

Impact of the Proposed Cargo Port on the Traffic Characteristics of Ponnani Town and Abatement Measures

Irshad C.K., Gummy Joseph Kattoor, Abdul Malik K.V.

Abstract— *Traffic impact assessment is a powerful tool for engineers to determine the possible impacts of a project on the traffic and transportation infrastructure and to identify the road way improvements required to ensure that the road network will operate safely and efficiently for upcoming years. This study examines the impact that a cargo port at Ponnani would have on roadway travel and transportation infrastructure, both today and in the future, throughout the region and recommend abatement measures. The study will use a spread sheet based model to determine the number of road vehicles especially cargo trucks that would be added to the existing traffic flows as a result of the proposed cargo port. The assessment will be focused on the daily and peak hour traffic associated with the project after it will be commissioned on 2017. Specific travel demand forecasts for the Ponnani town would be assessed both for the existing traffic situation and for the traffic attracted due to the initiation of the cargo port.*

Index Terms— *Traffic impact assessment, Cargo port, Cargo traffic.*

I. INTRODUCTION

With the evolution of containers and growth in inter-modalism, recent years have seen a tremendous growth in international and domestic movement of trade through seaports. Due to increase in port activity, there has been an increase in port traffic [1]. The Government of Kerala intends to provide a boost to coastal shipping with development of ports, which will ease the burden on the heavily congested highways in the state apart from savings in transportation cost. Ponnani is a coastal town in Malappuram district of Kerala. It is only a fishing harbour with a signal station. The Government of Kerala has awarded a project to Chennai based M/s. Malabar Port Private Limited (MPPL) for developing an All Weather Deep Water port at Ponnani. In this regard GoK and MPPL have signed a concession agreement, dated September 29, 2011. It is considered that the port at Ponnani would be the first port in India to be developed by reclaiming land from the sea.

The proposed cargo port is located in the estuary where the Bharathapuzha joins the Arabian Sea and the all-weather

facility now being developed is designed to handle vessels of up to 50,000 DWT (Dead Weight Tonnage). The port is expected to speed up all-round development in the Malappuram, Palakkad and Thrissur districts and also prop up the proposed Coimbatore - Palakkad industrial belt. The Port is first in Kerala to be taken up the development works through Pubic Private Partnership (PPP).

Ponnani is likely to be the closest port from the industrialized regions like South Karnataka, Central and Western Tamil Nadu. Due to the vast development that will be initiated at the Ponnani cargo port, there is a great chance for attracting heavy traffic towards this town. So the existing infrastructure may be inadequate to cater for this increase in the travel demand. This study examines the impact that a cargo port at Ponnani would have on roadway travel and transportation infrastructure, both today and in the future, throughout the region and recommend abatement measures.

II. METHODOLOGY

A spreadsheet based model was developed to determine the number of road vehicles especially cargo trucks that would be added to the existing traffic flows as a result of the proposed cargo port from 2017 onwards.

A conventional four-step process was used for determining the traffic that will be attracted to the port, namely trip generation which comprises of calculating the number of trips generated by the proposed port, trip distribution in which each trip was connected with a destination, modal split in which, only the cargo trucks were considered and the fourth step that is the trip assignment where the truck trip were assigned to a particular route through Ponnani town. The assessment focused on the daily and peak hour traffic associated with the project after it will be commissioned on 2017. This enabled the effect of the port on the capacity of the road network to be assessed. Specific travel demand forecasts for the Ponnani town would be assessed both for the existing traffic situation and for the traffic attracted due to the initiation of the cargo port.

The traffic analysis identifies the existing or projected future roadway capacity, traffic safety and impacts on road infrastructure. The several impacts caused due to the commission of this cargo port in Ponnani town were determined and these impacts were analyzed. This was followed by suggestion of suitable abatement measures and recommendations in order to counteract these imposed impacts.

Manuscript published on 30 December 2013.

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III. STUDY AREA AND NETWORKS

Ponnani Municipality is the study area. It is a coastal municipality and an important fishing center in Malappuram District in the Indian state of Kerala, spread over an area of 24.8 Km².

