



**GOVERNMENT OF KERALA
KERALA STATE PLANNING BOARD**

**FOURTEENTH FIVE-YEAR PLAN
(2022-2027)**

**WORKING GROUP ON
TRANSPORT**

REPORT

**INDUSTRY AND INFRASTRUCTURE DIVISION
MARCH 2022**

FOREWORD

Kerala is the only State in India to formulate and implement Five-Year Plans. The Government of Kerala believes that the planning process is important for promoting economic growth and ensuring social justice in the State. A significant feature of the process of formulation of Plans in the State is its participatory and inclusive nature.

In September 2021, the State Planning Board initiated a programme of consultation and discussion for the formulation of the 14th Five-Year Plan. The State Planning Board constituted 44 Working Groups, with more than 1200 members in order to gain expert opinion on a range of socio-economic issues pertinent to this Plan. The members of the Working Groups represented a wide spectrum of society and include scholars, administrators, social and political activists and other experts. Members of the Working Groups contributed their specialized knowledge in different sectors, best practices in the fields, issues of concern, and future strategies required in these sectors. The Report of each Working Group reflects the collective views of the members of the Group and the content of each Report will contribute to the formulation of the 14th Five-Year Plan. The Report has been finalised after several rounds of discussions and consultations held between September and December 2021.

This document is the Report of the Working Group on Transport. The Co-Chairpersons of Working Group were Dr Tom V Mathew and Shri K R Jyothilal IAS. Shri V Namasivayam and Dr K Ravi Raman, Members of the State Planning Board, co-ordinated the activities of the Working Group. Er Joy N R, Chief, Industry & Infrastructure Division was the Convenor of the Working Group and Shri G T Shibu, Assistant Director, Industry & Infrastructure Division was Co-Convenor. The terms of reference of Working Group and its members are provided in Appendix II of the Report.

Member Secretary

PREFACE

The geographic features of Kerala are unique as it has three broad topographical regions running from north to south viz. the coastal plain, undulating mid lands, and the highlands. Forty four rivers cut across the State. The land available for building transport facilities is limited. Built transport infrastructure includes significant sectors of road, rail, air, inland waterway, and coastal transport. Hence, Transport development in Kerala has built on the specific features of its geography and its human-built resources. The future of transport was understood to lie in an integrated system of connectivity.

In the last five years, the State Government has made significant interventions to develop an integrated transport sector in the State. Despite, several schemes and measures to boost the 13th Five Year Plan, the transport industry in the State could not reap best out of it due to the slowdown of economic activity during the period. Transport was the worst affected sector during 2018-19 floods and the Covid-19 pandemic. Travel restriction that were put in place to minimize the spread of the virus resulted in the sharp decline of revenue from operation, worker's wages etc. Recognizing the vital role of the transport industry in the economic development, the government is making every possible effort to reinvigorate the sector through various initiatives.

Government interventions in transport sector, especially relating to modernization, integration of various modes of transport and improvements in last mile connectivity have brought positive changes in the previous plan period. The momentum has to be channelized, positives increased and gains consolidated, to bring benefits to all sections of society. The Working Group has analyzed the transport sector in detail and the recommendations are expected to bring significant changes in the sector and invigorate it.

Dr Tom V Mathew
Co- Chairperson

Shri K.R. Jyothilal IAS
Co- Chairperson

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ABBREVIATIONS

ABS	Automatic Block Signalling
ANERT	Agency for New and Renewable Energy Research and Technology
ATF	Aviation Turbine Fuel
ATIAL	Adani Trivandrum International Airport Limited
ATMS	Advanced Traffic Management System
BG	Broad Gauge
BPCL	Bharat Petroleum Corporation Ltd
BPKM	Billion Passenger Kilometre
BRTS	Bus Rapid Transit System
BTKM	Billion Ton Kilometre
CAGR	Compound Annual Growth Rate
CBD	Central Business District
CCTV	Closed Circuit Television
CIAL	Cochin International Airport Limited
CNG	Compressed Natural Gas
CSIND	Coastal Shipping and Inland Navigation Department
DFC	Dedicated Freight Corridor
DMRC	Delhi Metro Rail Corporation Ltd
DPR	Detailed Project Report
EBR	Expanded Board of Railways
EIA	Environmental Impact Assessment
EMU	Electric Multiple Unit
ETC	Electronic Toll Collection
EV	Electric Vehicle
e-VTOLS	Electric Vertical Take-off and Landing Vehicle
FCEV	Fuel-Cell Electric Vehicle
FOB	Foot Over Bridge
FYP	Five Year Plan
GAD	General Arrangement Drawings
GDP	Gross Domestic Product
GIS	Geographical Information System

GSDP	Gross State Domestic Product
GSVA	Gross State Value Added
ICCC	Integrated Command and Control Center
ICT	Information and Communication Technology
IOCL	Indian Oil Corporation Limited
iRAP	International Road Assessment Programme
IRCTC	Indian Railway Catering and Tourism Corporation
ITS	Intelligent Transportation System
IWAI	Inland Waterways Authority of India
IWT	Inland Water Transport
JMVP	.Jal Marg Vikas Project
JV	Joint Venture
KAMCO	Kerala Agro Machinery Corporation
KHRI	Kerala Highway Research Institute
KIAL	Kannur International Airport Ltd
KIIFB	Kerala Infrastructure Investment Fund Board
KMBR	Kerala Municipal Building Rules
KMRP	Kochi Metro Rail Project
KMTA	Kochi Metropolitan Transport Authority
KRDCL	Kerala Rail Development Corporation Ltd.
KRFB	Kerala Road Fund Board
KRSA	Kerala Road Safety Authority
KSCSTE	Kerala State Council for Science, Technology and Environment
KSEB	Kerala State Electricity Board
KSIDC	Kerala State Industrial Development Corporation
KSINC	Kerala Shipping and Inland Navigation Corporation
KSRTC	Kerala State Road Transport Corporation
KSTP	Kerala State Transport Project
KWIL	Kerala Waterways and Infrastructures Limited
LPG	Liquefied Petroleum Gas
LSB	Long Span Bridge
LSGD	Local Self Government Department

MDR	Major District Road
MEMU	Mainline Electric Multiple Unit
MNRE	Ministry of New and Renewable Energy
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoRD	Ministry of Rural Development
MoRTH	Ministry of Road Transport and Highways
MRTS	Mass Rapid Transport System
MVD	Motor Vehicles Department
MVRC	Mumbai Rail Vikas Corporation
NABARD	National Bank for Agriculture and Rural Development
NATPAC	National Transportation Planning and Research Centre
NH	National Highway
NHAI	National Highway Authority of India
NHM	National Hydrogen Mission
NMT	Non-Motorised Transport
NRI	Non Resident Indian
NW	National Waterway
ODC	Over Dimensional Cargo
PIWTT	Protocol on Inland Water Transit and Trade
PMAY-G	Pradhan Mantri Awaas Yojana-Gramin
PMGSY	Pradhan Mantri Gram Sadak Yojana
PMIS	Project Monitoring Information System
PMS	Pavement Management System
PPP	Public Private Partnership
PPR	Appraisal of Preliminary Project Reports
RBDCK	Roads and Bridges Development Corporation of Kerala
RICK	Road Infrastructure Company Kerala
RIDF	Rural Infrastructure Development Fund
RLDA	Rail Land Development Authority
ROB	Railway Over Bridge
RRSK	Rashtriya Rail Sanraksha Kosh
RRTS	Regional Rapid Transit System

SDGs	Sustainable Development Goals
SH	State Highway
SHSR	Semi High Speed Rail
SIA	Social impact assessment
SPV	Special Purpose Vehicle
SWTD	State Water Transport Department
TOD	Transit-Oriented Development
UMTA	Unified Metropolitan Transport Authority
VCF	Value-Capture Finance
WCC	West Coast Canal

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EXECUTIVE SUMMARY

Transport system plays an integral role in country's economic and social development. The transportation system in Kerala includes road, rail, water and air transport modes with each involving different types of infrastructure, vehicle and modes of operation. Over years, Kerala has placed emphasis on integrated and holistic development of a multi-model transportation system.

Road transport is considered to be one of the most cost effective and preferred modes of transport, both for freight and passengers as it provides last mile connectivity and penetration in populated areas. Roads also play an important role in inter-modal transport development, establishing links with airports, railway stations, and ports. The road in Kerala includes classified and non-classified roads as stipulated by Indian Road Congress. Road density in Kerala is 548 km per 100 sq. km, which is roughly three times the national average. The length of road per lakh population is 993.54 km and almost 90 per cent of the road network is single lane. The National Highways, considered to be the primary network, carries 40 per cent of the total traffic, and the State Highways and Major District Roads (MDRs) - the secondary road network – carries another 40 per cent of the road traffic. Thus around 12 per cent of the road network handles almost 80 per cent of the traffic in the State. State PWD, National Highway Authority of India (NHAI) under Ministry of Road Transport and Highways (MoRTH), Local Self Governments, National Transportation Planning and Research Centre (NATPAC), Motor Vehicles Department (MVD), KSRTC, Roads and Bridges Development Corporation of Kerala (RBDCK), Kerala State Transport Project (KSTP), Kerala Road Fund Board (KRFB) and Road Infrastructure Company Kerala (RICK) Ltd and the agencies involved in the sector.

The road transport industry is dominated by private service providers. The road freight services are wholly owned and operated by the private sector. Kerala State Road Transport Corporation (KSRTC) is the single largest public sector undertaking in the transport sector, carrying out passenger transport operations in the State. Average fleet held by KSRTC in 2020-21 was 5,483. The number of buses aged 10 years and above was 2998 as in March 2021. Hence around 54 per cent of vehicles owned by KSRTC are aged over 10 years. The agency is facing financial crisis. As on March 2021, there are 148.47 lakh motor vehicles registered in the State. Out of the total registered vehicles in Kerala, more than 65 per cent are two wheelers.

Inland Water Transport (IWT) in the form of rivers, canals, backwaters and creeks, is intended to enhance the overall capacity of transportation network. Water ways in the state include the main arterial West Coast Canal (WCC) and feeder canals. The total length of the potential Inland Water ways in the State is 1,700 km. Total length of WCC is 612.45 km. There are 1,100 km feeder/link canals connecting WCC and important destinations. The state has 5 National Waterways having a length of more than 459 kms. In addition, there are State Waterways.

The State Water Transport Department (SWTD) is an essential service department under the state government and is committed to cater to the transportation needs of the public residing in the waterlogged areas of Alappuzha, Kottayam, Kollam, Ernakulam, Kannur and Kasaragod districts. The department handles ferrying 160 lakh of commuters per annum with wooden/steel/Solar based fiber Glass passenger vessels covering a total route length of 1971.30 Km in 116 identified routes. The success story of India's first solar ferry 'Aditya' running between Viakkom and Thunakadavu, is a model for other states.

The Coastal Shipping and Inland Navigation Department (CSIND) is involved in the infrastructure development of waterways and promotion of inland navigation in Kerala. The Department undertook work along the state waterways and made it navigable. A special boat is operated in Parvathy Puthanar stretch from Kovalam to Akkulam canal. Stretches along Kollam canal and Varkala lake to Eravipuram Canal are made navigable. Kerala Shipping and Inland Navigation Corporation Ltd. (KSINC) is the pioneer of inland navigation in the State. The agency owns two yards for the construction and maintenance of small vessels. KSINC's own cruise vessels, the premier 'Sagararani' (1 and 2) and the exclusive luxury cruise, 'Nefertiti' are its highlights.

The State rail network operates through Palakkad and Thiruvananthapuram Railway Divisions, covering 13 railway routes. Kerala Rail Development Corporation (KRDCL), a Joint venture company is charged with the execution of the Semi High Speed Rail Project called The Silver Line/K-Rail. The Light Metro Rail Project which was proposed to be implemented in the cities of Thiruvananthapuram and Kozhikode has been realigned with the Government of India's new metro policy.

The Kochi Metro Rail Project (KMRP) is a project of the State Government designed to address the transportation woes of Kochi City. The Project is implemented through Kochi Metro Rail Lt.(KMRL) in phased manner. The Phase-I of the project is almost completed. The phase II (Pink Line) from JLN Stadium to info park via Kakkanad was sanctioned and foundation stone for the same was laid. Kochi Water Metro Project is a unique project, which envisages the creation of modern water transport infrastructure in the Greater Kochi.

Kerala is the first State in the country to have four international airports namely, Thiruvananthapuram, Kochi, Kozhikode and Kannur. More than eight lakh domestic passengers and 50 lakh international passengers are using these airport facilities in the State every year. Kerala recently operationalized Kannur International Airport and is being developed by KIAL in two phases under PPP mode. In 2022-23, the airport handled a total passenger traffic of 96,012 passengers which comprises 34,016 domestic and 61,996 international passengers.

The recent developments in the aviation sector are highly promising. Setting up of airstrips-heliports using small, single-engine aircraft connecting major tourist destinations is a landmark initiative. The plan is to set up air strips at Bekal in Kasaragod, Kalpetta in Wayanad and Idukki in the initial phase. The proposed Sabari Greenfield Airport will built in Erumely of Kottayam district for the convenience of Sabarimala pilgrims.

