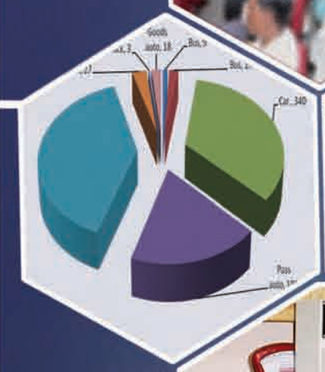
ANNUAL REPORT 2010-'11

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

Annual Report 2010-'11



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From Director's Desk...

I have great pleasure in presenting this Annual Report of NATPAC for the period 2010-11. This reporting period proved to be another remarkable year for NATPAC in its efforts to serve the country as a leading R & D Centre in the field of Traffic and Transportation. Seven well established divisions of this institution, viz., Traffic and Transportation Division (TTD), Regional Transportation Division (RTD), Traffic Safety Division (TSD), Highway Engineering Division (HED), Water Transport Division (WTD), Extension Services Division (ESD) and Central Support System Division (CSSD) are carrying out research in multi-disciplinary areas of Transportation. The major achievements of NATPAC are briefly outlined in this report.

Over the past decades, NATPAC has emerged as a premier institution devoted to Research, Consultancy and Training activities in the field of Transportation and allied areas. NATPAC's requirement of a new campus was finally realized. The Hon'ble Chief Minister of Kerala, Sri. V.S. Achuthanandan laid the foundation stone for the new office building of NATPAC to house the laboratories at Akkulam, Thiruvananthapuram on 4th June 2008 in the land allotted by CESS for the purpose.

The focus of R&D activities of NATPAC come under the following broad themes: Regional Transportation, Rural Roads Planning, GIS applications in road projects, Traffic and Transportation Studies, Urban Transport Planning, Economic and Financial Evaluation of Infrastructure Projects, Traffic Safety, Road Safety Auditing, Road Safety Education Materials, Highway Engineering, Pavement Evaluation Studies, Tourism Infrastructure Development and Water Transportation. During 2010-'11, the R & D activities of NATPAC showed an upward trend. The Institution has been striving to become a centre of excellence in the field of Transportation by engaging partnership with National and International agencies and making its research and training activities relevant to the needs of its clients. NATPAC continued studies on Integrated Development of Transport Infrastructure for emerging towns. This year suitable remedial measures were prepared for the smooth and accident free movement of traffic for the Kottarakkara town.

Preparation of Inventory of Roads for Grama Panchayaths was another core activity of NATPAC. The spatial data base for the 16 Grama Panchayaths in Kannur District was prepared. Detailed road network map for Rural Local Bodies using GIS format were prepared which will enable to prepare an Integrated District Development Plan. As per the directions received from Shri Vijayanand, IAS, Director, IMG and the request from the President, West Kallada Panchayath, NATPAC prepared a mobility plan for the panchayath. The Centre also undertook the Traffic and Transportation studies for selected 23 towns in the State for the Department of Town and Country Planning.

The updated Price Indices for Stage Carriage Operations (PISCO) and for Autorickshaw & Taxi operations (PIATO) are prepared as input to Government for revising the fare for buses, taxi and auto rickshaw services in the State from time to time. NATPAC has done field evaluation studies

on bituminous mixes modified with waste plastics. The use of waste plastic for road construction can save the environment, increase the service life of roads, reduce the consumption of petroleum products and serve the society with additional income for those associated with it. NATPAC analysed accident causative factors at accident-prone locations on State Highways of Northern Kerala and formulated accident abatement measures.

NATPAC is only one of its kinds to undertake R&D and sponsored research programmes on Waterways and Inland Water Transport System in the whole of India. NATPAC has undertaken studies for all round development of West Coast Canal system which entails in development of backwater tourism and employment generation activities, besides reducing congestion on roads.

NATPAC has strength in carrying out economic and financial feasibility studies for construction of bypasses, widening the existing roads and highways, comprehensive traffic and transportation planning studies, traffic engineering and management studies, preparation of short and medium traffic improvement measures, parking and circulation plans, intersection designs, etc. for cities and towns, and studies related to road safety and rural road planning.

NATPAC Library is well equipped and is involved in providing assistance to the scientists, researchers, and students in their scientific and academic activities related to traffic and transportation.

NATPAC's commitment towards Public Safety has prompted it to take up several studies, publications and programmes on 'road safety'. NATPAC has also been able to project the State's requirements in the area of Inland Waterways, Highway development and capacity building of transportation sector at the Central Government level.

On behalf of NATPAC, I express my deep gratitude to the Hon'ble Chief Minister of Kerala, Executive Vice President, distinguished members of the Executive Committee of KSCSTE, Research Council and Management Committee of NATPAC who provided unending support and valuable advice to the Institute. We are also grateful to the professionals, experts and representatives of technical institutions and non-governmental organisations for their assistance and cooperation in conducting the programmes and activities of the Institute. I thank all the Scientists and staff of the Institute who had contributed to the research activities of the Institute during the year.

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STUDIES/ PROJECTS

1 Development of Pattom - Kesavadasapuram Road in Thiruvananthapuram City - Impact on Traffic Flow and Safety of Road Users

A properly designed roadway has to take into consideration the mobility and safety of road users and the motorists. While developing major traffic corridors ad hoc road development strategy is followed and the roads are developed in bits and pieces. With limited facilities, these roads do not adequately address the requirements of safe driving, parking and pedestrians facilities. Absence of proper facilities for road users lead to delay to traffic, increased accident risk, and haphazard parking which eventually cause safety problems to road users.

Realizing the importance of this, NATPAC has taken up a study to evaluate the impact of developing a model road corridor on the safety of road users. Pattom - Kesavadasapuram section of NH-47 in Thiruvananthapuram city is taken up as a case study corridor. This high density traffic corridor is a major entry point for traffic coming from the northern side of Kerala through National Highways and the Main Central Road to Thiruvananthapuram city. A number of major traffic generators like public and semi-public institutions, educational and medical facilities, and important commercial establishments are located along this corridor.

The aim of the study is to evaluate the impact of development of a major road corridor on traffic flow and safety of road users. The specific objectives of the study are given below:

a) To examine the design principles followed in planning and construction of major arterial road scheme and identify the deficiencies in providing geometric features and auxiliary facilities on the identified road.

b) To assess the traffic flow and speed characteristics of vehicles.

c) To suggest appropriate modifications to various roadway elements including parking, street furniture and pedestrian facilities to improve the operational efficiency and safety of road users.

The scope of the study was confined to the stretch of National Highway between Pattom and Kesavadasapuram passing through the city of Thiruvananthapuram.

The following tasks were carried out:

a) Review of the geometric features of the identified road corridor including the accident statistics and traffic flow characteristics.
b) Inventory of the existing road side appurtenances and their adequacy, adherence to standard code of practice, visibility angle and their cause-effect on the safety of motorists.
c) Detailed traffic analysis on the project road.
d) Preparation of road development plan for the identified road corridor.

The improvement proposals for the identified corridor include:

- Minor geometric corrections were proposed for Pattom and Kesavadasapuram junctions.
- Bus stops located on the carriageway between Pattom and Kesavadasapuram were proposed for relocation with segregated bus bays and shelters
- Considering the relevance of traffic signs in promotion of road safety, a comprehensive traffic signage scheme and proper road markings have been proposed at appropriate locations
- As a short-term measure, organized parking lots are demarcated along the road stretch.
- Pedestrian actuated signal is suggested near the Kendriya Vidhyalaya School and Govt. Model H.S.S. and a grade-separated pedestrian facility is warranted in front of St. Mary's High School in view of heavy pedestrian cross movement during school timings.
- The study stretch consists of dual carriageway with central divider. Suitable street lighting is suggested on the central reserve fitted with double arms. For street lighting, sodium vapour lamps are proposed.
- It is proposed to landscape the median strip with greenery and traffic channelizers at the intersections with appropriate plants.

An improvement plan for Kesavadasapuram junction is illustrated in **Figure 1.**

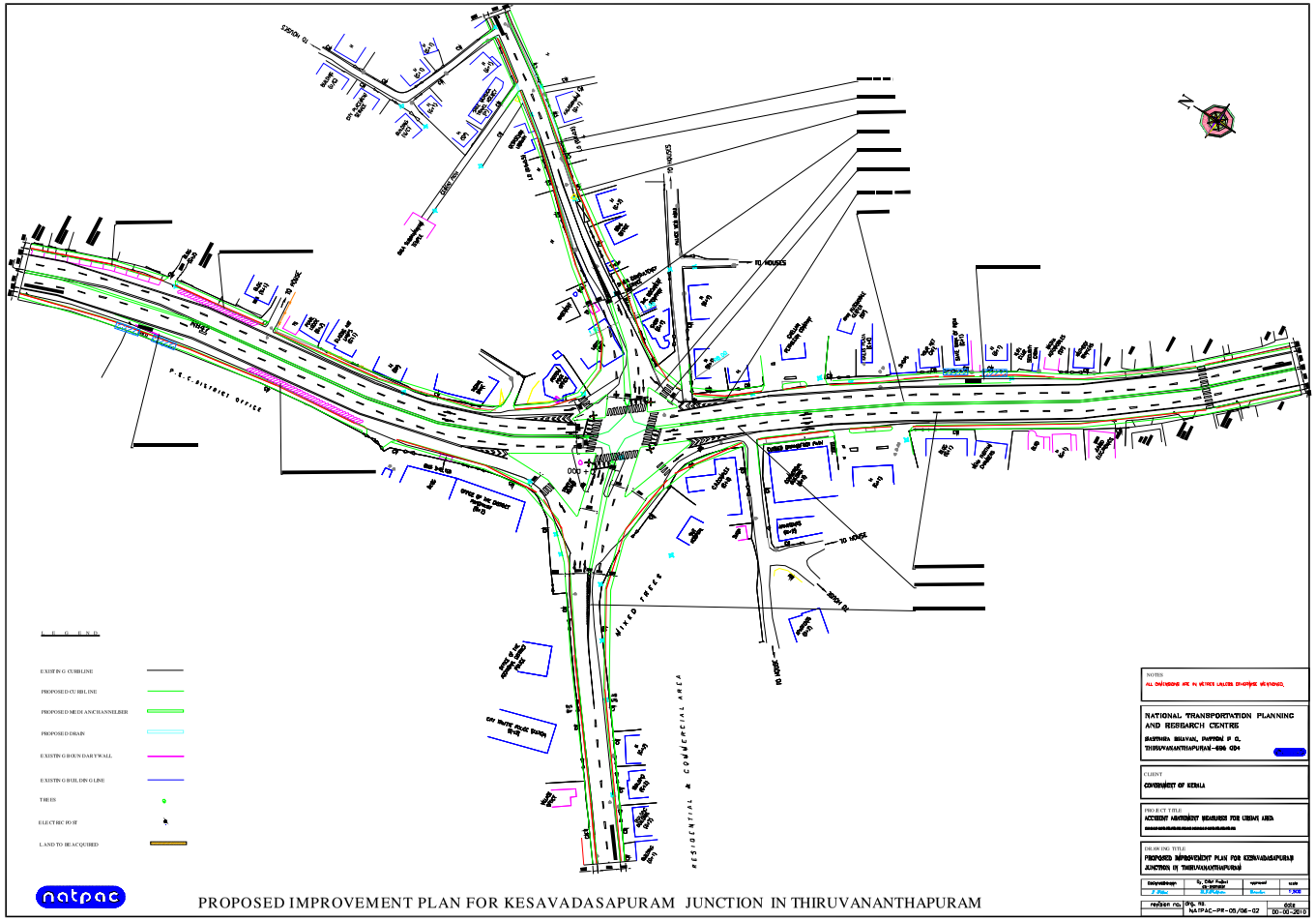


Figure 1
Proposed Improvement Plan for Kesavadasapuram Junction in Thiruvananthapuram

2 Price Index for Stage Carriage Operations in Kerala

In Kerala, both KSRTC and private operators provide bus transport services. There are about 20,000 buses registered as stage carriages of which, the KSRTC operates around 6,000 buses. A large number of privately owned stage carriages are single bus operators. With the introduction of the revised Motor Vehicle Act and Rules, the earlier system of restricting the permits to stage carriages stands abolished. In the present system, there are virtually, no restrictions on the issue of permits. Consequently, there exists an unhealthy competition among the bus operators on the same routes leading to low turn-over of bus users. There is no scientific data to assess the impact of fare revision and profitability of operation of the private stage carriages. The major objectives 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.

There was increase in fuel prices and certain other cost inputs such as tyre, tube etc. since then. Fuel cost alone showed an increase of 15 percent during the period. It is found that the value of PISCO index (Base=2005) as on January 2011 prices is 128.07 as against the index of 116.21 during January 2010 showing an increase of 11.95 percent (**Table 1**). The present study is carried out based on the available secondary data collected by NATPAC from various sources. Frequent fluctuations in fuel and other cost inputs and also the load and lead parameters could not be realistically estimated. The cost of components and weights used for computing the values of these factors remain unaltered. For a comprehensive revision of fares, a detailed study on the route and operating characteristics, traffic density, load, lead, revenue, social impact assessment etc. need to be conducted.

Table 1
Computation of Price Index for ordinary private stage carriage operations as on January 2011
(Base Year =September 2005)

Product/ Components	Unit	Current Quantity per-km(Base=1996)	Current Year Price (Base Year =2005-Sep)	Index Value per-km-(Base Year=2005-Sep)	New index value/km(Jan.2010)	RF-WPI/CPI(27 Feb.2010-Jan.2011)	New index value /km (Jan.2011)
VARIABLE COST		**Q1**	**P1**	**Q1*P1**	P3*Q2*RF2	RF3	RF3*G
HSD	Litre	0.2222	33.75	7.5	9.035	1.1453	**10.3475**
Lubricants							
Engine Oil	Litre	0.0010125	109	0.1104	0.1762	1.0751	0.1894
Gear Oil	Litre	0.0001875	97	0.0182	0.0291	1.0751	0.0313
Other Oil	Litre	0.0003125	97	0.0303	0.0518	1.0751	0.0557
Grease	Kilogram	0.000133333	117	0.0156	0.0249	1.0751	0.0267
Sub-total				**0.1745**	0.2819		**0.3031**
Tyre & Tube							
New	One set	5.71429E-05	8150	0.4657	0.6229	1.1361	0.7076
Retread	One set	5.71429E-05	1950	0.1114	0.1437	1.1361	0.1632
Sub-total				**0.5771**	0.7665		**0.8708**
Spare and maintenance							
Diesel engine	Number	0.000004	280000	1.12	0.609	1.0042	0.6116
Starters	Number	1.66667E-05	11934	0.1989	0.1795	1.0042	0.1803
Alternators	Number	0.00002	10161	0.2032	0.1556	1.0042	0.1562
Batteries	Number	6.66667E-06	7700	0.0513	0.0419	1.0042	0.042
Diesel Fuel pumps	Number	0.0000125	37355	0.4669	0.6082	1.0042	0.6107
Gear box	Number	0.000005	70600	0.353	0.3924	1.0042	0.394
Spring leaf-front	Number	1.21212E-05	10549	0.1279	0.1182	1.0042	0.1187
Spring leaf-rear	Number	1.21212E-05	12000	0.1455	0.1377	1.0042	0.1383
Brake linings	Number	3.33333E-05	1600	0.0533	0.0472	1.0042	0.0474
Clutch phase	Number	1.66667E-05	5267	0.0878	0.0842	1.0042	0.0845
Wheel bearing	Number	2.22222E-05	7462	0.1658	0.1275	1.0042	0.1281
Sub-total				2.9737	2.5013		**2.5118**
Total Variable Cost				**11.0508**	**12.3028**		**13.7301**
Fixed cost							
Wages and Salaries							
Average Wage	4 persons	0.016	117.546	1.8807	4.1997	1.1289	4.741
PF/Welfare fund	4 persons	0.016	14.1055	0.2257	0.0504	1.1289	0.0569
ESI	4 persons	0.016	1.17546	0.0188	0.0479	1.1289	0.054
Bonus	4 persons	0.016	23.509	0.3761	0.9211	1.1289	1.0399
Gratuity	4 persons	0.016	9.4036	0.1505	0.3829	1.1289	0.4322
Sub-total				**2.6518**	**5.6019**		**6.3241**
Tax		1.21212E-05	125280	1.5185	1.248	1	1.248
Insurance		1.21212E-05	11086	0.1344	0.646	1	0.646
Cost of capital		1.21212E-05	147785	1.7913	0.161	1.011041	0.1627
Sub-total(Except Salary)				**3.4443**	2.055		2.0568
Depreciation		1.21212E-05	69728	0.8452	0.8536	1	**0.8536**
Total Fixed Cost				**6.9413**	**8.5105**		**9.2344**
All components				18.1665	21.0952		23.2677
PISCO INDEX				**100**	**116.121**		**128.08**

3 Computation of Price Index for Auto rickshaw and Taxi Operations in Kerala

Urban transportation has become the basic ingredient for providing the much-needed mobility to men and materials and also for the growth of the urban economy. There are 4.8 lakhs Auto rickshaws and 1.45 lakhs taxis in the state having valid registration as on March 2010. Out of 4.8 lakhs autos, about 3.04 lakhs autos are using petrol as fuel. Over 1.68 lakhs autos are using diesel fuel and around 10,000 autos are using LPG fuel. Taxis are using mostly diesel engines. No scientific study was conducted in the past on the computation of exact cost of operation of these vehicles under optimum operating conditions and their periodic variation according to variation in input prices. The impacts of the periodic fare revision on profitability of operation have also not been assessed scientifically by carrying out ex-ante and ex-post fare revision studies. The major objectives were to find out the operational characteristics like passenger load, passenger lead, daily collection and expenditures (fixed and variable cost) of Auto & Taxi operations in Kerala and to prepare Price Indices for Auto and Taxi Operations (PIATO) for understanding the periodical movement of prices of operating cost, and other inputs for different types of Auto and Taxi operations.

National Transportation Planning and Research Centre (NATPAC) brought out PIATO for the first time in Kerala State. Cost table approach is adopted to compute cost of operations of vehicles under optimum utilization of capacity, which is derived from detailed analysis of life cycle behavior of almost all important vehicle components. The index presents a clear methodology for taking decisions such as fare revisions.

