

Vytilla Mobility Hub: A Gateway to Kerala



1. Introduction

Kochi, the commercial capital of Kerala, is one of the fastest growing two-tier metropolitan cities in India with a population of 13.55 lakh, including the Kochi Urban Agglomeration (KUA).¹ The Kochi Urban Agglomeration comprises of Kochi Municipal Corporation, five municipalities, 15 Panchayats and a part of three Panchayats. The city has an area of 94.88 sq. km. Urban expansion during the past few decades outgrew the limits of Kochi City. The immediate hinterland of Kochi Port has been delineated as the Greater Kochi Region, which covers 731 sq. km- almost eight times the area of the city.

According to a study, the city has seen a real estate growth of 30 per cent on a yearly basis for the last couple of years and has a GDP growth rate of 8.3 per cent². Kochi is seen as one of the top three IT/ITES commercial real estate destinations and the availability of 15 Giga bytes bandwidth, through undersea cables ensures seamless data flow and lower operational costs, compared to other major cities in India. Moreover, some very important port-oriented developments are being planned in the city such as the Vallarpadam Transshipment terminal, the LNG terminal at Puduviye, the SBM of KRL at Vypin, and the SEZ at Vypin. Thus, it goes without saying that Kochi is bound to see a fair amount of commercial investment and development in the years to come. According to the City Development Plan of the Corporation of Kochi, investments to the tune of Rs 15,000 crore are expected to come in the next five years. NH 17, NH 47, NH 49 and National Waterway 3 pass through Kochi. Kochi also has a strategically located Sea Port and an International Airport³.

The population growth in Kochi Municipal Corporation alone is expected to be 10 per cent per decade. The growth of population in the remaining area is expected to be 19 per cent per decade. Although the present population of the adjoining municipalities and Panchayats is less than the population of the Kochi Municipal Corporation, it is projected that the former will be

¹ Census of India, 2001

² http://www.ctreeconsulting.com/downloads/Concept%20Tree_Market%20Research_Kochi.pdf

³ NH 17 enters Kerala at Thalapadi and joins NH 47 at Edapally and is 420 km long.

NH 47 enters Kerala at Wayalara and leaves at Kalyikkavila and is a 416 km long and passes through the Vytilla Junction.

NH 49 enters Kerala at Bodimettu and joins NH 47 at Kundanoor and is 167.6 km long

National Waterways 3 (NW – 3) consists of the Kottapuram-Kollam stretch (168 km) of the West Coast Canal along with Champakara canal (923 km) and Udyogmandal canal (14 km)

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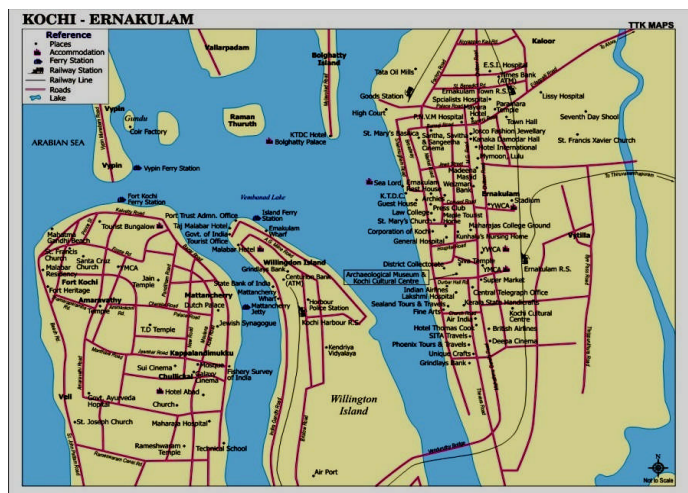
greater. This will create unprecedented transport demand and passenger inflow to the already congested city adding more inter-city buses and private vehicles.⁴

Kochi city alone accounts for 40 per cent of the urban population in the district. The Greater Kochi Development Authority (GCDA) area encompasses the Municipal Corporation area, six municipalities and adjoining 32 Gram Panchayats. The GCDA covers an area of 729.21 sq. km with a total population of 1,797,779 (2001). According to Census 2001, the average population density of GCDA area is 2,465 persons per sq. km. In the city central area, the population density is as high as 6,287 persons per sq. km while it is 1,803 persons per sq. km in the outer fringes.