Major constraints faced in the road and road transport sector of the state is the enormous growth of motor vehicles, especially two wheelers and four wheelers not corresponding to the capacity of the roads. Another major hurdle in road development is the issues associated with land acquisition and land encroachment. Lack of way side amenities and absence of parking lots/bays at major places poses major threat in the sector.

Lack of a master plan for the development of waterways network is the major issue in the development of Inland navigation. Existing canals face issues like, encroachment of canal sides, damage, lack of timely maintenance, siltation and sediment deposition, lack of adequate width, growth of water hyacinth and weeds, construction of road along the bank reducing width of canal etc. Water Transport is also adversely affected due to lack of modern inland vessels, absence of navigation aids, small sized navigation locks without modern lock gate/ operation system.

Inadequate capacity of the existing railway lines and stations and high utilization (nearing saturation) of the existing Rail Transport System is a bottleneck in the development of rail network in the state. Aviation sector of the state is constrained by land acquisition issues and material resources for expansion of airports and construction of new ones. Gaps in seamless hinterland connectivity and integration with other transport modes are a concerns in the sector.

Development of integrated approach for development of transport sector has become inevitable. The existing road network has to undergo a qualitative improvement with the aim to reduce traffic congestion and delay, easy access to destinations and reduction in accident risks. This calls for better road network planning and project prioritisation. There is also a need to ensure compliance with standards / guidelines. Formation of a nodal agency to integrate all modes of transport under one umbrella for better coordination is essential.

An action plan should be made for prioritising the road works in the State. Major emphasis should be given to widening the State Highways and MDRs along with professional design and adequate drainage facilities. The new road development initiatives like the National Highway 4 laning, hill highway, coastal highway and by passes needs to be completed during the 14th Five-Year Plan period. Creation of a people oriented public transportation facility with enhanced and efficient mobility and safety should be the key goal of the 14th Five Year Plan in the road transport sector. The development of the road transport industry should be guided by long term objectives of internationally comparable quality and sustainability

There exists immense potential to develop Inland Water Transport as a supplementary, cheap, eco-friendly mode of transportation and also ensure much required hinterland connectivity to the urban centres. A composite / integrated master plan needs to be devised for the holistic development of waterways in the State focussing on development activities along with the movement of passengers and cargo, and operation of waterway in Kovalam - Kasaragod stretch as per national standards by 2025. The focus of 14th Plan should be to put requisite infrastructure on the existing waterways, make them fully functional, take up second phase of development and get on with development of new NWs on fast track supporting from IWAI.

Move for integration of rail network with other modes of transport including development of Multi-modal hubs, development of integrated timetabling, integrated ticketing and fare collection mechanism is a need of the time. Development of Semi High Speed rail projects like Silver Live will largely address the transportation needs of the mass. Further, working in co-ordination with the Union Government to get rail based mobility projects will benefit the state in large way. Key recommendation for the development of the rail sector include the preparation of Rail Sector Vision document for the horizon year 2050 or 2075, the preparation of short and long term plans, incorporation of all rail based and guided mobility projects under the rail sector.

Improvement of capacity utilization involving passenger and cargo facilities in terminals will greatly help to develop aviation sector in the state. Aviation segment has to focus on multimodal integration of transport facilities as well for attracting tourist passenger demand. The State can look to explore beneficial schemes such as UDAN for improving the ridership and promoting common people to opt for air travel as a means of transport. A coordinated development of the four airports in Kerala has to be targeted with appropriate intervention measures in order to optimize the resource allocation to the best advantage of air transport sector in Kerala.

The scope of Clean Green Digital mobility has to be explored to the maximum in the backdrop of increasing carbon emission and consequent air pollution. The Government should pay more attention to green initiatives and support sustainable transport as the way forward. However, for sustainability measures to have lasting outcomes in policy and practice, institutional reforms are urgently needed. Research and Development is the backbone of any development and is essential to keep pace with the fast changing times. Research and Development in the field of bio-fuels and piloting of Hydrogen mobility can help in replacing conventional fuels with Bio/Hydrogen-fuels and reducing the emission to a great extent. The existing R&D institutions have to be strengthened and provided with ample funds/ opportunities to excel and be beneficial for the state and the society at large.

CHAPTER 1

TRANSPORT SECTOR AND STATUS IN KERALA

Transport system plays an integral role in country's economic and social development. It improves the quality of life of people, provides seamless access to commodities and services and connects people. The importance of transport and better connectivity increases in the light of increasing globalization, intensifying international relations, growing urbanization and roles ascribed to it in mitigating poverty and improving livelihood. Modern, efficient, affordable, dependable and safe transport facilities and services are hence considered lifelines of a good economic system. The transportation system includes road, rail, water and air transport modes with each involving different types of infrastructure, vehicle and modes of operation. The holistic development of a multi-model transportation system and their integration assumes great significance in modern times.

1.1 Road Transport

Road transport is considered to be one of the most cost effective and preferred modes of transport, both for freight and passengers as it provides last mile connectivity and penetration in populated areas. A good road network is vital to the economic development and social integration of the country. It provides connectivity to remote areas, accessibility to markets, schools, hospitals and opens up backward regions to trade and investment. Roads also play an important role in inter-modal transport development, establishing links with airports, railway stations and ports.

1.1.1 Road profile

Total road length in Kerala in 2020-21 is 2,38,773.02 km. This includes classified and non-classified roads as stipulated by Indian Road Congress. Road density in Kerala is 548 km per 100 sq. km, which is roughly three times the national average. The length of road per lakh population is 993.54 km and almost 90 per cent of the road network is single lane. The National Highways, considered to be the primary network, carries 40 per cent of the total traffic, and the State Highways and Major District Roads (MDRs) - the secondary road network carries another 40 per cent of the road traffic. Thus around 12 per cent of the road network handles almost 80 per cent of the traffic in the State.

There are 11 NHs in the State having a total length of 1,781.50 km. Out of this total length, the NH Wing of State PWD maintains a length of 548.00 km and the National Highway Authority of India (NHAI) under Ministry of Road Transport and Highways (MoRTH) maintains 1233.50 km. The State maintained NH portion comprises of 51.00 km road with paved shoulders, 331.00 km with 2 lane and 166.00 km with intermediate lane. The length of State Highways (SH) is 4,127.83 km and that of Major District Roads (MDR) is 25,394.32 km. These are maintained by PWD Roads and Bridges. Hence, the total length of roads maintained by PWD Roads and Bridges is 29,522 kms in 2020-21 (12 per cent of total roads in state). Out of the total length of the State highways, 898.74 km is four lanes, 3,193.50 km is two lanes and remaining 35.75 km is single lane roads. Out of

the 25,394 km of MDRs, 52 km (0.20 per cent) is four lanes, 10,593 (41.80 per cent) km is two lanes and remaining 14,748 (58 per cent) km is single lane roads. Of the total road network in the State, 83.74 per cent is owned and operated by the Local Self Government. The roads maintained by different Local Governments in 2020-21 is 1, 99,953.70 km, of which 1,31,597.6 km (49.58 per cent) are black topped, 31,395.10 km (11.83 per cent) are cement concrete, 72,762.70 km are earthen roads (27.41 per cent), 18,669.70 km metalled roads (7.03 per cent) and others 10,996.02 km (4.14 per cent) with varying standards. Details are provided in **Table 1**.

Table 1 Length of major types of roads in Kerala 2020-21

Sl. No	Type of roads	Length (km) 2020-21	Percentage
1	National Highways (NH)	1,781.50	0.74
2	State Highways (SH)	4127.83	1.73
3	Major District Roads (MDR)	25394.32	10.64
4	Local Self Government Departments (LSGDs)	1, 99,953.70	83.74
5	Others (Railways, KSEB, Forest, Irrigation, Dewasom etc..)	7,515.67	3.14
	Total	2,38,773.02	100

Source : Economic Review 2021, State Planning Board

There are 2,778 bridges maintained by PWD Bridges Wing along State Highways (41), Major District Roads/ Other District Roads (2,098) and Village Roads/ROBs (139). Out of the total bridges, 111 bridges built across National Water Ways (65) and State Water Ways (46).

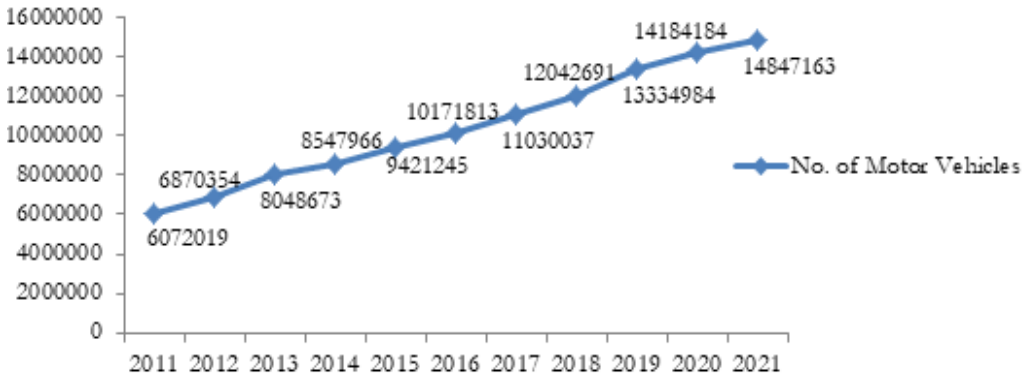
Other agencies involved in the road transport sector in Kerala are National Transportation Planning and Research Centre (NATPAC), Motor Vehicles Department, KSRTC, Roads and Bridges Development Corporation of Kerala (RBDCK), Kerala State Transport Project (KSTP), Kerala Road Fund Board (KRFB) and Road Infrastructure Company Kerala (RICK) Ltd.

1.1.2 Road traffic

As on March 2021, there are 148.47 lakh motor vehicles registered in the State. The number of newly registered vehicles in 2020-21 was 6,62,979 numbers. It means that the number of registered vehicles has increased by 4.67 per cent over the previous year. Out of the total registered vehicles in Kerala, more than 65 per cent are two wheelers. Goods vehicles constitute only 4.58 per cent of total vehicles, while buses constitute only 0.85 per cent. Cars, Taxis and Jeeps together constitute 22.6 per cent of total registered vehicles in the state. The large number of two wheelers and cars over taxis and buses show a preference

for personalised transport over shared transport. The mismatch between growth in motor vehicles and the capacity augmentation of roads has resulted in increasing traffic congestion and road accidents throughout Kerala.

Figure 1 Increase in number of vehicles in Kerala



Source : Economic Review 2021, State Planning Board

Vehicle population is growing at a Compound Annual Growth Rate (CAGR) of 9.6% since 2000, and the passenger traffic is 12,000 Billion Passenger Kilometer (BPKM). Growth of the traffic in Kerala is far greater than the growth of highways resulting in capacity saturation.

1.1.3 Road Safety

According to State Crime Records Bureau of Kerala, 2,979 deaths and 30,510 injuries were reported in Kerala in 2020 from 27,877 road accidents. Up to August, 2021, 20,818 accidents cases were reported. The total number of road accidents has increased, as a whole from 2010. However, a decline is witnessed in 2020 due to pandemic related reduced traffic on the roads.

The number of road accidents has to be seen in the light of tremendous increase in the number of vehicles in the state. The accidents per lakh vehicles registered in the State were 576 per lakh vehicles in 2011, and it has reduced to 188 in 2020. Accident trend in Kerala in 2011-2020 is given in **Table 2**

Table 2 Accident trend in Kerala in 2011-2020

Year	No. of Motor Vehicles	No. of Accidents	Accidents/lakh vehicle
2011	60,72,019	34,946	576
2012	68,70,354	35,282	514
2013	80,48,673	37,204	462
2014	85,47,966	35,198	412
2015	94,21,245	37,253	395
2016	1,01,71,813	39,137	385
2017	1,10,30,037	38,777	351
2018	1,20,42,691	38,734	322
2019	1,41,84,184	41,111	289
2020	1,48,47,163	27,877	188

Source: Motor Vehicles Department, State Crime Record Bureau

Road accidents are attributed mainly to driving, road condition, vehicle condition and environment. Majority of road accidents involve two wheelers that constitute 65 per cent of vehicles registered in the State. Road Safety being a complex issue, it requires consistent, prolonged and concerted efforts from various stakeholders to achieve the goals.

1.1.4 Road Improvement Programmes

National Highway Authority of India (NHAI) and the State PWD are involved in the improvement and maintenance of National Highways in the state. The State PWD is responsible for policy, planning, design, construction and maintenance of the State Highways (SHs), Major District Roads (MDRs) and the National Highways (on behalf of the NHAI). Kerala State Transport Project (KSTP), Kerala Road Fund Board (KRFB), Roads and Bridges Development Corporation of Kerala Ltd (RBDCK) and Road Infrastructure Company Kerala Limited (RICK) are also involved in implementation of road projects in the State. The works taken up include road improvements, repair and maintenance of existing roads, relaying and upgradation with a view to address geometrical improvement, junction improvement and other technical corrections.