The fare for Taxi services was fixed as Rs. 7.0 per kilometer and that of Autos at Rs. 5.50 per km. as per the fare revision effected in March 2010. The Price Indices for Taxi Operations (PITO) moved from 119.04 in February 2010 to 126.01 as on 15th December 2010 showing an increase of 5.85 percent (**Table 2**). The Price Indices for Auto Rickshaw Operations (PIARO) moved from 122.72 in February 2010 to 136.4871 as on 15th December 2010 showing an increase of 11.22 percent (**Table 3**). Periodical updation of PIATO gives a scientific basis of fare revision of Stage Carriage Operations.

Table 2
Computation of Price Index for Taxi Operation (PITO) in Kerala as on 15th December 2010
(Base Year =June 2006)

Sl No	ITEMS	PRICE/COST as on June 2006	QTY	Value /km as on June 2006	PRICE/COST as on 27 Feb.2010	Value/km as on 27 Feb.2010	Price as on 15 Dec.2010
A	**VARIABLE COST**						
	Fuel cost (Petrol)	33.75	0.0625	2.109375	38.97	2.435625	2.586875
	Engine system	67106.33531	5.49E-06	0.3686	85514.3024	0.469711	0.48972092
	Lubrication system	14631.8	1.57E-05	0.23	21216.11	0.3335	0.3710981
	Clutch system	5871.1062	1.03E-05	0.06055	7468.09777	0.07702	0.08030125
	Housing system	9735.348	4.75E-06	0.046215	12342.86065	0.058593	0.06108933
	Propeller system	5119.05	5.23E-06	0.02676	6414.307756	0.033531	0.03495945
	Gear Box	19761.99	5.52E-06	0.10902	25100.02094	0.138468	0.14436692
	Exhaust system	2962.19	1.04E-05	0.0308	3768.923725	0.039188	0.04085764
	Wheels and tyres	868.69	7.75E-06	0.006729	1154.179373	0.00894	0.00932131
	Body	16741.5545	1.76E-05	0.294097	18522.57094	0.325384	0.37515725
	Brake system	27749.51	4.4E-06	0.122118	34906.22705	0.153613	0.16015679
	Front &rear suspension	20151.552	9.75E-06	0.1964	26014.8827	0.253545	0.26434613
	Steering system	16936.23	1.12E-05	0.1903	21650.01453	0.243265	0.25362866
	Electrical sys	5032.35	9.02E-06	0.0454	6722.605923	0.060649	0.06323256
	Fuel system	34009.29	1.02E-05	0.3475	42542.60454	0.434692	0.45320993
	Miscellaneous	10737.01	1.34E-05	0.1434	13726.89957	0.183332	0.1911421
	Sub Total (Variable)			4.327264		5.249056	5.57946334
B	**FIXED COST**						
	Wages and Salaries	48000	1.54E-05	0.738462	64415.58442	0.991009	1.10609391
	Road Tax	1140	1.54E-05	0.017538	1140	0.017538	0.01753846
	Interest	3498	1.54E-05	0.053815	3498	0.053815	0.05381538
	Depreciation	26666	1.54E-05	0.410246	26666	0.410246	0.41024615
	Insurance	5250	1.54E-05	0.080769	4725	0.072692	0.07269231
	General Overheads	6000	1.54E-05	0.092308	7125	0.109615	0.1142851
	Sub Total (Fixed)			1.393138		1.654917	1.77467131
C	**TOTAL(VAR. +FIXED)**			**5.720402**		**6.903973**	**7.35413465**
D	ROI	48000	1.54E-05	0.738462	51000	0.784615	0.78461538
	GRAND TOTAL			6.458864		7.688588	8.13875004
	INDEX			**100**		**119.04**	**126.01**

Table 3
Computation of Price Index for Auto Rickshaw Operation (PIARO) in Kerala as on 15th December 2010 (Base Year =June 2006)

Sl No	ITEMS	PRICE/COST as on June 2006	QTY	Value /km as on June 2006	PRICE/COST as on 27 Feb.2010	Value/km as on 27 Feb.2010	% change from Feb.2009 to 27 Feb. 2010	Price as on 15 Dec.2010
A	**VARIABLE COST**							
	Fuel cost (Petrol)	45	0.033333333	1.5	50.27	1.675667	17.01583	59.04
	Engine system	14241.34	1.18493E-05	0.16875	19617.54	0.232454	4.263224	20453.263
	Lubrication system	10395.54	2.50011E-05	0.2599	15073.53	0.376855	18.30028	16772.892
	Clutch system	1995	2.0016E-05	0.039932	2645.038	0.052943	2.360599	2757.7187
	Housing system	2992	7.78743E-06	0.0233	3832.88	0.029848	0.88006	3996.1639
	Propeller system	968	1.83884E-05	0.0178	1282.056	0.023575	2.345493	1336.6729
	Gear Box	3967	1.66978E-05	0.06624	5282.805	0.088211	1.456311	5507.8568
	Exhaust system	1154.25	1.28222E-05	0.0148	1522.929	0.019527	1.456311	1587.8069
	Wheels and tyres	5410	3.27301E-05	0.17707	6619.335	0.216652	2.745671	7631.8822
	Body	12702	8.9356E-06	0.1135	16839.88	0.150474	2.15103	17557.273
	Brake system	3533	2.51911E-05	0.089	4780.782	0.120433	3.66991	4984.448
	Front &rear suspension	5010	2.29541E-05	0.115	6645.057	0.152531	2.34681	6928.1425
	Steering system	1154.5	4.98051E-05	0.0575	1554.183	0.077406	3.646607	1620.3925
	Electrical sys	6864.4	1.46174E-05	0.10034	8760.48	0.128056	1.456311	9133.684
	Fuel system	2328.25	1.19188E-05	0.02775	2951.805	0.035182	1.456311	3077.5545
	Miscellaneous	4320	2.22222E-05	0.096	6087.273	0.135273	5.442177	6346.596
	Sub Total (Variable)	77035.28		2.866882		3.515088	10.84116	
B	**FIXED COST**							
	Wages and Salaries	36000	0.000025	0.9	50727.27	1.268182	5.442177	56618.182
	Road Tax	530	0.000025	0.01325	530	0.01325	0	530
	Interest	2561	0.000025	0.064025	2561	0.064025	0	2561
	Depreciation	5667	0.000025	0.141675	5667	0.141675	0	5667
	Insurance	2200	0.000025	0.055	1775	0.044375	0	1775
	General Overheads	2000	0.000025	0.05	2205.3	0.055133	1.456311	2299.2481
	Sub Total (Fixed)			1.22395		1.586639	4.357157	
C	**TOTAL(VAR. +FIXED)**			**4.090832**		**5.101727**	**8.739943**	
D	ROI	15300	0.000025	0.3825	15522.82	0.38807	1.456311	17325.465
	GRAND TOTAL			**4.473332**		**5.489797**	**8.190891**	
	INDEX			**100**		**122.7228**	**8.190891**	**136.4871**

4 Integrated Transport Development for Kerala-VISION 2030

Transportation is the foundation of the entire economy and quality of life. Transport is a key component of growth and globalization of the country. It is the key necessity for specialization-allowing production and consumption of products at different locations. Progress follows the lines of transportation. To avoid traffic congestion around the populated areas, suburbs and satellite towns are being linked up with rapid transit systems.

Kerala is comparatively better placed than most other states in India, in terms of road length. There are about 1.6 lakhs kilometers of roads in the state of which only 20 percent are motorable. The quality of transport system in Kerala needs much improvement. Although road transport dominates the transportation scenario in the state, people depend on railways for long haul transport needs. An integrated, well coordinated and balanced package of multi-modal investment plan need to be evolved at regional level, and in cities and towns to increase connectivity, capacity, convenience and reliability of public transport, by a mix of modes, at the same time encouraging walk and cycle trips which are environment friendly.

The major objective of the study is to evolve a conducive transport regime for Kerala to meet requirements of faster mobility, safety, access to social and economic services and minimizing the impact of negative externalities and to ensure full use of available transport infrastructure through low-cost optimization measures. Many sub – tasks has to be performed for the study to assess the existing traffic demand by all modes and their modal split with a long term '*Vision 2030',* with the help of secondary data, to project total transportation demand and modal split in 2030, to assess the resource cost to the economy for alternative inter-modal split, development of cost-effective road/rail/water based forms of public systems and inter-modal integration, reduction of emissions from motor vehicles, land use- transport integration and to arrive at optimum modal split and modal network configuration.

The transport sector including land, sea and air modes has a strategically significant role to play in fostering and sustaining the socio-economic development of the Kerala. It is required to optimize the existing resources in transportation as part of steps to develop a more holistic, integrated and strategic transport system to respond more effectively to the transport needs

and complexities. The lack of a strong coordinating mechanism for urban transport planning and management is a 'key gap' in the current institutional framework. The government is looking to optimize the existing resources to improve the services by enhancing the quality of the modes of transportation currently in use and introducing better inland water and coastal water transportation to exploit the State's enormous resources. In short, integration of all the modes of transportation can make the best use of the routes available and thereby reduce the total travel distance.

5 Traffic and Transportation Studies for 23 Towns in Kerala

Kerala is one of the densely populated State in the country with a population density of 820 persons per sq.km., three times the national average. Urbanization in Kerala is not limited to designated cities and towns. Barring a few panchayats in hilly tracts and some isolated areas in backwater region, the entire State depicts the picture of a rural-urban continuum.

The Department of Town& Country Planning, Government of Kerala is in the process of preparation of Maser Plan for selected urban areas in the State. As part of this, NATPAC has carried out traffic and transportation studies for 23 towns as per the list shown below (**Table 4**):

Table 4
List of Towns where Traffic and Transportation Studies were carried out

A	**Large town (above 1 lakh population)**	**C**	**Small town (Less than 50,000 population)**
1	Thiruvananthapuram	1	Kayamkulam
2	Kollam	2	Pathanamthitta
3	Alappuzha	3	Adoor
4	Thrissur	4	Angamaly
5	Kozhikode	5	Paravoor
6	Palakkad	6	Moovattupuzha
B	**Medium size town (population 50,000-1.00 lakh)**	7	Aluva
1	Neyyantinkara	8	Kothamangalam
2	Kottayam	9	Idukki
3	Thodupuzha	10	Kalpetta
4	Malappuram		
5	Vadakara		
6	Kannur		
7	Kasaragod		

The major objectives of the study are:

(i) To assess the existing condition of transportation network and to identify the main problems and issues;
(ii) To collect the traffic volume on selected roads and to assess the extent of shortfall of the road system;
(iii) To study the origin-destination characteristics of traffic passing through the town and assess the extent of bypassable traffic;
(iv) To estimate the traffic flow pattern for the horizon year and formulate a suitable road development plan keeping the growth potentials of the towns in mind.

Keeping in mind the general objectives of the study, a detailed methodology for undertaking the study was adopted which consists of a set of tasks as given below;

i. Appreciation of the study region and reconnaissance survey;
ii. Review of past study reports/development proposals;
iii. Collection of data from secondary sources and identification of data gaps;
iv. Design and conduct of primary surveys covering road inventory, volume count, O-D survey, parking study, speed & delay characteristics;
v. Analysis and interpretation of data to prepare a data-base of the city, traffic and transportation scenario and travel characteristics of the study area;
vi. Estimation of traffic and transport demand for horizon year; and identification of deficiencies in major travel corridors;
vii. Preparation of long term traffic and transportation improvement proposals for the town.

Various tasks involved in the study are :

- *Reconnaissance survey*
- *Review of earlier studies and development schemes*
- *Collection of secondary data*
  - Maps showing transport network, ward boundaries etc.
  - Population and socio-economic characteristics
  - Vehicle population details
  - Data pertaining to rail, water and air transport services in the selected towns.
- *Primary surveys*
  - Road inventory survey
  - Speed and delay survey
  - Traffic volume survey
  - Parking survey
  - Pedestrian survey
  - Origin-destination (OD) survey
- *Analysis of data*
  - Base year transportation network
  - Capacity utilization of major roads and intersections
  - Parking demand and supply characteristics
  - Pedestrian flow pattern
  - Pattern of inter-city passenger and freight movement
  - Characteristics of inter-city passenger and goods traffic
- *Forecasting of transport demand for horizon year*
- *Preparation of transportation development Plan*

6 Traffic Studies for Cochin-Coimbatore Industrial Corridor

Government of India jointly with State Governments proposed to develop a Dedicated Freight Corridor between Cochin and Coimbatore. The cities of Coimbatore and Cochin are experiencing rapid economic growth and this growth is now spilling into the neighboring districts. It is assessed that this growth could be nurtured into a holistic development of the entire region if it is channelized into a properly planned Corridor Development, connecting the two Cities. The concept of the Cochin – Coimbatore Industrial Corridor Project, modeled on the Delhi – Mumbai Industrial Corridor Project, has emerged as a result of this thinking. Infrastructures Kerala Ltd. (INKEL) has been mandated by Government of Kerala to prepare a detailed development plan for the proposed Cochin – Coimbatore Industrial Corridor.

In this context, to assess the traffic scenario of the corridor and to predict the demand for various horizon years, to assess the infrastructure requirement, NATPAC was entrusted with the task of preparing a Traffic and transportation plan for the corridor. A brief profile of the study area, the broad scope and objectives of the study, existing and projected traffic scenario are discussed below:

The following objectives were set for the study:

(i) To assess the traffic flow characteristics of the study region;
(ii) To assess the quantum of goods movement through the study region;
(iii) To project the passenger and freight traffic for the next 20 years.

The following tasks were performed for the study:

i. Surveys and Collection of data

ii. Analysis of data

- Average annual daily traffic (AADT) along the study stretch
- Pattern of passenger and freight movements

iii. Future traffic scenario

- Existing traffic volume passing through the study region
- Traffic flow generated due to the impact of proposed infrastructures in the study region
- Traffic flow generated and induced to the existing travel corridors due to the proposed improvements in the road network.

iv. Traffic pattern on the corridor
v. Origin-destination of passenger traffic
vi. O-D of Goods traffic

Movement of goods traffic to the tune of 142,518 MT was carried out through the five survey locations on the Cochin -Coimbatore industrial corridor. The major traffic generator of goods traffic was Eranakulam city area with 34,641 MT (24% of total traffic), followed by Tamil Nadu State with 16,611 MT (12%), other States excluding Kerala and Tamil Nadu with 12,472 MT (8.75%) and Palakkad area with 9,809 MT (7%).

Similarly, in the case of goods traffic attraction, Eranakulam city area had the dominant share with 24,670 MT of traffic (17%), followed by Tamil Nadu State with 21,651 MT (15%), other States excluding Kerala and Tamil Nadu with 13,569 MT (10%), Thrissur area with 13,758 MT (10%), and Palakkad area with 12,309 MT (9%).

Construction materials were carried in large quantities to the extent of 25% of total goods traffic, followed by industrial goods (22%), agricultural products (16%), petroleum products (11%) and food grains (4.50%).

Traffic projection was carried out for all the five travel corridors of the Cochin-Coimbatore industrial corridor. Projection was made separately for the three types of traffic flows as discussed below.

a) Projection of existing traffic
b) Projection of generated traffic due to infrastructure development
c) Generated and induced traffic

Projected traffic on the five travel corridors of the Cochin -Coimbatore industrial corridor were obtained by adding up the three components of traffic discussed above.

7 Integrated Development of Transport Infrastructure for an Emerging Town – Kottarakkara Gramapanchayath in Kollam District

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.

This study aimed at understanding the extent of transportation facilities available in a region, the selected area being the Kottarakkara Gramapanchayath in Kollam District, which has the potential of emerging as a town in a short period.

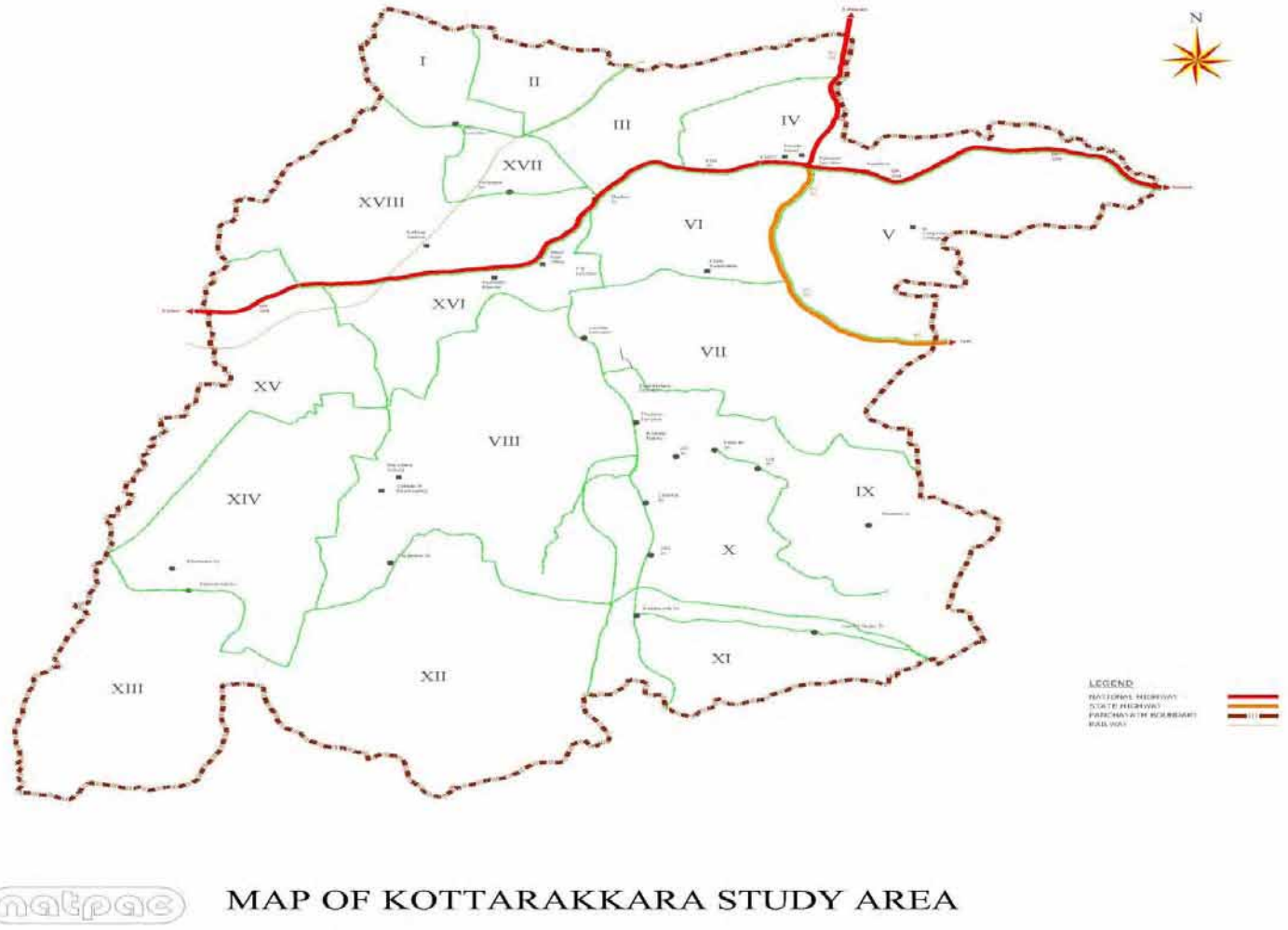
The scope of the study is limited to understand the existing transport infrastructure facilities available in the Kottarakkara Gramapanchayath and to suggest and formulate strategies for improving the mobility within the region.