The projected population of the City Development Plan (CDP) area based on the natural growth trend is estimated to be 12.52 lakh in 2011, 13.69 lakh in 2021 and 14.29 lakh in 2026. Also, once the major projects planned materialize, some migration can be expected. There is a large percentage of floating population, which commutes daily to the city from a radius of about 100 km. The total population, including the expected migration and the floating population, is estimated to be 17.52 lakh by 2011, 21.69 lakh in 2021 and 25.29 lakh in 2026 in the CDP area. The City Development Plan of Kochi city comprises the following townships and Panchayats:

1. Kochi Municipal Corporation
2. Kalamassery Municipality
3. Tripunithura Municipality
4. Elamkunnappuzha Panchayat
5. Njarakkal Panchayat
6. Mulavukad Panchayat
7. Kadamakkudy Panchayat
8. Cheranallur Panchayat
9. Eloor
10. Varapuzha
11. Thrikkakara

Fig 1: Map of Kochi City



⁴ http://jnnurm.nic.in/nurmudweb/toolkit/KochiCdp/Executive_Summary.pdf
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12. Thiruvankulam
13. Maradu
14. Kumbalam
15. Kumbalangi
16. Chellanam

Being considered as the Central Business District (CBD) of Ernakulam district from a larger perspective, the pressure in Kochi Corporation area is primarily from the outskirts of the city township as described below:⁵

Table 1: Projected population of Kochi city

S.No.	Area	2001	2011	2021	2026
1	Kochi	596,473	618,348	640,379	648,398
2	Municipalities-2	123,000	142,360	159,233	165,750
3	Panchayats-13	418,940	491,317	569,927	615,521
	Total	1,138,413	1,252,025	1,369,539	1,429,669

Source: City Mobility Plan, 2007, Kerala Sustainable Urban Development Project

⁵ **Central Business District (CBD)** is the commercial and often geographic heart of a city. It is typified by a concentration of retail and commercial buildings. Central business districts usually have very small resident populations. Some of the characteristics of CBD are:

- Geographical centre of the settlement
- Land use
 - Distinct land use patterns different from the surrounding areas
 - High concentration of public buildings and offices
 - Very tall buildings to maximize land use of expensive real estate
 - Activities concentrated in areas of functional zoning
 - Major retail outlets
- Transport
 - High concentration of traffic
 - Great concentration of pedestrians
 - High use of public transport and High employment rate

A transportation study conducted has shown that nearly 2.5 lakh persons commute to the core city daily thereby increasing the pressure on civic amenities and congestion on major traffic corridors

Records say that about 2,000 vehicles are registered in the city limits in a month; 85 per cent of which are private ones. The widening gap between the growing number of vehicles, the lack of infrastructure and unscientific plans has turned life worse for the average Kochiite. The city roads are over-crowded with road-based public and private vehicles. Kochi has around 630 city buses, 3,000 auto-rickshaws, 6,500 taxis and countless cars and motorcycles. The city is reeling under traffic congestion, increased accidents, air and noise pollution and sluggish traffic movement. The public transport system is not adequately catering to the growing transport and connectivity needs of the city. While certain areas are well-connected and serviced, others are ignored, even though there is a demand and need in those areas. Adding to the woes, there are around 2,766 long - distance private and Government buses, originating and terminating from the two major bus terminals in the city, creating chaos on the roads that they ply on.