1.1.5 Coastal Highway

The coastal highway from Thiruvananthapuram to Kasargod is a prestigious project envisaged by the Kerala Government along the most beautiful coastal belt of the State. The Government approved project of 655 kms from Kollankode in South Kerala border to

Kunjathoor in Kasaragod District costs ₹6,500 crore with funding support from KIIFB.

1.1.6 Hill Highway

Govt. of Kerala declared the biggest State Highway 59 (SH 59) as Hill Highway or Malyora Highway connecting almost all districts except Alappay from Nadarapadavu in Kasaragode to Parassala in the Trivandrum district. The proposed Hill Highway of 1332.16 Km envisages hilly region north-south corridor development by upgrading or improving the existing network optimally which is also called as ‘Kerala Spice Route’ which connects almost all the cities/townships engaged in spices and other high range products and trade. KRFB is the SPV of the project and works to the tune of 1734.14 crore in 21 reaches of 521.79 Km sanctioned and works in two stretches completed and the balance are in progress.

1.1.7 Kerala State Transport Project (KSTP)

KSTP-II is a World Bank assisted project and the Bank has approved ₹2,403 crore (US\$445 million) for the project. The disbursement ratio is 56: 44 between World Bank and Government of Kerala for the eligible items (except land acquisition and operation cost). The original loan closure date was in April 2019. This was extended to April, 2021. The project has three components (A) upgradation of 363km of road; (B) road safety management; and (C) institutional strengthening. The project includes innovative components like development of a demonstration safe corridor of 80 km, strengthening of Kerala Road Safety Authority and other institutions including PWD Road Safety Cell, Community Participatory Road and Asset Management Programmes, strengthening of Public Information and Grievance Redressal Cell in PWD and the pilot project on road improvement through Public Private Partnership (PPP).

1.1.8 Challenge Fund Programme

Challenge fund falls under safety management initiatives of the World Bank assisted KSTP programme-II. The objective of this programme is to develop another five “safe corridors/zones” across the State, through local partnerships. The Challenge Fund is intended to elicit innovative road safety proposals in a collaborative effort between local road user stakeholder groups and District Road Safety Councils (DRSCs), Kerala Road Safety Authority (KRSA), PWD and KSTP.

1.1.9 Rebuild Kerala Initiative (RKI)

As part of the Rebuild Kerala Initiative (RKI), KSTP has undertaken reconstruction/restoration of the roads damaged due to the floods and landslides in 2018 utilizing World Bank assistance of ₹1,200.0 crore and German Bank assistance of ₹1,800.0 crore. World Bank would provide 100 per cent assistance under Development Policy Loan and German Bank (KfW) would provide loan assistance of 70 per cent of estimated cost. The projects funded by the World Bank are being undertaken on engineering, procurement and construction (EPC) mode and that of German Bank is under item rate contract.

1.1.10 City Road Improvements

Kerala Road Fund Board (KRFB) is a statutory body under the State Government established by the Kerala Road Fund Act (KRF Act) 2001. It mainly implements the City

Road Improvement Projects on Public Private Participation (PPP) mode. The KRFB has executed city improvements on Design, Build, Finance, Operate and Transfer (DBFOT) Annuity mode. In Thiruvananthapuram City, 16 stretches of roads for length of 42.069 km have been completed and now the project is in its Operation and Maintenance stage.

KRFB has completed the Kozhikode City Road Improvement Project Phase I (A), which involved development of 22.251 km over 6 corridors at a total concessionaire's cost of ₹211.00 crores. Kannur City development project involves improvement of 44.065 km of 11 corridors at an estimated cost of ₹401.467 crore excluding land acquisition cost. Acquisition of 26 hectares of land at an estimated cost of ₹337.648 crore is involved in the project.

1.1.11 Smart City Projects

Approximately 54 kms of roads have been identified to be developed as smart roads in Thiruvananthapuram Smart City project. The overall scope of the smart road project is to provide overlay design for the existing road with detailed strip plans, junction designs, cycle track and footpath design. Under this project, road design, road signage and markings have been carried out.

1.1.12 Public Transport and Kerala State Road Transport Corporation (KSRTC)

In Kerala, the road transport industry is dominated by private service providers. The road freight services are wholly owned and operated by the private sector. As per data presented by the Hon'ble Minister for Transport in the Kerala Legislative assembly, in July, 2022, Kerala had a public transportation fleet of 14317 buses which included 10304 private buses and 4013 KSRTC buses. KSRTC is a significant player in passenger transport via road. KSRTC is the single largest public sector undertaking in the transport sector, carrying out passenger transport operations in the State. Average fleet held by KSRTC in 2020-21 was 5483. The number of buses aged 10 years and above was 2998 as in March 2021. Hence around 54 per cent of vehicles owned by KSRTC are aged over 10 years. The staff strength of the organisation as on April, 2022 is 25603 and witnessed a sharp decline from 43363 in 2016-17. KSRTC is facing deep financial crisis due to low fleet utilization and load factor in comparison to other better performing SRTCs.

1.2 Rail Transport

The State has a rail network of 1257 km route length with a total track length of 1588 km and 20 ordinary stations operating through Palakkad and Thiruvananthapuram Railway Divisions, covering 13 railway routes. There are about 200 railway stations in the State (95 under Palakkad Division and 105 under Thiruvananthapuram Division). Doubling and electrification works are in progress in various parts of the State. Feasibility studies for some new lines are also underway in the rail sector.

1.2.1 Kerala Rail Development Corporation Ltd (KRDCL)

K-Rail has been incorporated as a joint venture company with an equity share of 51 per cent and 49 per cent between GoK and GoI. This has been formed with the objective of taking up major railway infrastructure development projects in Kerala on a cost sharing mode. The Company has an initial paid up capital of ₹100 crore which can be enhanced,

based on the quantum of projects to be undertaken.

Following projects are proposed to be undertaken by KRDCL across the State:

1. The 529.45 km Semi high-speed rail corridor from Thiruvananthapuram to Kasargode
2. The 240 km Thalassery – Mysore Rail Project provide direct rail link from central Malabar region to Mysore.
3. The 176 km Nilambur – Nanjangud Project Connect Mysore with Cochin and provide a direct and shorter Bangalore-Kerala connectivity through Mysore.
4. Construction of 27 ROB/RUB Works

1.2.2 Semi High Speed Rail Project (Silver Line)

The Silver Line Project is a 529.45 km long semi high speed rail corridor connecting Kasaragod and Thiruvananthapuram, which will enable to run its train at an operating speed of 200 kmph. This will have 1435mm Standard Gauge and double track. It is proposed to have a rolling stock of 9 cars initially, which will be increased to 12 cars. This will ease the transport between North and South ends of the State and reduce the total travel time to 4 hours against the existing 10-12 hours. The project is envisaged keeping in view its economic and environmental benefits in terms of steep reduction in carbon emissions.

1.2.3 Kochi Metro Rail Project (KMRP)

KMRP is the flagship project of the GoK designed to address the transportation woes of Kochi City. The project is implemented through the Kochi Metro Rail Ltd (KMRL) which is a SPV jointly owned by the GoK and GoI through equity participation. The GoI sanctioned the project in July 2012 to construct a fully elevated metro viaduct with 22 stations for 25.612 km stretch from Aluva-Petta at a total cost of ₹5,181.79 crore,. KMRL has signed an agreement with GoI and Delhi Metro Rail Corporation Ltd (DMRC) for executing the project as per the tripartite agreement signed between GoI, GoK and KMRL.

The major section of Phase I from Aluva to Petta (25.612 km) having 22 stations was commissioned on June 19, 2017. The stretch from Petta to SN Junction (1.8 Km) is in progress and the stretch from SN Junction to Thripunithura (1.2 Km) is expected to be complete by September, 2023. Phase II is envisaged from JLN Stadium to Kakkanad IT City (11 KM) for at an estimated cost of ₹1957.05 crore. Construction related activities are expected to start after obtaining approval from Government of India. Preparatory works for road widening have already started. As phase III, it is propose to extend the line from Aluva to Nedumbassery International Airport.

1.2.4 Light Metro Rail Projects at Thiruvananthapuram and Kozhikode

Light Metro Rail Project is a Mass Rapid Transit System (MRTS) proposed to be implemented in the cities of Thiruvananthapuram and Kozhikode. The work is proposed to be funded by KIIFB. The projects are to be realigned with the Government of India's new metro policy. KMRL is being considered by the Government as the executing agency.

1.3 Air Transport

Air transport industry has been among the worst hit by the pandemic, with many airlines forced to suspend or close its operations, upsetting supply chains globally and leading to job losses. India's domestic passenger traffic slipped to a 10 year low in 2020-21.

Kerala became the first State in the country to have four international airports namely, Thiruvananthapuram, Kochi, Kozhikode and Kannur. More than eight lakh domestic passengers and 50 lakh international passengers are using these airports facilities in the State every year.

1.3.1 Cochin International Airport Ltd. (CIAL)

The first green-field airport in India, the CIAL was ranked the third best airport in the 50 to 150 lakh passengers category based on the 2016 Airport Service Quality (ASQ) Survey conducted by Airports Council International (ACI), Montreal, Canada. The airport has 3,400m length with 45m wide code E runway. Total area of the renewed domestic terminal is 6 lakh square feet, apart from the existing one lakh square feet.

In 2020-21, 18,857 domestic and 8,129 international flights operated from the airport. But in 2021-22, as on September, 2021, it was 11,119 and 6,658 flights respectively. The volume of cargo handled were 31,756 tonnes through domestic services and 14,089 tonnes through international services.

1.3.2 Kannur International Airport Limited (KIAL)

Kannur International Airport Limited (KIAL) was set up by GoK to build and operate Kannur International airport. The airport project is being developed in two phases by KIAL. The first phase is envisaged to span from 2016-17 to 2025-26 and second phase would be from 2026-27 to 2045-46. The first phase was inaugurated in December 2018. The facilities in the airport include a runway length of 3,050 m (10,006.56 ft.), with a terminal building of 96,000 sq.m, 20 parking stands (apron), and 22, 000 sq.m car/bus parking, 1,200 sq.m. ATC/Technical Building and around 7,750 sq.m near the apron area of Ground Service Equipment Parking area.

As on September, 2021, 2,808 domestic flights and 1,620 international flights operated from the airport. 1, 87,402 domestic passengers and 3, 04,289 international passengers travelled during 2020-21. The revenue earnings were ₹42.00 crore in 2020-21 and ₹27.49 crore in 2021-22 (up to September, 2021).

1.3.3 Thiruvananthapuram International Airport

Thiruvananthapuram International airport is the first airport in the State. The domestic terminal with an area of 99,000 Sq. ft. can handle around 400 passengers at a time. Terminal 2, with passenger handling capacity of 1600, is for international operations and also handles domestic operations of Air India. Annual passenger handling capacity of the new international terminal (T2) is around 1.8 million.

The Airports Authority of India (AAI) under a concession agreement had transferred Thiruvananthapuram International Airport to M/s Adani Thiruvananthapuram International Airport Ltd (ATIAL) for operations, management and development under

Public Private Partnership (PPP) for 50 years. The formal transfer was held on October 14, 2021.

1.3.4 Air strips

Besides the four international airports, Kerala may soon have a string of airstrips-heliports, which can operate small, single-engine aircraft connecting major tourist destinations. The objective of the initiative is the comprehensive development of the State's aviation sector. The airstrip-heliports are planning to commence airline service connecting the State's major tourist spots by operating tiny single-engine aircraft having 8-10 seats. The plan is to set up the proposed air strips at Bekal in Kasaragod, Kalpetta in Wayanad and Idukki in the initial phase. Initial works for these strips are being undertaken. The State Government has requested the Centre to include the proposed air strips under its Regional Connectivity Scheme-UDAN to operate them as feeder ports of the international airports.

1.3.5 Sabarimala Airport Project

Sabari Airport is a proposed Greenfield airport project to be built in Erumely of Kottayam district for the convenience of Sabarimala pilgrims. The proposed site is spread over 2,263 acres (9.16 km²) of land at Cheruvally Estate in Manimala panchayath, Kanjirappally Taluk is located on the way to the Sabarimala temple. Government had appointed a special officer for land acquisition, which is proposed to be carried out in a timely manner on the basis of the progress of the court proceedings relating to land. Experts put forward that Heli tourism will have good prospects in this region.

1.4 Inland Water Transport

Inland Water Transport (IWT) is a viable mode of transportation to enhance the overall capacity of transportation network. India has an extensive network of inland waterways in the form of rivers, canals, backwaters and creeks. Freight transportation by waterways is highly underutilised in the country as compared to developed countries. India's hinterland connectivity is mainly based on road and rail with waterways. Inland Water Transport (IWT) in India has the potential to supplement the over-burdened railways and congested roadways. In addition to cargo movement, IWT sector also provides a convenient function in related activities such as carriage of vehicles {on Roll-on-Roll-off (Ro-Ro) mode of cross ferry} and tourism.