The methodology adopted for the study consisted of secondary data collection, primary surveys including inventory, traffic volume - link and turning movement, parking surveys, pedestrian movement surveys, data analysis and interpretation.

The study area with an area of 17.40 km^2 and a population of 27,783 is divided into 18 wards. The place is well connected, with a good *network* of *roads* and frequent bus services to all places. The **Main Central Road** (MC Road), which is the arterial State Highway in the Travancore region of Kerala state, passes through Kottarakkara. The Kollam – Shenkottai road (NH 220) is another major road passing through the region.

Analysis of traffic volume surveys revealed that maximum traffic was flowing in the Pulamon-Senkottah section (12116 PCU) followed by 9094 PCU in the MC Road (Pulamon-Thiruvananthapuram section). The traffic volume in other sections varied between 2800 to 8400 PCU per day.

Turning movement surveys were carried out at major intersections in the study area and it was found that the peak hour traffic at Pulamon junction was 4600 PCU followed by 3700 PCU at Market junction and 2200 PCU at TB junction.



MAP OF KOTTARAKKARA STUDY AREA

Figure 2

Of the fifteen corridors where parking accumulation survey was conducted, it was found that the road stretch between Sasthamkotta Road to Canara Bank had highest parking accumulation of 115 vehicles at 11.30 hour on a normal working day where maximum traffic flow and parking demand occurs.

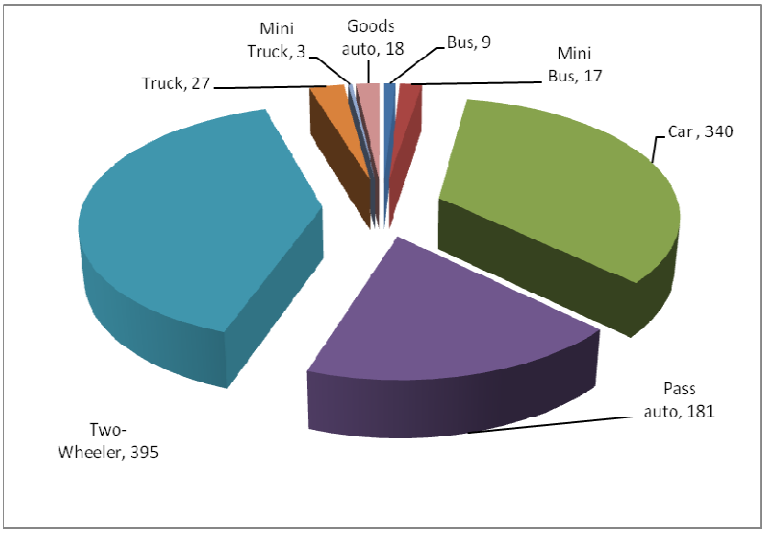


Figure 3
Parking accumulation at different road sections in Kottarakkara Panchayath

Pedestrian volume survey was conducted at all important intersections and road sections where the cross movements of pedestrian movement was found to be very high.

Table 5
Peak hour Pedestrian cross movements at major locations in Kottarakkara

Sl.No.	Name of location	Pedestrian Volume
1	Pulamon Junction	967
2	Market Junction	1160
3	KSRTC Bus stand Area	1431
4	Private Bus Stand	772

Based on the field data collected and the corresponding analysis, the following traffic problems relating to Kottarakkara Gramapanchayath has been identified.

- Augmentation of capacity of roads is very much essential in the near future unless of which there will be traffic congestion problems.
- Inadequate Parking Space
  - Unorganized on-street parking is seen in most of the locations and which is due to the absence of proper parking lots.
- Pedestrian traffic
  - There are no proper pedestrian crossing arrangements in most of the junctions except Pulamon junction. No well designed zebra crossings or medians are maintained.
- Poor surface condition of roads
  - The poor surface condition of roads is another key issue which is to be addressed. This reduces the overall performance of the transport network.
- Heavily trafficked Pulamon junction and Market junction
  - Pulamon junction is the Junction where the Thiruvananthapuram-Kottayam State Highway (MC Road) and the Kollam-Chenkotta National Highway meets. It is also considered as a main shopping location in Kottarakkara. In addition, the KSRTC and Private Bus stands are also located near to the junction. So the traffic clogging here is heavy. The situation in Market junction is also comparable.

8 Preparation of Computerized Inventory of Roads for Peravoor and Kuthuparamba Block Panchayaths in Kannur District

The State Government has recently 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 16 Grama panchayaths in two block panchayaths viz Peravoor and Kuthuparamba 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 Departments/Agencies.

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 meters 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.

Significance of the Study

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.

Some of the maps developed in GIS platform are shown below:

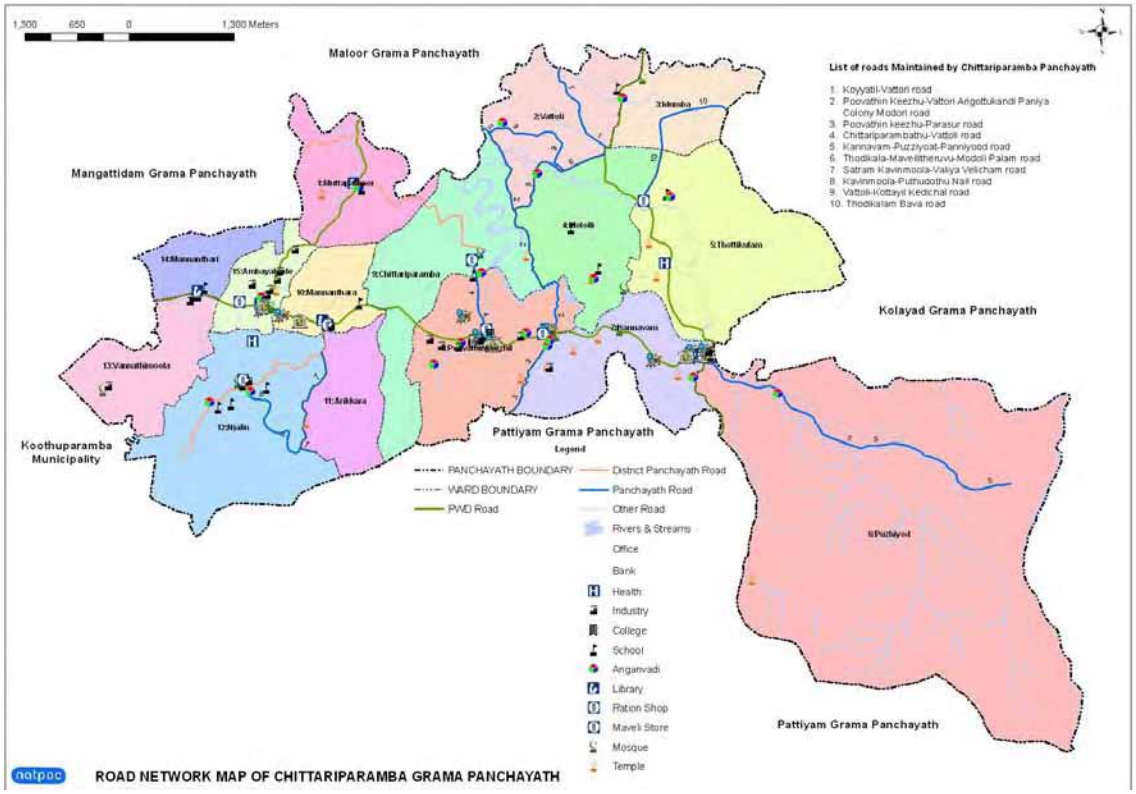


Figure 4
Road network map of Chittariparamba Grama Panchayath

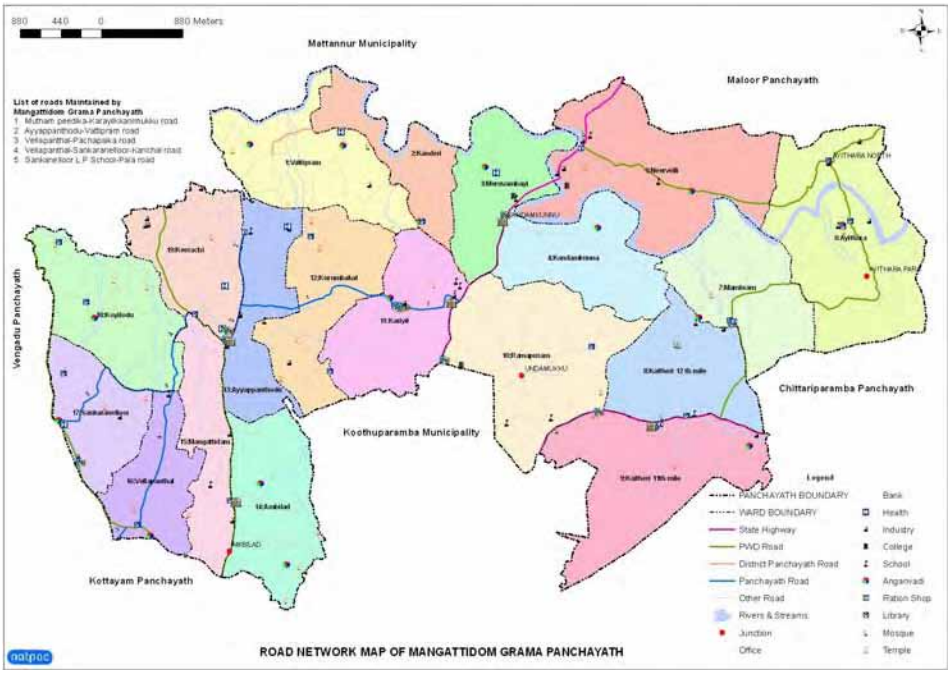


Figure 5
Road network map of Mangattidom Grama Panchayath

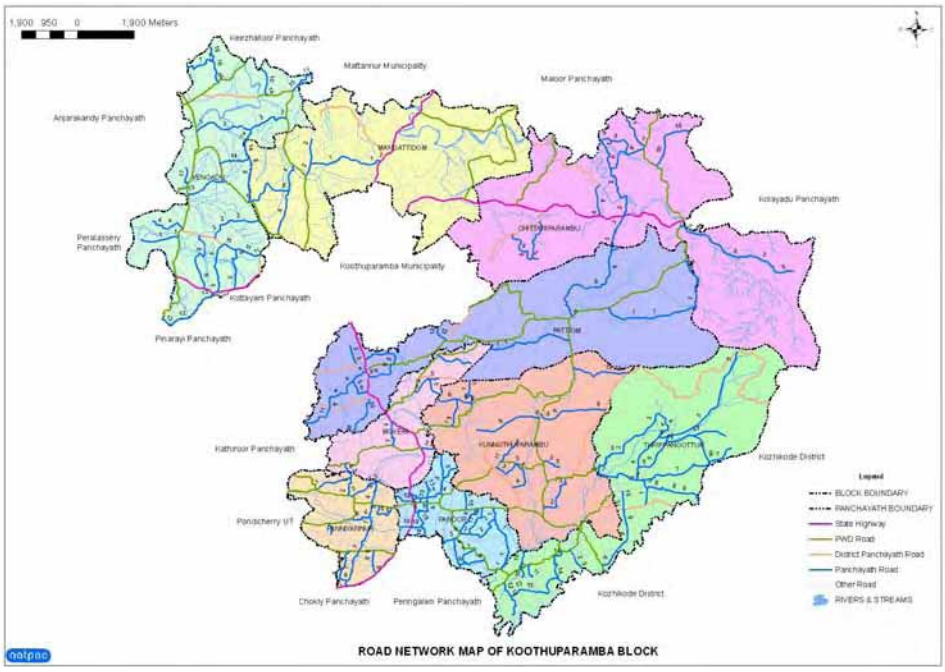


Figure 6
Road network map of Koothuparamba Block

9 Pre-feasibility study of improving Road Connectivity to Kannur Airport

The Kerala Road Fund Board (KRFB) had sanctioned NATPAC a pre-feasibility study for improvement of seven identified roads in Kannur region to 2/4/6 lane standards to provide adequate road connectivity to Kannur Airport. The main objective of the study was to find out the financial viability of improving the identified roads through private participation and explore the possibility of tapping the economic benefits, likely to be accrued to the local residents and other road users due to the project and use the resources for cross subsidization of the road connectivity improvement projects. NATPAC carried out broad traffic estimation, projection, assignment, and selection of route/alignment, likely toll collection and road wise financial analysis. No detailed survey of the alignment or designs of roads or land acquisition plans were aimed at the pre-feasibility stage.

The details of the projected daily tollable traffic (PCU) at identified seven roads in Kannur Airport influence area under different scenarios are shown in **Tables 6 & 7** respectively. Based on quick estimate it is found that total of Rs. 1,177 crores will be required for constructing 196 kms. of project road to varying standards consisting of Rs. 686 crores for civil construction and Rs. 490 crores for land acquisition. This capital is expected to be raised by the SPV through equity and loan combination. Cost details for widening roads to different road lane standards for the identified roads are shown in **Table 8**. The Economic Internal Rate of Return (EIRR) for the proposed 2/4/6 lane widening of 196 kms. of project road is found to be more than 30.45%. The maximum EIRR of 44.9% is found for widening of Mattannur – Iritty road (4 lanes) and minimum EIRR of 13.9% is found for widening of Mattannur – Wayanad road.

As per the pre- feasibility study conducted based on limited surveys, rough cost estimate, and financial analysis, Kannur – Mattannur road, Thalassery – Mattannur road and Thaliparamba – Mattannur road will qualify for development to 4/6 lane standards on Public – Private partnership on annuity basis. The present pre-feasibility report intended to give only a broad picture of undertaking the proposed airport road connectivity project under public – private participation nods. The preliminary financial analysis results suggest that the project will not

be financially viable without major financial commitment from the Government especially considering the present uncertainty brought about by global economic recession.

Table 6
Projected daily tollable traffic (PCU) under Scenario I (Intense traffic/land use growth)

Sl.No	Name of Roads	2008	2012	2017	2022	2027	2032	2037	2041
1	Thalassery-Mattannur Road	6911	21422	35466	58055	51268	71793	78533	78533
2	Thaliparamba-Mattannur Road	8064	23398	38972	65989	103470	132059	145596	145596
3	Coorg-Irrity-Mattannur Road	8085	21473	34938	58015	54238	69222	76318	76318
4	Kannur-Mattannur Road	7693	22673	37416	62982	98364	125539	138410	138410
5	Wayanad-Mattannur Road	3756	12448	20932	35822	56540	72161	79555	795555
6	Mattannur-Anjarakandy Road	4051	9972	16044	25817	41677	65696	75957	75957
7	Thalassery-Nadapuram Road	5627	16729	26808	26808	26808	26808	26808	26808
All Seven Roads		**5260**	**16099**	**25192**	**38679**	**55903**	**80606**	**94413**	**94413**

Table 7
Projected daily tollable traffic (PCU) under Scenario II (Moderate traffic/land use growth)

Sl.No	Name of Roads	2008	2012	2017	2022	2027	2032	2037	2041
1	Thalassery-Mattannur Road	6911	12527	18364	27208	38518	50673	65657	79048
2	Thaliparamba-Mattannur Road	8064	17906	25737	37427	52176	67549	79279	79279
3	Coorg-Irrity-Mattannur Road	8085	17121	24724	36080	51005	68237	81488	81488
4	Kannur-Mattannur Road	7693	18412	26770	39336	55312	72113	94253	116955
5	Wayanad-Mattannur Road	3756	8205	11893	17440	24456	31759	41372	51220
6	Mattannur-Anjarakandy Road	4051	10260	14687	21199	29490	38494	50335	62454
7	Thalassery-Nadapuram Road	5627	9487	13840	13840	13840	13840	13840	13840
All Seven Roads		**5260**	**12113**	**17604**	**39336**	**55312**	**72113**	**72113**	**116955**

Table 8
Summary of cost details for widening roads to different road lane standards (Rs.lakhs)

Sl.No	Name of Roads	Type of improvement	Cost per km	Total cost
1	Thalassery-Mattannur Road	4-Lane	313.16	8549.38
2	Thaliparamba-Mattannur Road	4-Lane	305.84	12233.7
3	Coorg-Irrity-Mattannur Road	4-Lane	403	11404.8
4	Kannur-Mattannur Road	4-Lane	425.8	10006.3
5	Wayanad-Mattannur Road	4-Lane	342.4	9929.61
6	Mattannur-Anjarakandy Road	4-Lane	318.86	6791.65
7	Thalassery-Nadapuram Road	2-Lane	196.46	4282.88