The NH 66 (Panvel-Cochin Highway) passes through the town Centre, and it has direct connectivity to Guruvayur through SH-62. Road connectivity for the port will make use of the existing network. The distance of the port site is approximately 0.5 km from NH. Apart from the road sections, the intersections usually act as bottlenecks in the network that can also experience capacity problems. The study intersections were selected based on their proximity to the Port site. Fig 1 shows the study area with roads and study intersections.

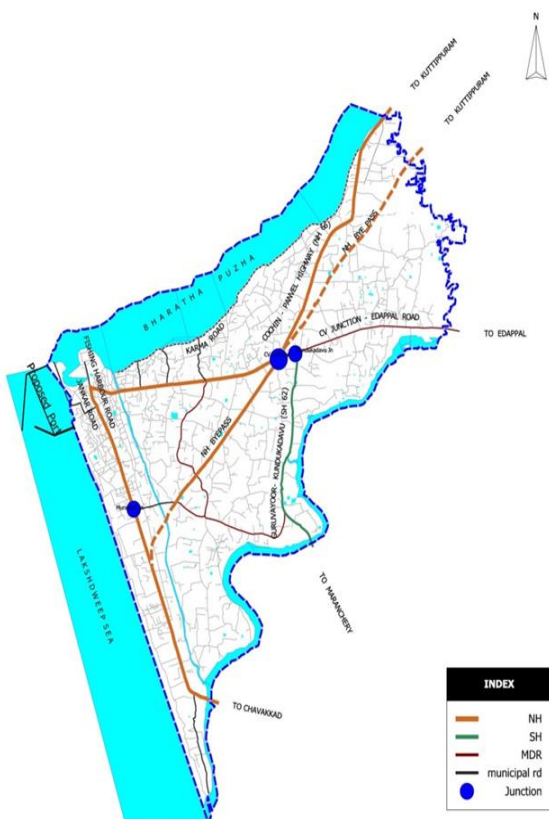


Fig. 1 Road Networks and Study Intersections on Ponnani Town Along with Proposed Port

IV. EXISTING TRAFFIC CHARACTERISTICS

Use Existing Traffic details were collected from the different locations of Ponnani municipality by conducting different traffic surveys such as Road inventory survey, mid-block volume survey, outer cordon volume survey, turning movement survey on intersections and Speed and delay survey. In that volume surveys are the main data source for this traffic impact study.

A. Traffic Volume at Mid-Block and outer-cordon Stations

Table I

Existing (2013) Volume - Capacity Ratio of Major Road Links and Outer Cordons in Ponnani

Sl No	Road Links or Count Stations	Capacity PCU/hr	Peak Volume PCU/hr	V/C Ratio
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1	Chamravattom to CV Jn	1500	1489.5	0.99
2	CV Jn to Chandapadi	1500	3016	2.01
3	Chandappadi to Court	1200	1404	1.17
4	Court to Municipal Jn	1500	1536	1.02
5	NH Bye pass	1500	1017	0.67
6	CV Jn to Cheriya palam	1500	1491	0.93
7	Gym Road	700	243.5	0.34
8	Harbour Road	700	347	0.49
9	Gulab Nagar	1500	786	0.524
10	Puthu Ponnani	1500	929	0.619
11	Cheriya Palam	1500	1004	0.669
12	KK Bridge	1200	488.5	0.407

On NH 66, sections are heterogeneous in nature, were found to be over utilized or near about the capacity. Even though the stretch between Chandappadi to court is a part of NH 66, the inventory survey indicates there is no such a quality of arterial road with respect to pavement width, right of way etc., there for these stretch is treated as Sub arterial road. The all stretches on NH 66 through Ponnani town were found to be over utilized.

The capacity utilization of the other major links in the town was found to be almost within the capacity.

The river shore/ fishing harbour roads such as Gym road or Harbour road were found to be within the capacity limit.

Among the twelve selected sections/roads, the section between CV junction to Chandappadi constituted the highest v/c ratio of 2.01 and thus leading to inevitable traffic congestion and delay.

B. Traffic Movements at Major Intersections

The volume count at intersections was carried out for a period of 15 hours ranging from 7.00 am to 10.00 pm to ascertain the morning and evening peak hour traffic demands. Total volume, composition of traffic and turning characteristics were recorded for different types of vehicles by trained field staff for each intersection separately. The peak hour traffic volume on these intersections is given in Table 2.

