PROJECT REPORT

On

Implementation of SilverLine (Semi High Speed Rail) From Thirvananthapuram To Kasaragod

BY

DEVINDER SINGH 2K20/EMBA/13

Reviewer: **Shri Mohit Beniwal**

DELHI SCHOOL OF MANAGEMENT
Delhi Technological University
Times New Roman, Bold
Bawana Road Delhi 110042

CERTIFICATE

Sh Devinder Singh, of EMBA 2020-22 completed the assignment to create the Detailed Project Report on Implementation of Silverline(Semi High Speed Railway) from Thiruvananthapuram to Kasargod," which was recognized to Delhi School of Management, Delhi Technological University, Bawana Road, Delhi-42 for my Degree of Masters of Business Administration.

Guide Signature Head Signature (DSM)

Location:
Date:

DECLARATION

I, Devinder Singh, an EMBA (2020-22 batch) student at Delhi School of Management, Delhi Technological University, Bawana Road, Delhi - 42, am writing to inform youthat I have completed the dissertation report "**Implementation of SilverLine (Semi High SpeedRail) From, Thirvananthapuram To Kasaragod**" in order to finish the MBA degree.
The contents and statistics supplied in this report are accurate to the best of my ability.
This report is not forwarded to the other University as part of the degree program.

Devinder Singh
Location
Date:

ACKNOWLEDGEMENT

I am grateful to my Director, Dr. Archana (Professor, Delhi School of Management (DTU)), for her wise counsel. Thank you for always encouraging and supporting me at all phases. I'd also want to thank my project's Co-Guide, Sh Mohit Beniwal, for his invaluable help, without which the project could not have been finished. I also appreciate his patience in providing me with a concentrated approach to the current assignment.

Because of my colleagues who participated in this project and contributed to the completion of many critical tasks.

Mr. DEVINDER SINGH (2K20EMBA13)

DETAILED PROJECT REPORT

DETAILED PROJECT REPORT FOR SILVERLINE (SEMI HIGH SPEED RAIL) FROM THIRUVANANTHAPURAM TO KASARAGOD

IDENTIFICATIONTABLE

Client/Projectowner	Kerala Rail Development Corporation Limited(K-Rail)
Project	SilverLine (SemiHighSpeedRail) From Thirvananthapuram To Kasaragod
Study	Detailed Project Report For SilverLine (Semi High Speed Rail) FromThirvananthapuramToKasaragod
Typeofdocument	Detailed Project Report
Date	08-05-2022
Filename	KRDCL-FEA-GEN-SYST-REP-00001.
Framework	General
Referencenumber	IN01T18A37
Confidentiality	External
Language	English
Numberof pages	71

Contents

INTRODUCTION

1.1 Background

In recent decades, India's rapid economic growth has resulted in an increase in the amount of people and products transported across the country. Dedicated Freight Corridors (DFC) are being built to convey freight from Delhi to Mumbai and Kolkata in order to address the increased demand for commodities transportation. In December 2009, the Ministry of Railways of the Government of India released the "Indian Railway Vision 2020," which intends to renovate current conventional lines, increase capacity, and create high-speed railway lines for faster and improved passenger transportation. India currently lacks a high-speed rail (HSR) corridor that meets international requirements. The Vande Bharat Express, which runs between New Delhi and Varanasi and has an operational speed of 160 km/h and an average speed of 100 km/h, is currently India's fastest train.

Kerala State, which has one of the highest population densities in the country, India, has 205545.62 km of roads (3.49% of India's total) whichtranslates to about 615.5 km of roadper lakh population. The road traffic has been growing at a rate of 10 to 11%, whereas Road length growth has been negligible. This has resulted in great increase in roadcongestion. Thiruvananthapuram, Kochi, Kozhikode, and Kannur all have international airports that connect the state to the rest of the country and the rest of the world. A total of 1588 km rail line with nearly 200 Railway stations connects all major towns and cities of Kerala except in highland districts of Idukki and Wayanad. Existing railway and road networks in the state are not amenable to faster travel. Averagespeed on road and by trains in the State is among the lowest of all regions of the country.

There is a widespread realization that the economic and social life in the state of Kerala suffers from slowspeed of travel on its existing highways and railways. The idea of high-speed rail corridor between Thiruvananthapuram and Kasaragod was first announced in the 2009-10 Kerala Budget. In 2009, the then government had set up a corporation named Kerala High Speed Rail Corporation Ltd (KHSRC) to implement the project. Following that, Delhi Metro Rail Corporation (DMRC) had conducted a feasibility study and submitted a report in 2012.The project which had an estimated cost of Rs 1.27 lakh crore, however, failed to be implemented due to various suggestionors and the government had dissolved the KHSRC.

Augmenting the present Rail Infrastructure, Kerala Government has decided to build special railway corridor between Thiruvananthapuram and Kasaragod andin the 2019-20 Kerala budget, Finance Minister, Shri. Thomas Isaac had announced a 515km elevated corridor with an estimated cost of Rs 55,000
crore.

But later it was decided to construct third and fourth railway lines considering the escalating cost of construction for elevated corridor. The 529.45 km long project, which is executed by Kerala Rail Development Corporation Limited (K-Rail), a joint venture of Government of Kerala and Ministry of Railways, for implementing the railway infrastructure in the state. K-Rail estimated the cost of project as Rs 63941 crores and according to K-Rail, the proposed third and fourth railway lines are planned to be in mostly straight alignment which is designed to run at a Semi-High Speed of 200 Km/h.

The Semi High-Speed Rail (SilverLine) Project is expected to complete by 2025, will reduce journey time from Thiruvananthapuram to Kasaragod from 12 hours to just 4 hours. This SilverLine will reduce congestion and pollution on the roads, improve safety and comforts.

The airport at Kochi will be connected in the SilverLine. This rail line will pass through eleven districts, and will stop at 11 stations namely Thiruvananthapuram, Kollam, Chengannur, Kottayam, Ernakulam, Kochi Airport, Thrissur, Tirur, Kozhikode, Kannur and Kasaragod. From Thiruvananthapuram to Tirur, the proposed rail line will pass by a stretch that is different from the existing railway line and from Tirur upward, the line will run parallel to the existing track up to Kasaragod. The rail corridor will also have roads parallel to it and there will be underpasses for road traffic at every 500 m.

The SilverLine project is estimated to reduce approximately 3,51,940 tons of carbon dioxide equivalent emission by 2029-30, and 5,94,636 tons by 2052-53.

The SilverLine development and operation should, therefore, be planned with careful consideration of their environmental impacts. Tominimize these adverse effects that may be created by the SilverLine development project, it is essential to identify the Environmental Impacts - both positive and negative and formulate Environment Management Plan based on the Environmental Impact Assessment.