Traffic and Transport in Urban Area

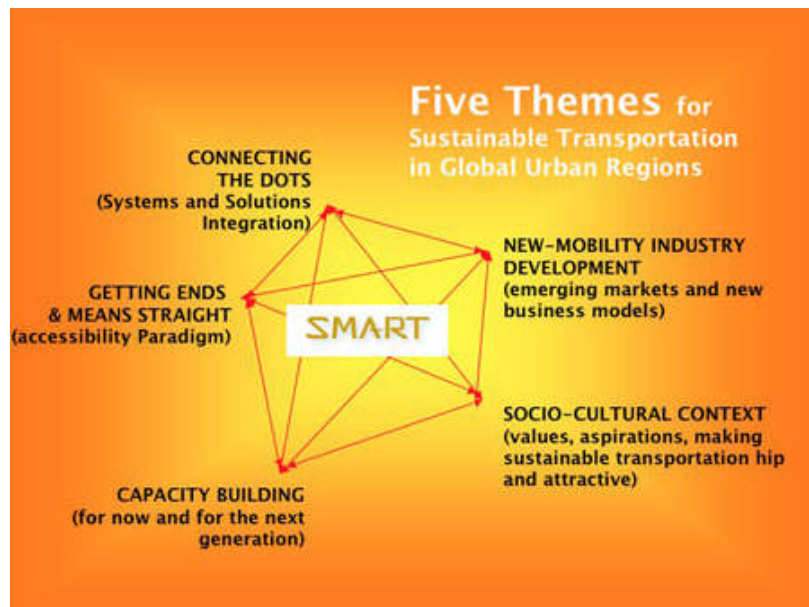
This study focuses on the intended outcome of the proposed Vytilla bus terminal, which will act as the mobility hub for this growing city. This report has looked at the various secondary data resources available to elicit the logic behind the proposed bus terminus in order to comprehensively argue the impact and necessity of implementation of the proposal. The basic reason for planning a modern integrated bus terminus is to accommodate the demands and requirements of an urban agglomerate like Kochi in terms of traffic and transportation. It would be futuristic and provide a platform for the establishment of a unified urban transport authority (UMTA) in the days to come. Sustainable transportation incorporating various elements of development is the key to the success of the proposed project⁶.

⁶ MoA of Kochi Corporation with JNNURM says; for traffic and transport services there would be an integrated plan prepared in the implementation of which existing stakeholders like Public Works Departments, Police, Kerala State Road Transport Corporation, Private Bus Service providers and the Corporations would be given definite roles and a coordination arrangement put in place, to ensure that every actor plays his assigned role properly. Constitution of Greater Kochi transport authority (page number 55)

The objective of any successful traffic and transport model shall be to ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and other such needs. This can be achieved by⁷:

1. Incorporating urban transportation as an important parameter at the urban planning stage, rather than being a consequential requirement
2. Encouraging integrated land use and transport planning so that travel distances are minimized and access to livelihood, education, and other social needs, especially for the marginal segments of the urban population, is improved

Fig 2: Model for Sustainable Transportation



Source: <http://um-smart.org>

3. Improving access of business to markets and the various factors of production
4. Bringing about a more equitable allocation of road space with people, rather than vehicles, as its main focus

⁷ <http://um-smart.org/>

5. Investing in transport systems that encourage greater use of public transport and non-motorized modes, instead of personal motor vehicles
6. Establishing regulatory mechanisms that allow a level-playing field for all operators of transport services
7. Introducing Intelligent Transport Systems for traffic management
8. Increasing effectiveness of regulatory and enforcement mechanisms
9. Addressing concerns on road safety and trauma response
10. Reducing pollution levels through changes in travelling practices, better enforcement, stricter norms, technological improvements, etc.
11. Building capacity (institutional and manpower) to plan for sustainable urban transport and establishing knowledge management system
12. Promoting the use of cleaner technologies
13. Raising finances, through innovative mechanisms that tap land as a resource, for investments in urban transport infrastructure
14. Associating the private sector in activities where their strengths can be beneficially tapped
15. Taking up pilot projects that demonstrate the potential of possible best practices in sustainable urban transport

The City Development Plan of Kochi has outlined the following strategies to overcome the obstacles in traffic and transport issues in urban areas:

1. Improvement of the existing road network to facilitate free flow of traffic
2. Completion of the traffic network
3. Integration of different modes of transport by creation of terminal and interchange facilities
4. Constitution of a Greater Kochi Transport Authority
5. Traffic and transportation management, using GIS & GPS technologies
6. Creation of an Urban Transportation Development Fund
7. Encouraging Water Transport

8. Improving the share of public transport
9. Introduction of MRTS, streamlining and regularising heavy cargo transport
10. Junction and traffic signal improvement and parking management

According to the study for Kerala State Urban Development Project, some of the major issues related to traffic and transport are:

1. Majority of traffic problems are concentrated along two east west corridors of the city i.e. Banerji Road and S A Road
2. Absence of bus terminals
3. Concentration of commercial activities in the core area
4. Absence of mass rapid transportation system
5. Absence of integration of different modes of transport
6. Uncontrolled increase in personal vehicles, due to absence of an adequate public transport system

Transport System in Kochi

The existing public transport system consists of buses and ferry services operated mainly by private operators. There are about 630 intra-city buses operating on 160 routes originating and terminating at 60 locations scattered all over the city⁸. In addition to the above, there are about 2,300 long-distance private (*mofussil*) buses and 466 intercity/state Government buses, which enter city roads.