Table II

Peak Hour Traffic Volume on Study Intersections

Sl. No.	Intersection and Arms	Peak Hour Traffic (PCU/hr)
1	CV Junction	4019
	a) Chamravattom Road	1969
	b) Ponnani Road	2482
	c) NH bye pass	1483
2	Edappal Road	2250
	KK Junction	2159
	a) Ponnani Road	1166
	b) Edappal Road	1472
3	c) Maranchery Road	1196
	Municipal Junction	1550
	a) Ponnani Road	1065
	b) Chavakkad Road	1169
	c) NH Bye pass	897

V. PORT TRAFFIC ASSESSMENT

A detailed traffic study was carried out by M/s Feedback Services (P) Ltd to assess the traffic potential of various commodities for Ponnani port. Northern, Western and Central Tamil Nadu and South Karnataka form the catchment area for Ponnani port. Coimbatore, Tirupur, Erode, Salem, Chennai, Bangalore, Mysore and Madurai are the cities which will be benefitted with Ponnani port. These areas have got several major industries and agricultural centers which are expected to make use of Ponnani port for importing or exporting either their raw materials or finished products. It is estimated that 44% of the container will be transported via dedicated rail connectivity and 56% via proposed road connectivity. The effective working days are considered as 350 days. A commodity wise traffic expected to be handled at Ponnani through road for twenty eight years assuming realistic scenario is given in table 3.

Table III
Expected Traffic From/To the Port through Road

Year	Expected Commodity (MTPA)			Total (MTPA)	Total No. of Vehicles AADT	PCUs AADT
	Container	General Cargo	Thermal Cargo			
2017	2.128	1.4	0.168	3.696	506	2278
2020	4.088	2.856	0.224	7.168	986	4437
2025	5.768	3.808	0.28	9.856	1350	6075
2030	7.504	4.872	0.392	12.768	1749	7870
2035	9.576	6.048	0.504	16.128	2209	9941
2040	12.208	7.448	0.672	20.328	2785	12530
2045	15.568	9.128	0.84	25.536	3498	15741

VI. TOTAL FUTURE TRAFFIC DEMANDS

Traffic in Kerala has been growing at a rate of 10-12% every year. As Ponnani is a medium class town in Kerala and due to the absence of the past traffic data's for the Ponnani, it is assumed that the traffic is growing at rate of 11% every year, which is an average traffic growth rate of the states in Kerala.

A. Proposed Routes or Roads under Construction

The road connectivity for the port will make use of the existing road network. Strengthening of the existing Jankar road is necessary to carry heavy traffic from the cargo port. Recently four lane NH byes pass under developing, which will connect CV Junction to Kuttippuram Bridge, which is expected to open before January 2015. Another Municipal road named Karma road is under construction which will connect the port area to Chamravattom barrage along the banks of Bharathapuzha.

Both new NH bye pass and Karma road were not considered during the volume study. Karma road is a river side road and it has not followed any standard specifications, hence it

cannot support heavy traffic, but it may useful for the passage of private vehicles of the staffs of the port. Hence Karma road is not considered for the future traffic projection due to its inability to support heavy traffic movement. The new NH bye pass connecting CV junction to Kuttippuram Bridge will attract traffic from the existing CV junction-Tavanur to Kuttippuram stretch on NH 66. This diversion would affect only the traffic in the existing Chamravattom to CV junction stretch and the external cordon at Gulab nagar on NH-66. A certain percentage of traffic shall be diverted to the new NH bye pass after opening it by taking an assumption that the major share of traffic is through the road which have more capacity than the existing portion of the NH between CV junction to Chamravattom. After the opening of NH new bye pass connecting CV junction to Kuttippuram in 2015, about 70% of the traffic of the existing CV junction to Kuttippuram stretch will be divert to the new NH and remaining 30% will be continued through the existing route.

B. Traffic Due to Other Development

No planned or approved development projects within or near the Ponnani town are expected to have an impact on traffic conditions by upcoming years.

C. Port Generated Traffic

The proposed Ponnani port is likely to augment the traffic on Ponnani to Palakkad road and NH 66 especially in the section between Kuttippuram to Chavakkad.