The National Waterways Act, 2016 has declared 111 inland waterways as 'National Waterways' (NWs) in the country to promote shipping and navigation on them. Inland Waterways Authority of India (IWAI), an autonomous organization under the Ministry of Shipping Ports and Water ways is primarily responsible for the development, maintenance and regulation of those waterways which have been declared as NWs under National Waterways Act, 2016.

1.4.1 National Waterways in Kerala

As part of a programme for developing waterways by the Central Government, the portion of West Coast Canal from Kollam to Kottapuram and Udyogamandal and Champakara Canals were declared as National Waterway 3 in 1993. The NW-3 is now extended up to Kozhikode by the National Waterway Act 2016.

After the National waterway Act 2016, three canals were added to National Waterways under class 3 specification of 2.20m draught, 6.0m vertical clearance and 32- 40m width. National Water Ways in Kerala are listed in **Table 3**.

Table 3 National Water Ways in Kerala

Sl.No	Route	Length (in Km)	NW No.
1	Kollam – Kottapuram portion of WCC	168	
	Udyogamandal canal	23	
	Champakara canal	14	
	Kottappuram-Kozhikkode portion of WCC	160	NW-3
2	Alappuzha -Changanassery	28	NW-8
3	Alappuzha- Kottayam- Athirampuzha	38	NW-9
4	Kottayam-Vaikkam	28	NW-59
5	Poovar- Erayumanthurai-AVM canal (Major portion in TN)		NW-13
Total Length (excluding AVM canal)		459 KM	

Source: Inland Water Ways Authority, Kochi.

In terms of tonnes, total cargo moved in NW.3 in an organized way by barges in 2019-20 was 5.74 lakh tonnes, which mainly consists of sulphur, phosphoric acid, liquefied ammonia gas, rock phosphorous, etc. An analysis of cargo movement in NW 3 during the last five years is given in **Table 4**

Table 4 Cargo Movement in NW.3 during last 5 years in lakh million tonnes (LMT)

Financial Year	Cargo Movement (in L.MT)		Total Cargo Movements (in L.MT)
	Champakara Canal	U d y o g a m a n d a l Canal	
2016-17	3.20	7.13	10.33
2017-18	2.83	1.90	4.73
2018-19	3.50	0.78	4.283
2019-20	4.44	1.30	5.74
2020-21	5.37	1.98	7.35

Source: Inland Water Ways Authority of India, Kochi

1.4.2 State waterways

The state waterway portion of WCC starts from Kovalam in south and meets national waterway (NW- 3) at Kollam and has a length of 74 km. Kozhikkode–Vadakara stretch is partially navigable. The reaches of waterway north of Valapattanam up to Neeleswaram is presently navigable as per State waterway standards. Further for

extending WCC up to Bekal, Neleswaram river and Chittari river are to be connected with new canal. The Government of Kerala has given priority for the development of west coast canal. In addition to WCC, there are many feeder canals and link canals connecting WCC and various commercial and tourism centers and various ports. Development of these feeder canals are to be taken up on priority basis.

1.4.3 Development of Water Ways in the State

Development standards are adopted for water ways in Kerala. Class-3 specification is adopted for National waterways in Kerala. Class-1 and Class-3 specifications are adopted for state waterway portions of WCC and feeder canals. A total of 312 solar powered lighted buoys and 17 beacon lights were maintained by IWAI all along NW.3 to facilitate safe navigation round the clock. IWAI undertakes dredging, bank protection and widening to facilitate transport through waterways.

The Government of Kerala has planned to make all navigation canals functional by 2025 with all allied facilities including terminals for cargo and container operations, boat jetties for passenger transport and tourism amenity centers at every district along WCC with connectivity with other mode of transportation. Safety measures, signals for day and night journey are to be provided. Integration with other modes navigation and navigation information system, signals and warning system are essential for smart water ways. In order to accelerate the construction and allied activities GoK formed a company, Kerala Waterways and Infrastructures Ltd. (KWIL) jointly with Cochin International Airport Ltd (CIAL).

1.4.4 Coastal Shipping and Inland Navigation Department (CSIND)

The Coastal Shipping and Inland Navigation Department is involved in the infrastructure development of waterways and promotion of inland navigation in Kerala. The Department undertook work along the state waterways and made it navigable. A special boat is operated in Parvathy Puthanar stretch from Kovalam to Akkulam canal. Stretches along Kollam canal and Varkala lake to Eravipuram Canal are made navigable. In Vadakara to Mahi canal, 10 Km stretch was made navigable. Construction of 3 out of 6 foot bridges and two road bridges (Parambil, Kallayi) completed. Stretch from Valappattanam to Neeleswaram also made navigable. Coastal Shipping and Inland Navigation Department constructed Champakkulam Jhankar boat jetty in Alappuzha and boat jetty near KMML, Chavara for handling hazardous materials like sulphuric acid and furnace oil.

1.4.5 Kerala Shipping and Inland Navigation Corporation Ltd (KSINC)

Kerala Shipping and Inland Navigation Corporation Ltd. (KSINC) is the pioneer of inland navigation in the Kerala waterways and is a Government of Kerala undertaking. KSINC owns two yards for the construction and maintenance of small vessels. KSINC maintains high standards of excellence in every aspect of building, maintaining and operating vessels catering to a wide range of customer requirements. KSINC's own cruise vessels, the premier 'Sagararani' (1 and 2) and the exclusive luxury cruise, 'Nefertiti' are its highlights.

1.4.6 State Water Transport Department (SWTD)

The State Water Transport Department is an essential service and caters to the traffic needs of the inhabitants of the Districts of Alappuzha, Kottayam, Kollam, Ernakulam, Kannur and Kasaragod. The Department handles about 160 lakhs of passengers per annum using wooden/steel/solar based fibre glass passenger boats. At present limited water transport facilities are available in Kerala at Kollam, Alappuzha, Kottayam, Ernakulam and Kannur districts. At present, 80,000 people adopt water transport daily through 13 stations and 81 boats of SWTD. Department introduced India's first solar passenger vessel ADITHYA which is operating successfully.

1.4.7 Inland Waterways Authority of India (IWAI)

IWAI is a Central Government agency for the development of inland waterways. Its objective is the development of inland waterways which are declared as National Waterways in the State. Thus, development activities in the National waterways are done by IWAI using the central fund.

1.4.8 Kerala Waterways and Infrastructure Ltd (KWIL)

With a view to give an impetus for the development of waterways in the State in general and to develop the Kovalam-Kasaragod waterway in a phased manner in particular, the State Government has decided to set up a Special Purpose Vehicle with 49 percent stake each by the State Government and Cochin International Airport Ltd (CIAL) and the remaining 2 percent by other agencies. Accordingly, a public limited company named KWIL was incorporated under the Companies Act, 2013 on October 3, 2017.

1.4.9 Water Metro Project

Kochi Water Metro Project is a unique project, which envisages creation of modern water transport infrastructure in the Greater Kochi. The project will connect 10 islands and will have a length of 76km. The total revised project cost is ₹ 1064.83 crore of which ₹ 908.76 crore is funded by KfW, Germany, and ₹ 156.07 crore by GoK. Land acquisition cost by GOK amounts to ₹72 crore. The Water Metro system will have an integrated ticketing with Kochi Metro Rail. Passenger Vessels with comparatively higher speed and with modern safety measures are proposed under the project. Once completed, it will serve as a feeder service to suburbs along with canals and rivers where transport accessibility is limited. Inauguration of Water Metro with 5 terminals and 5 numbers of 100 passenger boats is expected by August 2022. The total project is expected to be completed by March, 2024.

1.5 R&D in Transport

National Transportation Planning and Research Centre (NATPAC) under Kerala State Council for Science, Technology and Environment (KSCSTE), Kerala Highway Research Institute (KHRI) and Design, Research, Investigations and Quality Control Board (DRIQ Board) are three R&D institutions in transport sector in Kerala. While NATPAC involves with various modes of transport, KHRI and DRIQ concern themselves with road transport.

NATPAC is the research centre conducting research and development and extension activities in the field of transportation and allied areas. Broadly the NATPAC focuses on

transportation planning in all spheres of transportation, traffic management and road safety and providing consultancy services to Government at all levels and various user agencies in the domain area.

KHRI is the only research institute under Kerala Public Works Department, and it imparts technical training programmes involving nationally and internationally eminent faculties to improve the quality of PWD works. KHRI is acknowledged as Centre of Excellence vide G.O. (Ms) No.53/2020/PWD dated June 11, 2020, to act as an advisory body/ think tank for transforming the road sector in Kerala by prioritising the thrust areas and providing thought leadership, strategic advice and problem-solving inputs.

1.6 Clean Green Digital Mobility

Clean Green Digital mobility means the movement of people & goods through low carbon modes, combined with digital technology to enhance the quality of life of the people. The Government agencies at the city, state and central level are paying greater attention to sustainable transport as the way forward for mobility sector. However, for sustainability measures to have lasting outcomes in policy and practice, institutional reforms are urgently needed.

1.6.1 Government initiatives for Clean Green Digital mobility

The state government has taken various steps in the field of digital and clean mobility, some of which have been briefed below:

- i. Usage of Information and Communication Technology (ICT) applications in Intelligent Transportation System (ITS) like GPS tracking of public utility vehicles, AI cameras for violation detection and surveillance, e-services, etc.
- ii. Initiation of usage of electric vehicles and pilot charging stations
- iii. Usage of Inland Water Transport (mode with lowest carbon footprint)
- iv. Steps in infrastructure development for cargo handling in non-major ports for facilitating inter-state cargo to shift from road to water transport mode.
- v. Initiatives on fuel efficiency norms undertaken by the Government of India
- vi. Setting up of Kochi Metropolitan Transport Authority (KMTA), as part of Kerala Metropolitan Transport Authority Act 2019, for coordination of transport services and related aspects.
- vii. Steps for new public transport systems to manage additional transport requirements.
- viii. Steps for introduction of God's Own Travel (GoT) card in Kerala

1.6.2 Electric Vehicle Policy 2019

Kerala Government through its Electric Vehicle Policy 2019 had targeted to roll out one million EVs in the state by 2022 and transition of entire fleet of KSRTC's 6000+ buses

into electric vehicles by 2025. It proposed setting investment targets for component manufacturing, electric vehicle manufacturing in the long term and Centres of Excellence in the EV value chain. Other strategic initiatives included viability gap funding (exploring road tax concession), creating adequate charging infrastructure, promotion of local manufacturing, awareness creation and promotion and human capacity building and re-skilling. The number of electric vehicles registered in 2020 was 1,334. However, the number of electric vehicles registered till September 2021 was 4,742. Total number of electric vehicles registered in the state till August 2022 is 34,776.

1.6.3 Green Hydrogen

The Kerala Government is set to switch to Hydrogen fuel cell considering the growing energy demand and the need for a green energy economy. With this in mind, the leading colleges in Kerala would be partnering with Birmingham Centre for Fuel Cell and Hydrogen Research under University of Birmingham, UK. It is also envisaged to set up pilot hydrogen fuelling stations at Vizhinjam and Kochi ports. As per the budget declaration, Kerala would pilot hydrogen fuel based public transport buses. In addition, the utilization of government agencies like Titanium KMML Ltd can also be boosted by R&D support.

1.6.4 Biofuels

Research and development in the field of biofuels can help in replacing conventional fuels with biofuels and reducing the emissions to a great extent. Dubai-headquartered Neutral Fuels, a clean energy company, and Qatar-based Erigo Bio Fuels have joined hands to set up a biodiesel plant in Kasaragod, the first in Kerala. The plant will convert used and waste cooking oil into biodiesel, and will have a capacity to produce 500 tonnes of biodiesel every month, which comes to around 5.30 lakh litres.

CHAPTER 2

PERFORMANCE OF TRANSPORT SECTOR IN 13TH FIVE YEAR PLAN

The Government accorded high priority for the development of transport sector during the 13th Five Year Plan period. The highlights of the vision for Transport sector set out in 13th FYP document are detailed below.

2.1 Vision for Transport Sector in 13th Plan

2.1.1 Roads and Road Transport

The aim of the 13th Five-Year plan was to develop national, coastal, and hill highways in the State, establish a core road network linking north-south corridors and state highways, road safety and adoption of innovative technology to improve functioning and productivity across multiple areas.

The 13th Plan proposed to concentrate on, first, strengthening the physical infrastructure (of roads and other aspects of transport); secondly, restructuring the institutional framework in the transport system. Building a multimodal transport system will require coordination among various physical infrastructure providers, including the State Public Works Department, Railways, Inland Transport Authority, airports, and coastal shipping agencies.

During the 13th Plan, the Government of Kerala targeted to develop and expand various highways in the State, including national highways, state highways, hill highways and coastal highways as per national standards. NH 47 and NH 17 were to be converted into four-lane roads. The strengthening of east-west corridors across the State was another important objective. Following the vision of an environmentally sustainable Kerala, government emphasised building green corridors, and the promotion of green logistics and green vehicles (including fleet renovation programmes adopting innovative technologies). It is also important to develop facilities for non-motorised transport in cities, including skywalks, footbridges and allied facilities.