Present Project

The K-Rail has selected the Centre for Environment and Development (CED), Thiruvananthapuram, to carry out the Rapid Einvironment Impact Assessment (EIA) study of the proposed SilverLine and issued the Letter of Award (LoA) on 30.09.2019. The assignment is to help the K-Rail in identifying environmental and social impacts; prepare environmental and social management plans to mitigate the identified issues and to ensure that the proposed works are designed and constructed in line with the regulations and stipulations of MOEFCC, CPCB, SPCB, KRDCL and international funding agencies like KfW, ADB, JICA, WB & AIIB. Since the proposed Project is a railway project, Environmental Clearance is not required from MoEFCC, Government of India, but K-Rail in its commitment to safeguard the environment and also to mitigate the social impact due to project is desirous of conducting the EIA. The EIA report is a prerequisite for various international funding agencies and it is also to be incorporated in the Detailed Project Report (DPR).

Purpose of the Report

EIA study is executed in the project planning stage such that the potential environmental impact due to the project implementation is identified at the planning stage itself and necessary mitigation measures to avoid, minimise or mitigate is duly integrated in the project design phase towards ensuring that the proposed developments are made in due compliance with the environmental sustainability.

Objectives of the EIA Study

The overall objective of the present assignment is to carry out a Rapid Environment Impact Assessment (EIA) for the proposed SilverLine Project between Thiruvananthapuram to Kasaragod (Total Length of corridor: 529.45 km); to assist the K-Rail in identifying environmental and social implications; to produce an Environmental Management Plan to alleviate the identified issues; and to ensure that the proposed works are designed and built in accordance with the regulations established by the K-Rail, the organizations and funding agencies like MOEF&CC, CPCB, SPCB, KRDCL and KfW/ ADB/ JICA/ WB/ AIIB.

The following are the precise goals:

1. **Analyze the project based on its components and identify actions that can have a significant positive or negative impact on the local environment;**
2. **To anticipate and measure the severity of the various project components' impacts on the local environment;**
3. **Conduct an assessment of the current environmental conditions in the area, taking into account factors such as air, land, and water quality, regional biodiversity, people's socioeconomic conditions, and the area's infrastructure capacities, among others.**
4. **To propose control methods for the SilverLine Project's primary impacts, as well as to draught an Environmental Management Plan for the SilverLine Project.**

PROJECT DESCRIPTION

Type of Project

The present proposal is for the Thiruvananthapuram - Kasaragod Semi High-Speed Railway (The SilverLine) Project being executed by Kerala Rail Development Corporation Limited (K-Rail), a joint venture of Government of Kerala and Ministry of Railways, Government of India. The SilverLine project of 529.45km, begins at Kochuveli (near Thiruvananthapuram Airport) in Thiruvananthapuram District and runs through Kollam, Alappuzha, Kottayam, Ernakulam, Thrissur, Malappuram, Kozhikode and Kannur districts before entering Kasaragod District. The planned route lies between Latitude 8°30'44.88"N-Longitude 76°53'52.43"E and Latitude 12°29'28.37"N -Longitude 74°59'15.57"E.

Need of the Project

Kerala State, which has one of the highest densities of population in India, has eleven National Highways which run for about 1781.5 km. The road traffic has been growing at a rate of 10 to 12%, whereas Road length growth has been negligible. This has resulted in great increase in road congestion.

The total rail network in Kerala is 1045 km in length, with 181 stations and serving 9 routes, connects all Kerala. The existing railway and road networks in the state are not amenable to fastertravel. Average speed on road and by trains in the State is among the lowest of all regionsof the country. Hence, the necessity for developing SilverLine corridors has been felt, which will cater the needs of rapidly growing and expanding economy and thereby curb the highroad-based greenhouse gas emissions.

The SilverLine is expected to complete by 2025, will reduce journey time from Thiruvananthapuram to Kasaragod from 12 hours to just 4 hours. This line will reduce congestion and pollution on the roads, improve safety and comforts. The positive impacts of the project are safety; High Capacity and Frequency; High Energy Efficiency and Low Emission of Greenhouse Gas (Reduce impact of ClimateChange); Travel time reduction; Employment generation; and Strong Infrastructure to counter Natural Disaster.

Location of the Project

The proposed SilverLine alignment starts at the Kochuveli near Thiruvananthapuram and ends at Kasaragod. The total length of SilverLine alignment is 529.45 km consisting of embankments, tunnels, and viaducts.

Table 2.1 Salient features of Thiruvananthapuram- Kasaragod SilverLine Project

Sl. No.	Description	Details
1	Route Length	529.45 km
2	Gauge	1435 mm (Standard Gauge)
3	Maximum Operational Speed	200 km/h
4	Stations	Thiruvananthapuram at Kochuveli, Kollam, Chengannur, Kottayam, Ernakulam, Kochi Airport, Thrissur, Tirur, Kozhikode, Kannur and Kasaragod
5	Type of Structures	Tunnel – 11.53 km (2.17%), Bridges – 12.99 km (2.44%) Viaducts – 88.41 km (16.61%), Embankments – 292.73 km (55.00%), Cuttings – 101.74 km (19.12%), Cut & Cover – 24.79 km (4.66%)
6	Track Structure	Mostly Ballasted and ballast-less in viaduct & tunnels
7	Maintenance Depots	Workshop at Kollam and Inspection Depot at Kasaragod
8	Train type	EMU type
9	Car body Width	3400mm (max)
10	Seating	2+2 (Business), 3+2 (Standard)
11	Passenger capacity per Train	675 (9 car set)
12	Traction	2x25kV Auto Transformer Type Feeding System Overhead Contact System – simple catenary type

Sl. No.	Description	Details
13	Power Supply	Kerala State Electricity Board supply supplemented by renewable energy supplies
14	Signalling & Train Control System	ETCS level 2 system
15	Communication	LTE with BTN
16	Daily Ridership	79934 in 2025 – 26 (including Airport trips, additional trips due to introduction of city feeder, TOD) increasing to 158946 (including additional trips) in 2052 – 53
17	Train Set	9 cars extendable to 12/15
18	Train operation	37 services in 2025 with peak headway of 20 minutes, increasing to 65 in 2052 with peak headway of 10 Minutes
19	Cars requirement	261 in 2025 increasing to 492 in 2052
20	Fare Collection	Automatic Fare collection system with Centralized Computer and other supporting systems

21	Completion time	5 years
22	Capital cost (Rs) (March 2020 price)	49919 Crores
23	Cost with IDC (Rs)	63941 Crores
24	Financing	Debt Rs.33700cr (52.7%), Equity-MoR-Rs.3125cr (4.89%), GoK-Rs.3253cr (5.09%) and other equities-4252cr (6.65%), GoK (land, EIA and R&R)-13362cr (20.90%), Subordinated debt-GoI-Rs.3189cr (4.99%), GoK-Rs.2896cr (4.53%) and balance in IDC-Rs164cr (0.26%)

ENVIRONMENTAL BASELINE DATA

Study Area

The SilverLine alignment of 529.45 km begins at Kochuveli (near Thiruvananthapuram Airport) in Thiruvananthapuram District and runs through Kollam, Pathanamthitta, Alappuzha, Kottayam, Ernakulam, Thrissur, Malappuram, Kozhikode and Kannur districts before entering Kasaragod District. The planned route lies between Latitude 8°30'44.88"N-Longitude 76°53'52.43"E and Latitude 12°29'28.37"N-Longitude 74°59'15.57"E.

