RP 00110	Study of ambient air quality and its contribution to climate changes in Kerala	Directorate of Environment & Climate Change, Kerala (EMAK)
4	C 00411	Improvements to Nayathodu Junction (Angamaly)	Public Works Department (Roads), Ernakulam
5	C 00211	Study on existing Cross Structures along National Waterways III	Inland Waterways Authority of India (IWAI)
6	C 00311	Measurement of Air Quality & Noise level at IISER Campus Vithura	Centre for Water Resources Development and Management (CWRDM)
7	C 01308	Road connectivity to the proposed KINFRA Industrial Park in Manjeswara , Kasaragod	Kerala Industrial Infrastructure Development Corporation (KINFRA)
8	C 00610	CDP & Mobility Plan for Mattannur Urban area	Municipal Council, Mattannur Municipality
9	C 01111	Development of Thiruvalla – Puthuppalli – Kottayam (Manarkad) Combined Bypass	Public Works Department (NH), Government of Kerala
10	C 00209	Supervision of installation of comprehensive signage scheme for Kovalam Tourist Area	Dept. of Tourism, Govt. of Kerala
11	C 00711	4/6 Laning of Kazhakuttam to Kerala / Tamil Nadu Border stretch of NH 47( from KM 00/00 - KM 43/00)- Traffic Survey	National Highways Authority of India (NHAI)

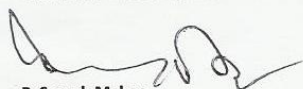


Sl. No.	Code	Project	Sponsored by
12	C 01211	4 lane section of Edappally – Aroor on NH 47 (Km 342 to Km 358.750)- Traffic Survey	National Highways Authority of India (NHAI), Cochin Region
13	C 00911	Restructuring of the jurisdiction of PWD AEs based on Assembly Constituency	Public Works Department (PWD) Government of Kerala
14	C 00412	Traffic Forecasts for the proposed Personal Rapid Transit System (PRTS) in Thiruvananthapuram City	Infrastructures Kerala Limited (INKEL)
15	C 00512	Toll collection potentials for NH-7 between Thumbipadi and Namakkal in Tamil Nadu	National Highways Authority of India (NHAI), Chennai Region
16	C 00112	Widening, strengthening and extension of existing Tippu Sultan Road	Roads and bridges Development Corporation, Kerala (RBDCK)
17	C 00212	Pre-feasibility study for constructing a Green-Field Highway between Nedumbassery and Vytilla in Kochi	Kochi Metro Rail Ltd (KMRL)
18	C 00612	Improvement of Aswini Junction in Thrissur Town	Public Works Department (PWD) Roads Division- Thrissur
19	C 00511	Assessment of supply and demand of Railway Tickets	Trivandrum Railway Division, Southern Railways
20	C 00611	Techno Economic Feasibility Study for extension of NW-3 towards north of Kottapuram and south of Kollam	Inland Waterways Authority of India (IWAI)
21	C 00811	Feasibility Study for the setting up of a Monorail system from Technocity ( Pallipuram) to Neyyattinkara in Thiruvananthapuram District	Transport Dept., Government of Kerala

**NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE, TRIVANDRUM**  
**( A unit of Kerala State Council for Science, Technology & Environment. Govt. of Kerala )**  
**Consolidated Income & Expenditure Account for the year ended 31/03/2012**

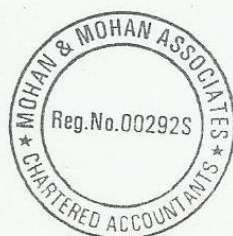
Expenditure	Sch No	Year ended 31.03.2012	Year ended 31.03.2011	Income	Sch No	Year ended 31.03.2012	Year ended 31.03.2011
		₹	₹			₹	₹
To Infrastructure Strengthening (Plan)	10	2,11,16,411	1,431	By Grant from Government of Kerala	7	4,06,44,354	7,73,46,177
To Infrastructure Strengthening (Non Plan)	11	9,64,724	6,41,870	By Other Receipts	8	53,74,866	23,55,398
To Salaries and Allowances (Plan)	12	86,916	-	By Depreciation written back	1	29,25,228	18,20,209
To Salaries and Allowances (Non Plan)	13	2,37,59,239	3,25,09,393	Income from Sponsored Project	9	31,05,722	48,52,602
To Depreciation	1	29,25,228	18,20,209	Other Project Expenses			8,45,689
To Consultancy Project Expenses		31,05,722	20,42,584	Excess of Expenditure over Income			15,68,026
To Refund to Govt of Kerala		91,930					
To Other Project Expenses			8,45,689				
To Transfer to Building fund			3,40,00,000				
To Transfer to Corpus Fund			6,14,839				
To Project Expenses under Plan scheme			1,63,12,085				
<b>Total</b>		<b>5,20,50,170</b>	<b>8,87,88,100</b>	<b>Total</b>		<b>5,20,50,170</b>	<b>8,87,88,100</b>

For Mohan & Mohan Associates  
Chartered Accountants



R. Suresh Mohan  
Partner  
Membership No. : 013398  
Firm Reg. No.: 0020925

Place : Thiruvananthapuram  
Dated : 05.02.2012



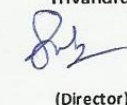
For National Transportation Planning and Research Centre  
Trivandrum



(Dy Registrar)



(Registrar)



(Director)

Place :Thiruvananthapuram  
Dated:  
03.02.2012

**NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE, TRIVANDRUM**  
**( A unit of Kerala State Council for Science, Technology & Environment. Govt. of Kerala )**  
**Balance Sheet as on 31st March 2012**