Two major transport infrastructure projects proposed to be made functional during the 13th Plan are the Kochi Metro and the Kannur airport. In the long run the State targeted to shift traffic from road to rail across the length of Kerala.

Ensuring road safety is of the utmost importance while devising transport policies for the State. Injuries and fatalities on account of road accidents have been rising at an alarming rate in Kerala. The State sought to launch a number of steps to tackle this problem, including the installation of speed cameras and new measures for law enforcement and road safety auditing.

Targets for the 13th Five-Year Plan

Public Works Department (Roads and Bridges)

The road density in Kerala is roughly three times the national average. The most important goals now are to take up works involving road improvements, repair and maintenance of

existing roads, relaying and upgradation.

- All highways and district roads will be modernized as bitumen macadam and bitumen concrete roads.
- Special emphasis on completion of bypasses and roads over bridges (RoBs).
- Works with an estimated cost of ₹5,628 crore (for 182 road projects) and ₹2,557 crore (for 69 bridge and RoB projects) are to be taken up with the financial assistance of KIIFB. These projects include development with maintenance contracts.
- Natural Rubber Modified Bitumen (NRMB) will be used for surface bituminous layers.
- Development and completion of the proposed hill highway.
- Development and completion of coastal highway.
- Procurement of mobile road repairing unit.
- Maintenance contract to be included while tendering works of main roads.
- To speed up land acquisition process, rehabilitation package will be introduced.
- Road safety will be given prime importance in road projects. Junction improvement works and construction of footpaths will be taken up wherever required. Road safety audit will be conducted for all major roads by accredited agencies and an integrated program for pathways for cyclists and pedestrians to be worked out.
- More drains will be constructed to protect roads.
- Second phase of PRICE software for, submission of DPR to Government, computerized bill preparation (e-bill), e-measurement books and progress monitoring.
- Development and Improvement of 9,000 km of roads (3,000 km SH and 6,000 km MDR). Priority will be given for surfacing with bitumen macadam and bitumen concrete.
- A core road network will be developed connecting major roads, railway stations, bus terminals, ports, industrial areas, east-west connectivity etc. in each district.
- The upkeep of roads and bridges using latest technologies in road maintenance will be taken up as per the new Road and Bridges Maintenance Policy.
- City road improvement will be taken up for more cities and major towns as done for Thiruvananthapuram.
- Propose to construct 60 bridges during the Plan period. Pre-stressing procedure will be used in the construction of bridges. Instead of conventional standard design, aesthetic design will be preferred.
- Inspection of all the existing bridges has been carried out. 165 bridges are to be reconstructed, 200 to be rehabilitated, and 1,281 require urgent routine maintenance. Remedial measures will be taken to attend all defects and proper maintenance.

- Construction of at least 100 km of roads per year using waste shredded plastic for surfacing/resurfacing.

Road Transport

Kerala State Road Transport Corporation (KSRTC)

- Steps to rejuvenate KSRTC focusing on human resources, operational and technical issues, and efficient utilisation of infrastructure and resources.
- Renovation and reconstruction of workshops, buildings and shelters of KSRTC.
- Reduction in number of days of vehicle docking for repair and number of off-road buses through modernization including engine shop modernization, installation of wheel alignment machines in each district, air compressors, hydraulic lifts, construction of effluent treatment plants, paint booths etc.
- To improve the productivity of KSRTC, proper training for drivers, technical personnel and officers will be provided for better utilization of super class services.
- Introduction of CNG and electric buses and purchase of multi-axle vehicles for the operation of super class services within and inter State.
- Technology upgradation including the use of electronic ticketing machine (ETM) and global positioning system (GPS).

Motor Vehicles Department (MVD)

- The Motor Vehicles Department envisioned to complete road safety and transparency in all the services rendered, to enforce Motor Vehicles Act and Rules effectively and to enhance tax revenue collection.
- The department proposed to carry forward the modernization and development activities undertaken during the previous Plans taking into account the recommendations of the Working Group on Road and Road Transport and the relevant state and national policies.
- Road Transport Safety Measures. Installation of speed cameras, signal violation dictation cameras, purchase of interceptors, GPS based vehicle tracking systems, modernization of fleet, Third Eye enforcement project and developing Road Safety Data Control Centre Training.
- Implementation of e-governance – programs intended to improve the quality of service rendered by the department.
- Establishment of vehicle stations cum driver testing tracks on PPP mode. The PPP mode is yet to be finalised.
- Set up Model Inspection and Certification Centre sanctioned by Government of India. The project can be taken up on PPP mode.

- Establishment of MVD unit offices to make the enforcement stronger and cater the road safety services to remote villages of Kerala.

2.1.2 Other Transport Services

Light Metro Rail Projects at Thiruvananthapuram and Kozhikode

The Light Metro Rail Project is a Mass Rapid Transit System (MRTS) proposed to implement in Thiruvananthapuram and Kozhikode by a special purpose vehicle Kerala Rapid Transit Corporation Limited (KRTL). The detailed project report (DPR) has been prepared by Delhi Metro Rail Corporation (DMRC). The estimated cost of the project is ₹4,219 crore for Thiruvananthapuram and ₹2,509 crore for Kozhikode, totalling ₹6,728 crore (including central taxes and land cost). The revised DPR, based on the new Metro Policy of the central government is under review of the Mass Rapid Transit System of the Kerala Government.

Water Metro project: Kochi Metro Rail Corporation (KMRL) proposed to implement the Kochi Water Metro Project at a cost of ₹741.28 crore with the financial assistance of a German Financial Institution (KfW), with the state funding of ₹103 crore. The total revised project cost is ₹1064.83 crore of which ₹908.76 crore is funded by KfW, Germany, and ₹156.07 crore by GoK. Land acquisition cost by GOK amounts to ₹72 crore.

2.1.3 Inland Water Transport

Developing the West Coast Canal system from Kovalam in Thiruvananthapuram district to Bekal in Kasargod district (Ch. 0 km to 611 km) is an important project to be completed in the 13th Five-Year Plan Period. This involves the development of the existing canal system to State or National Waterway class 3 standards. Action has been taken to improve and modernize the waterway along the Kollam – Kovalam stretch and the Kottappuram–Nileswaram stretch of the West Coast Canal utilising various funds. In the first phase, priority will be given to rendering the waterways navigable. Once this is achieved, all infrastructure facilities such as cargo terminals and various cross structures will be provided.

The following were the targets set for the 13th five year plan period.

1. Develop potential stretches of the West Coast Canal and its feeder routes – approximately 800 km (265 km of West Coast Canal + 535 km of feeder routes) of waterway with a target of 160 km per year i.e. Kovalam to Kollam stretch (74 km) and Kozhikode to Neeleswaram (Kooliyangalani cut) (191 km) stretch of West Coast Canal along with its feeder routes and also stretches of National Waterway III.
2. Increase the volume of passenger traffic from the present 150 lakh/annum to 300 lakh/annum.
3. Achieve 12 per cent modal shift in inland cargo to water transport sector (both coastal shipping and IWT) from the present level of seven per cent.

Strategies for the 13th Five-Year Plan

The following were the strategies to achieve the targets in the 13th five year plan period.

a) Fairway Development

1. Full-fledged waterway development by Inland Waterways Authority of India (for National Waterways) and Coastal Shipping and Inland Navigation Department (for State Waterways).
2. Comprehensive master plan for development.
3. Use modern technology for fairway development.
4. Adopt modern dredging techniques.

b) Transport Infrastructure

1. IWT terminals to be developed as cargo and passenger multimodal hubs.
2. Deploy modern cargo handling equipment at terminals.
3. Use modern navigational aids and communication systems.
4. Use hybrid vessels with green energy (solar, CNG, etc.) for SWTD and KSINC.
5. Set up vessel banks.
6. Set up adequate vessel repair facilities.

c) Training Institutions

1. Trained human resources to be made available for terminal and vessel operation.
2. Business and tourism promotion experts to be made available.
3. Crew training and logistic training centres/institutes to be set up.

d) Policy Matters

1. Constitute State Maritime Board.
2. Integration of coastal shipping with IWT.
3. Incentivise movement of cargo/passenger through water transport mode — both coastal shipping and IWT.
4. Mandatory movement of hazardous cargo and certain per cent of bulk cargo through waterway mode, wherever it exists.

e) Funding

1. Major projects under KIIFB funding.
2. Explore Sagarmala funding for integration of IWT and coastal shipping to achieve IWT connectivity to all major and minor ports.
3. PPP funding for terminal construction, operations, and vessel operations.
4. Subsidy scheme for building new IWT vessels.
5. Alternate source of funding through World Bank, Asian Development Bank, KINFRA, etc.
6. VGF scheme for PPP projects.

Key initiatives proposed for the 13th Plan

Five major projects, identified are:

1. Development of Parvathy – Puthanar (0.0 to 16.045 Km) (Kovalam – Akkulam)
2. Development of 2 tunnels at Varkala.
3. Development of Canoli canal in Kozhikode town.
4. Mahe – Valapattanam reach (Ch.467.690 Km to 526.200 Km) which includes 26 Km uncut portions.
5. Neeleswaram – Bekal reach (Ch 590.530 Km to 621.600 Km) which consists of 21.07 Km uncut portion.

Considering the huge capital investments required for these 5 components, financial assistance under KIIFB is expected and these works may be executed through a special purpose vehicle.

Other Development Activities proposed

1. Akkulam – Kollam reach (chainage 16.00 km to 74.00 km).
2. Kozhikode – Vadakara reach (chainage –402.18 km to 450.08 km).
3. Vadakara – Mahe reach (chainage – 450.08 km to 467.69 km).
4. Sulthan Canal (chainage – 555.90 km to 559.750 km).
5. Construction of crossing structures.
6. Development of feeder and link canals.
7. Development of jetties and terminal facilities.
8. Inland navigation promotion fund
9. Providing navigation facilities.
10. Formation of Kerala Waterways and Infrastructure Limited (KWIL) as a special purpose vehicle to facilitate timely development of inland waterways in Kerala.

2.2 Financing Development in Transport Sector in the 13th Five Year Plan

A total budget outlay for Transport sector in 13th five year plan was of ₹8395.85 crore and the expenditure was ₹19,177.65 which is 2.2 times the outlay. It is evident that over years, budget allocation for the sector has increased many folds. Among the total funds budgeted, the largest share (ie more than 73 per cent) was earmarked for 'Roads & Bridges'. While other subsectors incurred expenditure less than their budget outlay, 'Roads & Bridges' and 'Other Transport' incurred expenditure higher than their outlay. Expenditure in 'Roads & Bridges' is almost double the outlay. This trend in expenditure needs to be examined. 'Other Transport Services' sub-sector witnessed huge hike primarily because it covers most major infrastructure projects like KIAL, Kochi Metro etc.

Table 5 shows the budget allocation for various sub sectors under the transport sector during the 13th Five Year Plan Period and expenditure incurred by each subsector during the period.

Table 5 Budget Outlay and Expenditure across sub sectors in Transport sector in 13th Five Year Period

(₹ in lakh)

Sub Sectors	Annual Plan 2017-18		Annual Plan 2018-19		Annual Plan 2019-20		Annual Plan 2020-21		Annual Plan 2021-22		13 th Plan Total	
	Outlay	Exp.	Outlay	Exp.	Outlay	Exp.	Outlay	Exp.	Outlay	Exp.	Outlay	Exp.
Port, light-house and shipping	13811	21344	12642	6349	11006	3851	8013	6083	8012	3105	53483	40734
Roads and Bridges	135094	239319	145432	240150	136713	248466	110210	305237	91026	158854	618475	1192027
Road Transport	8286	87116	9115	71662	10243	99408	14768	143368	14768	2152	57180	403708
Inland Water Transport	16307	3032	12938	3931	13145	3030	11110	2240	14610	8311	68551	20545
Other Transport Services	10	89516	10	34270	9	23816	26262	87015	16008	26129	41896	260749
Total-Transport	173508	440330	180137	356363	171116	378572	170363	543946	144424	198553	839585	1917765

Source : Planspace and Accounts

2.3 Major achievements in Transport sector in 13th FYP

Roads and Road Transport

- Total road length in Kerala increased from 218942.426 Km in 2016-17 to 238773.02 km during 2020-21.
- KHRI has been upgraded as Centre of Excellence vide G.O. (Ms) No.53/2020/PWD dated 11.6.2020 with thematic areas like Innovation in design/construction practices Road asset management, Road safety management, Quality assurance and contract management and Promoting indigenous research and development.
- Kollam bypass work completed and inaugurated on January 15, 2019 at a project cost of ₹352.05 crore and Alappuzha bypass work completed and inaugurated on January 28, 2021 at a project cost of ₹348.43 crore.
- Construction of 15 kms Coastal Highway from Padinjarekkara to Unniyal in Malappuram district is in progress and currently 52 per cent of the work has been completed.
- The DPR of 25 reaches 1251.04 km Hill highway has been prepared and submitted to KIIFB for financial sanction. Out of 25 reaches; KIIFB has accorded financial sanction for 18 reaches for a total amount of ₹1,506.24 crore. The total length of sanctioned reaches is 460,599 km. Work has been started in 7 reaches.
- PWD (Bridges) maintain 2761 bridge assets under 516 in State Highways, 1894 in Major District Roads and 351 in Other District Roads and others.
- KSRTC commenced 'Relay' Point to Point service on June 26, 2020 to facilitate long distance travel during Covid-19 phase and Bus-on-Demand ("BonD") service on July 2, 2020.
- The Motor Vehicles Department (MVD) has rolled out 65 electric vehicles for enforcement activities - a novel initiative in electric mobility.
- Introduced VAHAN and SARATHY online portal for vehicle registration and driver licensing.
- Opened 13 new Sub RT Offices.