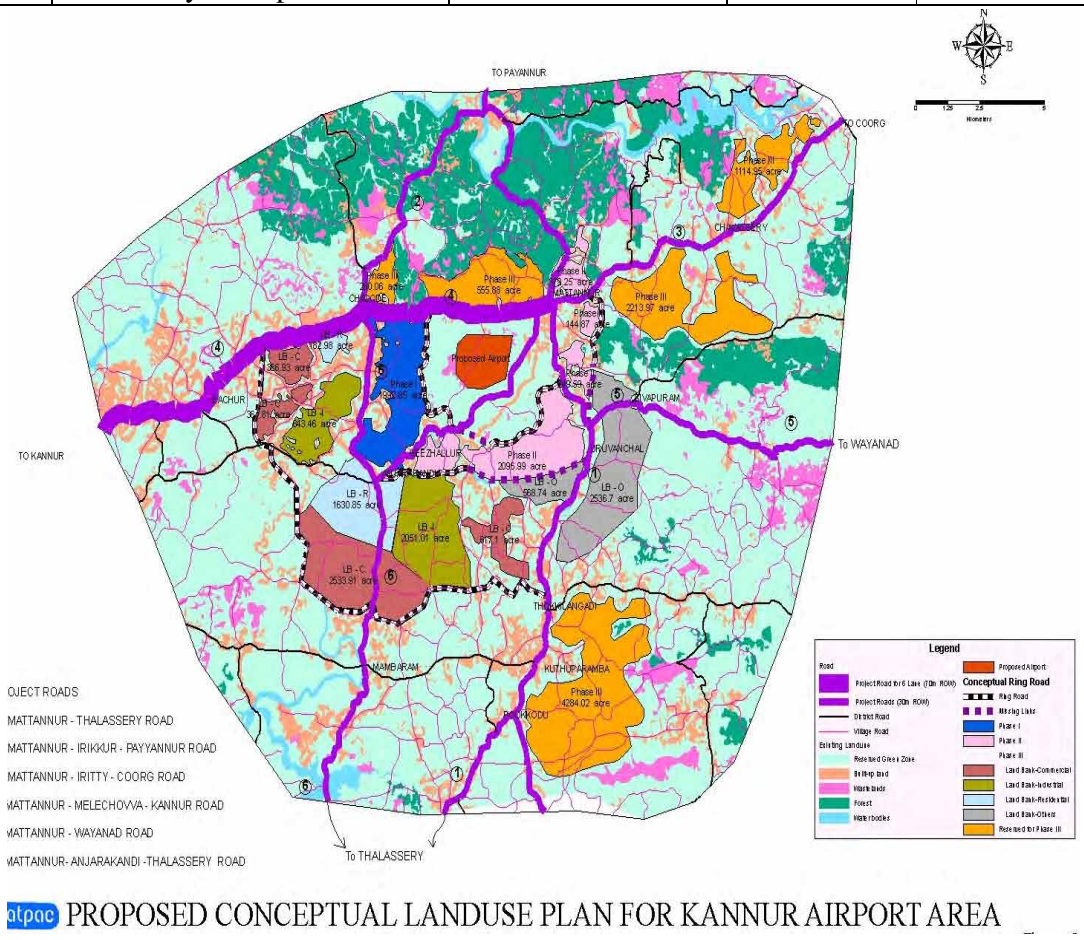


Figure 7

10 Resource Mapping of Road Construction Materials in Kerala- a Case Study of Pathanamthitta 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 this year the quarries of Pathanamthitta district were studied.

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

Mineral aggregates constitute a major portion of total construction materials. So it is essential to make right choice of aggregates for efficient performance as construction material. Performance of various structures is heavily influenced by the choice of proper aggregate for particular jobs. The significant properties of aggregates should be tested, as they will affect the performance of structures. Hence various tests were conducted on the coarse aggregates collected from various quarries located in three taluks of Ranni, Kozhencherry and Thiruvalla in Pathanamthitta district. The laboratory tests on the materials collected from the taluk of Mallappally is in progress. Altogether 53 coarse aggregate samples and 22 sand samples are tested in this phase. The results of the laboratory tests conducted on 32 samples of coarse aggregates are summarized in **Table 9** and the test results on fine aggregates are summarized in **Table 10.**

Table 9
Results of tests on Coarse Aggregates

Sample No.	FI %	EI %	CI %	AIV %	Sp.gr	Water absorption %	Bulk density kg/l	% of voids	Abrasion value %
1	18.41	20.32	38.73	31.18	2.72	0.39	1.64	39.67	32.8
2	2.37	21.34	23.71	*	2.77	0.32	1.61	42.03	21.4
3	9.38	13.79	23.17	*	2.65	0.12	1.58	40.34	39.6
4	6.48	37.20	43.67	*	2.61	0.20	1.46	44.05	14.28
5	5.23	11.93	17.15	34.06	2.58	0.8	1.6	37.9	32.8
6	3.69	8.04	11.73	24.94	2.64	0.31	1.55	41.21	28.8
7	2.6	17.8	20.41	*	2.7	0.15	1.52	43.69	16.4
8	5.28	11.41	16.68	34.5	2.61	0.61	1.6	38.81	37.6
9	17.05	13.37	30.42	26.01	2.69	0.20	1.57	41.75	32
10	23.09	55.76	78.85	*	2.65	0.06	1.51	42.92	21.8
11	18.10	36.32	54.43	*	2.65	0.18	1.46	44.89	26
12	24.79	57.68	82.47	*	2.76	0.16	1.55	43.86	32.8
13	12.16	52.38	64.54	*	2.82	0.24	1.45	48.52	26.8
14	16.02	22.66	38.68	39.53	2.8	0.25	1.63	41.69	48
15	24.34	23.40	47.74	*	2.66	0.18	1.44	45.93	39.8
16	32.77	51.25	84.02	*	2.79	0.18	1.26	54.91	21.8
17	24.44	46.32	21.80	*	2.69	0.21	1.57	41.59	30.2
18	23.08	60.78	83.86	36.46	2.7	0.26	1.62	40.01	36.8
19	23.15	29.73	52.88	37.92	2.75	0.88	1.74	36.7	52.8
20	22.55	32.86	55.41	*	2.79	0.24	1.49	46.45	30.2
21	21.49	27.5	48.99	40.79	2.77	0.24	1.63	41.26	43.6
22	21.60	37.91	59.51	*	2.79	0.26	1.50	46.22	34
23	10.57	0	10.57	*	2.76	0.13	1.29	53.06	34
24	9.41	40.26	49.67	28.6	2.72	0.12	1.67	38.8	44
25	17.14	36.21	53.35	33.37	2.75	0.2	1.55	43.48	40.8
26	7.41	62.67	70.07	*	2.75	0.11	1.39	49.35	24.8
27	16.87	36.63	53.51	*	2.80	0.45	1.61	42.84	27.8
28	27.22	23.64	50.87	22.12	2.79	0.40	1.68	39.71	31.6
29	2.63	30.33	32.96	*	2.76	0.01	1.60	41.96	23.6
30	6.45	18.20	24.65	31.00	2.81	0.39	1.68	40.14	30
31	5.21	54.98	60.19	*	2.82	0.42	1.67	40.98	27
32	25.12	38.76	63.87	32.13	2.80	0.13	1.61	42.65	34.8

*(F.I - Flakiness Index, E.I - Elongation Index, C.I - Combined Index, Sp.gr - Specific Gravity, A I.V – Aggregate Impact Value, * Required gradation was not available)*

Out of the 32 samples tested only nine samples of the coarse aggregates have combined index value less than 30 % and hence they could be used for various pavement construction purposes. Out of the tested samples only one aggregate sample has got the aggregate impact value less than 24% and hence it could be used for Bituminous Concrete (BC) layer construction. The bulk density value of all samples are less than 2.8 g/cc, which is the desired range and hence they could be used for various bituminous courses, cement concrete works, RCC works and masonry works. The Los Angles Abrasion tests conducted on the samples indicates that most of them have got good resistance to abrasion.

Various tests were conducted on the fine aggregates collected from 22 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 fineness modulus of the eight fine aggregate samples is well below the limiting value of 3.5 and hence they are suitable for satisfactory concrete works. Nineteen samples has silt content values in the desired range and hence they are suitable for good concrete works. The bulk density values of the 15 samples are in the desired range of 1.6 to 1.7 g/cc.

Table 10

Summary of Results of tests on Fine Aggregates

Sl. No.	SC	FS	MS	CS	SC	FM	Silt content	Bulk density	Moisture content at Max.Bulking	% of max. bulking	Remarks
1	0.6	92.9	6.6	0	SP	1.7	0.12	1.5	7.6	66	1)Silt content should not be more than 3% for uncrushed material(for use in concrete) 2)The limiting value for bulk density is 1.6 to 1.7 kg/l 3) A sand having a fineness modulus more than 3.5 will be unsuitable for making satisfactory concrete. 4) The percentage of bulking so found out could be employed for correcting the volume of fine aggregate to be used for construction works.
2	0.4	41.3	54.3	3.7	SP	2.9	1.44	1.6	11	57	
3	0.1	8.1	90.8	0.8	SP	3.7	0.24	1.6	11	53	
4	0.4	5.3	84.3	9.9	SP	4.2	1.32	1.6	11.8	34.5	
5	0.4	6.5	83.1	7.1	SP	4.2	2.56	1.6	10.4	27.1	
6	0.2	0.5	64.4	31.1	SP	5.1	0.68	1.6	11.2	24	
7	2.1	93.2	3.7	0.4	SP	1.1	4.04	1.5	11	95	
8	0.5	8.1	61.5	20.5	SP	4.6	0.92	1.7	9.5	49	
9	0.1	19.2	61.7	15.9	SP	4	0.12	1.7	11.2	58	
10	0.3	20	59.7	17.2	SP	4	1.56	1.7	10.3	56	
11	0.9	24.6	54.5	16.3	SP	3.8	2.36	1.7	10	51	
12	0.8	28.2	55	10.3	SP	3.6	1.88	1.8	10	43.5	
13	1.3	39.3	43.4	11.3	SP	3.3	0.56	1.7	10.4	64	
14	2.1	42.4	43.1	10.6	SP	3.0	3.32	1.8	7.8	69	
15	1.3	80.4	10.3	4	SP	1.7	2.12	1.5	11.2	73	
16	0.5	5.4	51.6	31.6	SP	5	2.24	1.7	12	42	
17	0.9	32.7	40.4	16.7	SP	3.7	4.04	1.8	13.2	64.5	
18	1.1	24.6	54.3	14.7	SW	3.8	2.12	1.7	12	51	
19	0.30	14.9	71.8	11.4	SP	4	0.84	1.7	12	46	
20	1.5	50.6	33.9	9	SP	2.7	2.68	1.8	13.2	88.2	
21	0.6	19.1	72.3	7	SW	3.8	1.48	1.7	5.2	51.5	
22	1.3	37.8	49.8	8	SP	3.2	2.64	1.7	10	56	

(SC- Silt $ Clay, F.S - Fine Sand, M.S - Medium Sand, C.S - Coarse Sand, S.C - Soil Classification, F.M - Fineness Modules, SW - Well Graded Sand and S.P - Poorly Graded Sand)

11 Use of Waste Plastic for Road Construction

The extensive use of plastic has resulted in accumulation of enormous waste, the disposal of which poses a big problem. The present system of disposal is not eco-friendly and effective. Alternate use of waste plastic is an urgent need of the hour.

The study is to explore the possibility of usage of waste plastic in road construction on a large scale basis, carry out further research in the field and identify the data gap, develop methodology for processing the waste, conduct 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 from Kokkalai to KSRTC Junction (700m) in Thrissur district was overlaid using modified mix with waste plastic in December 2010. These studies may be a step towards providing input for evolving guidelines / specifications for the use of waste plastic materials in road construction and help 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 conform 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 at Kozhikode (600m length), Logans Road at Thalassery (650m length) and Kokkalai to KSRTC Junction (700m) in Thrissur district. A surface layer of 20mm Premix Chipping Carpet (PMC) with modified mix is laid on the first three roads and a layer of 50mm BM + 20mm PMC is laid on the Kokkalai road 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 the same aggregates without plastic coating showed about 2% stripping.

Plate 1
Mini hot mix plant

Plate 2
Preparation of plastic coated aggregates (PCA) in the field

- *Field Performance Studies*

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

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

Plate 3
Skid resistance studies

Plate 4
Roughness studies using MERLIN

- *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 5
Texture Depth Study

12 Use of Geo-Synthetic Materials in Road Construction

The soil reinforcement is an effective and reliable technique for improving the strength and stability of soil. Geotextiles have a great potential for application in improving the strength of the weak subgrade soil on roads. In conventional method of reinforced soil construction geotextiles are used and normally oriented in a predefined direction and are introduced sequentially in alternate layers. The discrete fibers on the other hand are simply added and mixed randomly with soil, much the same way as cement, lime or other additives.

Coir geotextiles are mostly woven coir mattings of various yarns with different mesh size. If coir geotextiles have to find increasing use for both domestic use and export, a new classification system for these products must indicate their grade and use for different purposes. Kerala needs development in this sector which can be made only through research and field trials. It is proposed to lay test tracks and canal bank protection at the premises of new office building of NATPAC at Akkulam using biodegradable geosynthetics like coir. The performance of the same will be monitored and evaluated.

Scope and Objectives

As per IRC: 37-2001 the strength of sub-grade soil expressed in terms of CBR (California Bearing Ratio) should be a minimum of two percent. 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

Weak clayey soil collected from the sub-grade of a road was used for the study.

Table 11
Properties of the Soil used in the Study

Property	Soil A
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 12
Comparison of CBR values of Soil A

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 6
One inch size coir mesh

Plate 7
Half inch size coir mesh

Plate 8
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.

The use of geo-textiles is effective when good quality sub base materials are not available within economic lead and when CBR of sub-grade is low.

13 Ambient Air Quality and its contribution to Climate Change in Kerala

The atmosphere is a complex dynamic natural gaseous system that is essential to support life on planet Earth. The air pollutants are added in the atmosphere from variety of sources that change the composition of atmosphere and affect the biotic and abiotic environment. The concentration of pollutants varies spatially and temporally causing the atmospheric pollution pattern to change with different locations and time due to changes in meteorological factors and topographical features. It is estimated that nearly 60 percent of the atmospheric pollution is caused by automobiles, 17 percent by industrial activities and the rest by other sources.

In Kerala, transportation is one of the most important sources of air pollution. The exponential growth of automobiles in Kerala has been considerably increased faster than the rate of population growth. Industries are the other major sources of pollution in many places. But Kerala's industrial growth is very low when compared to rest of India. As a result of this, a study has been conducted to determine the air quality of Kerala and the contribution to air pollution is estimated.

Scope and Objectives

The major objectives of the study are as below:

- Assess air pollution concentrations at 55 locations in 14 districts of Kerala with varying number of anthropogenic sources;
- Study the temporal and diurnal variation in pollutants concentration along with traffic activities;
- Assess the status of air pollution to adjudge the effectiveness of air pollution control strategies and long term management of air pollution;
- Prepare the Air Pollution Index (API) for all the stations;
- Obtain the wind rose diagram for the study area;
- Develop a model for change in climatic conditions in Kerala due to air pollution;
- Formulate preventive and control measures for abatement of air pollution.

1 Materials and Methodology

1.1 Ambient Air Quality Monitoring

Under air quality monitoring program, five pollutants namely carbon monoxide (CO), Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx), Respirable Particulate Matter (RSPM) and Suspended Particulate Matter (SPM) were measured. The particulate

matter such as SPM & RSPM sampling was made for 8 hours on a 24 hours basis, the gaseous matter such as SO_2 & NO_2 were made for four hours on a 24 hours basis and the CO monitoring was made as hourly average. High Volume Sampler (Model: Respirable Dust Sampler APM 460BL & Gaseous Sampling APM 411) and CO analyzer (Model: gaZguard Tx CO) are the equipments deployed to measure the concentration of pollutants. The monitoring of pollutants was carried out for 24 hours with a frequency of three days observation at a station.

1.2 Air Quality Index

The air pollution index can be determined by the following equation:

Air pollution index (API) = $\frac{1}{4}\left[\frac{SO_2}{S_{SO_2}}+\frac{NO_2}{S_{NO_2}}+\frac{RSPM}{S_{RSPM}}+\frac{SPM}{S_{SPM}}\right]\times 100$

Where,
SO_2, NO_2, RSPM and SPM represent the measured values
S_{SO2}, S_{NO2}, S_{RSPM} and S_{SPM} represent the AAQ standard values prescribed by CPCB.

From air pollution index, the sampling station can be categorized into clean, light, moderate, heavy and severe pollution levels.

1.3 Measurement Meteorological Parameters

The meteorological parameters such as wind speed, wind direction, temperature and relative humidity are measured. Wind logger is the equipment which measures the wind speed and wind direction, thermocouple sensors are used to measure the ambient temperature and RH data logger is the instrument which measures the Relative Humidity. The hourly average of each parameter is observed and the wind rose graphs at 08:30 Hrs are plotted on the observed wind speed and wind direction data.

1.4 Vehicle Population

The volume of traffic is expressed in vehicles per hour or vehicles per day. The traffic census was taken by noting the number of vehicles at all the monitoring stations of various classes that passed through the count stations in both directions at 15 minutes interval. Vehicles are categorized as per Indian Road Congress (IRC) guidelines into two wheeler, car, jeep, van, auto rickshaw, pick – up auto, Light Commercial Vehicle (LCV), Multi Utility Vehicle (MUV), Bus, truck, trailer and others.

1.5 Vehicular Emission

Type of pollutants emitted by vehicles varies significantly by the category of vehicles and the type of fuel used for propulsion, say petrol driven or diesel run engine, capacity of engine, age of vehicle and condition of pavement etc. The vehicular emission can be estimated using following equation:

$$E_i = \sum (Veh_j \; x \; D_j) \; x \; E_{i,j,\,km}$$

Where,

E_i – emission of compound (i)
Veh_j – number of vehicles per type
D_j – distance traveled by vehicle type
$E_{i,j,\,km}$ – emission factor (i),vehicle type (j) per driven kilometer

The emission factors according to fuel types and category of vehicles for Indian vehicles established by The Automotive Research Association of India (ARAI), which was accepted by the Ministry of Environment and Forest (MoEF) has been adopted for this study.

2 Ambient Air Quality in Kerala

The result of ambient air quality and the determined air pollution index of all the stations are summarized in **Table 13**.