Ecologically Sensitive Areas

The proposed SilverLine corridor is not a nationally or internationally recognized area for nature conservation. However, the Kerala State is known for its conservation and there are 7 national parks and 15 wildlife sanctuaries in the state. The alignment lay out has been very wise as it doesn`t covers any protected areas like National Parks, Wildlife Sanctuary and Biosphere Reserves as per Wildlife Protection Act, 1972 along the both side of the alignment (10 km wider) of the proposed site or proposed station areas. No area or village along the alignment or proposed station falls under Western Ghats Notification, 2015. Hence, no ecologically sensitive areas were observed during our field survey and as per our secondary data review as per Kasturirangan and Gadgil Report on WGEEP. Eco-sensitive zones are shown in Table 3.62, Fig. 3.24 & Fig.3.25 and the proposed SilverLine activity is far away from such ecological sensitive areas.

Table 3.62 Environment Sensitive Locations in the Study Area

Sl. No.	Category	Name
1	Ramsar Sites	Ashtamudi Wetland (614 km^2), Sasthamkotta Lake (3.73 km^2) & Vembanad-Kol Wetland (1512.5 km^2)
2	CRZ 1 (No intervention areas)	Areas delineated as CRZ 1 in the Coastal Zone Management Plan of the state
3	Biosphere reserves	Nilgiri Biosphere Reserve (5,520 km^2) & Agasthyamalai Biosphere Reserve (3,500 km^2)
4	National Parks	Eravikulam National Park (97 km^2); Periyar National Park (350 km^2); Silent Valley National Park (89.52 km^2); Mathikettan Shola National Park (12.82 km^2); Anamudi Shola National Park (7.5 km^2); Pambadum Shola National Park (1.318 km^2) and Karimpuzha National Park (230 km^2)
5	Wildlife sanctuaries	Periyar Wildlife Sanctuary (427 km^2); Wayanad Wildlife Sanctuary (344.44 km^2); Parambikulam Wildlife Sanctuary (285 km^2); Neyyar Wildlife Sanctuary (128 km^2); PeechiVazhani Wildlife (125 km^2); Chimony Wildlife Sanctuary (85 km^2); Shenduruny Wildlife Sanctuary (171 km^2); Chinnar Wildlife Sanctuary (90.44 km^2); Idukki Wildlife Sanctuary (70.0 km^2); Aralam Wildlife Sanctuary (55 km^2); Peppara Wildlife Sanctuary (53 km^2); Thattekadu Bird Sanctuary (25.16 km^2); Mangalavanam Bird Sanctuary (0.0274 km^2); Kurinjimala Sanctuary (~32 km^2) & Ranipuram Wildlife sanctuary (~80 km^2)
	Tiger Reserves	PeriyarTiger Reserve (777.54 km^2) & ParambikulamTiger Reserve (285 km^2)
	Reserve forests	Attappadi (249 km^2)
	Mangrove sites	Ernakulam & Mattancheri Channels (1.69 km^2); ChittariPuzha & Anela Puzha (0.34 km^2); Dharmadam-Edakkad (0.26 km^2); Dharmadam Puzha & Anjrakandi Puzha (2.46 km^2); Valapattanam estuary (0.99 km^2); Ramapuram Puzha (1.14 km^2) & Pazhayangadi estuary (4.62 km^2)

Human Environment: Socio-Economic Aspects

Demographic Profile

The demographic structure of the study area was derived primarily from 2011 Census records for the Kerala State (Table 3.63). Kerala consists of 14 districts spread over an area of 38861 km^2. Total population is about 33.4 millionwith about 48% male and 52% female population. Out of the total population, Scheduled Caste and Scheduled Tribes are 9.1% and 1.45% respectively. Population density is 860 persons/km^2 with rural and urban population density of 559 and 2097 persons/km^2 respectively. Literacy rate is more than 84%. Average family size is 4.25 persons per household. Sex ratio (female to male population) is 1.084.

Table 3.63 District-wise distribution of the population in different age groups, Kerala

	Unit	Numbers in Different Age Group in total District population			% of Different Age Group in total District population		
		0-14	15-59	60+	0-14	15-59	60+
1	Kasaragod	3,42,696	8,35,111	1,29,568	26	64	10
2	Kannur	5,94,411	16,06,593	3,21,999	23	64	13
3	Wayanadu	2,12,246	5,26,414	78,760	26	64	10
4	Kozhikode	7,49,692	19,72,762	3,63,839	24	64	12
5	Malappuram	12,41,491	25,26,407	3,45,022	30	61	9
6	Palakkadu	6,78,192	17,95,096	3,36,646	24	64	12
7	Thrissure	6,88,592	20,01,050	4,31,558	22	64	14
8	Ernakulam	6,93,215	21,35,689	4,53,484	21	65	14
9	Idukki	2,47,338	7,32,193	1,29,443	22	66	12
10	Kottayam	4,13,849	12,47,065	3,13,637	21	63	16
11	Alappuzha	4,46,279	13,57,100	3,24,410	21	64	15
12	Pathanamtitta	2,32,670	7,50,202	2,14,540	19	63	18
13	Kollam	5,83,023	17,00,534	3,51,818	22	65	13
14	Thiruvanathapuram	7,07,280	21,60,992	4,33,155	21	66	13
	Kerala	78,30,974	2,13,47,208	42,27,879	23	64	13

Source: Census 2011

Tourism: Kerala, God's own country, an internationally recognized popular tourist destination, is known for its tourists' attractions, namely very long coastal line, lakes, backwaters, beaches as well tea gardens on hills and number of archaeological monuments and museums.