Characteristics

1. The buses contribute about 14 per cent of the vehicular traffic and carry 73 per cent passenger traffic.
2. The share of cars in terms of vehicular trips is about 38 per cent carrying 15 per cent of the passengers
3. Two-wheelers contribute 35 per cent of vehicular traffic and eight per cent of passenger traffic.

⁸ *Comprehensive Study for Transport System for Greater Kochi Area*, Rites Ltd, 2001
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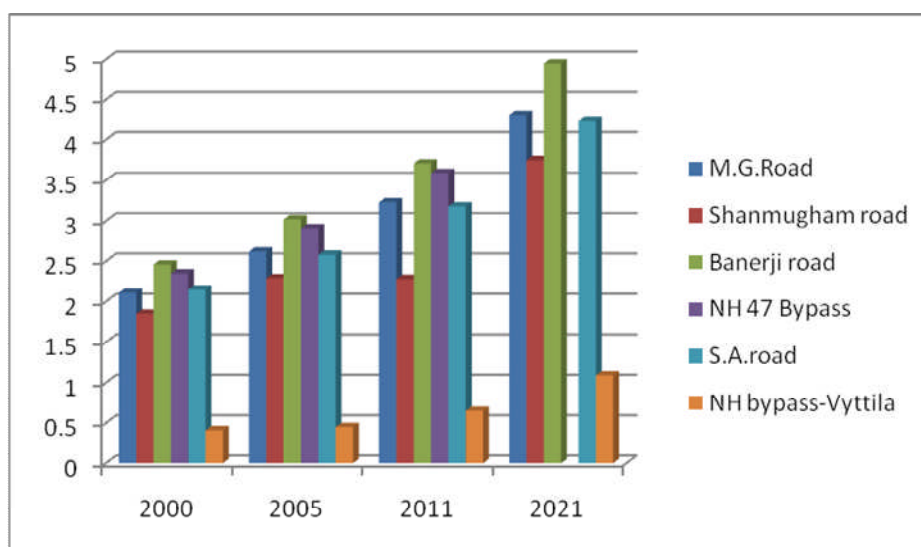
4. Auto-rickshaws contribute about 13 per cent of vehicular traffic and four per cent of passenger traffic.
5. The city has insufficient carriage way width.
6. It has insufficient on-street and off-street parking facility.
7. Absence of good quality link roads connecting the three major corridors, viz. Shanmugham Road, M.G. Road and Chittoor Road.
8. The presence of a railway line dividing the city into two parts, due to the absence of Railway Overbridges.
9. Over saturation in SA road and Banerji Road; the only connection to the eastern part of the town, due to large volume of traffic and presence of intersections at close intervals.

Road Network Inventory

According to the City Mobility Plan, Kochi City:

"The road network is constituted by a broken grid iron pattern. The main emphasis is on the north south axis with minor roads giving the east west connection. Undue concentration of services is seen in certain areas of the city. The lack of accessibility is caused by poor quality of roads, inadequate road width crossing of railway lines, canals and back waters. Main roads catering to the core area are M.G. road, Shanmugham road and Chittoor road running north south and there are only two east west corridors viz. Banerji Road and S.A. road. Trunk routes connecting the city are NH 17, NH 47, NH 49, Kothamangalam –Tripunithura-Ernakulam road, and Ettumanoor- Tripunithura- Ernakulam road. The completion of Gosree bridges has converted Vypin road also as a trunk route connecting Kodungallur, Chavakkad and Ponnani through NH 17."

Fig 3: Daily Passenger Traffic at Various Road Sections (in lakh)



10. Source: NATPAC study report, May, 2006.

Table 2: Average Daily Traffic Volume (PCUs) at Outer Cordon Locations

No.	Location	Inflow	Outflow	Total
1	NH 47 towards Allapuzha	14108	13434	27542
2	Puthotta bridge (Kottayam road)	2553	1742	4295
3	Hill Palace Junction (towards	7391	7757	15148
4	Aluva – Perumbavoor road	10679	10127	20806

Source: Rites Primary Survey, 2000

Table 3: Summary of Daily Vehicular Traffic at Outer Cordon Survey Locations in Kochi City

Sl.No	Name of Location	Name of Road	In		Out		Total	
			No	PCU	No	PCU	No	PCU
1	Permpadappu	Palluruthy-Kumbalangi road	3,342	2,473	2,891	2,252	6,233	4,725