Table 13
Summarised Result of Air Quality and Air Pollution Index

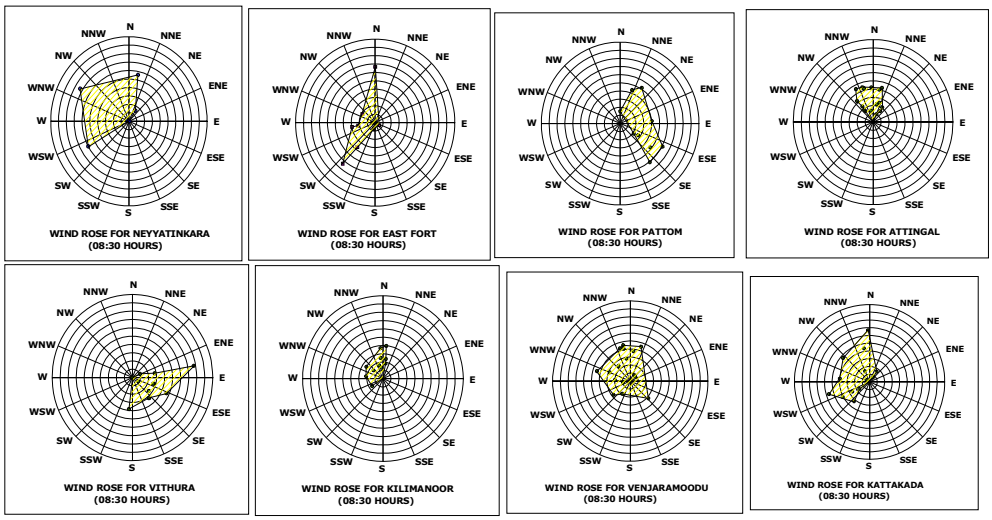
Sampling Station	SPM levels (µg/m3)	RSPM levels (µg/m3)	SO_2 levels (µg/m3)	NO_2 levels (µg/m3)	CO levels (µg/m3)	API Values	Air Pollution Index
Neyyatinkara	82.98	45.09	7.66	28.44	609.22	50.81	Moderate
East Fort	64.73	49.77	11.29	39.43	639.89	52.77	Moderate
Pattom	49.34	62.49	8.52	31.06	634.11	50.74	Moderate
Attingal	56.2	39.46	8.18	27.91	408.78	41.77	Light
Vithura	73.49	44.64	10.07	33.48	403.78	50.58	Moderate
Kilimanoor	64.6	19.71	12.16	29.52	475.78	37.39	Light
Venjaramoodu	30.4	23.40	8.46	26.97	445.00	28.42	Light
Kattakada	66.55	34.48	9.53	15.65	405.56	38.87	Light
Kottarakara	62.13	40.35	15.11	13.47	507.11	41.28	Light
Pathanapuram	40.17	36.23	14.39	12.84	391.00	33.65	Light
Sasthamkotta	54.46	18.04	12.18	13.03	391.44	29.01	Light
Chavara	73.97	40.78	28.24	27.19	517.22	52.81	Moderate
Karunagappally	60.74	35.22	17.36	14.38	469.89	39.78	Light
Kundara	86.02	23.46	21.66	20.42	639.56	44.43	Light
Chinnakada	91.74	40.88	18.11	19.64	677.44	51.77	Moderate
Angamaly	76.71	36.38	24.22	19.07	689.65	47.87	Light
Aluva	41.47	25.64	34.71	25.03	707.44	39.72	Light
Kothamangalam	63.85	26.41	21.38	14.55	643.89	38.20	Light
Kochi	79.24	44.96	38.86	27.81	1263.18	59.38	Moderate
Vaikom	53.32	19.28	19.75	14.15	432.16	31.96	Moderate
Ponkunnam	46.89	52.10	16.98	14.11	454.11	43.15	Moderate
Thiruvalla	71.98	52.71	28.89	22.33	643.32	55.96	Moderate
Adoor	54.05	34.86	26.89	21.30	666.77	43.10	Light
Ranni	85.79	39.14	33.07	27.78	593.28	56.77	Moderate
Palakkad	90.38	53.76	30.23	27.54	647.05	63.05	Moderate
Mannarkad	79.25	50.12	21.87	19.10	479.53	53.95	Moderate
Ottapalam	60.54	39.56	20.32	15.76	555.85	42.89	Light
Kunnamkulam	63.66	36.88	19.32	13.67	574.86	41.59	Light
Thrissur	68.05	37.16	16.60	15.55	896.86	42.54	Light
Kodungallur	71.88	43.15	19.14	16.58	724.13	47.12	Light
Aroor	64.05	36.64	18.21	14.37	896.55	41.42	Light
Kayamkulam	56.05	46.71	16.00	14.51	470.34	43.01	Light
Mavelikkara	51.48	27.55	17.94	14.21	364.83	34.40	Light
Kumily	34.45	19.33	18.51	13.76	332.80	26.75	Light
Munnar	28.39	18.67	16.96	14.13	311.12	24.59	Clean

The 24 hourly average values of gaseous pollutants such as CO, SO_2 and NO_2 have been found to be well within the prescribed standards on all the days at all the stations. The reason for these values may be due to non-existence of any commercial and industrial activities in nearby area. The concentration of particulate matter at urban centres have been found to be slightly higher than the 24 hourly average standard value of Central Pollution Control Board (CPCB).

But the three days average values of all the parameters have been found to be well within the prescribed standards. The trend of air pollution index values shows that it may be budged to high pollution index in this decade itself due to rapid increase in number of vehicles, urbanization and other anthropogenic sources.

3 Wind Rose

From the 24 hourly observed data, the wind rose graphs for Thiruvananthapuram district is shown below as a sample**.**



4 Vehicle Population

The 24 hours continuous traffic volume survey was conducted at upward and downward direction of all sampling stations and the existing vehicular traffic at each station is shown in **Table 14**. Personalized vehicles such as two wheelers, cars and multi utility vehicles are the leading vehicles on roads. Other category vehicles are also taking major part in vehicular emission. Buses and trucks are major sources which causes more CO_2 concentration into the atmosphere.

Table 14
Summarised Vehicle Population

Sampling station/Vehicle category	Two Wheeler	Auto Rick shaw	Pick Up Auto	Car	MUV*	LCV**	Bus	Truck /Tractor	Total
Neyyatinkara	10517	1229	273	3876	1635	506	1705	1902	**21643**
East Fort	26219	21749	613	12118	2654	1192	11229	467	**76241**
Pattom	31824	14624	728	28442	6249	1410	8054	819	**92150**
Attingal	10251	4528	515	9316	2510	1489	2186	1180	**31975**
Vithura	4281	1459	312	1957	474	433	409	474	**9799**
Kilimanoor	5795	4442	284	5462	1505	594	1044	875	**20001**
Venjaramoodu	7326	2611	421	6791	1417	680	1134	949	**21329**
Kattakada	5861	2089	337	4754	850	612	849	639	**15991**
Kottarakara	4001	2195	240	4002	1438	574	733	685	**13868**
Pathanapuram	4014	1991	263	2507	545	440	603	883	**11246**
Sasthamkotta	7651	1155	405	2629	370	302	727	964	**14203**
Chavara	17922	6210	1380	10040	5176	2509	2877	2681	**48795**
Karunagappally	11423	5590	853	9795	4959	1638	2641	2018	**38917**
Kundara	9262	2047	640	6471	1239	1149	1246	1195	**23249**
Chinnakada	21849	7768	1794	11016	5303	2886	7612	3733	**61961**
Angamaly	11085	2704	1008	11976	4234	2518	1517	5596	**40638**
Aluva	12940	6470	1520	11061	1447	583	3620	2649	**40290**
Kothamangalam	11728	8184	574	5540	1419	482	1809	444	**30180**
Kochi	87382	16421	2508	41268	32254	1367	8507	1535	**191242**
Vaikom	6589	1138	446	2451	778	416	574	596	**12988**
Ponkunnam	4041	4792	301	5419	1444	745	896	518	**18156**
Thiruvalla	8716	2196	753	8872	1659	1540	1532	978	**26246**
Adoor	14625	4550	558	7851	1436	860	2902	842	**33624**
Ranni	9383	3888	366	5161	1173	1204	1729	850	**23754**
Palakkad	17045	12334	542	6284	808	596	3345	1247	**42201**
Mannarkad	9950	6801	726	4793	1130	992	2015	1245	**27652**
Ottapalam	9923	6683	638	4815	1106	1190	1709	1363	**27427**
Kunnamkulam	10011	6331	602	4795	1005	861	1859	1537	**27001**
Thrissur	28228	21216	771	12035	2144	1156	4800	315	**70665**
Kodungallur	18393	4854	787	6361	1079	1326	2436	964	**36200**
Aroor	20963	2918	2321	15527	3028	2333	3009	7175	**57274**
Kayamkulam	10958	1730	557	8908	1500	800	786	2476	**27715**
Mavelikkara	11771	1953	455	4452	634	596	1039	604	**21504**
Kumily	4593	3609	244	3565	1196	569	1027	399	**15202**
Munnar	2382	3495	247	3794	1101	440	493	334	**12286**

5 *Vehicular Emission*

The vehicular emission at all sampling stations has been evaluated based on the total vehicle of each category and the corresponding emission factors. It is represented in kg/km/day. The estimated vehicular emission is given in **Table 15**

Table 15
Summarised Vehicular Emission

Place Name	Pollutants Concentration in kg/km/Day				
	CO	**HC**	**NO_x**	**CO_2**	**PM**
Neyyatinkara	56.67	12.21	43.14	4157.64	4.66
East Fort	227.22	78.90	150.9	13018.1	12.5
Pattom	206.09	65.80	122.1	14551.1	10.9
Attingal	70.22	22.35	46.14	5617.75	5.06
Vithura	20.13	7.52	12.26	1459.13	14.9
Kilimanoor	40.64	17.11	25.64	3292.64	2.89
Venjaramoodu	43.60	13.75	27.76	3590.6	3.09
Kattakada	32.97	10.91	20.35	2585.80	2.29
Kottarakara	28.36	9.93	19.12	2475.52	2.22
Pathanapuram	25.72	9.00	18.42	2033.47	2.18
Sasthamkotta	32.24	9.03	21.04	2172.55	2.37
Chavara	107.64	33.88	75.14	8677.10	8.83
Karunagappally	86.10	26.77	61.79	7363.93	6.92
Kundara	50.01	14.22	32.88	3957.33	3.84
Chinnakada	182.22	43.13	142.06	13213.87	14.40
Angamaly	93.67	21.49	83.48	9686.15	10.84
Aluva	102.28	29.09	75.17	7785.64	7.59
Kothamangalam	62.08	30.23	32.60	3852.44	3.29
Kochi	331.54	109.01	167.36	24973.78	16.90
Vaikom	26.77	8.31	16.11	1863.25	1.87
Ponkunnam	34.69	16.92	20.55	2931.55	2.38
Thiruvalla	54.86	15.14	35.50	4627.04	4.09
Adoor	80.58	24.14	50.03	5254.98	4.84
Ranni	55.39	18.87	35.37	3868.64	3.87
Palakkad	100.72	45.04	59.95	5912.48	5.89
Mannarkad	65.41	26.58	42.76	4468.17	4.64
Ottapalam	62.76	26.43	40.74	4398.70	4.65
Kunnamkulam	64.23	25.28	43.14	4472.04	4.75
Thrissur	150.54	76.13	75.67	8508.44	7.22
Kodungallur	82.42	27.49	47.85	5003.96	5.05
Aroor	140.34	29.48	117.82	12610.51	14.23
Kayamkulam	55.55	14.60	39.37	5000.03	4.90
Mavelikkara	44.30	14.17	23.64	2736.27	2.58
Kumily	32.65	13.79	20.08	2427.72	2.16
Munnar	21.75	11.77	12.36	1935.54	1.48

The estimated vehicular emission indicates that the ground level concentration is increasing rapidly due to personalized vehicles and it leads the significant values of green house gas emissions. Other pollutants such as CO, HC and PM concentrations are also showing crucial values. Prior attention is mandatory for preventive and control measures of vehicular emission.

14 Constraints in developing West Coast Canal in Kerala- a Case Study of National Waterway No.III

The section of the West Coast Canal between Kollam and Kottapuram was declared as a National Waterway III in the year 1993. But even after providing the necessary infrastructure facilities, the anticipated traffic has not been achieved. This study was taken up with the objective of investigating the constraints which are responsible for the low volume of cargo movement on this stretch of the waterway.

The three basic IWT related infrastructure for development of waterways are:

(a) Fairway or navigational channel with desired width and depth

(b) Navigational aids for safe navigation

(c) Terminals for berthing of vessels, loading/unloading of cargo and for providing interface with road and rail.

Constraints Encountered in the Development of NW III

Hydrographic factors namely waterway depth and width are necessary for efficient navigation. The minimum 2.2 m depth and 40 m width is not available across several sections of NW-III. Insufficient horizontal and vertical clearances at the site of cross structures and locks also pose problems. The standard vertical clearance according to national waterway standards is 7 m and in the case of waterway width the standard specified is 40m. Closely related is the constraints due to the locks at Thrikunnupuzha and Thaneermukkam, the dimensions of which leads to severe constraints. Therefore the design vessel dimension has to be modified to suit the dimension of the cross- structures, which results in forgoing the crucial economies of scale. Chinese fishing nets /Stake nets/ clay mining /shell gathering in the waterways etc., results in barges travelling at below optimal speed. Local community issues such bank encroachment, problems posed by fishermen, dumping waste into the waterway etc., are assuming serious dimensions and constitutes a major problem. Lobbying by the road transport operators is another factor which militates against water transport.

Plate 9
Aluva Terminal

Plate 10
Kayamkulam Terminal

Suggestions for Improvement

The hydrographic factors namely the depth and width needs to be provided according to standards specified for NW- III – Class 3 standards. This would require dredging at several locations of the waterway. Removing fishing nets projecting into the waterways, and allocating areas for fishermen will help in making the channel free of obstructions.

Development of feeder canals of NW-3 will give a boost to waterborne cargo movement. Standardization of cargo handling is another important step which has to be taken and it will also go a long way in encouraging the use of waterway for transportation. Standardization of cargo can become a reality only with containerization of cargo. Therefore a programme for containerization needs to be initiated.

Conceptualization of cargo oriented projects linked to specific industrial units such as cement, fertilizers, food grain movement between the warehouses of the Food Corporation of India (FCI) located within the state, with guaranteed quantity of cargo for a specified time frame for movement by waterways is also recommended. Encouraging facilities for construction/ repair of barges is necessary for promoting waterways. Addressing issue of shortage of man power in IWT sector is also suggested.

Waterway operation which involves huge investment, facilitating financing by the banks for construction of inland vessels is suggested, besides providing a subsidy for barge

manufacturing on one hand, and extending subsidy on a tonne – Km basis for movement of cargo through the waterways.

Delineation of revenue land along the waterways and rehabilitation of encroachers along the banks will help in solving the waterway width constraint. For water transport to flourish, each region on the bank needs to have an economic base involving primary and secondary activities. This would imply that the agricultural sector needs to be revived.

A community participatory approach wherein the local community becomes the stake holders in conserving the fragile land- water edge is recommended for putting an end to encroachment and also dumping of waste.

15 Impact of posting Scientific Speed Limits on National Highways- a Case Study of Thiruvananthapuram- Kollam Section of NH-47

Speed limits are primarily set for safety reasons, i.e., to reach a balance between the travel time and crash risk and to provide a basis for enforcement of inappropriate speeding behaviour. The goal of proposing speed limits on the highway is to indicate the motorists a reasonable speed under prevailing conditions that will provide adequate reaction and stopping time on that road. This, in turn, leads to more uniform travel speeds that reduce tailgating and lane changing, which are the major causes of traffic crashes. While determining the speed limit, the practice is to consider the 85^{th} percentile speed. Other features like the geometrics of the road, roadside development, pedestrian activity, access control in the area and the accident history are also considered subjectively. Fixing of scientific speed limits on National Highways is one of the measures to limit the negative effects of excessive and inappropriate speed and also to minimize the adverse impacts on road safety, the environment and the functional efficiency of the road.

Considering the importance of speed limits in reduction of accident risk and severity of crashes, a research study has been undertaken to evaluate the impacts of posting speed limits on 70 km section of National Highway No.47 section between Thiruvananthapuram and Kollam.

Scope and objectives

The aim of the study was to examine various techniques available in establishing scientific speed limits on highways and propose appropriate speed limits on the selected stretch of NH 47 in Kerala. Besides the task of setting speed limits, the study also evaluated the impact of the scheme in reduction of road accidents and the operational efficiency of the highway system. To achieve this, the objectives of the study were oriented as given below:

(i) To conduct a review of the state-of-art technology in arriving at appropriate speed for the identified corridor.

(ii) To assess the travel speeds of various types of vehicles on different sections of the road under study.

(iii) To evaluate the parameters like land use pattern, roadside developments, pedestrian movements, access points, intersections and geometry of the road stretch and their influence on average speed of different vehicle types.

(iv) To identify the locations where speed restriction is to be imposed and
(v) To assess the impacts of various speed control measures like speed limit, signage, and geometric corrections to improve the safety and acceptable level of service.

The scope of the study was limited to Thiruvananthapuram - Kollam section of NH 47 with a distance of 70 km.

Methodology

The tasks carried out include collection of data through primary and secondary sources, analysis of data to extract the necessary inputs for the study and formulation of speed limit on the study stretch.

The required data for the study were collected through various surveys which include:

- Road Inventory to assess the geometric profile of the highway
- Traffic surveys, pedestrian and parking activities along the study stretch
- Speed and delay survey
- Collection of accident data for the last three years.

Data collected from field surveys were systematically analyzed to extract the required inputs for the study which included:

- Analysis of speed data and estimation of the 85^{th} percentile speed on selected sections;
- Analysis of traffic flow, pedestrian and parking activities;
- Influence of road geometrics, land use and roadside developments on the speed-flow relationship of the section;
- Posting differential speed limits for various types of vehicles;
- Evaluation of impact of speed limits.

Findings

A scheme to post speed limits for different sections of the highway was devised. The locations where speed limit has to be introduced and the type of control devices were also finalized.

There are several tools available for management of speed. The study recommended posting of advisory speed limit as a measure for bringing a balance between safety and travel time. Besides engineering treatments, effective enforcement of speed limits by police and the use of

extensive public information and education programmes for encouraging compliance to both advisory and statutory speed limits would be required. The advisory speed posted is based on the 85th percentile method which was modified on the basis of trial runs and speed tests.