Table 3.65 Month-wise foreign tourist arrivals in India & Kerala in 2017

Sl.No.	Month	No. of FTAs in 2017	
		India	Kerala
1	January	964,109	150,808
2	February	931,025	135,089
3	March	885,936	107,141
4	April	717,899	82,633
5	May	622,408	49,073
6	June	663,470	44,040
7	July	779,309	72,552
8	August	719,129	73,736
9	September	719,964	54,700
10	October	866,976	79,957
11	November	997,738	107,028
12	December	1,167,840	135,113

Source: Ministry of Statistics, GoI & Department of Tourism, Kerala

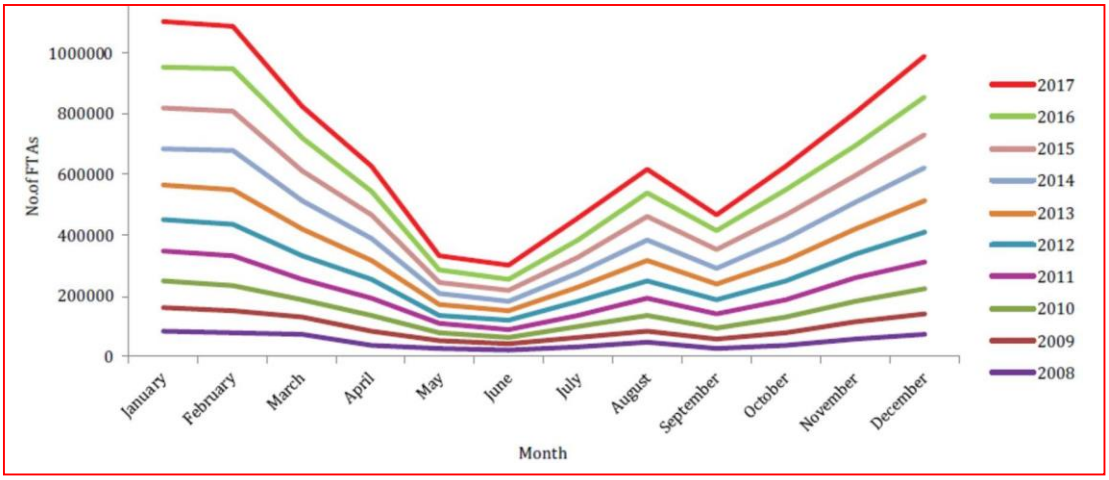

Fig. 3.27 Month wise comparison of foreign tourist arrival in Kerala from 2008 to 2017

Table 3.66 Month-wise domestic tourist arrivals in Kerala in 2016 and 2017

Sl. No.	Month	No. of Domestic Tourists Arrival	
		2016	2017
1	January	1,077,231	1,221,074
2	February	1,006,111	1,034,563
3	March	960,467	1,014,877
4	April	1,012,844	1,213,252
5	May	1,206,350	1,338,330
6	June	891,614	1,027,361
7	July	913,886	1,083,162
8	August	1,043,362	1,138,533
9	September	1,129,260	1,188,959
10	October	1,337,191	1,379,190
11	November	1,187,620	1,401,610
12	December	1,406,599	1,632,609
	Total	1,31,72,535	1,46,73,520

Source: Department of Tourism, Kerala

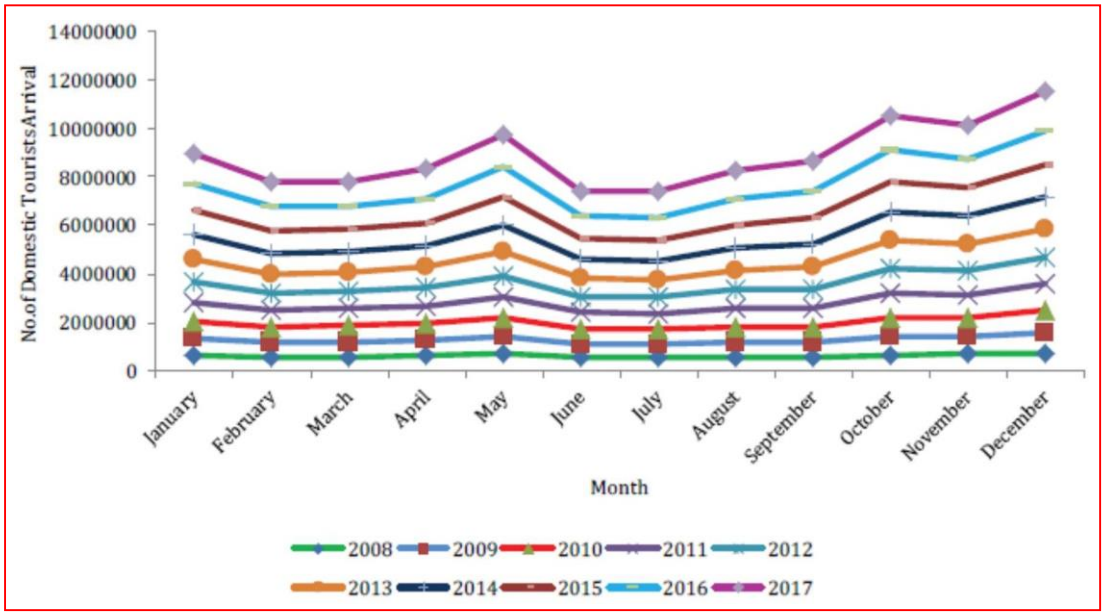

Fig. 3.28 Month wise comparison of domestic tourist arrival in Kerala from 2008 to 2017

ANTICIPATED ENVIRONMENTAL IMPACTS MEASURES

Introduction

The identification, evaluation and prediction of Impacts and suggesting mitigation measures is the most important step of an environmental impact assessment and this always depends. The quantitative prediction of impacts is vital to define pragmatic environmental management plan for implementation during the construction and operation phase for minimizing the adverse impacts on environmental quality.

The SilverLine alignment avoids declared regions such as national parks, wildlife sanctuaries, biosphere reserves, and other ecologically sensitive places. However, because the alignment runs along to one of the Global Biodiversity Hotspots, the Western Ghats, biodiversity consequences must be carefully examined. Where the alignment passes over or above a number of families and institutions (shops, schools, temples and mosques, etc.) must be relocated and restored. Specific places are also analysed in detail for societal implications, and mitigating methods are offered. The proposed SilverLine project has a number of positive impacts and benefits, including technology transfer, safe, fast, and energy efficient transportation connectivity between Thiruvananthapuram and Kasaragod, increased productivity, job creation, and promoting a modal shift from private vehicles to SilverLine rail, resulting in a reduction in air pollutants and greenhouse gas emissions. Anticipated impacts due to various activities envisaged during construction and operation of SilverLine have been assessed and further mitigation measures have been suggested for each of the following environmental components.