1) Trip Distribution from port

Based on the potential of the Hinterland it is assumed that the major share of the cargo from the Ponnani port is mainly towards East, which is Palakkad-Coimbatore-Tirupur-Erode-Salem region and it constitutes about 75-85% of the total cargo. Tirur-Malappuram-Calicut-Mysore region attracts about 10-20% of total cargo and the remaining cargo is attracted towards the southern parts of Ponnani which includes Kodungallore-Guruvayur-Thrissur regions. Based on these assumptions the cargo route assigned from the port is as follows;

80% of the total cargo from the Ponnani port will pass through the route of cargo port-Court Jn-Municipal Jn.-CV Jn-Edappal, 15% will pass through Port-Court jn- Municipal jn-CV Jn-Chamravattom via new NH bypass and only 5% of total traffic is assigned on Port-Court jn-Municipal jn-Puthu Ponnani-Chavakkad road.

2) Peak Hour Traffic Distribution from Port

The cargo port will operate 24 hours per day and 7 days a week. The cargo traffic from the port is not uniformly distributed over time. The peak hour cargo traffic distribution to the roads through Ponnani town and intersections are given in table 4.

Table IV
Peak Hour Traffic Distribution from Port

Sl. No.	Road Links/Count stations	2017	2020	2025	2030	2035	2040	2045
1	New NH Bye pass	28.46	55.46	75.94	98.38	124.3	156.7	196.8



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2	Court-Municipal Jn	189.8	369.8	506.3	655.9	828.4	1044	1312
3	Municipal Jn.-Puthu Ponnani	9.487	18.49	25.31	32.79	41.42	52.22	65.59
4	NH Bye Pass	180.3	351.3	481	623.1	787	992.2	1246
5	CV Jn-Cheriyapalam	151.8	296	405	524.7	662.7	835.5	1049
6	Cheriyapalam	151.8	296	405	524.7	662.7	835.5	1049
7	Jankar road	189.8	369.8	506.3	655.9	828.4	1044	1312

D. Future Total Traffic

Future total traffic includes traffic projection of base year traffic volume and port generated traffic. Based on the

existing and port generated traffic, the traffic, the traffic scenarios will be project for the upcoming years as given in table 5.

Table V
Future Total Traffic –Road Sections

Sl. No.	Road Links/Count stations	2014	2015	2016	2017	2020	2025	2030	2035	2040	2045
1	Gulab Nagar	873	285	316	351	467	724	1121	1738	2694	4176
2	Chamravattom-CV Jn	1653	540	599	665	885	1371	2125	3294	5105	7913
3	New NH Bye pass	-	1295	1438	1625	2178	3366	5199	7905	12410	19189
4	CV Jn-Chandappadi	3348	3716	4125	4579	6089	9439	14630	22676	35148	54480
5	Chandappadi-Court	1558	1729	1920	2131	2835	4394	6810	10556	16362	25361
6	Court-Municipal Jn	1705	1892	2100	2522	3471	5313	8107	12377	18945	29057
7	Puthu Ponnani	1031	1144	1271	1420	1894	2933	4539	7026	10879	16847
8	NH Bye Pass	1128	1253	1391	1724	2405	3664	5556	8433	12844	19617
9	CV Jn-Cheriyapalam	1655	1837	2039	2415	3306	5071	7757	11873	18211	27982
10	Cheriyapalam	1114	1237	1373	1676	2323	3547	5395	8211	12536	19185
11	KK Bridge	542	601	668	742	986	1529	2370	3673	5693	8824
12	Gym Road	270	300	333	370	492	762	1181	1831	2838	4398
13	Harbour road	385	428	475	527	701	1086	1683	2609	4044	6268

VII. IMPACT ASSESSMENT AND ABATEMENT MEASURES

A. Impact on Traffic Condition

During the construction period for the cargo port, traffic impact will occur as a result of the transportation of personnel, construction materials and equipment to the site. In the absence of data regarding construction phase, it is assumed that the traffic during the construction phase is not more than that of operation phase. Hence, here providing abatement measures will also capable for catering the traffic during the operation phase.