2	Chellanam	Thoppumpadi to Chellanam road	2,703	2,212	2,427	2,023	5,130	4,234
3	Near GIDA bridge	High court to	6,798	6,194	6,616	6,614	13,414	12,807
4	Near Bridge	Chittur road	4,459	4,059	4,603	3,977	9,062	8,036
5	Near Cheranallur	NH-17	5,062	5,346	5,165	5,131	10,227	10,477
6	Edappally bridge	NH-47 & bypass	25,415	31,829	23,571	28,331	48,986	60,159
7	Near Thodu	Kakkanad road	16,427	15,214	15,235	14,765	31,662	29,979
8	Arkkakadavu bridge	Alinchuvadu to Thrippunithura	3,159	2,448	2,560	1,969	5,720	4,417
9	Petta bridge	Thrippunithura road	17,377	18,705	18,120	21,229	35,497	39,934
10	Thykoodam bridge	NH-bypass	12,999	16,674	16,238	21,242	29,237	37,915
11	Edakochi	NH-47	3,533	3,942	3,803	4,403	7,336	8,345

Source: NATPAC study report, May, 2006.

High demand corridors identified by Rites 2001

- Banerji Road (Marine Drive to bypass)
- M.G. Road (from Naval bases to Madhav Pharmacy)
- S.A Road (Pallimukku to Vytilla)
- Eda Kochi Road (Thamupadda to Aroor)
- Bypass Road (Edappally to Vytilla)
- Shanmughan Road (BTH to Marine Drive)

Problems Identified by Rites 2001 in the City's Corridors

- Volume capacity Ration (V/C)⁹ in all the major corridors is above 1.
- Degree of congestion¹⁰ for all the high demand corridors are below 30

⁹ Volume to Capacity Ratio (V/C) is measured of the congestion of the mid-block locations. According to Indian Road Congress Standards, the acceptable level of service under the normal road condition should be below 0.8.

¹⁰ Degree of Congestion is relative value of the maximum posted speed observed on the road network to the speed on that link

- c) Congestion index
- d) Parking index
- e) Saturation of capacity of intersection
- f) PV2 values (pedestrian volume *VehicleVolume2 during peak hour)

The peak-hour traffic on the high-density corridors within the city is expected to rise to 25,000 by 2021.

Vehicle Population Growth



The number of vehicles in Ernakulam District has increased from 91,411 in 1989-1990 to 9,38,124 in 2007-08, showing an average annual growth rate of 13 per cent. With more



cars and vans being added to the vehicle fleet every year, there is a matching rise in the sale of scooters and motorbikes as well, crowding the roads of Kochi. Every year about 1,000 auto-rickshaws are added in Kochi alone. When 30,000 vehicles get added to the already soaring figures of vehicles on Kochi roads, the very narrow lanes of the city are inadequate for the increased traffic.

Kochi roads are hit not only by vehicles of the metro, but also by hundreds of vehicles entering from neighbouring districts, with people flooding the city to attend work and institutions or on shopping sprees. Since the city has absorbed neighbouring islands with Goshree Bridges, it is high time newer options to contain the crowd emerging through the Vypin Island are thought

$D_c = S_p - S_o * 100 / S_p$; D_c -Degree of Congestion, S_p -Maximum posted speed in Km/hr (ideal is 45Km.hr), S_o -Observed link speed in Km/hr.

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of. Nowadays, a good number of vehicles coming from the north by National Highway-17 turn left at North Parur as a faster and easier route to Ernakulam via Vypin.¹¹

Table 4: Growth of Vehicle Population in Ernakulam District.

No.	Type of vehicle	1989-90	1994-95	As on 31.3.2004	As on 31.3.2005	As on 31.3.2006	As on 31.3.2007	As on 31.3.2008
1	Goods vehicle	12059	15315	41258	43984	46528	51533	55249
2	Bus/Minibus	2076	5176	25418	26549	28457	30455	32165
3	Car/Jeep/Van	24737	37481	163793	174281	183983	200873	214008
4	Two-Wheelers	44129	165250	433747	463365	490795	535153	573027
5	Taxi	-	-	18502	19877	21231	23274	25083
6	Auto	-	-	29959	32109	33554	36389	38592
7	Total	83001	223222	712677	760165	804548	877677	938124