- Land Environment (Impact on land use, soil fertility and agriculture)
- Water Environment ((Impact on ground water quality, surface water quality)
- Air Environment (Impact on Ambient air quality)
- Noise Environment (Impact on Ambient Noise & Vibration)
- Biological Environment (Impact on flora and fauna)
- Socio-economic Environment (Impact on other infrastructure, employment, public health and safety, cultural resources and aesthetics)

Land Environment

Land Environment: Impact during Construction Phase

There will be a change in topography and land use of the corridor due to acquisition of

agricultural land, commercial and/ or residential land for the proposed SilverLine alignment. During construction phase. Cutting of trees that falls within formation width of 18 to 25 m may reduce the ecological balance of the area and also trees and bushes will be cleared for the construction of associated infrastructure. No forest area exists along the project alignment or its corridor. The impact on land use characteristics during construction phase also include impact to ancillary sites such as borrow areas, quarry areas, labour camps, contractors' camps, etc. Large quantity of quarry material will be required for the construction of project infrastructure.

Water Environment

The proposed semi-high-speed rail alignment is running through various land uses including wetlands/ paddy fields and many times will cross rivers and drains. The impacts predicted due to the semi-high-speed rail corridor on water environment could be attributed to pre-construction (location, design, etc.), construction and operation phases of project.

Air Environment

The air environment in the proposed SilverLine corridor will be affected by various suggestionors including the design, process technology, raw materials used, transportation of raw materials and products, storage facilities and material handling, and operation and maintenance practices.

Noise and Vibration

A field review of the existing and proposed land uses within 500 m on either side of the proposed alignment and construction sites was undertaken for identifying the nature and location of sensitive receptors. For noise and vibration assessment purposes, all residential receivers are considered to be of a sensitive nature. Other sensitive receptors include commercial receptors, educational facilities, schools, *Anganvadis*, places of worship and hospitals.

Socio-economic Environment

A socio- economic survey was carried out in the SilverLine corridor as part of the project to identiy the perception/ attitude of the people towars the project. The survey was conducted along the alignment, around 30 m from the centre line of the alignment. The survey was conducted through consultation and disclosing the project details to the project affected people in the grama panchayats and urban local bodies through which the SilverLine is passing.

ANALYSIS OF ALTERNATIVES - PROJECT ALIGNMENT AND TECHNOLOGY

Introduction

Analysis of Alternatives (AoA) aims to identify alternate project options and should be conducted during project design and planning stage in order to identify cost-effective alternatives, reduce adverse impacts and risks, improve performance and validate the appropriateness of the selected option. The proposed SilverLine connects the State Capital, Thiruvananthapuram to the northern most district, Kasaragod. The SilverLine passes through the entire length of the State and the environmental and socio-economic aspects influence the route alignment.

With or Without Project Scenario

The 'with' or 'without' project scenarios are a major consideration of the cost-benefit analysis of a project. Providing better and faster connectivity across the State will ensure that goods and people can move in and out of the areas more efficiently. Benefits of the SilverLine over the other mode of transportation are presented inTable 5.1.

Table 5.1 Benefits of SilverLine over the other mode of transportation

Parameters	SilverLine	Other mode of Transportation (Railway/ Road/ Air/ Water way)
Land use	The SilverLine is more efficient on landuse – an average SilverLine uses ~2.4 ha per km. Land impacts significantly reduced as alignment from Tirur to Kasaragod are parallel to the existing railway line. Elevated alignment will again reduce the land impacts	For widening of the road to meet the requirement, 6.1 ha per km land need to be acquired The land requirement for construction of 6 lane highway to cater same amount of traffic is 3 times more

Travel Time	Time savings from the SilverLine are significant. 4 hours after the start of SilverLine service between Thiruvananthapuram and Kasaragod. As an alternative against air travel, SilverLine offers convenience through better connectivity to local transport infrastructure.	More time due to slow speed. 10 to 12 hours depending upon the speed of train. By air it takes 1 hour to travel between Thiruvananthapuram and Kannur. Access to the airport is not convenient in all the cities and not connected to local city transport.
GHG Emissions	Due to higher energy efficiency of the SilverLine operations, net GHG emissions are expected to be lower. Annual average emissions reduction of about 2,87,994 Tonnes CO_2e/year	The GHG emission has been estimated to be 31,20,328 Tonnes CO_2e in 2019 and it will be 45,84,786 Tonnes CO_2e in year 2024, without SilverLine operation
Fuel Consumption	Significant reduction in fuel consumption	Higher fuel consumption due to increased number of private vehicles

Alternative Scenarios for SilverLine

This section deals with the rationales behind preferred choice of taking the Embankment Route *Vs* the No-SilverLine/ Business as Usual evaluation *Vs* Express Highway and comparison of impacts.

Alternative 1- SilverLine with Embankment, Cuttings and viaducts with minimal cut and cover, Tunnels and Bridges

More than 60% of the alignment is on embankment, 19% on cuttings, 11% on viaducts and less than 10% of the alignment is on cut and cover, bridges and Tunnel.

Alternative 2 - No SilverLine - Business-as-Usual

In the absence of SilverLine, the passenger travel choices will continue to operate on the existing modes including road, rail and air.

Alternative 3 – Express Highway

Construction of a new express highway requires more land acquisition and may have high social and environmental impacts. The land requirement for construction of Express highway to cater same amount of traffic is 3 times more.

Comparison of Alternatives

As can be seen from the preceding sections, each of the three options has some advantages and disadvantages in terms of overall impact (environmental, social, etc.). Alternative 1 is the most desired option after weighing the positives and downsides of the three alternatives as well as some limitations. The results of a thorough assessment of three options are summarised and presented.

Study on Socio-Economic Environment

A socio-economic survey was done as part of the project. The survey was conducted along the alignment. The survey was conducted through consultation and disclosing the project details to the project affected people in the grama panchayats and urban local bodies through which the SilverLine is passing. A structured schedule was designed to collect information from the residents staying within 30 m of the proposed alignment. The grama pacnchayts and urban local bodies where the alignment passes through are randomly selected for the study. Further a cluster sample method was used for identifying the households to be interviewed. Demographic and economic data were collected from the respondents. Information regarding land availability, land use and structure of the same is also collected. Availability of basic amenities like schools, hospitals, etc were asked to assess the infrastructure need of the population after materializing the proposed rail line. The attitude of the people towards the project will reveal their expectations and apprehension based on rumors and misconceptions. Such information is also collected during the field work. The schedule was tested with a limited sample and modified. The data collection was done by trained staff with mode of communication as Malayalam. The outcome of the data analyzed are provided in Tables 6.5 to 6.10. and Fig. 6.3 to 6.4.