Traffic impacts during the operation phase will result from the transportation of personnel to and from the port, as well as the import and export of containers. The Ponnani cargo port will operate 24 hours per day, 7 days a week. The traffic from the port will affect both road sections and intersections of the town.

1) Impact on Road Sections

In 2017, the port will come in to exist, so the extra port generated volume is taken into account from the year 2017.

Fig 2 shows the percentage of additional PCU on the main corridors of Ponnani due to the port operation.

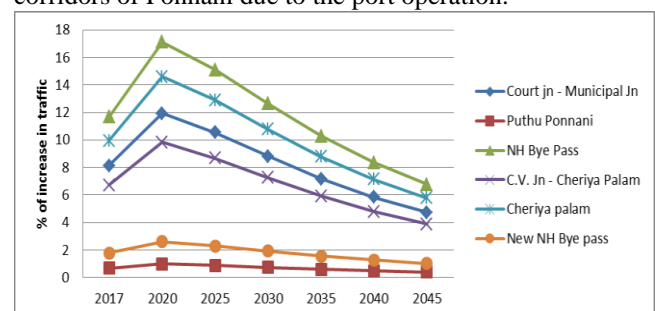


Fig. 2 Percentage of Increase in Traffic due to the Port

In the year of 2017 due to the port generated traffic the v/c increases. The road that will experience the highest traffic increase in NH bye pass and it will reach above 17% of increase in traffic during the days of 2020.

The table 6 shows the LOS for the stretches with and without considering the port generated traffic in the year 2017, 2020, 2025 and 2030.

Table 6
Level of Service for Upcoming Years (With or Without)

Sl.No.	Road Sections	2017		2020		2025		2030	
		W/O	W	W/O	W	W/O	W	W/O	W
1	Gulab Nagar	A	A	A	A	A	A	C	C
2	Chamravattom-CV Jn	A	A	A	A	E	E	F	F
3	New NH Bye pass	A	A	A	B	E	E	F	F
4	CV Jn-Chandappadi	F	F	F	F	F	F	F	F
5	Chandappadi-Court	F	F	F	F	F	F	F	F
6	Court-Municipal Jn	F	F	F	F	F	F	F	F
7	Puthu Ponnani	E	E	F	F	F	F	F	F
8	NH Bye Pass	F	F	F	F	F	F	F	F
9	CV Jn-Cheriyala Palam	F	F	F	F	F	F	F	F
10	Cheriyala Palam	F	F	F	F	F	F	F	F
11	KK Bridge	B	B	D	D	F	F	F	F
12	Gym Road	A	A	C	C	F	F	F	F
13	Harbour road	C	C	F	F	F	F	F	F

(W-With Port, W/O-Without Port)

The peak hour traffic generated during port operation, when added to the current traffic volumes, will not change the level of service of the road section except new NH bye pass in 2020. But, even without considering the port generated traffic most of the road sections have a LOS ratio of F in the year 2030, except Gulab Nagar stretch. So it is very important to take sufficient abatement measures to handle this critical situation.

2) Impact on Intersections

Based on the traffic volumes and number of arms, CV junction will be the most critical intersection in the town. As per the IRC standards, it is important to introduce a roundabout when the peak hour traffic volume lies between 500 pcu to 3000 pcu, or need signalization when volume cross 3000 pcu/hr. There for, CV junction needs signalization and other two needs roundabout now itself.

The Municipal junction will experience the highest traffic increase after the port commission due to the close proximity from the port. The peak hour PCU of total vehicles passing through the municipal junction will increase 1550 per day in 2013 to 2543 per day in 2017. The net increase in a single year of 2017 is about 8.1% due to the port operation. Fig. 3 shows the percentage of increase in total pcu of intersections.