The posted advisory speed would not be applicable for all times of the day, and for all weather conditions. The motorists are expected to make appropriate judgment during night time and adverse weather conditions. It is expected that implementation of the speed limit scheme at appropriate level, would be beneficial to the motorists road users and the society, at large.

The study report will assist road safety authorities in addressing the speeding problem, thereby reducing the overall impact of traffic causalities on road users.

16 Study of Paratransit Services for Selected Cities in Kerala

'Paratransit' encompasses a variety of transport modes, organizational structures, and service facilities falling in between two most properly known types of conventional transport, viz. Mass Public Transit Services (MPTS) and private vehicles (cars, scooters, etc).

Scope and Objectives

i. To identify and study the characteristics of Paratransit modes;
ii. To analyses and study various current issues regarding paratransit like, Organizational set-up, policy and planning, impact on employment, co-ordination and competition, cost of service etc.;
iii. To develop models to estimate the demand of paratransit; and
iv. To study the behavior and characteristics of paratransit drivers.

Methodology

NATPAC has collected data on paratransit modes for few cities in Kerala. The data and other information available in reports and published material was collected. Primary surveys to understand the problems of drivers were also conducted.

By using time series data, demands for paratransit modes for cities in Kerala are estimated. Along with traffic demand estimation, a comparative analysis of paratransit modes has been undertaken. Suitable models to estimate the optimum number of different types of paratransit modes is developed and used.

Table 16
Paratransit modes in Kerala

Year	Taxi	Auto-Rickshaw	Mini bus	Total
2001	90473	241236	58726	390435
2002	103991	278456	65681	448128
2003	111241	299225	72263	482729
2004	112884	314945	83814	511643
2005	123381	339607	90697	553685
2006	131832	362447	99547	593826
2007	140507	379220	112863	632590
2008	134650	391100	108230	633980
2009	142054	422905	110833	675792

Source: Economic Review 2009

Findings

Paratransit modes in urban areas occupy an important place. These modes have many distinguishing characteristics, like, low carrying capacity, low speed, high cost, and low fuel efficiency, more dependable and easily available. Due to many advantages the paratransit modes offer the commuter, these have grown quick fast. However, as the city size increases mass transit tends to carry proportionately more passengers.

The study has proposed two models to estimate the demand for paratransit modes. For this purpose, a concept of Capacity Equivalent Auto Rickshaw (CEAR) has been introduced. The CEAR has been defined as the weighted average of various paratransit modes, weights being the service capability of these modes. The computation of CEAR may be of great value when the combined demand of all paratransit modes is to be estimated.

The second model tries to estimate the population size 'p' which can be satisfactorily served by one vehicle of mode 'm'. This is achieved by first estimating the traffic demand of population 'p' for mode 'm' and then equating it with the estimated service capability of one vehicle of mode 'm'. Once the value of 'p' is known, the total demand for mode 'm' can be calculated just by dividing the total population of the city by 'p'.

Models developed can be used as a tool for obtaining the optimum demand for various paratransit modes on other places where similar transportation scenario is found.

17 Traffic Medicine- a Status Report

The term traffic medicine has evolved to embrace all those disciplines, techniques, and methods aimed at reducing the harm traffic crashes inflict on human beings. While the vast majority of harm results from road vehicles, traffic medicine also includes injuries from all vehicles traveling over land, sea, and air, and under-water and in space. The trauma surgeon treating the victim of a crash, the people transporting the victim from the crash site to medical treatment, those in the system dispatching help to the crash site are all involved in traffic medicine. The automotive engineer working to improve vehicle crashworthiness, develop better safety belts, brakes, or lights is practicing traffic medicine; likewise, the roadway engineer designing safer roads, or the traffic engineer developing safer traffic control systems. Those advocating, developing, administering and enforcing traffic safety policy are all involved in traffic medicine. Researchers discovering more about the biomechanics and epidemiology of traffic crashes, the backgrounds and mental states of crash-involved drivers, or developing new surgical procedures to treat crash injuries are all involved in traffic medicine. Those involved in training and educating drivers or others, such as pedestrians or passengers, participating in transportation systems are likewise involved in traffic medicine. Educators in the areas described earlier are also practicing traffic medicine.

Scope and Objectives

The study concentrated on preparing a status report of "Traffic Medicine" for Kerala. The main objectives of the study are as given below:

(i) To review the emergency medical care system in Kerala, with special reference to Trivandrum.
(ii) To analyse the accident injury pattern of accident victims from hospital records.
(iii) To interact with doctors involved in treating accident victims, especially orthopedic and neuro surgeons, in order to understand the problems of accident victims as perceived by them.
(iv) To prepare resource material for training NGOs and other interested persons in taking care of accident victims and administering first-aid at accident site.
(v) To examine the accident victims rehabilitation programme and suggest methods to improve the system.
(vi) To study the present system of trauma registry in hospitals and suggest methods for improvement.

Methodology

The first part of the study examined the emergency medical care system in Kerala, and studied the ambulance service system. The second part of the study concentrated on understanding the injury pattern of accident victims. Accident victims are classified according to helmet/non helmet users, seat belt/non seat belt users and socio-economic and demographic characteristics. Interviews and discussions with doctors were conducted to understand the problems of accident victims. The third part of the study examined the rehabilitation programme of accident victims. Along with this resource - material for training volunteers, NGOs etc in first-aid, and care of victims at accident site are also developed.

Conclusion

The MACT and Peoples' Lok Adalat is a good beginning to cut the delays in disposing of accident claims. But there are obvious short comings with respect to the expenses incurred, the amounts claimed and the amounts actually disbursed. These processes should be further streamlined to avoid falsification of records and to make sure that injured persons get a fair share of their medical expenses as compensation after the accident.

In the case of rehabilitation services in Thiruvananthapuram, the suggestions from some physiotherapists are:-

(i) The Government should start a degree in physiotherapy.
(ii) One physiotherapy centre in Medical College is not enough. Road traffic injuries are increasing. The demand for physiotherapy is also increasing. They should start physiotherapy department in district hospitals.
(iii) They should start high quality training in Physiotherapy and increase recruitment.

Road traffic injury is a major problem in Trivandrum, but, it has got very little attention in terms of support for interventions to reduce them. A comprehensive injury prevention program with a public health and traffic medicine perspective has to be considered, if the policy makers are serious about the problem.

Policy makers should acknowledge that accidents are a public health problem and take immediate action. At first, a preliminary policy should be attempted from the health sector point of view. The following activities should be supported:

- A booklet as training resource for paramedics
- Establishment of a trauma registry/hospital RTA surveillance system
- Education of general public and
- Prevention education in educational institution and community organisations.

Characteristics of accident victims can be analysed and suitable insurance plan need to be developed. A database is prepared regarding the accidents reported in Thiruvananthapuram city. Improvement measures are suggested for trauma registration in hospitals.

18 Identification of Accident Prone Locations and Improvement Measures in State Highways of Northern Kerala

NATPAC collected accident data for major stretches of state highways in Northern Kerala for the past years and analysed the trends in accidents and compared appropriate accident ratios as indicators across the districts and the highways.

Scope and Objectives

- To analyse the accident causative factors and to arrive at accident abating measures
- To identify accident prone locations of first, second and third orders to be improved on priority basis, and
- To prepare improvement plans for accident prone stretches in the highways

Study Area

- SH 23 (Shornur- Perinthalmanna–Length 39.3 kms)
- SH 53 (Perinthalmanna-Palakkad -Length 35. 3 kms)

Methodology

- Collect reliable data on accident frequency and characteristics, geometric features on the roads and traffic volume.
- To analyze the accident causative factors.
- Records from Police stations along the state highways forming the vital source are to be perused for FIR details.
- Prioritising the accident prone locations in terms of number of accidents, Frequency & Severity
- Safety Auditing of identified segments
- To suggest improvement measures for identified accident prone locations

Conclusion

The accident black spots on major SH corridors have been identified and conducted engineering surveys have been conducted. Identification of accident prone locations and geometric improvement measure packages will be useful to Public Works Dept. (Roads) and Local authorities.

19 Comprehensive Signage Scheme for Kovalam Tourist Area

Kovalam beach resort is located 16 kms away from Thiruvananthapuram City. It has become an internationally renowned beach with three adjacent crescent beaches. The tourist center has plenty of attractions to cater to the needs of large number of tourists visiting Kovalam Beach and they include tourist resorts, hotels, restaurants, ayurvedic centers, recreation facilities etc. In the absence of systematic and uniform signage scheme, locating a particular facility within Kovalam is a strenuous task for visiting tourists. There is an urgent need to have a uniform and systematic signage scheme to guide the tourists to the desired facilities available in the tourist center. It can be achieved, to a large extent, through installation of sign boards at strategic locations showing various facilities available in the immediate vicinity as well as in the neighborhood.

At the instance of Department of Tourism, Government of Kerala, NATPAC has prepared a comprehensive signage scheme for Kovalam tourist area. The project was undertaken in two phases. In the first phase, Detailed Project Report for implementing the scheme was prepared in the year 2009. In the second phase, preparation of Tender Documents for the execution of the project and supervision of installation and quality control of the project was undertaken.

The study was confined to Kovalam Tourist Area, covering the roads leading to Kovalam Beach from NH bypass and all the feeder roads and foot paths linking various tourist facilities like hotels, resorts and other establishments.

Major tasks carried out under Phase I of the study include:

- A detailed inventory of the study area and identification of the locations of tourist facilities and tourism products;
- Identification of type of signages to be posted;
- Detailed design of sign boards conforming to the specification and color codes as per National/ International standards;
- Preparation of detailed drawings for various types of sign boards, type of materials to be used for fabrication of the signboards and the grade of materials, including reflective sheets;
- Total requirement of sign boards in terms of number of boards of various types, preliminary cost for execution of the project;

- Preparation of Project Report containing the type of information to be provided in various signages, location for posting these boards, design of various types of sign boards and type of materials to be used.

Design - A sign boards were suggested for all major roads in the Kovalam tourist area. Each board will give information about four major destinations enroute. The information consisted of the name of destination, distance to the destination and direction of travel.

Design - B sign boards carry names of facilities, symbols regarding the type of facility and the direction of travel.

Design - C sign boards are suggested on the pathways leading to the Beach. Each board gives names of six or four facilities, symbols regarding the type of facility and the direction of travel.

Based on detailed site visit and inventory of various facilities available, tentative locations for installation of sign boards along all the roads and pathways in the Kovalam Tourist Area were identified.

After identifying the locations for sign boards, information to be provided on each board were assessed. The following information pertaining to the tourism attraction/ tourist facilities were provided in different types of sign boards.

i) Name of tourism attraction/tourist facility
ii) Symbol representing the tourist facility
iii) Distance
iv) Direction of travel

A total of 53 sign boards were proposed in the Kovalam tourist area which were installed under the monitoring and supervision of NATPAC Team.

TRAINING AND EXTENSION PROGRAMMES

1 Road Safety Training Programme for Government Staff/Department Drivers

NATPAC organized a "State –Level Road Safety Training Programme for Government Staff/Department drivers". The programme was formally inaugurated by Shri Jose Thettayil, Hon'ble Minister for Transport on 27th September 2010 at Sasthrabhavan, Pattom.

Plate 11
Inauguration of the State-level Road Safety Training Programme for Government Staff/Department drivers by Hon'ble Minister for Transport, Govt. of Kerala

Plate 12
Dr.C.T.S Nair, Executive Vice President, KSCSTE addressing the participants at the inaugural session of the Training Programme

The main objective of the training programme is to educate Government Staff/Department drivers on defensive driving. Experts from Police Department, Doctors, Motor Vehicle Department and NGOs delivered lectures on topics related to road safety. The programme is organized in such a way that the benefit from this training will reach to Government

Staff/Department drivers of all the districts. Eight programmes were completed this year starting from Thiruvananthapuram District.

*	Thiruvananthapuram	:	27th and 28th September 2010 4th and 5th October 2010 6th and 7th October 2010 11th and 12th October 2010 (at Sasthrabhavan, Pattom) – drivers from Thiruvananthapuram and Kollam Districts were covered
*	Kottayam	:	29th and 30th November 2010
*	Ernakulam	:	2nd and 3rd December 2010
*	Kozhikkode	:	14th and 15th December 2010
*	Palakkad	:	17th and 18th December 2010.

Drivers from almost all Government departments participated in the Training Programme. After each training programme, feedback were taken from the participants. The analysis of feedback shows that this training programme will definitely show positive results in the future.

Certificates were issued to all the participants at the end of each training programme. Study materials on road safety prepared by NATPAC were distributed to the participants.

An expert team of Eye Specialists checked the eye sights of drivers who participated in the training programme. The drivers with some type of visual acuity have been recommended for detailed check up.

Road Safety exhibition and audio-visual programmes depicting the characteristics of various types of accidents were also conducted.

The technical sessions were handled by experts from NATPAC and from outside.

The following topics were discussed in the training programme:

- **Road accident scenario –causes and mitigate measures** - by Dr.G.Ravikumar, Head, Extension Services and Project Development Division, NATPAC.

- **First-Aid to accident victims** - by Captain (Dr.) George Selvaraj, Chief Consultant Orthopaedics, P.R.S.Hospital, Thiruvananthapuram; Dr.Dominic Mathew, Consultant in Anaesthesia, Kottayam and Dr.Venugopal, Emergency Medicine, MIMS Hospital, Kozhikkode.

- **Kerala Motor Vehicle Rules** - by Shri.Prabhakaran Thampy, Rtd.R.T.O.

- **Safe driving and traffic control measures** - by Shri.T.V.Satheesh, Vice President, World Road Safety Partnership.

- **Driving style and psychology** - by Smt.Navoma Money, Psychologist.

- **Vehicle Fitness** - by Shri.P.T.Haridasan, Vehicle expert.

- **Defensive driving techniques and tips to reduce accidents** - by Dr.G.Ravikumar, Head, Extension Services and Project Development Division, NATPAC.

- **Traffic rules and road signs** - by Shri.P.T.Haridasan, Vehicle expert; Shri.Roy Thomas, Motor Vehicle Inspector, Pala; Shri.T.G.Gokul, Motor Vehicle Inspector, R.T.O., Palakkad and Smt.Brinda Sanil, Asst. Motor Vehicle Inspector, Thiruvananthapuram.

Plate 13 (a)

Plate 13 (b)

Plate 13 (c)

Plate 13 (d)

Plate 13 (e)

Plate 13 (f)

Glimpses of the State-level Road Safety Training Programme for Government/Staff Department drivers

2 Road Safety Week-2011

NATPAC as part of Road Safety Week organized a week long Road Safety programme. Shri.Jose Thettayil, Hon'ble Minister for Transport of Kerala inaugurated the programme on 4th January 2011 at Sasthra Bhavan, Pattom. The programme was sponsored by Kerala Road Safety Authority. Activities during the Road Safety Week included:

i. Seminar on "Ensuring Road Safety in Urban Areas" (4th January 2011)
ii. Higher Secondary Teachers Training Programme (5th January 2011)
iii. Painting, Quiz and Elocution Competitions for students (6th January 2011)
iv. Training Programme for Tipper Lorry Drivers, at Saw Mill Association Auditorium, Perumbavur (9th January 2011)

In all these programmes, faculties from NATPAC, Police, NGO's and outside experts had participated.

Plate 14
Welcome speech by Smt.B.G.Sreedevi, Director, NATPAC

Plate 15
Shri Jose Thettayil, Hon'ble Minister for Transport, Govt. of Kerala inaugurating the Road Safety Week Celebrations

Plate 16

Presentation by Dr.M.V.L.R. Anjaneyulu, Professor in Civil Engineering, NIT, Kozhikode on " Road Safety Issues in Northern Kerala"in 'Road Safety Week-2011'

Plate 17

Presentation on 'Traffic Rules and Road Signage', by Smt Vrinda Sanil

3 Road Safety Training Programme for Tipper Lorry and Commercial Vehicle Drivers

NATPAC in association with Kerala Road Safety Authority organized a "State wide road safety training programme for tipper lorry and other commercial vehicle drivers of Kerala", covering drivers from major towns and districts in Kerala to impart the training. The programme included one day class on various aspects of road safety, interactive sessions, free eye check –up, road safety exhibition and audio-visual programmes.

The main objectives of the programme are:

- To educate tipper lorry and other commercial vehicle drivers, who are yet to undergo any formal training programme on defensive driving;
- To devise methods of defensive driving for tipper lorry and commercial vehicle drivers;
- To chalk out and implement different training programmes for different target groups;
- To monitor post- training behavior of drivers.

The drivers were selected with the help of various drivers' unions like Tipper-Earth Movers Association and Motor Vehicle Department Officials. Selected drivers who were not involved in any road accidents were honored during the function.

Selected faculties and experts of NATPAC took classes on various aspects of road safety. The training module includes:

i. General Road Safety Scenario (global, national and state)
ii. Driver and Road User Behavior - common mistakes
iii. Traffic rules and Road signages
iv. Personality Development
v. Vehicle fitness and fuel saving methods
vi. Defensive Driving Techniques
vii. First aid

NATPAC conducted training programmes at important towns & community centers. They are:

1. Irinjalakkuda - 24.01.2011
2. Thrissur - 25.01.2011
3. Pudukkad (Kodakara) - 09.02.2011

4.	Tirur-Thrissur	-	10.02.2011
5.	Muthuvara	-	03.03.2011
6.	Kodungallur	-	04.03.2011
7.	Ollur	-	09.03.2011
8.	Madakkathara	-	10.03.2011
9.	Nadathara	-	22.03.2011
10.	Chalakkudy	-	23.03.2011
11.	Guruvayur	-	24.03.2011
12.	Pathanamthitta	-	09.07.2011
13.	Angamaly	-	14.07.2011

Feedbacks were taken from the participants after each programme. Response was good and the drivers were of the opinion that similar types of training should be made available to remaining drivers also. NATPAC has taken all efforts to involve Police Department, Motor Vehicle Department and other local NGOs working in similar areas for the above programmes.