Table 6.5 Background information of the respondent

Household information	Description	Percentage
Sex of the respondent	*Male*	*78.6*
Religion	*Hindu*	*62.2*
	Muslim	*19.3*
	Christian	*18.5*

Ownership of House	*Own*	*89.0*
Type of House	*Concrete*	*80.8*
Current status of house	*Work completed*	*90.6*
Toilet facility	*Yes*	*99.6*
Electricity	*Yes*	*99.1*
Piped water	*Yes*	*54.1*
Availability of two-wheeler	*Yes*	*69.7*
Availability of four-wheeler	*Yes*	*43.0*
Total		*481*

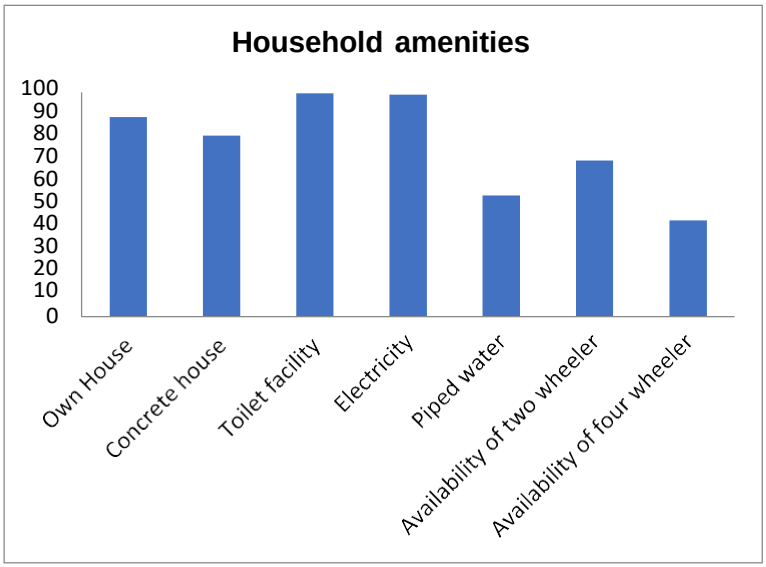

Fig. 6.3 Graphical representation of household amenities

A total of 481 data were analyzed for the final report. The interviewer tried to meet the head of the household for accurate information. In the absence of that person, the next senior member was interviewed. 78.6 percent of the respondents were male. More than three fifth of the households were Hindus. Percentage share of Muslims and Christians hovered around 19 percent. It is almost similar to the religious composition exist in the state. However, a large proportion of Hindus are residing within 30 meters of the proposed rail line. The basic amenities available in the house are also collected. 89 percent of the respondents own their house. Nearly 11 percent are staying in rented houses. Majority of the houses (90.6) are fully constructed. Concrete houses form 81 percent of the total constructed houses. Availability of electricity and toilet are almost universal. However, only 54 percent of the houses are using piped water for drinking. Others mainly depend on well.

Presence of household amenities like Television, Refrigerator is also universal. 70 percent of the houses have a two-wheeler, while that reduces to 43 percent for four wheelers.

Information about family and income were collected for the study. As the State has already explored the benefits of nuclear family structure, only 29.6 percent of the households are following joint family system. 67.7percent of the houses in the area are nuclear families and 2.7 percent of the interviewers stay single. 47.6 percent of the houses have only a single male member and another 2.6 percent have no male members. At the same time, only one percent of the houses have no female members. Presence of 2 or more female members is reported in 53.5 percent of the houses. Surprisingly, 31 percent of the households have no children. This can be coincided with the current low-fertility regime in the State having TFR of 1.8. 37 percent of the households have two children and households with more than 2 children are only 8.7.

Table 6.6 Family and economic situation of the household

Variables	Description	Percentage
Type of family	*Joint family*	*29.6*
No. of male members	*None*	*2.6*
	Single	*47.6*
	2 or more	*49.8*
No. of female members	*None*	*1.2*
	Single	*45.3*
	2 or more	*53.5*
No. of children	*None*	*30.7*
	Single	*23.9*
	2 Children	*36.6*
	More than 2	*8.7*
Monthly income of the family	*Less than 1000*	*49.6*
	1000 to 10000	*36.0*
	More than10000	*14.4*
Monthly expenditure	*Less than 5000*	*44.0*
	5000-10000	*40.5*
	More than10000	*15.5*
Main source of income	*Salary*	*38.9*
	Agriculture	*16.8*
	Business	*19.6*
	Manual &others	*24.7*
Additional source of income	*Yes*	*20.4*
Type of ration card	*white*	*29.5*

	blue	*32.4*
	pink	*23.3*
	yellow	*5.8*
	No Card	*9.0*
No. of earning members	*Nobody*	*4.3*
	Single	*71.2*
	2 or more	*24.5*
No. of dependents	*Nobody*	*3.2*
	1dependent	*33.4*
	2or more	*63.4*
Total		***481***

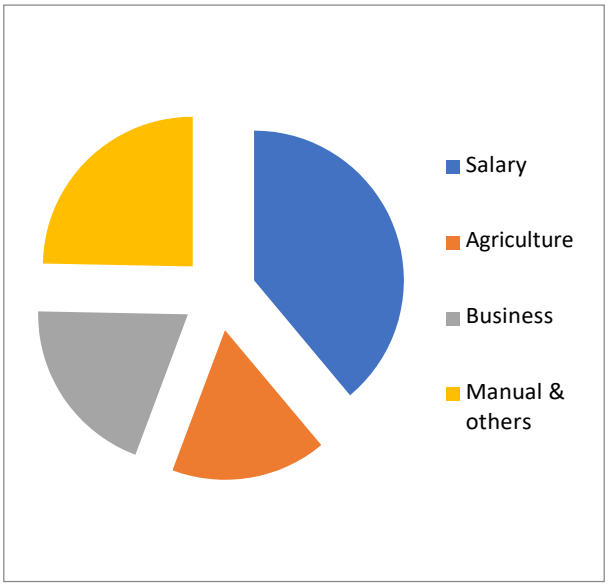

Fig 6.4 Graphical representation of main source of income

There is a tendency not to reveal the income of the household in surveys in India. Here also 50 percent of the houses reported their monthly income below Rs. 1000/- which is not reliable. At the same time, only 20 percent of the households reported their expenditure below Rs. 1000/-. Expenditure based analysis reveals that another 24 percent of them are spending about Rs. 5000/- to meet their monthly consumption. About 40 percent of the households spent between Rs. 5000 to 10000 in a month. About 39 percent of the households reported monthly salary from Government jobs or private as their main source of income. Another one fourth is involved in manual labor. Agriculture is the main source of income for 17 percent of the households. 20 percent of the entire households have reported additional source of income. 14 percent of them are getting additional income from

agriculture activities. In total, about 31 percent of the entire households are engaged in agriculture activities beside the proposed rail line. The colour of the Ration card is also asked to verify their financial status. About 60 percent of the households hold either white or blue ration cards. It revealed that 23 percent have Pink colored Ration card and another 5.8 percent is having Yellow, which comes under special subsidized categories. It is worrying that nine percent of the households have not obtained a ration card for them. Nearly three quarter of the households have single earning member and 25 percent have two or more earning members. 63 percent of the household have 2 or more dependants and 33 percent have one dependant. As the number of dependants increase their monthly consumption on education and treatments of elderly will also increase. Only 3 percent of the households are left without dependent population.