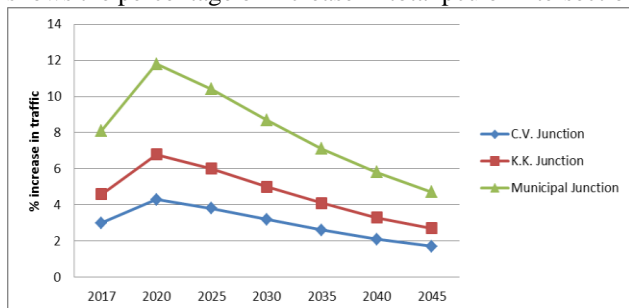


Fig. 3 Percentage of Increase in Traffic due to the Port on Intersection

Abatement Measures

The width of all road stretches should be increased to ensure a smooth traffic flow. It must be strictly implemented in the existing NH bye pass and Court Junction to Municipal Junction stretch of NH 66. These stretches must be provided with four lanes. All the municipal or local road stretches must

be upgraded to at least sub-arterial road standard to increase the capacity. Kollan padi road, JM road, Kollan padi kadavanadu road, MLA road and Pallappuram must be upgraded so that the traffic from major parallel roads will be attracted to these roads.

The proposed extension of NH bye pass from Pallappuram to A.L.P School area on NH should be made into a reality soon.

Construct a Bridge on Pookaitha kadavu across Ponnani Kayal which will connects Kollan padi Kodavanad road to the Veliamcode on NH, and also it is recommended to develop these road to two lane standard, hence the Chavakkad to Edappal or Kuttippuram traffic will diverted from the town centre.

It is also recommend to develop an outer ring road to divert the Edappal or Kuttippuram bound traffic from Chavakkad side or vice versa, by strengthening the three existing roads connecting Palappetti on NH 66 with Perumbadappu on SH 62, Biyyam on Edappal road with Athani on SH 62 and Puzhambram on Edappal road with Kandamkurumbu kavu on NH 66. In this, Palappetty Perumbadappu road and Biyyam Athani road is outside the municipality.

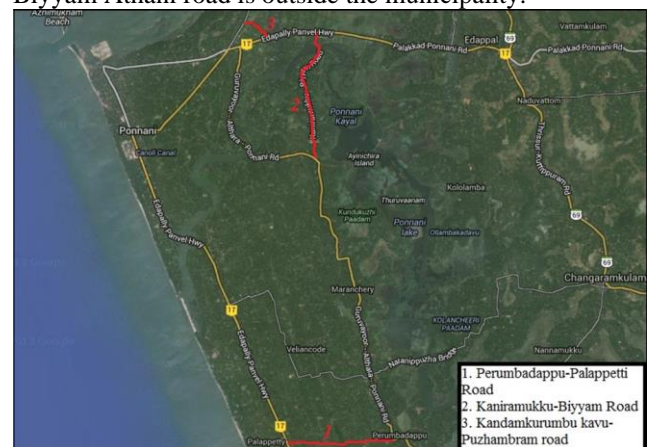


Fig. 4 Recommended Outer Ring Road by Strengthening Three Existing Roads

The use of public transport should be encouraged in municipal area. This can be done by means of introducing an effective public transport system such as low floor buses to the nearest towns or as city services. This will reduce the volume of private vehicles on the entire road stretch.

The installation of traffic signal at all the three intersections such as CV jn, KK junction and Municipal jn will reduce the number of vehicle stops and overall delay for all vehicles passing through this intersection.

B. Impact on Road Infra-Structure

Trucking has become the most popular mode of freight transportation because of its efficiency and convenience, and this preference has resulted in increased highway maintenance costs worldwide. Commonly identified pavement distress associated with heavy vehicles can be characterized as fatigue cracking and rutting. On rigid pavements damage includes transverse cracking, corner breaking, and cracking on the wheel paths. Flexible pavements and granular roads are most susceptible to rutting. In all cases, cracking and rutting increase pavement roughness and reduce pavement life.

Light vehicle have a very small impact on the structural capacity of the road pavement compared to heavy vehicles and therefore only the forecast truck volumes have been considered in this part of impact study. The impact of the port traffic on the road pavement infrastructure has been assessed by comparing the cumulative daily volume of trucks on the roads from 2017 to 2045 with and the without the project Without the port, the truck traffic on the Court jn to Municipal jn route will increase from 302 per day in 2013 to 1465 per day in 2035. This is an increase of 385% over the period of 22 years, which is equivalent to an average annual component traffic growth rate of 11% per year.