Plate 18
Inauguration of training programme at Irinjalakuda by Shri.Thomas Unniyadan, Hon'ble M.L.A of Irinjalakuda

Plate 19(a) *Plate 19 (b)*

Honoring the best drivers

Plate 20

Presentation on 'Traffic Rules and Road Signs' by Dr.G.Ravikumar, Head Extension Services Division, NATPAC

Plate 21

Demonstration class on rescuing an accident victim

4 Seminars Organised and Invited Lectures

- The "*National Technology Day Celebration*" was organized on 10th June 2010 in association with Sree Chitra Thirunal College of Engineering (SCTCE) at Main Seminar Hall, SCTCE. The programme was inaugurated by Dr.V.K.Damodharan, Former Director, State Committee for Science, Technology and Environment (STEC). Dr.A.Ramesh, Head, IC Engine Laboratories, IIT Chennai delivered Technology Day Lecture. Awards were distributed to students for outstanding project works.
- In connection with 'Road Safety Week 2011', a Seminar on "*Ensuring Road Safety in Urban Areas*" was conducted on 4th January 2011, at Sasthrabhavan, Pattom. Dr.Mahesh Chand, Head, Traffic Safety Division, NATPAC presented paper on 'Road Safety Scenario in urban areas in Kerala' and Dr.M.V.L.R.Anjanayulu, Prof. in Civil Engineering, NIT, Calicut presented paper on 'Road Safety issues in Northern Kerala'.

5 Road Safety Training Programme for various User Groups

- Awareness class on 'Traffic rules and road safety' to the NCC Cadets of ATC Camp at MCHSS Kottukalkonam, Balaramapuram, on 29th April 2010.

- Road Safety awareness programme for students at the summer school organized by State Central Library, on 5th May 2010, at State Central Library, Thiruvananthapuram.

- NATPAC, in association with M/s Merchem, at Ernakulam conducted Road Safety training programme for drivers of tourist taxis attached to the Cochin International Airport, Nedumbassery on 30th June 2010.

- Road Safety training class for students of St.Joseph school, Thiruvananthapuram.

- Road Safety training class for Police personnels at Police Training College, Thiruvananthapuram.

- Road Safety Awareness Training Programme for drivers of VSSC, at VSSC, Thiruvananthapuram.

- Road Safety Awareness Training Programme for drivers of KSRTC, Thiruvananthapuram.

- Road Safety Awareness Training Programme for autorickshaw drivers, in connection with Janamaithry Suraksha Project, at Thiruvananthapuram.

6 Participation in Workshops, Seminars and Other Training Programmes

Name of Programme	Organized by	Date	Location	Participants
Seminars				
"Career Advancement Programme for Scientists"	KSCSTE	22.09.2010	Sasthra Bhavan, Pattom	Salini. P.N P. Kalaiarasan Sabitha N M
"23rd Kerala Science Congress"	KSCSTE	29.01.2011-31.01.2011	Centre for Earth Science Studies (CESS), Thiruvananthapuram	Scientists of NATPAC
"Ramsar designated Wet lands of Kerala-values and threats" – as part of World Wetlands Day	KSCSTE	02.02.2011	Sasthra Bhavan, Pattom	B.G.Sreedevi Satheish B Nair
"Women Achievers in Science"	KSCSTE	08.03.2011	Sasthra Bhavan, Pattom	B.G.Sreedevi Salini. P.N P. Kalaiarasan
Workshops				
"Second stake holder Workshop-KSTP"		14.12.2010		B.G.Sreedevi Satheish B Nair D.Robinson
"Workshop on Indian Innovation Growth Programme-2011"	Dept. of Science & Technology	07.01.2011	Thiruvananthapuram	P. Kalaiarasan
"Workshop on Cement Concrete Roads and Ultra Thin White Topping"	Cement Manufacture Association of India, Thiruvananthapuram	05.02.2011	Thiruvananthapuram	B.G.Sreedevi
"Workshop on Research Methodology"	Dept. of Mechanical Engineering, NIT, Calicut	04.04.2011-05.04.2011	NIT, Calicut	V.S.Sanjay Kumar Sabitha N M
Training Programmes				
Short term course on computational method in fluid flow and Heat Transfer	Dept. of Aerospace Engineering, IIST, Thiruvananthapuram	12.07.2010-16.07.2010	IIST, Thiruvananthapuram	Sabitha N M
Statistical software for data analysis	NORMA, Thiruvananthapuram	26.07.2010-30.07.2010	NORMA, Thiruvananthapuram	T.Ramakrishnan
Presentation and Communication Skills for Scientists	Xavier Institute of Management, Bhubaneswar	06.09.2010-11.09.2010	Xavier Institute of Management, Bhubaneswar	V.S.Sanjay Kumar M.S.Saran

7 Guidance to Students' Projects

Students from National Institutes and reputed Professional Colleges have undertaken their project works/thesis under the guidance of NATPAC Scientists.

Name of the Institution	Course	No. of Students	Division under which guidance provided	Topic
Gayathri Vidya Parishath College of Engineering, Visakhapatnam	B.Tech	4	Traffic & Transportation Division	Traffic improvement schemes for central areas of Thiruvananthapuram city
Mar Baselios College of Engineering & Technology, Thiruvananthapuram	B.Tech	5	Highway Engineering	Study on use of Waste Plastic in Bituminous Mixes
Marian Engineering College, Thiruvananthapuram	B.Tech	6	Regional Transportation Division	Rationalization of Bus Stops: A case study along Pattom-Kesavadasapuram Route
P A Aziz College of Engineering, Thiruvananthapuram	B.Tech	6	Highway Engineering	Use of Coir Geo-textiles in Sub-grade Soils
Musliyar College Of Engineering & Technology, Pathanamthitta	B.Tech	4	Traffic & Transportation Division	Traffic improvement schemes for Central junction in Pathanamthitta town
St. Gits College of Engineering & Technology, Kottayam	B.Tech	5		
TKM College of Engineering, Kollam	B.Tech	6	Highway Engineering	Study on use of Fly ash in Bituminous Mixes
College of Engineering. Thiruvananthapuram	M.Tech	5	Highway Engineering	Study on Resource Mapping of Road Construction Materials in Pathanamthitta District using GIS
National Institute of Technology, Thiruchirappalli	M.Tech	1		
Indian Institute of Technology, Kharagpur	M.Tech	1		
Indian Institute of Technology, Chennai	M.Tech	1	Highway Engineering	Resource Mapping of Road Construction Materials in Pathanamthitta District

8 Exhibitions

- Conducted Road Safety Exhibition in connection with 'Kadathanadu Mahotsavam', at Vatakara, Kozhikode, 21st to 23rd May 2010.

- Road Safety exhibition and audio-visual programmes in connection with "State – Level Road Safety Training Programme for Government Staff/Department drivers", organized by NATPAC.

- Road Safety exhibition and audio-visual programmes in connection with "Road Safety Week Celebration 2011".

- Road Safety exhibition and audio-visual programmes in connection with "State wide road safety training programme for tipper lorry and other commercial vehicle drivers of Kerala".

- 23rd Kerala Science Congress – Exhibition at Centre for Earth Science Studies (CESS), Thiruvananthapuram. 29th to 31st January 2011.

9 Publications

Research Papers

B G.Sreedevi, Salini.P N & Satheish B Nair, "*Field Performance Indicators for Natural Rubber Modified Bitumen in a Tropical Setting"*. Indian Highways, January 2011, Vol.39, No.1.

Elangovan T, *"Green Transport Concept-Prospects in India"*. Indian Highways**,** May 2010, Vol.38, No.5.

Elangovan T, "*Sustainable Transport Development***" (***സുസ്ഥിര ഗതാഗത വികസനം കേരളത്തിൽ***).** Janpatham, Department of Information and Public Relations, Government of Kerala, September 2010.

Paper Presentations

P N Salini, B G Sreedevi, "*Vehicle Axle Loading Pattern on Highways in Kerala"*. National Conference on Recent Advances in Civil Engineering (RACE 2010), Cochin University of Science and Technology, Cochin, 16th – 18th September 2010.

P. Kalaiarasan, B G Sreedevi , *"Ambient air quality monitoring and evaluation of vehicular emission in Thiruvananthapuram district, Kerala"*. National Conference on Recent Advances in Civil Engineering (RACE 2010), Cochin University of Science and Technology, Cochin, 16th – 18th September 2010.

T Elangovan, B G Sreedevi, T Ramakrishnan, Salini P N,*"Traffic Potentials and Prospects of an Elevated Road Corridor Between Aroor and Edappally in Kochi*". 11th National and 1st International Conference on Technological Trends (ICTT 2010), Organized by College of Engineering Trivandrum, 25-27 November 2010.

P. Kalaiarasan, B G Sreedevi,*"Status of air quality in Thiruvananthapuram district, Kerala"*. 23rd Kerala Science Congress, Centre for Earth Science Studies (CESS), Thiruvananthapuram, January 29 to 31, 2011.

Chapters in Conference Proceedings/Compendium

Sabitha N M, B G Sreedevi, *"Management of Inland Waterways in Kochi city"*. Proceedings of 4th CUSAT National conference on Recent Advances in Civil Engineering, Cochin, September 16-18, 2010, PP 267-274.

Sabitha. N M, B G Sreedevi, *"Improvement of connectivity between Kochi Seaport and Airport through Inland Waterways"*. Proceedings of International Conference on Technological Trends (ICTT 2010), Organized by College of Engineering Trivandrum, 25-27 November 2010. PP 454-460.

B G Sreedevi, *"Greening the Transport Sector of Kerala –Road and Waterways"*. Compendium of 23rd Kerala Science Congress, Centre for Earth Science Studies (CESS), Thiruvananthapuram, January 29 to 31, 2011.

10 Invited Talks/Media Interactions

B.G.Sreedevi

Invited Talk

"*Pedestrian Safety*". Institution of Engineers, Kochi Local Centre, 15th September 2010.

"Scientific Research and Technology Applications". International Congress on Kerala Studies, Thiruvananthapuram, 1st- 2nd January 2011.

"*Perspective on infrastructure for industrial growth –Transport"*. International Congress on Kerala Studies, Thiruvananthapuram, 1st- 2nd January 2011.

"Road safety". Road safety week 2011, organized by Save Life Charitable and Road Safety Protection Society, 10th February 2011.

"Perspective on Transport Development for Kerala- Road and Waterways". Kerala Development Congress, 12th February 2011.

"Safety on Roads'. Short term training programme on Safety Aspects in Engineering, organized by CUSAT, 7th March 2011.

Media Interactions

"*Road Safety Scenario in Kerala*". Talk on All India Radio on 8th January 2011.

"Railway Budget 2011-12". Discussion in Doordarsan on 25th February 2011.

T.Elangovan

Invited Talk

"Road Transport Development – Problems and Possible Actions for Kerala". Kerala Watch, Thiruvanathapuram, 29th April 2010.

"Technological Advancement for Steady Progress of India". Talk delivered on National Technology Day Celebrations, Sree Chithra Thirunal College of Engineering, Thiruvanathapuram, 10th June 2010.

"Prospects of Highway Development in Kerala". One-day Seminar organized by Institution of Engineers (India), Kerala Chapter, 16th June 2010.

"Sustained Urban Development". Invited talk & Moderator for Technical Session at International Conference on "Global Warming, Climate Change, Sustainable Development

and Secular Spirituality", organized by Santhigiri Research Foundation, Trivandrum, 9-11 September 2010.

"Towards Green Transport Development". National Conference on Recent Advances in Civil Engineering held at Cochin University of Science and Technology, Kochi (Kerala), 17th September 2010.

"Urban Transportation - Integration of Public Transport Services in Cochin City". Key Note address at Plenary Session of Two-day Conference (INFRACON-2010) organized by Confederation of Indian Industries, Cochin Chapter on 5th October 2010.

"Sustainable Development". 1st International Conference on Technological Trends at College of Engineering, Trivandrum, 26-28 November 2010.

"Prospects in Highway Developments in Kerala". 2-day Technical Seminar organized at College of Engineering, Trivandrum, 26th March 2011.

11 Nomination to Technical Committees/other Advisory Bodies/Membership of Professional Bodies

B.G.Sreedevi

- Member, Kerala Road Safety Authority
- Member, District Road Safety Council and Traffic Advisory Committee
- Member, State Advisory Committee, Kerala State Electricity Regulatory Commission

T.Elangovan

- Director on the Board of Directors of Kerala Shipping & Inland Navigation Corporation Ltd – A Govt. of Kerala Undertaking
- Member, Highway Research Board – Identification, Monitoring and Research Applications (IMRA) Committee, IRC, New Delhi
- Council Member, Indian Roads Congress, 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 Revision 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

- Appellate Authority, NATPAC under Right to Information Act 2005 (from 12.03.2010 to 15.11.2010)

12 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

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

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

Calenders

1. Steps to Use Bus safety
2. Safe Road to school – Crossing the Road Safety
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)

INFRASTRUCTURE

1 New Campus for NATPAC at Akkulam, Thiruvananthapuram

The Hon'ble Chief Minister of Kerala, Sri.V.S.Achuthanandan laid the foundation stone for the new office building of NATPAC at Akkulam, Thiruvananthapuram on 04.06.2008. The new building is being set up opposite to the Centre for Earth Science Studies (CESS).

Three floors have been completed. It is proposed to occupy three labs in the ground floor – Bitumen Lab, Aggregate Lab and Soil Lab. The new campus at Akkulam aims at giving a fresh impetus to the organization's research activities and scope for future development.

2 Testing Facilities/Equipments Available in NATPAC Laboratory

Sl. No.	Item
I. Soil Testing Equipments	
1.	Soil sieves
2.	Mechanical sieve shakerv(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
II. Aggregate Testing Equipments	
18.	Aggregate sieves
19.	Aggregate Impact Value test equipment
20.	Los Angeles abrasion testing machine
21.	Stripping value test equipment
22.	Specific gravity test - Density basket
23.	Shape test - Thickness gauge & Length gauge, Angularity number test
III. Bitumen & Emulsion	
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
34.	Particle charge test apparatus - emulsion
35.	Residue on 600 micron sieve test apparatus - emulsion
36.	Coagulation test apparatus - emulsion

Sl. No.	Item
37.	Settlement test apparatus - emulsion
IV.	**Tests on Mixes**
38.	Marshall stability test equipment.
39.	Motorized centrifuge extractor
40.	Core cutting machine - (100mm dia. core bit)-undisturbed sampling of bituminous pavement.
V.	**Test on Pavement and evaluation**
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
VI.	**Environment Lab**
47.	CO Analyzer
48.	CO_2 Analyzer
49.	NO_2 Analyzer
50.	CH_4 Analyzer
51.	Cup Anemometer
52.	Wind vane
53.	Wind logger
54.	RH meter
55.	Thermo couple sensor
56.	Spectrophoto meter
57.	Noise level meter
VII.	**Traffic Engineering Lab**
58.	Speed Radar
VIII.	**Water Transport Lab**
59.	Echo sounder
60.	Portable cantilever scale
IX.	**Topographic Survey**
61.	DGPS
62.	Single Frequency GPS- 5 nos.
63.	Total station- 3 nos.
64.	Automatic level- 2 nos.
65.	Theodolite
66.	High end plotter- 2 nos.
X.	**General Accessories for Lab**
67.	Thermostatically controlled drying oven 0-150^{0}C
68.	Thermostatically controlled water bath
69.	Electronic balances – 200 g, 2 kg, 50 kg
70.	Soaking tank

Sl. No.	Item
71.	Heater
72.	Semiautomatic balance 10 kg – 2 nos.
73.	Traffic safety appurtenances
74.	Power generator- 2 nos.
75.	External car battery-3 nos.
76.	Digital Thermometer
XI.	**Application Softwares**
77.	MX ROAD
78.	AUTO CAD
79.	ARC GIS
80.	3D MAX
81.	TALLY
82.	STAD PRO
83.	HDM IV
XII.	**Computing Facilities**
84.	Desktop Computers-100 nos.
85.	Printers (A3 & A4)- 25 nos.
86.	A3 Laser Printer- 2 nos.
87.	Photostat- 4 nos.
88.	Laptops- 10 nos.

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 staffs 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.

THE ORGANISATION

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.

KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY AND ENVIRONMENT

The members of the State Council consist of the following:

Chief Minister of Kerala	-	President
Minister for Industries, Govt. of Kerala	-	Vice President
Minister for Finance, Govt. of Kerala	-	Vice President
Minister for Agriculture, Govt. of Kerala	-	Vice President
Minister for Health, Govt. of Kerala	-	Vice President
Minister for Education, Govt. of Kerala	-	Vice President
Minister for Forests, Govt. of Kerala	-	Vice President
Minister for Water Resources, Govt. of Kerala	-	Vice President
Vice Chairman, State Planning Board, Kerala	-	Vice President
The Chief Secretary to Government of Kerala	-	Vice President
The Executive Vice President, KSCSTE	-	Member
The Secretary, Department of Science and Technology, Government of India	-	Member
The Vice Chancellor, Cochin University of Science and Technology	-	Member
The Vice Chancellor, Kerala Agricultural University	-	Member

The Secretary to Government, Finance Department, Govt. of Kerala	-	Member
The Secretary to Government, Planning and Economic Affairs Department, Govt. of Kerala	-	Member
The Director, Vikram Sarabai Space Centre, Thiruvananthapuram	-	Member
The Director, NIST, Formerly (RRL-T), Thiruvananthapuram	-	Member
The Director, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram	-	Member
The Member Secretary (nominated by Government)	-	Member
Director, TBGRI, Trivandrum	-	Member
Director, KFRI, Peechi, Thrissur	-	Member

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

KSCSTE EXECUTIVE COMMITTEE

Executive Vice President (Ex-officio)	-	Chairman
Secretary, Department of Science & Technology, Government of India or his/her nominee (Ex-officio)	-	Member
Secretary, Planning & Economic Affairs, Government of Kerala (Ex-officio)	-	Member
Additional Chief Secretary, Finance, Government of Kerala (Ex-officio)	-	Member
Director, TBGRI, Trivandrum	-	Member
Director, KFRI, Peechi, Thrissur	-	Member
One representative each of Science and Technology, Industry and Environment Departments nominated to the Council by the Government of Kerala	-	Members
Member Secretary, KSCSTE	-	Secretary

RESEARCH COUNCIL OF NATPAC

1. Dr. C E G Justo - Chairman
   334, 25th Cross, 14th Main,
   Banashankari 2nd 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, Government 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, 7th 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. Director, NATPAC -Member Convener
   Thiruvananthapuram

MANAGEMENT COMMITTEE OF NATPAC

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

INFORMATION OFFICERS AS PER THE RIGHT TO INFORMATION ACT

Public Information Officers	:	Shri. D.Robinson, Scientist E2 *(Scientific and Technical Matters)* Shri. P C. Sivadas Assistant Registrar (Administration) *(Administrative Matters)*
Asst. Public Information Officer :		Smt.V.S.Manju Office Assistant
Appellate Authority, RTI Act	:	T.Elangovan Scientist-G (upto 15.11.2010) Smt.B.G.Sreedevi Director (w.e.f 16.11.2010)

INTERNAL COMMITTEES

Library Committee

Shri.G.C.Das Gupta Deputy Chief Project Coordinator	Chairman
Dr.G.Ravikumar Scientist-E2	Member
Shri.Tomy Cyriac Scientist-E2	Member
Shri.D.Sunder Scientist-E1	Member
Shri.K.Mohanakumar Assistant Registrar (Finance)	Member

Editorial Board of 'Mobility'

Shri.G.C.Das Gupta Deputy Chief Project Coordinator	Chairman
Dr.G.Ravikumar Scientist-E2	Member
Shri.D. Robinson Scientist-E2	Member
Shri.D.Sunder Scientist-E1	Member Convener

Capital Purchase Committee

Dr.Mahesh Chand, Chief Project Coordinator	Chairman
Shri.G.C.Das Gupta, Deputy Chief Project Coordinator	Member
Shri.D. Robinson, Scientist-E2	Member
Shri.P.C.Sivadas, Assistant Registrar (Admn.)	Member
Shri.K.Mohanakumar, Assistant Registrar (Finance)	Member

NATPAC STAFF –AS ON 01.04.2011

Smt.B.G.Sreedevi Director

Scientific Personnel

1	T. Elangovan	Scientist - G
2	Dr. Mahesh Chand	Chief Project Coordinator
3	G. C. Das Gupta	Deputy Chief Project Coordinator
4	Dr. G. Ravikumar	Scientist –E2
5	N. Vijaya Kumar	Scientist –E2
6	Tomy Cyriac	Scientist –E2
7	D. Robinson	Scientist –E2
8	Satheish B. Nair	Scientist –E2
9	D. Sunder	Scientist –E1
10	V.S. Sanjay Kumar	Scientist-B
11	P.Kalaiarasan	Scientist-B
12	B.Subin	Scientist-B
13	P N Salini	Scientist-B
14	M S Saran	Scientist-B
15	N.M.Sabitha	Scientist-B
16	Arun Chandran	Scientist-B

Technical Staff

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

Administrative Staff

33	K.George Koshy (upto 12.03.2010)	Registrar
34	P.C. Sivadas	Assistant Registrar (Admn.)
35	K. Mohanakumar	Assistant Registrar (Finance)
36	J.Krishnamoorthy	P.A. to Director Grade -4
37	T. Vijayan	P.A. to Registrar Grade 1
38	Abey George	P.A. to Registrar Grade 1
39	D. Shaju	Section Officer Grade-1
40	R. Lekha	Typist cum Stenographer -4
41	A. Praveen Kumar	Clerical Assistant Grade -1
42	P. K. Rajan	Driver Higher Grade
43	G.Ragesh	Driver Grade –I
44	A.Somaraj	Driver Grade -I
45	Sukhdev Kolay	Jr. Assistant / Sr.Helper
46	C. Viswanathan	Jr. Assistant / Sr.Helper
47	P. X. Mathew	Jr. Assistant / Sr.Helper
48	S. Jayakumar	Helper Grade -4
49	G. Suresh Kumaran Nair	Helper Grade -2
50	A.Anil Kumar	Helper Grade -I
51	P. Lakshmi	Helper Grade -4
52	Athira S Kumar	Helper Grade -I

New Recruitments

P Kalaiarasan, Scientist B

Subin B, Scientist B

P N Salini, Scientist B

M S Saran, Scientist B

N M Sabitha, Scientist B

Arun Chandran, Scientist B

Retirements

Sri.R Subramony
Deputy Registrar (Fin) Gr.1
Superannuated on 31st May 2010

Sri. M C Rajeevan
Scientist-E2
Resigned on 30th July 2010

Sri.U.J.Philipose
Scientist-F
Superannuated on
30th September 2010

Sri.K Ramachandra Kaimal
Principal Technical Officer
Superannuated on
31st Octoberr 2010

Sri. E Ramakrishnan
Technical Officer Gr-5
Superannuated on
31st Octoberr 2010

Smt.K Visalakshy Amma
Jr.Library Assistant-Gr-5
Superannuated on30th
November 2010

Sri.C V Ramachandran
PA to Registrar
Superannuated on
31st January 2011

PLAN STUDIES UNDERTAKEN DURING 2010-'11

Sl.No.	Code	Project
1	PR 04/09-10	A study of Paratransit Services for selected cities in Kerala
2	PR 05/09-10	Traffic Medicine –A Status Report
3	PR 14/05-10	Preparation of Inventory of Roads for Grama Panchayaths in a District – a case study of Kannur District
4	PR 05/08-10	Preparation of Inventory of Roads for Grama Panchayaths in a District – a case study of Kannur District
5	PR 01/17-10	Resource Mapping of Road Construction Materials in Kerala- Case study of Thiruvananthapuram and Alappuzha Districts
6	PR 01/09-10	Demonstration project on the use of NRMB, CRMB and Plastic Waste for road construction and study on its suitability to Kerala conditions
7	PR 15/05-10	Periodic Updation of Price Indices for Stage Carriages Operation (PISCO) in Kerala
8	PR 10/09-10	Impact of traffic signs and road markings on improving the traffic flow and safety of road users- Case study of Pattom-Kesavadasapuram Section of NH-47 in Thiruvananthapuram City
9	PR 01/10	Evaluation of speed limits on National Highways – Case study of Thiruvananthapuram –Kollam section of NH-47
10	PR 02/10	Constraints in Developing West-Coast Canal in Kerala – a case study of National Waterway III
11	PR 04/10	Use of Geo-synthetic materials in road Construction and embankment Works- A Demonstration Project
12	PR 05/10	Integrated Development of Transport Infrastructure in a Region- a case study of an emerging Town
13	PR 06/10	Regional Road network planning study for Kerala – Vision 2030

CONSULTANCY PROJECTS DURING 2010-'11

Sl. No.	Code	Project	Sponsored by
1	C 00610	Preparation of Transport Development Plan for Mattannur Municipality	Mattannur Municipality
2	C 00810	Road improvement plan for Balal Rajapuram Road in Kasargode District	Kasargode LSG
3	C 00210	Traffic studies for Perumbavur town	Perumbavur Municipality
4	C 00410	Traffic & Transportation studies for 23 towns in Kerala	Town & Country Planning Dept.
5	C 01110	Traffic studies for Cochin- Coimbatore Industrial Corridor Project	Infrastructures Kerala Limited (INKEL)
6	C 00209	Comprehensive signage scheme for Kovalam tourist centre	Dept. of Tourism, GoK
7	C 01109	Identification of Accident Prone Locations on State Highways in Kerala	Kerala Road Safety Authority (KRSA)
8	C 01009	Feasibility study of constructing an elevated corridor between Aroor and Edappally in Kochi	Infrastructures Kerala Limited (INKEL)
9	C 01208	Feasibility study for improving Road Connectivity to the proposed airport at Kannur	Kerala Road Fund Board (KRFB)
10	C 00809	Study on the navigability of canals in Kochi	Infrastructures Kerala Limited (INKEL)
11	C 01308	Feasibility study for establishing road connectivity to the proposed Kinfra Industrial Park in Manjeswara	Kerala Industrial Infrastructure Development Corporation (KINFRA)

Sl. No.	Code	Project	Sponsored by
12	C 01402	Feasibility study of constructing a coastal highway between Ponnani and Vengalam for NH-17 in Kerala State	Roads and Bridges Development Corporation, Kerala (RBDCK)
13	C 00805	Traffic and transportation system for Cochin city	Cochin Corporation
14	C 00308	Preparation of Master Plan for various destinations in Kerala	Dept. of Tourism
15	C 00608	Alignment study on a new road/Study on existing road from Kozhikode to KSIDC Industrial Growth Centre at Kinalur	Kerala State Industrial Development Corporation (KSIDC)
16	C 01108	Short term traffic improvements and long term road development schemes for the urban centre of Thalasserry in Kannur District	Thalasserry Municipality

NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE
(A DIVISION OF KSCSTE SASHTRA BHAVAN THIRUVANANTHAPURAM)

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2011

EXPENDITURE	Sch	YEAR ENDED 31/03/2011 Rs .Ps	YEAR ENDED 31/03/2010 Rs .Ps	INCOME	Sch	YEAR ENDED 31/03/2011 Rs .Ps	YEAR ENDED 31/03/2010 Rs . Ps
To Salaries & Allowances	A	31,087,589.00	15,496,578.67	By Grant - Government	J	77,346,176.67	37,046,229.84
" Staff Expenses	B	1,421,804.00	1,668,033.00	" Other Receipts	K	2,355,397.56	189,471.71
" Establishment Expenses	C	559,974.70	442,210.36	Income from sponsored projects	L	4,852,602.00	7,968,074.00
" Administrative Expenses	D	31,475.25	79,424.93	(Net of opening and closing work-in-progress)			
" General Expenses	E	51,851.35	72,003.50	Depreciation on GIA assets written back	V	1,820,209.13	1,506,253.80
" Sponsored Project Expenses	F	2,042,583.87	1,045,990.89	" Project Expenses for EMAK Study	H1	260,689.25	314,112.00
" Project Expenses Under Plan Schemes	G	16,312,085.13	12,287,979.38	" Project Expenses - KRSA Study	H2	560,000.00	
" Project Expenses for EMAK Study	H1	260,689.25	314,112.00	" National Technology Day Expenses		25,000.00	
" Transfer to Corpus fund -		614,838.60	875,303.10				
" Project Expenses KRSA Study	H2	560,000.00		Excess of Expenditure over Income		1,568,025.67	
15 % Consultancy receipts							
" Transfer to Building Fund		34,000,000.00	7,000,000.00				
" Transfer to Staff Welfare & Gratuity Fund			6,000,000.00				
" National Technology Day Expenses		25,000.00					
" Depreciation		1,820,209.13	1,506,253.80				
Excess of Income over Expenditure		-	236,251.72				
TOTAL		**88,788,100.28**	**47,024,141.35**	TOTAL		**88,788,100.28**	**47,024,141.35**

Notes to accounts Sch - X

AUDITOR'S REPORT

for NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE

Sr. FINANCE & ACCOUNTS OFFICER

REGISTRAR

DIRECTOR

30.5.11

30.5.11

NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE, TRIVANDRUM

(A DIVISION OF KSCSTE SASHTRA BHAVAN THIRUVANANTHAPURAM)

BALANCE SHEET AS AT 31st MARCH 2011

Liabilities	Sch	AS AT 31/03/2011	AS AT 31/03/2010	Assets	Sch	AS AT 31/03/2011	AS AT 31/03/2010
		Rs .Ps	Rs .Ps			Rs .Ps	Rs .Ps
GENERAL FUND	I	8,978,796.43	10,045,952.48	FIXED ASSETS	V	6,783,979.73	6,316,700.55
CURRENT LIABILITIES	II	4,069,829.18	3,499,186.22	CURRENT ASSETS	VI	3,727,988.55	12,337,334.38
ADVANCE RECEIVED, RESERVES AND UNSPENT GRANT	III	8,655,885.22	21,455,838.89	LOANS & ADVANCES	VII	55,210,119.03	21,310,987.54
				EXTERNAL PROJECTS: CURRENT ASSETS	VIII	19,208,259.26	25,290,212.04
CORPUS FUND	IV	8,223,401.80	9,251,822.98				
				BUILDING A/C - WORK-IN-PROGRESS		349,337.00	349,337.00
BUILDING FUND ACCOUNT		55,190,000.00	21,190,000.00				
CURRENT ACCOUNT WITH KSCSTE (FOR FURNISHING OF SEMINAR HALL)		161,770.94	161,770.94				
TOTAL		**85,279,683.57**	**65,604,571.51**	**TOTAL**		**85,279,683.57**	**65,604,571.51**

NOTES TO ACCOUNTS SCH -IX

AUDITOR'S REPORT

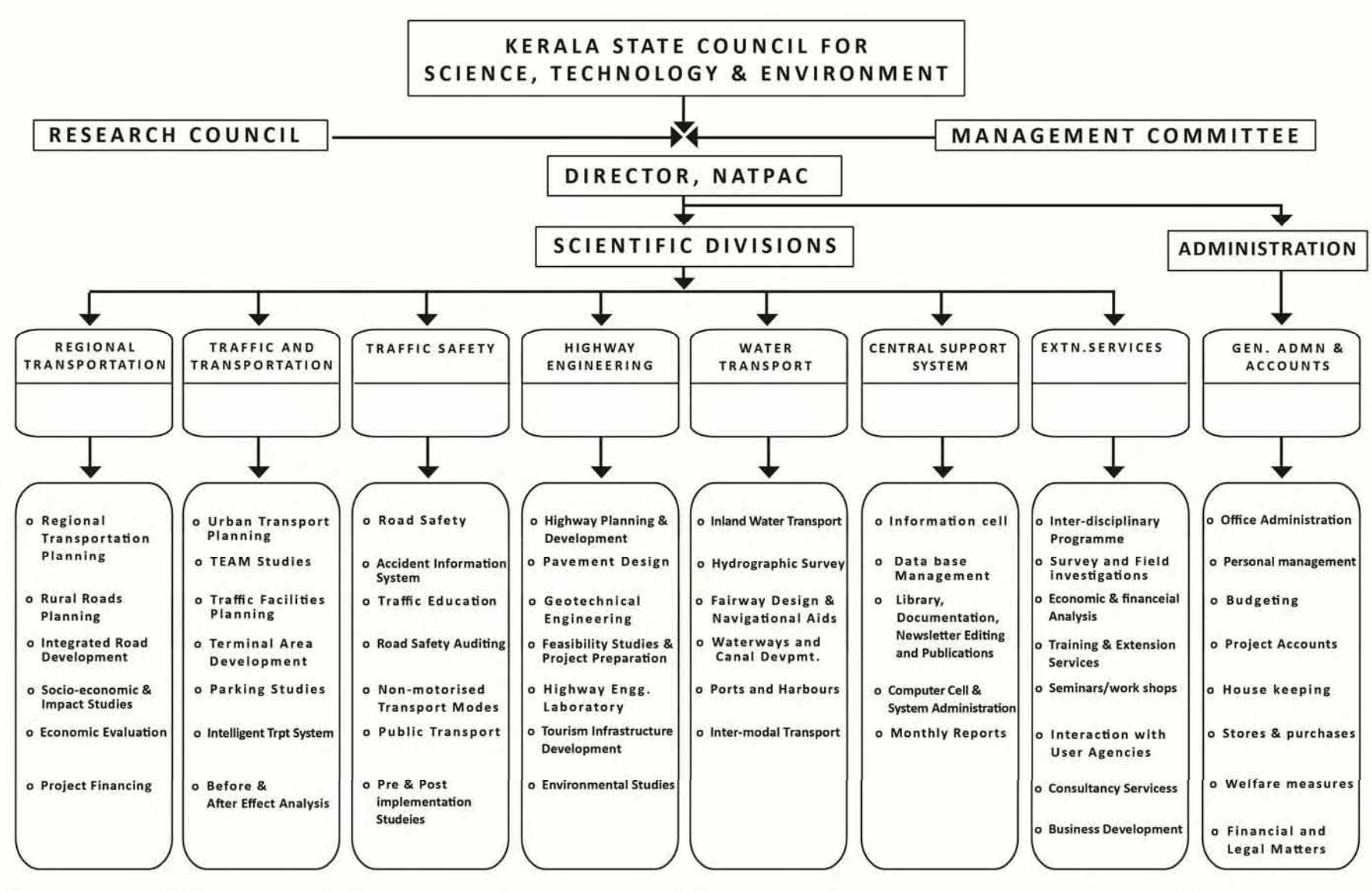
for NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE

30.9.11

Sr. FINANCE & ACCOUNTS OFFICER **REGISTRAR** **DIRECTOR**

M/S Jayakumar George & Associates Trivandrum Chartered Accountants

30.9.11


KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY & ENVIRONMENT
RESEARCH COUNCIL
MANAGEMENT COMMITTEE
DIRECTOR, NATPAC
SCIENTIFIC DIVISIONS
ADMINISTRATION
REGIONAL TRANSPORTATION
TRAFFIC AND TRANSPORTATION
TRAFFIC SAFETY
HIGHWAY ENGINEERING
WATER TRANSPORT
CENTRAL SUPPORT SYSTEM
EXTN.SERVICES
GEN. ADMN & ACCOUNTS
o Regional Transportation Planning
o Rural Roads Planning
o Integrated Road Development
o Socio-economic & Impact Studies
o Economic Evaluation
o Project Financing
o Urban Transport Planning
o TEAM Studies
o Traffic Facilities Planning
o Terminal Area Development
o Parking Studies
o Intelligent Trpt System
o Before & After Effect Analysis
o Road Safety
o Accident Information System
o Traffic Education
o Road Safety Auditing
o Non-motorised Transport Modes
o Public Transport
o Pre & Post implementation Studeies
o Highway Planning & Development
o Pavement Design
o Geotechnical Engineering
o Feasibility Studies & Project Preparation
o Highway Engg. Laboratory
o Tourism Infrastructure Development
o Environmental Studies
o Inland Water Transport
o Hydrographic Survey
o Fairway Design & Navigational Aids
o Waterways and Canal Devpmt.
o Ports and Harbours
o Inter-modal Transport
o Information cell
o Data base Management
o Library, Documentation, Newsletter Editing and Publications
o Computer Cell & System Administration
o Monthly Reports
o Inter-disciplinary Programme
o Survey and Field investigations
o Economic & financeial Analysis
o Training & Extension Services
o Seminars/work shops
o Interaction with User Agencies
o Consultancy Servicess
o Business Development
o Office Administration
o Personal management
o Budgeting
o Project Accounts
o House keeping
o Stores & purchases
o Welfare measures
o Financial and Legal Matters