Water Transport

- Inaugurated high-speed A/c Speed boat Vega-120 between Vaikom - Ernakulam on 04.11.2018 and launched "Vega 2" High speed Ac passenger (120 Pac) passenger cum boat on March 10, 2020 between Alappuzha-Kumarakom-Kottayam.
- India's first water taxi Nirva was inaugurated on 15th October 2020. Kerala is the first State to roll out a water taxi in India.
- Inaugurated India's first solar boat Aditya, with 75 passenger capacity on 12/01/2017. In 2020, Aditya won the Gustave Award for Best Ferry in the World.

Other Transport Services

- Kannur International Airport was inaugurated on December 9, 2018.
- Kochi Metro- Aluva to Petta (part of Phase I) stretch 25.2 km with 22 stations started operation.
- Ground breaking ceremony of first terminal (Vytila) of Kochi Water Metro Project was inaugurated on September 3, 2019.

- Government of India has accorded in-Principle Approval (IPA) for Silver Line project (Semi High speed rail project).
- The Kerala State Legislative Assembly has passed the Kerala Metropolitan Transport Authority (KMTA) Act 2018 in November, 2019. The authority will be an umbrella body responsible for the development, operation, maintenance, monitoring and supervision of urban transport in urban mobility areas.

CHAPTER 3

ISSUES & CHALLENGES IN TRANSPORT SECTOR

Roads

The road network of Kerala faces issues like -

- The existing road network has to undergo a qualitative improvement with the aim to reduce traffic congestion and delay, easy access to destinations and reduction in accident risks. This calls for better road network planning and project prioritisation. There is also a need to ensure compliance with standards / guidelines. Focus on periodic and systematic maintenance is low. Cost estimate is used instead of Detailed Project Report (DPR) in sanctioning of projects.
- Mushrooming of Private Vehicles and heavy growth of two wheelers and four wheelers is a major concern.
- Lack of utility plans
- Need for creative and new sources of funding of road works.
- Need to increase the pace of land acquisition and overcome delays due to litigations.
- Need to improve road safety and reduce accidents
- Problems associated with parking of vehicles
- Lack of suitable plans/techniques for Transport Waste Management
- Need for greater focus on enforcement of traffic rules
- Increasing encroachments on roads
- Lack of roadside amenities.

Water Transport

- Lack of Master Plan for development of Waterways network
- Existing canals face issues like, encroachment of canal sides, damage, lack of timely maintenance, siltation and sediment deposition, lack of adequate width, growth of water hyacinth and weeds, construction of road along the bank reducing width of canal etc.
- This leads to loss of navigability. Water Transport is also adversely affected due to lack of modern inland vessels, absence of navigation aids, small sized navigation locks without modern lock gate/ operation system, lack of terminals - cargo handling system and essential infrastructure, shortage of skilled workforce, non-compliance of guidelines for construction of bridge over the waterways (without adequate height and width) etc.
- Urban waste water disposal in canals has added to pollution in waterways.
- Continuous navigability is achieved only for the National waterway portion between Kollam and Kottappuram and the rest of the portions not developed in National waterway standard. Though state had arranged some works during the past decade, the width of the developed portions is within 14m to 20m only.
- Reluctance on the part of consignors and consignees to accept a modal shift to IWT mode.

- The progress of capital dredging and widening of narrow sections in NW-3 has been experiencing delay over the years due to various local issues related to the disposal of dredged material, demand for extra bank protection and dredged spoil, frequent stoppage of works and litigations by the local people and objection by the fishermen.
- Lack of a proper database including all information related to waterways. Knowledge gaps include lack of updated network data, database on IWT traffic, statistics of country boats, climate change impact and mitigation measures, pollution caused by transports, etc. No comprehensive hydrographic survey has been undertaken.

Railway

- The demand for formation of railway zone specifically for Kerala for speeding up the railway developmental projects of the state is yet to materialise.
- Effective follow up for the construction of Palakkad coach factory
- Construction of the Sabari rail
- Inadequate capacity of the existing lines and stations and high utilization (nearing saturation) of the existing Rail Transport System.
- Technical difficulties in removing the existing speed restrictions on rail.
- Inadequate platform and terminal facilities
- Large number of existing level crossings require ROBs

Almost all of these issues require action on part of the Union Government. However, progress has been slow in these.

Air Transport

- Lower volume capacity ratio - Kerala's four international airports have a combined terminal capacity of 30 million passengers per year, but they saw only 18.14 million passenger's last fiscal, a gap of around 12 million.
- Constraints in land acquisition and material resources for expansion of airports and construction of new ones.
- Gaps in seamless hinterland connectivity and integration with other transport modes.

R&D in Transport sector

- Lack of high end scientific infrastructure required for R&D
- Low level of funds available for R&D.

Clean Green Digital mobility

- Developing a transportation database - with all the details of transport supply in terms of road network parameters, infrastructure in place etc. along with the supply side details like public transport schedule, routing, fare etc. and traffic volume on each link on a temporal basis is required.
- Lack of coordination – Data captured/ generated by one department/ agency is seldom shared with another department/ agency due to lack of coordination/ vision for collective development. This hampers developmental initiatives, implementation projects etc. with cost overruns and time delays.

- Standardization of protocols and interface - which would enable interoperability of systems. For data security hack-proof systems have to be deployed.
- Underutilization of water transport potential with so many water bodies which are navigable. Interventions should be made to for a modal mix of transport with shift towards water.
- Absence of a manufacturing base for batteries, leading to sole reliance on imports to meet rising demand.
- Lack of charging stations makes it unsuitable for the consumers in covering long range.
- EVs have higher servicing costs which require higher levels of skill. India lacks dedicated training courses for such skill development.
- R&D in the field of emerging areas like green energy for transportation including Green Hydrogen is at very slow pace.

CHAPTER 4

SUGGESTIONS & RECOMMENDATIONS FOR 14TH FIVE YEAR PLAN

The creation of a transport system which is affordable, clean, efficient and safe should be the key goal of the 14th five-year plan in the transport sector. Such a transport system should be futuristic, sustainable, and be able to build upon the latest developments in technology. The hall mark of such a system would be its people centric approach and world class quality.

Excellence in construction and management has to be the guiding principle of all Government interventions in the 14th plan period. Interventions based on scientific approach and actions based on verifiable data / studies are sought to be designed for the period. The Plan seeks to take concrete steps for development of an integrated system involving all modes of transport, and enhanced coordination / cooperation across stakeholders.

1) Development of integrated approach for development of transport sector.

- It involves integrated management of transport infrastructure, mobility, urban development and environment protection which is essential for sustainable development.
- Transport integration process envisages bringing together elements of transport system across modes, sectors, operators and institutions etc. through scientific planning and delivery of outputs. This requires co-ordination among plans, policies and actions by multiple agencies.
- It involves physical and operational interface between modes and service integration (involving common fare, ticketing system etc.)

Transport Planning Framework should include.

- a) Macro/micro economic forecasting of States supplies and demands.
- b) Develop regional supply and demand forecasts aligning State level demands (Traffic generation)
- c) Construction of State Transport networks and distribution of traffic between various transport zones (Traffic distribution)
- d) Assessment of optimal allocation of traffic flow between different competing modes (modal split)
- e) Optimal route assignment on different modes (Network assignment)
- f) Evaluation of alternate Transport projects and policies.

Formation of a nodal agency to integrate all modes of transport under one umbrella for better coordination is essential. A Directorate of Mobility may be formed based on a detailed review/study, mapping the current role and responsibilities of various departments/agencies functioning in the State Transport sector, taking into account aspects mentioned above.

- 2) Transport in Kerala (TiK) - Five thematic areas which can pave foundations for mobility reforms in the State.
 - (i) Preparation of State wide integrated mobility plan on open GIS, based on District Level Plans of Town & Country planning Dept., Transport department and three MTAs.
 - (ii) Frameworks for integrated operations and monitoring by stakeholder agencies.
 - (iii) Operationalise 'Mobility as a Service' (MaaS) through 'Kerala Open Mobility Network', an aggregation of open digital mobility service mobile Apps
 - (iv) Integrated, unified, telescopic & automated fare structure and God's Own Travel (GOT) Card (Physical/Virtual/NFC) for end to end travel needs
 - (v) Tapping the clean & renewable energy sources for Mobility and creating a High powered committee such as "Kerala Hydrogen & E-Mobility Mission"
- 3) Need to decide a model mix of traffic across different modes. NATPAC have been assigned to work on it. After that need to decide upon investment across different modes
- 4) Analyse the implications of Vehicle Scrapping Policy proposed by Union Government and make adequate changes in rules / acts if any.
- 5) Initiate a comprehensive programme for training for transport officers which needs to be done on a wide scale.
- 6) Drafts of Road safety policy, Transport policy, Advertisement policy etc were prepared and reports were submitted to the government in 2015. These reports must be updated and brought into force.
- 7) Planning for Resilient Infrastructure- Transport infrastructure development should focus on three key principles of resilience building: robustness (strong design), redundancy (building extra capacity into systems to act as fail-safe networks) and resourcefulness (citizen empowerment).

8) **Public Transport**

Current situation demands mass transport facilities in urban areas like Metro, Commuter rail (Light Rail/Mono Rail) system etc. It is essential to enhance public transportation for the integration of transportation system. There is a need to increase the public transport to reduce the tremendous increase in personalized modes of transport on roads and move forward with sustainable transportation.

- Phased conversion of running Public Transport buses in the State on energy sources like CNG, LNG/Electric etc.
- Dedicated lanes for Public Transport System should be given top priority in all major urban areas along with the integrated terminals and public transport corridors.
- All bus stops should have modern bus shelters with passenger information systems and passenger amenities. Station accessibility has to be improved in line with the introduction of rationalized routes and feeder services.
- Presently the first mile/ last mile connectivity is served mostly by private vehicles followed by intermediate public transport vehicles such as taxis and autos and

non-motorized transport modes like cycles and walk to a lesser level. Such end-to-end connectivity has to be ensured.

- Coordination among different modes has increased, there is much more to be done in this direction.
- There is a need to reform transport regulation and organization to increase transit efficiency. Security for transit users should be improved. Intelligent transport system should be developed.
- To increase the efficiency of public transport system cleanliness, safety, accessibility and affordability should be maintained. The efficiency of the public transport system is also to be improved by comprehensively planning the routes and fleets and enhancing the travel information systems

9) **Bundling of Mobility Projects**

The large public transport infrastructure projects shall be bundled together with other city level and regional projects so as to have economic and financial effects. A largely viable project can be integrated with one or two other mobility projects which are having lower financial viability. This is possible when an integrated directorate is formed, and an integrated decision may be taken.

10) **Roads**

- An action plan should be made for prioritising the road works in the State. Major emphasis should be given to widening the State Highways and MDRs along with professional design and adequate drainage facilities. The new road development initiatives like the National Highway 4 laning, hill highway, coastal highway and by passes needs to be completed during the 14th Five-Year Plan period.
- There is a need to undertake development of State Highways, important MDRs and city roads in the State, through geometrical improvement, junction improvements, covering pedestrian facilities, utility ducts, re-laying the roads incorporating technical corrections and entering into maintenance contracts. Greater attention to be provided on road side parking.
- Some of the areas for development in the road transport in Kerala are improving the quality of journeys, tie-ups with private sector for development, improvements in processes and systems and adoption of technology innovations. Thrust areas in road sector for the next 5 years include pavement engineering, pavement asset management, traffic engineering, road safety, transportation planning, intelligent transportation systems, focus on Non-Motorized Transport, and use of mart and marginal materials for road construction.
- Budget allocation for road sector should be increased. The Government should also encourage the private investment in developing transport infrastructure in the state. The sources of financing the road transport sector are (1) Government Budget (2) KIIFB (3) NHAI (4) Central Road Fund and (5) Innovative new fund-raising mechanisms. To meet the expenditure on road development and to reduce dependence on borrowings, the Committee recommends setting up a non-lapsable and non-fungible “Highway Development Fund”.
- On street parking should be prohibited on all roads by taking effective control and sustained enforcement of the existing rules. Mandatory parking spaces which are stipulated by the Kerala Municipal Building Rules (KMBR) are not provided and

as a result building's parking requirements spills onto the carriageway of adjacent roads in most of the cases. The enforcing authorities to ensure that building rules on parking are followed. Policy level intervention is required for making traffic impact studies mandatory for medium and large-scale buildings. Traffic impact studies should address the issues of travel needs of the prospective visitors to and within the buildings and suggest measures to promote the use of public transport and non-motorized forms of transport. Peripheral parking schemes at outskirts of cities with public transport connectivity can be explored.