PROJECT BENIFITS

The Thiruvananthapuam - Kasaragod Semi High-speed Rail Project (popularly known as the SilverLine) is a visionary project which will create a new era of safety, speed and service for the people of Kerala. The SilverLine project brings with it several promising prospectsas detailed in the subsequent sections of this chapter.

Sl. No.	Monitoring Item	Unit	Unit Cost (INR)	Quantity	Total Cost (INR in Crore)
1	Air quality monitoring	No. of Sample	7500	330	0.248
2	Surface Water quality monitoring	No. of Sample	5000	720	0.36
3	Ground Water quality monitoring	No. of Sample	5000	720	0.36
4	Soil Quality	No. of Sample	6000	256	0.154
5	Monitoring of Embankment Drainage	Location	15000	200	0.3
6	Waste Management	Lump sum	2400000	1	0.24
7	Noise Monitoring	No. of Sample	5000	440	0.22
8	Vibration Monitoring	No. of Sample	20000	320	0.64
9	Biota and ecosystem	Lump sum	2400000	1	0.24
10	Land Contamination Monitoring	Lump sum	1600000	1	0.16

11	Occupational Health Monitoring	Session	100000	20	0.2
12	Involuntary resettlement, Poor	Lump sum			5.0
13	Social Aspects	Lump sum	1200000	1	0.12
14	Misdistribution of benefits and damages	Lump sum	1200000	1	0.12
15	Local conflicts of interest	Lump sum	1200000	1	0.12
Total					**8.482**

Observations from the project

There has been a significant increase in the Train Services on the existing double line between Thiruvananthapuram and Kasaragod leading to increased Capacity utilization to the tune of 115% in some sections. Due to the presence of large number of level crossings and sharp curves, even the fastest train takes 12 hrs to cover this section, traversing a length of 560 kms with a poor average speed of 45km/Hr. As such; there is no scope to increase the operating speed on these existing railway sections. In order to cater the future demand of rail traffic, 3rd and 4th Railway line between Thiruvananthapuram and Kasaragod as a Semi High Speed Rail (SilverLine) corridor is proposed with a maximum operational speed of 200kmph, to connect the north and south ends of the state in4 hrs. Kerala Rail Development Corporation Limited-a joint venture company of Government of India and Government of Kerala for rail development in Kerala State - was assigned as the execution agency of this prestigious project for planning and implementation.

Result

1) Longitudinal alignment along thickly populate cities serving maximum population in the state
2) 11 Stations: Thiruvananthapuram, Kollam, Chengannur, Kottayam, Ernakulam, Kochi Airport, Thrissur, Tirur, Kozhikode, Kannur Kasaragod. Traverses through 11 districts
3) Running time between Thiruvananthapuram kasargodu - 3:52 hrs & to Ernakulam - 9 minutes
4) Operating speed – 200 kmph
5) Project Cost – INR63,941 crore
6) Proposed fare is @ Rs. 2.75/km, comparable to the Third -AC train fare

7) Expected daily ridership of approx. 80,000 in 2025-26 and approx. 1.5 lakhs by 2051.

8) Adoption of the best state-of-the-art technology for Railway Systems.

9) Inter-change points at Kochuveli, Thrissur, & Kasargod stations to connect the existing Indian Railway network and seamless travel

10) Envisaged as Green-Project and aimed to reduce emission of 2.8 Lakh tons of Carbon dioxide per year (Carbon footprint) and contribute substantially to the Economic and Industrial advancement of the State.

Key Benefits

- Non-polluting mode of travel using Renewable energy.
- Stimulates economic development of the state.
- Generates employment opportunities.
- Complements tourism sector along the alignment.
- Enhances land value near the station area.
- Promotes business opportunities.

Conclusion

Suggestions over Myths

1. Myth:

Silverline can run on Broad Gauge and is also a better option than the Standard Gauge !

Suggestion:

In India, trains runs on Broad Gauge system in the existing Indian Railway network. Currently the maximum speed of trains in India is 160 Kmph. There is no universally acceptableinternational standards for Broad Gauge system. The standards of Broad Gauge are governed by the IRS Codes for train running in Indian railways. In order to run trains above 160 Kmph in Broad Gauge, new Standard/Specifications are to be framed in India which will take considerable time and effort.

In the international scenario Standard Gauge systems in most of the countries with trains running up to 350 Kmph are successfully operational for years. These Standard Gauge Systems are governed by European and International Standards like EN and UIC codes. Further, for rolling stock, technology is not available for speeds above 160 Kmph in India and not many international manusuggestionurers have technology for supplying Broad Gauge coaches.

The shortcomings of the Broad Gauge has been appraised by the new High Speed, semi high speed and metro projects in India and accordingly the Mumbai-Ahmedabad High Speed Rail Project, the RRTS Project in Delhi, all the Metro Projects have adopted Standard Gauge which is a proven technology.

2. Myth:

There is no need to build a separate rail corridor if the new track is built parallel to the existing Indian Railways track !

Suggestion:

Silver line is proposed as 3rd and 4th line between Thiruvananthapuram and Kasaragod parallel to the existing Indian Railway network. Since it was decided to have an operational speed of 200 Kmph, it was technically not feasible to have the new track adjacent to the existing railway track in south Kerala between Thiruvananthapuram and Tirur due to the large number of sharp curves and uneven terrain. Hence, a green field alignment has been proposed between Thiruvananthapuram and Tirur duly taking the alignment through least populated areas. However, since the existing rail alignment between Tirur and Kasaragod have relatively less number of sharp curves, the Silverline is planned parallel and adjacent to the existing railway track.

3. Myth:

Silverline will be irrelevant as Indian Railways is trying to increase the speed of existing trains!

Suggestion:

Indian Railway is currently running Gatimaan Express in Delhi-Agra section at a speed of 160 Kmph. Railway is also planning to upgrade the speed in Delhi-Mumbai and Delhi-Howrah section from 130 Kmph to 160 Kmph by augmenting the infrastructure in these sections including the provision of fencing. As per Railways current plan, the Golden Quadrilateral line (the line connecting Delhi, Mumbai, Chennai and Howrah) will be considered next for upgrading the speed. Currently, no railway section in Kerala has been planned for speed up-gradation.

The existing rail alignments have around 626 curves between Thiruvananthapuram and Kasaragod. Hence for increasing the speed in Kerala, these curves have to be straightened in addition to strengthening the existing formation, bridges and track.

4. Myth:

By switching to automatic signalling, the speed of the existing trains can be increased!