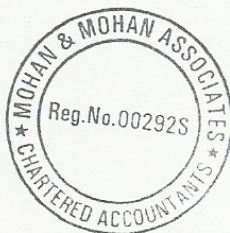
Liabilities	Sch No	As at 31.03.2012	As at 31.03.2011	Assets	Sch No	As at 31.03.2012	As at 31.03.2011
Reserves & Surplus	4	1,06,54,189	67,83,980	Fixed Assets	1	1,06,54,188	67,83,980
Current Liabilities	5	53,65,234	32,00,378	Current Assets	2	1,90,43,341	55,61,240
Unspent balance	6	1,74,53,437	49,71,316	Loans & Advances	3	5,89,65,331	5,78,00,453
Building Fund Account		5,51,90,000	5,51,90,000				
<b>Total</b>		<b>8,86,62,860</b>	<b>7,01,45,673</b>	<b>Total</b>		<b>8,86,62,860</b>	<b>7,01,45,673</b>

**For Mohan & Mohan Associates**  
**Chartered Accountants**



**R. Suresh Mohan**  
**Partner**  
**Membership No. : 013398**  
**Firm Reg. No.: 002092S**

**Place : Thiruvananthapuram**  
**Dated : 05.02.2013**



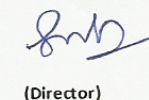
**For National Transportation Planning and Research Centre**  
**Trivandrum**



**(Dy Registrar)**



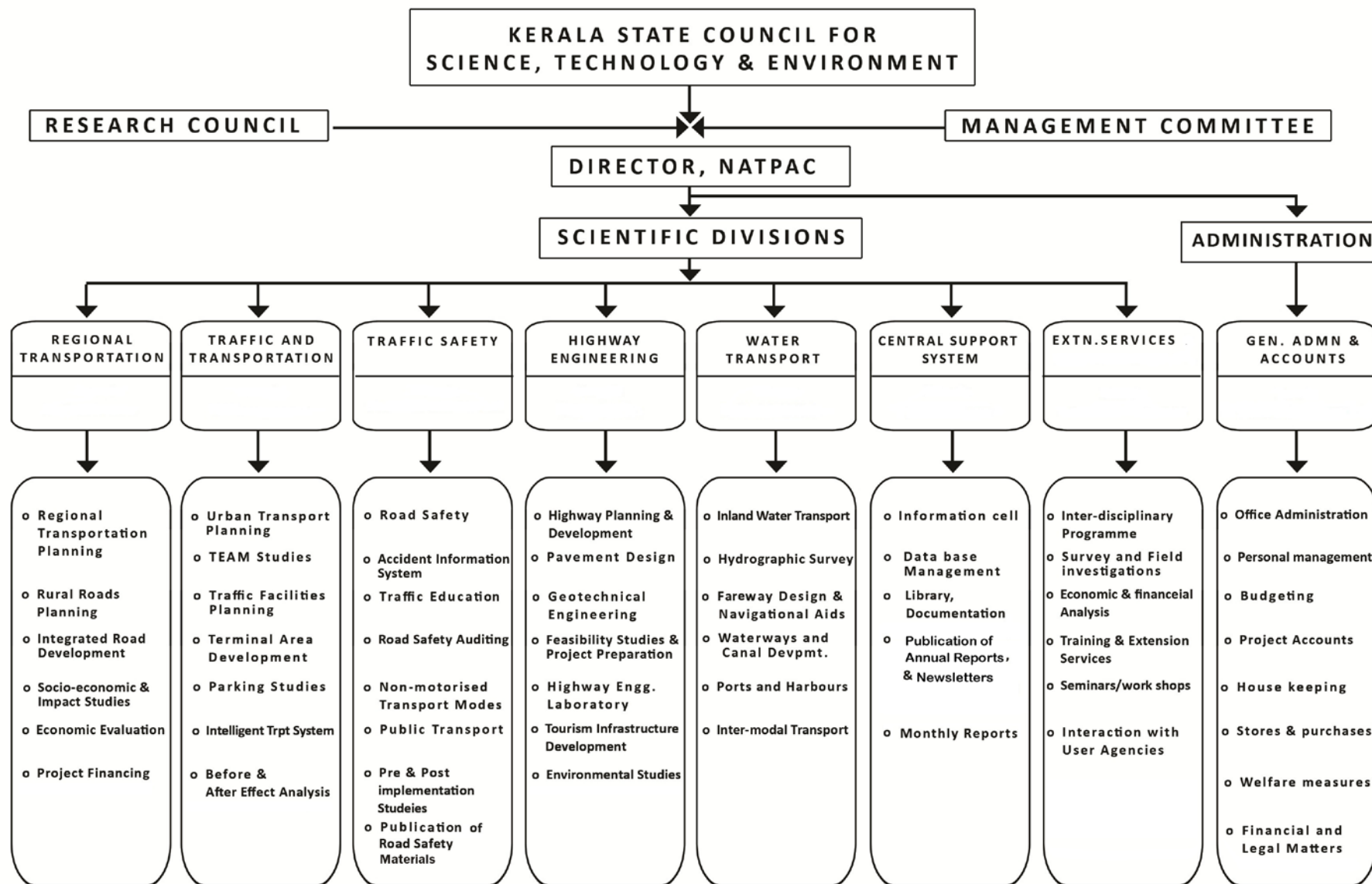
**(Registrar)**



**(Director)**

**Place : Thiruvananthapuram**  
**Dated: 05.02.2013**







## **National Transportation Planning and Research Centre**

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

Sasthra Bhavan, Pattom Palace P.O.,

Thiruvananthapuram - 695 004

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