- Measures to strengthen rules and ensure that 'Good Samaritans' are helping road accident victims and saving lives.
- Highway Protection Act is expedient to provide for the protection and development of highways and for the prevention of ribbon development along highways and encroachment and use of highways for purposes which will adversely affect the safety of traffic and proper condition of highways in the State of Kerala. Even though the act commenced in the 1999, the effective enforcement is still pending. Enforcement has to be ensured.
- **Caravan tourism:** Converting the existing vehicles to caravans or mobile units may be explored based on guidelines for promotion of tourism. Proper road side infrastructure with parking facility needs to be provided to encourage the Caravan tourism.
- **Strengthening of core road networks:** As part of the Rebuild Kerala Initiative, a core road network for Kerala has been identified. The development and maintenance of core road network to be given prime importance.
- **Strengthening of radial roads:** The development of national highway, coastal highway and hill highway enhances the north south connectivity of Kerala. The east - west roads connecting these highways/major roads to be improved to enhance the mobility of the hinterlands
- **Ring road and Bypasses for congested towns and cities:** The construction of bypasses and ring roads for congested cities should be prioritized in order to alleviate the traffic congestion that exists in these locations
- **Road safety:** Despite efforts to reduce road crashes and their severity, the number of fatal accidents in the state has not decreased. Previous efforts to be evaluated critically and an action plan to be developed to reduce fatal accidents by at least 10% over the next five years. Focus needs to be given to reducing the number of black spots in the state.

11) Green & Electric mobility

- Incentives for green technologies usage and development
- An initiative is required to convert existing vehicles into more environment friendly vehicles. Promote switching from conventional fuels to electric/ LPG/ CNG/ Hybrid etc.
- Imposition of green tax on vehicles above 10 years of registration may be explored
- Green initiatives like rubber, plastic in road construction should be encouraged.
- Developing sustainable models through green funds.
- Manufacturing of electronics components, battery and allied peripherals should

be incentivized

- Smart city initiatives need to be furthered for better surveillance, monitoring and integration of services provided to the public.
- Electric vehicle charging points and related facilities have to be planned to encourage their use on a large scale.
- Research areas proposed under Electricity based Mobility includes Optimum placement of EV charging stations on the core road network in Kerala, EV battery swapping centers, EV battery enhancement and Self-charging electric roads.

12) Digital Mobility for transformation of transportation & Logistics

The future transport planning should be data driven for which a state wide regional travel demand model is required based on which policy interventions could be undertaken. An open data policy needs to be promulgated for sharing of data among departments/ agencies. Visions like ‘One state one mobility app’, ‘One state one mobility card’ and ‘One state one mobility map’ may be explored.

Digital Transformation enhances collaboration and sharing while reducing the effort and increasing the flexibility of the operations. Research areas proposed under Digital Transformation of Transportation & Logistics:-

- Integrating road, rail water transport - multi-modal goods movement - webGIS application for operators
- Autonomous and Connected Transport Infrastructure
- Digitally connected cities & towns
- Drone-based goods delivery - algorithms and traffic control
- Mobility Database
- Traffic Analytical System
- Smart technologies & infrastructure

13) Rail Transport

Recommendations for the rail sector include the following:

- Rationalisation of long-distance freight movements with linkages to container terminals at nodal points including Ro-Ro services and efficient road connectivity
- Preparation of Rail Sector Vision document for Kerala
- Steps for integration with other modes of transport including development of Multi-modal hubs, development of integrated timetabling, integrated ticketing and fare collection mechanism
- K-Rail to conduct study to identify the best possible rail based mobility option for the major cities in Kerala
- Identification and integration of freight through corridors and logistics parks in association with Department of Industries.
- Discussion with Industries & Revenue Dept. for unbundling G-P-P (Govt.-Public-Private) opportunities for SEZs around (<10km) railway stations.
- Work in co-ordination with the Union Government to get rail based mobility projects (including new lines, extensions, up gradations) implemented in Kerala.

14) **Water Transport**

There exists immense potential to develop Inland Water Transport as a supplementary, cheap, eco-friendly mode of transportation and also ensure much required hinterland connectivity to the urban centres.

- A composite / integrated master plan needs to be devised for the holistic development of waterways in the State focussing on development activities along with the movement of passengers and cargo, operation of waterway in Kovalam - Kasaragod stretch as per national standards by 2025.
- The Government should prepare a mid-term and long-term vision that will ensure sustainable development of the IWT sub-sector in line with Integrated Multimodal Transport Policy.
- Development of West Coast canal from Kovalam to Bekal (616 km) to be completed by 2025
- Preparation of a database of all infrastructure and activities related to waterways used for asset management.
- Classification and fixing development standards for 1100 km feeder canals. Prioritisation and development of commercially essential feeder canals (about 500 km) by 2025.
- Inland waterways network should be reclassified according to sustainable navigability and traffic importance. The core waterways should include fairways connecting Thiruvananthapuram and Bakel and other National waterways, connecting all ports including the inland port at Kottayam and connecting local towns.
- Network development and dredging strategy should be prepared in line with the Waterway Management Plan. The new dredging strategy should coordinate and integrate programmes of CSIND and Kerala Waterways Infrastructure Ltd (KWIL).
- More private participation can be invited in the field of waterway management and operations, development of IWT infrastructure, dredging and maintenance of waterways, mechanization of cargo handling, development of inland container terminals and container traffic in the waterways.
- Competency certificates to different categories of crew should be awarded by training institutes after successful completion of service and training modules for each category.
- Strengthening of Institutional Mechanism in Water Transport Sector - The need of the hour in IWT today, is a unified authority to control and maintain the waterway developments and operations in a co-ordinated manner. Institutional capacity building, reforms and restructuring to be part of the initiative.
- The waterway sector is to be integrated with other transportation sectors, for passenger, cargo and tourism operations. This is expected to be implemented in Kochi, by UMTA. The inland port at Kottayam also has the capacity to act as a hub for cargo movement integrated with other modes.
- Policy support for shift of goods transport to water transport is essential in the state. Identification of potential cargo and provision for incentives to increase cargo transport.

- The state should not shy away from trying out the latest developments and options in water transport like amphibious vehicles, Water taxi, and Sea plane.
- IWT holds possibilities for the tourism sector. Products like canal and river cruise, water sports and adventure tourism, water front parks, walkways and safari zones hold great possibilities in Kerala. They have to be explored.
- Periodic monitoring of water quality and use of satellite-based models for assuring good water quality.
- Implementation of waste management system for proper disposal of toilet waste from boats
- Digitisation of boat registration and monitoring of boats using GPS
- Carrying capacity wise regulations in congested tourist boat routes.
- Providing infrastructure in waterways for cargo especially hazardous goods.
- Providing infrastructure for passenger transport and explore possibility of water metro model speed ferry service at various places.
- Integration of Inland water transport with coastal shipping.
- Existing act/rules on navigation canals and ferries are to be replaced by a new rule in line with new central government acts. It may be named as “Kerala navigation canals and public ferries act/rule” for the development, restoration, conservation, operations, maintenance, training, registration, implementation of regulations and fixing responsibilities of officers for the management of Inland navigation infrastructure in Kerala.
- Usage of fossil fuel is to be discouraged in new vessels plying for tourism and passenger transport. Solar and electrical vessels may be promoted and for the same provisions shall be incorporated in inland vessel rule and canals and public ferries rule. Emphasis should also be on installation of fuelling / charging stations and maintenance systems.
- Encouragement of research and development activities related to waterways to solve specific problems related to waterways.

The following administrative/ policy decisions may be explored for promoting IWT

1. IWT subsidy: Presently Re1/- per tonne- km has been given as subsidy for movement of cargo through inland waterways. This may be continued.
2. Subsidy for procurement of IWT vessels: 20% subsidy to be considered for procurement of new barges, boats, cruise vessels etc which is being built in Indian yards. The vessel should be operated in Kerala inland waters or coastal waters for a minimum period of 5 years.
3. VGF for creating IWT facilities. For encouraging PPP projects in the field of IWT, 20% Viability Gap Funding may be considered by the State Govt. A corpus fund to the tune of `100 crores may be catered for this purpose.

15) **Air Transport**

- Improve capacity utilization involving passenger and cargo facilities in terminals.
- Overcome land constraints in developing airports like Thiruvananthapuram, and Kozhikkode.

- Aviation segment has to focus on multimodal integration of transport facilities as well for attracting tourist passenger demand.
- The State can look to explore beneficial schemes such as Udan for improving the ridership and promoting common people to opt for air travel as a means of transport.
- Orientation of runways to be enhanced to attract wide bodied aircrafts as intermediate transit point for fuelling, MRO etc.

Thrust Areas of Development of Air Transport

- Development of Aviation Policy for the State
- Promoting private participation and investments
- Expansion of Infrastructure facilities with detailed financial viability studies
- Promoting construction of Airstrips and helipads for enhancing intra movements of small capacity air crafts, facilitating air taxis and helicopters for enhancing recreational, commercial, Tourism, health and disaster management operations
- Enhancing Green Field Development in Airports
- Promote collaborative tourism packages to attract foreign tourists.
- Development of Kerala Sea Plane Project
- Development of Sabarimala Airport must be given key priority and it may be developed as a green technology infrastructure facility with state-of-the-art multi-mode integration facility such as air way, roadway, railway and rope way connectivity.
- Development of airstrips/ helipads in tourism centers like Ashramam maidan in Kollam, Munnar, Thekkadi, Kalpetta, Bekal, Guruvayur, Palakkad, Alappuzha beach, Varkala and Kumarakom may be explored. Airline service can be explored, connecting the State's major tourist spots by operating tiny single- engine aircraft having 8-10 seats. These air strips could be of use for emergency evacuation in terms of emergency as well.
- Development of Helipads in all district centers
- Development of waterdromes and seaplane movement
- Development of export-oriented production centres near Airport
- Utilization of drone technology for diverse applications

16) Research & Development

Research and Development is the backbone of any development and is essential to keep pace with the fast changing times. The existing R&D institutions have to be strengthened and provided with ample funds/ opportunities to excel and be beneficial for the state and the society at large. Based on the existing challenges in the transport sector of the State, the following areas in R & D are identified:

- Transportation planning including resilient planning, infrastructure planning and freight/logistic planning
- Traffic engineering for dynamic traffic management.
- Intelligent Transportation Systems for seamless mobility and value added services
- Electric mobility
- Digital transformation of transportation & logistics in autonomous and connected transport infrastructure
- Road Safety including scientific crash data collection and management, smart traf-

- fic enforcement, road safety education and crash black spot studies
- Public Transport including multi-modal integration (road, rail, water, air, pipeline)
 - Non Motorised Transport for universal accessibility
 - Highway including road assets management system, new technologies and alternative materials
 - Construction materials
 - Sustainable Transportation.

Appendix I
Agency - wise Outlay and Expenditure in Transport Sector in 13th Five Year Plan

Department /Agency	Annual Plan 2017-18		Annual Plan 2018-19		Annual Plan 2019-20		Annual Plan 2020-21		Annual Plan 2021-22		13 th Plan Total	
	Budgeted Outlay	Expenditure	Budgeted Outlay	Expenditure	Budgeted Outlay	Expenditure	Budgeted Outlay	Expenditure	Budgeted Outlay	Expenditure	Budget	Expenditure
Port, lighthouse and shipping												
KMB	11786	20624	10949.5	5603.07	9795	2441.4	6912	5286.27	6912	2302.21	46354.5	36257.38
HED	1465	609	1437.5	555.68	956	1331.87	755	596.43	755	535.63	5368.5	3629.02
HSW	560	110	255	190.32	255	77.74	345	200.86	345	268.11	1760	847.98
Sub Total-Port	13811	21344	12642	6349.07	11006	3851.01	8013	6083.56	8012	3105.95	53483	40734.38
Roads and Bridges												
PWD (NH)	10022	28827.91	11024	37564.43	10924	39640.4	9594	41836.37	9594	19548.27	51158	167417.38
PWD (R&B)	125072	210491.67	134408	202585.5	125789	208825.68	100616	263401.54	81432	139305.72	567317	1024610.08
Sub Total - Roads and Bridges	135094	239319.58	145432	240149.9	136713	248466.08	110210	305237.91	91026	158853.99	618475	1192027.46
Road Transport												
KSRTC	4468	86460	4915	70194.93	5600	98736.72	10891	141414.11	10891	1912.26	36765	398718.02
Motor Vehicles Dept.	3818	656.57	4200	1467.53	4643	671.96	3877	1954.49	3877	240.09	20415	4990.64
Sub Total - Road Transport	8286	87116.57	9115	71662.46	10243	99408.68	14768	143368.6	14768	2152.35	57180	403708.66
Inland Water Transport												
SWTD	2200	1539.98	2420	1203.56	2811	637.9	2610	1384.7	2761	1265.53	12802	6031.67
CSIND	1322	165.6	1600	1168.92	8762	1381.3	7482	534.2	867	272	20033	3522.02
KSINC	12785	1326.7	8918	1558.52	1572	1011	1018	322	10982	6773.65	35716	10991.87
Sub Total-Inland Water Transport	16307	3032.28	12938	3931	13145	3030.2	11110	2240.9	14610	8311.18	68551	20545.56
Other Transport Services – Metro, Aviation & Others												
Sub Total-Other Transport Services	10	89516.93	10	34270.44	9	23816.47	26262	87015.42	16008	26129.91	41896	260749.17
TOTAL-TRANSPORT	173508	440330.15	180137	356362.87	171116	378572.44	170363	543946.39	144424	198553.38	839585	1917765.23

Appendix II
PROCEEDINGS OF THE MEMBER SECRETARY,
STATE PLANNING BOARD

(Present: Shri. Teeka Ram Meena IAS)

Sub: - Formulation of Fourteenth Five Year Plan (2022-27) –Working
Group on Transport- Reconstituted-Orders issued-reg.