Suggestion:

In Kerala Absolute Block Signalling System is currently operational wherein only one train run in a block section between two stations. By providing automatic signalling system, more number of trains can run in one block section but the speed of trains running on existing rail infrastructure cannot be increased. For increasing the sectional speed, the track structure has to be improved, bridges have to be strengthened and the curves have to be straightened. Alsofencing needs to be provided for speeds above

140 Kmph as per Indian Railways policy guidelines to ensure safety of public. Providing Automatic/Electronic Signalling System will only marginally increase the average speed and cannot in any way increase the speed near to 200 Kmph. The present Railway system have trains like Superfast trains, Mail/Express Trains, Passenger Trains and Goods Trains running at a speed varying from 100 Kmph to 35 Kmph. In such a mixed traffic system, speed of the slowest train will be the deciding suggestionor.

5. Myth:

It is possible to increase the train speeds by straightening the curves of the existing track and taking away the speed restrictions

Suggestion:

The existing Railway alignment from Thiruvananthapuram to Kasaragod have around 626 curves which will have speed restrictions varying from 20 Kmph to 110 Kmph. If the existing railway network has to be made suitable for speeds beyond 110 Kmph, all these curves have to be straightened. Out of the 576 Kms track, 36% of the trackis in curved alignment. Strengthening these 626 curves is a herculean task. As the existing railway line passes through densely populated and urban area, it is highly impracticable to straighten these curves since straight alignment will have to pass through thickly populated city centres. It is worthwhile to mention that the existing Broad Gauge network in Kerala is the same Meter Gauge network constructed by Britishers which was converted into Broad Gauge without straightening the curves. Further because of the poor soil conditions and old bridges, a large number of speed restrictions are in force and hence it is practically impossible to increase the speed. The mixed type of traffic consisting of Mail/Express trains, superfast trains and low speed goods trains also does not permit running large number of high speed trains.

6. Myth:

The only solution to train traffic woes in the state is doubling of the track !

Suggestion:

It is true that, doubling of the existing single line railway track in Kerala should have happened decades ago. The track being doubled currently will solve the existing traffic problem like over saturation, late running of trains etc. The current ongoing doubling work will not solve the real transportation requirements that will arise after 10 years and beyond. In the current doubling project, the second line is planned with the same curves running parallel to the existing alignment and hence the maximum speed of the section will not increase despite improvements made in the track. Hence there will not be any substantial time saving in the travel across Kerala even after the doubling works are completed.

7. Myth:

There is no need of relying on foreign technology, we have the facilities to manusuggestionure locally the trains and accessories.

Suggestion:

Semi High Speed Rail Project is a conventional railway system similar to the one operational in Indian Railways for speeds up to 160 Kmph. In Silverline, the designed speed has been fixed as 220 Kmph with an operational speed of 200 Kmph based on European/International Standards. Technology and manusuggestionurers are locally available except for rolling stock(train sets). Even rolling stock (Trainsets) to suit our specifications can be manusuggestionured in India as "Make in India" programme since many international train manusuggestionurers have manusuggestionuring facility in India. Silverline is conceived in full compliance with Public Procurement Policy guidelines of Government of India and the Atmanirbhar Bharat programme.

8. Myth:

If the Silverline tracks are in BG, the existing Indian Railway's long distance trains and freight trains can use Silverline track.

Suggestion:

For running trains at 200 Kmph, Standard Gauge is the most suitable technology. Further, Indian Railways have approved the proposal of Silverline as a standalone network. The existing trains of Indian Railways are currently not equipped with the latest ATP (Automatic Train Protection), ATO (Automatic Train Operation) systems which are essential for operation in Silverline at 200 Kmph. The rolling stock sets of Indian Railways including freight trains which have a maximum speed of 70 Kmph cannot be run in the Silverline, which is designed for 200 Kmph. The speed differential between the Indian Railway trains and Silverline trains will impact the average speed and throughput of the Silverline trains.

9. Myth:

If the National Highway development becomes a reality, what is the need of Silverline project?

Suggestion:

Currently, the National Highways in the state are facing unbearable traffic congestion with increase in vehicles every year. When National Highway development becomes the reality, there will be short term relief. But, as per the traffic survey, within five years these national highways will be again choked. Hence in every 5 to 10 years, Kerala has to plan for more National Highways or alternatively plan for Express Highways in green corridor. The current policy of the Government is to reduce the number of polluting vehicles and to switch over to public transport for which Silverline will contribute in a big way.

Silverline will also contribute in reducing the usage of fossil fuel and help in achieving the Paris Convention of Climate Change. Due to the increase in vehicle population, the average travel time by National Highway is not expected to reduce significantly and people will be forced to waste their productive time in travelling. The land requirement for Silverline is half of that of a 6 lane National Highway and can carry three times the traffic. The Silverline has been planned to take care of the traffic requirement over a period of next 50 years.

10. Myth:
The suburban rail project was better than the Silverline !

Suggestion:
Government of Kerala has taken the initiative and proposed a suburban rail project between Thiruvananthapuram and Chengannur. As per the proposed suburban project plan, automatic signalling will be provided in the existing Indian Railway network and additional trains will be operated to take care of the intercity commuters. However, Ministry of Railways have not agreed for the proposal since the existing railway network with two lines is primarily to cater for the long distance trains and freight trains of Indian Railways. Ministry of Railways have suggested that State Government may construct two additional lines for intercity suburban traffic and accordingly Government of Kerala has proposed this Silverline with two additional lines with a speed of 200 Kmph.

11. Myth:
Kerala needs bullet (high speed) trains in place of outdated semi high-speed rail corridor !
Suggestion:

In Kerala, the cities enroute the alignment are developed and the trains need to stop at all the 11 district headquarters or activity centres to give maximum benefit for the travellers. The average distance between the stations is around 50 kms. In a high speed rail networkwith trains running at 350 Kmph, a train has to travel around 20-25 Kms from start to reach the speed of 350 Kmph. Also for stopping a train, brake has to be applied at a distance of five kilometres before the station. So effectively the distance travelled by train at 350 kmph is considerably less and we are not effectively utilizing high speed network in major portion of the network. Stopping only at alternate stations may help to achieve speed but will not be beneficial to travellers resulting in lower traffic and affecting viability. In Kerala we have found that the average trip length is around 200 Kms, i.e majority of the people are travelling only for a distance of 200 Kms. The time taken to travel 200 Kms in a high speed network is just above one hour and in a semi high speed system it is one hour 25 minutes. Hence time saved is not substantial compared with the capital cost of construction. For constructing high speed network at 350 Kmph, the cost of construction will be twice compared to the semi high speed network and accordingly the ticket fares will also be doubled in the range of Rs.5 to 6 per kilometre, which may not be affordable to a large section of travelling public.

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