Fig. 5 shows that the percentage of increase in truck volume in major roads of Ponnani

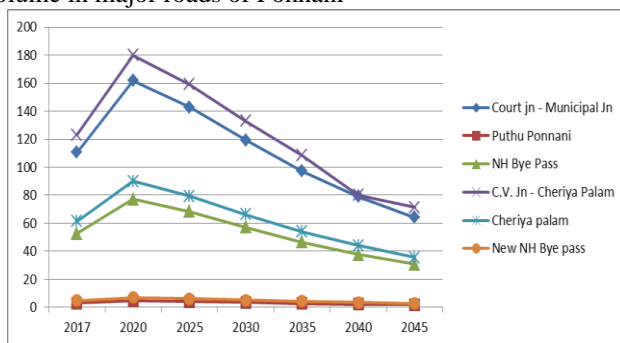


Fig. 5 Percentage of Increase in Truck Traffic due to port

The percentage increase is highest in the year 2020 and after that it decreases. CV junction to Cheriya palam is the stretch where there is a great increase in truck volume and minimum in the case of Puthu Ponnani.

Abatement Measures

The proposed rail connection to the port will transport 44% of the cargo from the port, which should be improved to maximum as possible, by adding extra trips or bogies.

Overloading of the trucks from the port should be avoided to limit the impact on the structural capacity of roads. This should be monitored by weighing vehicles before they leave the port.

Barge service should be introduced through Bharatha puzha and Tirur puzha from the port to distribute cargo to near areas.

C. Impact on Traffic Safety

As a result of the increase in traffic generated/attracted by the Ponnani port there is a potential for increasing accident rates. Heavy vehicles are involved in approximately 7% of total accidents and 9% fatal crashes in Kerala. In Kerala, The number of vehicle involved in accidents by trucks or heavy goods vehicles are highest in district of Malappuram (256 accidents/year). Recent years there is a reduction in fatal accidents from 40 to 27 and number of deaths 43 to 31 and no. of injured person 8 to 5 during 2008 to 2012 in Ponnani police station circle, and there is a chance for increase in the accident rates in the town area due to the truck traffic from the port.

Abatement Measures

Only properly trained drivers should be allowed to drive the vehicles from the port, and as well as, well maintained vehicles should be used for the cargo transport from the port. Inspections should be done randomly to check the vehicle condition and roads should be maintained properly.

Provide facilities like side walk, foot over bridge/sub way along with hand rails and barricade and traffic calming measures for the safe movement of pedestrians on high pedestrian movement areas such as municipal junction, CV junction, Court junction etc. In order to take into account the overall traffic safety, the implementation of the 3 Es (engineering, enforcement, education) through the 3Cs (coordination, cooperation, control) is one of the most effective measure.

VIII. CONCLUSION

The purpose of this study was to examine the expected impact of the proposed cargo port on the traffic characteristics of Ponnani town. Even without considering the generated traffic due to upcoming port, most of the road sections have level of service LOS F in the year 2030. The traffic generated during the port operation, will not change the level of service of the road sections on a higher scale. But the traffic situation will be more critical when the port come into exists, by increasing congestion, delay etc. In 2017, after the commission of the port, an additional 0.7% to 11.7% and 3% to 8.1% traffic volume will pass through the various road sections and intersections respectively. In case of the truck traffic, an additional 3% to 123% will pass through the major corridors and this may cause heavy impact on the road infrastructures and the potentiality of accidents in municipal area will increase. The facility is expected to have a larger impact in future, so the remedial measures like outer ring road, improvement of regional network etc. will have to be taken into consideration at this point of time. The above stated abatement measures including local network improvements, encouragement of public transport, increasing the connectivity etc. is expected to divert the traffic of light motor vehicles, which is the currently the major vehicle type in the corridors in future.



Thus it is very clear that the proposed port will increase the economy of Ponnani and State of Kerala as a whole. Even then, both project proponents and stakeholders tend to neglect the fact that port situated in built-up areas will generate and attract traffic.

ACKNOWLEDGMENT

The authors owe great many thanks to great many people for their help and support during the preparation of the paper. We are grateful to the staff of the Town and Country Planning Office, Malappuram, for their contributions to this paper. We would also like to thank the faculty of Department of Civil Engineering at Rajiv Institute Technology, Kottayam for their valuable support that made this paper possible



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