Read: 1. This office order of even No. dated 14.9.2021.
2. This Office order of even No.dated, 4.10.2021.

ORDER No.951/2021/SPB (AD3)/WG4 Dated:8.10.2021

As part of the formulation of Fourteenth Five Year Plan, the Working Group on **Transport** has been constituted vide paper read as 1st above. The Working Group on Transport has been reconstituted with two new Members and excluded one Member vide reference 2nd read above.

The Principal Secretary (Transport) and Co-chairperson, Working Group on Transport co-opted 1. Shri Sanjay Sridhar, Strategy Advisor for India, Urban Movement Innovation Fund and 2. Shri Sumanth Koorapati, Strategic Advisor & Country Head for LRTC GmbH as the new Members. Also, sub groups in six thematic areas are to be formed identifying Members from the Main Working Group.

The Working Group on Transport is therefore reconstituted as follows:

Co-Chairpersons

1. Dr Tom V Mathew, Professor, Department of Civil Engineering, Indian Institute of Technology, Bombay, Powai, Mumbai 400076, email: tvmm@civil.iitb.ac.in, Mob. 9819959439.
2. Shri K.R. Jyothilal IAS, Principal Secretary to Government, Transport Department, Govt. Secretariat, Thiruvananthapuram, Mob: 9447744200, email: secy.tspt@kerala.gov.in.

Members

1. Shri Anand Singh IAS, Secretary to Govt. Public Works Department, Govt. Secretariat, Thiruvananthapuram, Mob: 8826736327, email: secy.pwd@kerala.gov.in
2. Shri Biju Prabhakar IAS, Secretary to Government (Transport Department) and Managing Director, KSRTC, Thiruvananthapuram.
3. Shri M.R Ajith Kumar IPS, Transport Commissioner, Motor Vehicles Department, Thiruvananthapuram.
4. Shri S Suhas IAS, Managing Director, CIAL, email: md@cial.aero, Mob: 9895606246.

5. Shri V. Ajith Kumar, IRSSE, Managing Director, K-Rail, Trans Tower, Vazhuthacaud, Thiruvananthapuram.
6. Dr. K. Ravinder, Senior Principal Scientist, Transportation Planning and Environment Division, CSIR-CRRI.
7. Prof. Krishna Prapoorna Biligiri, Associate professor & Head, Department of Civil & Environmental Engineering, IIT, Tirupati, email: bkp@iittp.ac.in, Mob:7569263365.
8. Shri. Mathew George, Director (i/c), Inland Water Authority of India, National Waterway Road, Kamadikadavu, Maradu, Kochi, Tel: 0484-2389804, email: dirkoc.iwai@nic.in.
9. Dr Vasudevan S, Partner and Global Sector Lead- Airports Strategy & Operations
KPMG India. email: vasudevans@kpmg.com, Mob:9920515119.
10. Dr Samson Mathew, Director, NATPAC, Thiruvananthapuram, email: director.natpac@kerala.gov.in, Mob: 9443176759.
11. Dr B.G Sreedevi, Director (Rtd.), NATPAC, email:bgsreedevi@yahoo.com, Mob: 9446342828.
12. Shri Shaji V Nair, Director, State Water Transport Department, Near KSRTC Bus Station, Alappuzha 688011, email shajinairv@gmail.com/ directorswtd@gmail.com, 9400050320.
13. Shri Ajith Ramachandran, Chief Engineer, PWD (Roads) Thiruvananthapuram.
14. Shri Ranu Das, Chairman, Ultra PRT Ltd, United Kingdom, Mob:9810187313, email: ranudas@ultraprt.co.uk.
15. Shri A A Badusha, Senior Deputy Director, ARAI, Pune, Tel: 020-6762 1101 / 6762 1122, email:www.araiindia.com/badusha.apx@araiindia.com/badusha.vel@araiindia.com, Mob: 9975581060.
16. Shri Sanjay Sridhar, Strategy Advisor for India, Urban Movement Innovation Fund, email: sanjaysridhar@yahoo.com, Mob: 9740392216.
17. Shri Sumanth Koorapati, Strategic Advisor & Country Head for LRTC GmbH email: koorapati@gmail.com, Mob: 9971001799.
18. Shri K C Jayapalan, AITUC Office, HPO Road, Palakkad, email: ksjayapal@gmail.com Mob: 9447625248.
19. Shri Dejo Kappen, Kappil House, Meenachil P. O., Pincode 686577, Mobile No. 9447300978, email:dejokappen@gmail.com.
20. Shri James Vadakkan, Vadakkan House, Mundankal P. O., Pala, Arunapuram Via., Pin Code 686574, Phone 04822-213829, vadakkanjames@gmail.com, Mob.9497340829/ 9562856319.
21. Adv. M.S Skaria Chairman, Kerala Motor Transport Workers Welfare Fund Board, Kollam, email: advocatemsskaria@gmail.com/ motor.worker@

- gmail.com, Mob: 9447083373.
22. Shri Suresh Kumar S, Chief Engineer, KWIL, cekwil@keralawil.com, Mob: 9446594986.
 23. Shri Gopinathan Nair, Former General Manager, Railways, Mob:9900093936, email: nair2000rk@yahoo.com.
 24. Shri Sandith Thandasherry, Founder CEO – Navgathi Marine, Navalt Solar & Electric Boats, XShip Analytic, University Road, Cusat PO Kochi, Pin: 682022, Tel:+91 9895343637, email: sandith@navgathi.com.
 25. Shri K.S Vijayan, Former Executive Director, KSRTC, email: ksvijayan93@gmail.com, Mob: 9495125050.
 26. Shri K.S Sunil Kumar, State General Secretary, Kerala State Auto Taxi Light Motor Workers Federation (CITU), Motor Bhavan, Ayurveda College, Kun-nupuram, Kuthiravattom Lane, Thiruvananthapuram 1, Mob: 9447728289, email: ksatlmwf@gmail.com/ nalanchirahari@gmail.com.
 27. Shri Harikrishnan, General Secretary, Kerala State Transport Employees Union, PRA 180, Sasthanganalam P.O., Thiruvananthapuram, email:ksr-teaho@gmail.com, Mob:9496251552.
 28. Shri G.P Hari, AGM (Urban Transport), Kochi Metro, email:gphari70@gmail.com, Mob:7356148222.
 29. Shri T Elangovan, Former Director, NATPAC, email: tangoelango@gmail.com, Mob: 9447112510.
 30. Shri Rajesh Menon, Director General, Society of Indian Automobile Manufacturers (SIAM) email: rajesh.menon@siam.in, Mob: 9818048256.
 31. Shri Sabu Johny, State Chairperson – FADA Kerala & MD – EVM Automobiles, Mob: +919847555055, email: sabujohny@evmgroupp.co.in/ fada.kerala@fada.in.
 32. Shri Pradeep Gopalakrishnan, Kerala EV Dealers Association (founding Member), 9971110955, sinpar.enterprises@gmail.com.

Convener

Er. Joy N R, Chief, Industry and Infrastructure Division, State Planning Board, chiefindustry@gmail.com, joynr_spb.ker@nic.in, chiefindustry.spb@kerala.gov.in, Mob: 9447000868.

Co-Convener

Shri G.T Shibu, Assistant Director, Transport Sector, Industry and Infrastructure Division, State Planning Board, Mob: 9446024936, email:gtshibura@gmail.com.

Terms of Reference

1. To evaluate the growth of traffic both passenger and goods traffic and the share of public transport systems in Kerala.
2. To propose steps towards a time-bound action programme in respect of:

- (i) Rail transport
- (ii) Water transport
- (iii) Aviation
- (iv) Road transport in the State of Kerala.
- (v) Roads sector in Kerala

3. To suggest policy initiatives to improve resource mobilisation for the sector.

Terms of Reference (General)

1. The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to travelling allowances as per rules if reimbursement is not allowed from Departments.
2. The expenditure towards TA, DA and Honorarium will be met from the following Head of Account of the State Planning Board “3451-00-101-93”- Preparation of Plans and Conduct of Surveys and Studies.

Sub Groups- Team Leaders & Members

Sl. No	Name	Designation	Team Leader
Road and Road Transport			
1	Shri Anand Singh IAS	Secretary to Govt. PWD	
2	Shri Biju Prabhakar IAS	Secretary to Govt. (Transport Dept.) & MD, KSRTC	Team Leader
3	Shri M R Ajith Kumar IPS	Transport Commissioner, MVD	
4	Shri Ajith Ramachandran	Chief Engineer, PWD (Roads)	
5	Shri A A Badusha	Senior Dy. Director, ARAI, Pune	
6	Dr. B G Sreedevi	Director (Rtd.), NATPAC	
7	Shri Rajesh Menon	Director General, Society of Indian Automobile Manufacturers (SIAM)	
8	Shri Dejo Kappen	Kappil House, Meenachil P. O.	
9	Shri James Vadakkan	Vadakkan House, Mundankal P. O., Pala, Arunapuram	
10	Adv. M S Skaria	Chairman, Kerala Motor Transport Workers Welfare Fund Board, Kollam	
11	Shri K S Vijayan	Former Executive Director, KSRTC	
12	Shri K S Sunil Kumar	State General Secretary, Kerala State Auto Taxi LightMotor Workers Federation (CITU)	
13	Shri Harikrishnan	General Secretary, Kerala State Transport Employees Union	

14	Shri Sabu Johny	State Chairperson – FADA Kerala & MD – EVM Automobiles	
15	Shri Pradeep Gopalakrishnan	Kerala EV Dealers Association (founding Member)	
16	Shri K C Jayapalan	AITUC Office, Palakkad	
17	Shri Sumanth Koorapati	Strategic Advisor & Country Head for LRTC GmbH	
Rail Transport			
1	Shri V Ajith Kumar	IRSSE, MD, K-Rail	Team Leader
2	Shri Ranu Das	Chairman, Ultra PRT Ltd, UK	
3	Shri Gopinathan Nair	Former General Manager, Railways	
4	Shri G P Hari	AGM (Urban Transport), Kochi Metro	
R & D Institutions			
1	Dr. K. Ravinder	Senior Principal Scientist of Transportation Planning and Environment Division, CSIR-CRRI	
2	Prof. Krishna Prapoorna Billigiry	Assoc. Prof. & Head Dept. of Civil & Env Engg. IIT,Tirupati	
3	Dr. Samson Mathew	Director, NATPAC	Team Leader
Water Transport			
1	Shri Mathew George	Director (i/c), IWAI Kochi	Team Leader
2	Shri Shaji V Nair	Director, SWTD, Alappuzha	
3	Shri Suresh Kumar S	Chief Engineer, KWIL	
4	Shri Sandith Thandasherry	Founder CEO – Navgathi Marine, Navalt Solar & Electric Boats, Kochi	
Aviation			
1	Shri S Suhas IAS	Managing Director, CIAL	Team Leader
2	Dr Vasudevan S	Partner and Global Sector Lead- Airports Strategy & Operations, KPMG India	
3	Shri T Elangovan	Former Director, NATPAC	

Digital and Clean Mobility			
1	Shri K R Jyothilal IAS	Principal Secretary (Transport)	Team Leader
2	Shri Sanjay Sridhar	Strategy Advisor for India, Urban Movement Innovation Fund	
3	Shri G P Hari	AGM (Urban Transport), Kochi Metro	
4	Shri Pradeep Gopalakrishnan	Kerala EV Dealers Association (founding Member)	

To

Sd/-
Member Secretary

1. Dr K Ravi Raman, Member
2. Shri V Namasivayam, Member
3. To all Working Group Members

Copy to

PS to VC
PA to MS
CA to Member (Dr K Ravi Raman)
CA to Member (Shri V Namasivayam)
Sr. A.O, SPB
The Accountant General, Kerala
Finance Officer, SPB
Publication Officer, SPB
Sub Treasury, Vellayambalam
Accounts Section
File/Stock File

Forwarded/By Order
Sd/-
Chief, Industry & Infrastructure Division
(Convener)