Source: Economic Review, Kerala State Planning Board; RTO, Ernakulam



Lack of Carriage Way Width

The carriage way width of almost all the roads is totally insufficient. The roads are narrow and cannot withstand the growing traffic pressure. A study conducted by NATPAC in 2006 shows that in Kochi 16.3 per cent of the roads have less than 3m carriage way, while 56.6 per cent have single lane carriage ways of 3.5m, 13.2 per cent have

¹¹ http://yasoramskycity.com/html/increasing_demand_for_road.htm
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intermediate lane of 5.5m, 8.5m two lanes and 0.70 per cent have three lanes with shoulders and 4.7 per cent more than four lanes. Lack of carriage width is causing problems like delay, congestion and accident. Not many roads in the city can be widened. Pedestrians and cyclists are also pressing for more space. There is also the need for parking space on these roads. An appropriate way of addressing this issue is to lessen the traffic within the city. Taking off long-distance buses plying within the city would definitely reduce the chaos on the roads and ease the traffic to a great extent.

Table 5: Carriage way width

Sl. No	Carriageway width	Road length (km)	Percentage
1	Less than single lane	100.125	16.3
2	Single lane	347.68	56.6
3	Intermediate lane	81.295	13.2
4	Two lane	52.355	8.5
5	Three lane	4.05	0.7
6	Four lane	28.46	4.7
	Total	613.965	100

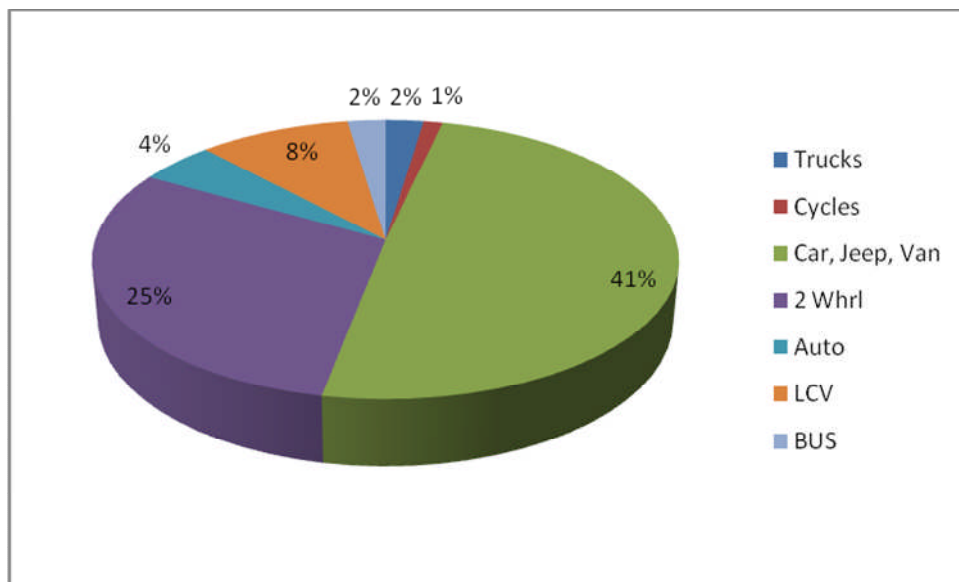
Source: NATPAC study report, May, 2006.

M.G. Road is the spine of the city connecting the two main east-west corridors of SA Road and Banerji Road and extending to Wellington Island, Fort Kochi and Mattancherry. Banerji Road connects the high court to the bypass passing through MG Road, Chittoor Road, North R.O.B., Kaloor, Palarivattam and Edappally. It connects the CBD to residential areas on northern parts in addition to the International Airport. The traffic on this road is the maximum in the city. Both sides of these roads are occupied mainly by commercial setups. All these roads are

characterized by close intersections which frequent stoppages and on-the-street parking, reducing effective carriage.

From the nine-screen line location conducted by NATPAC in 2005 to study the traffic volume of the city it was found that Kaloor Thodu on Banerji Road recorded the highest traffic volume of 57822 PCU¹² followed by ROB at North over bridge (47827) PCU on Banerji Road and ROB at South (37211 PCU) on SA road. Category wise analysis of traffic movements showed that two-wheelers constituted the majority of traffic on all the screen line survey locations. Composition of two-wheelers in the total traffic ranged from 32 per cent to 59 per cent of whole traffic and that of car ranged from 20 per cent to 37 per cent.

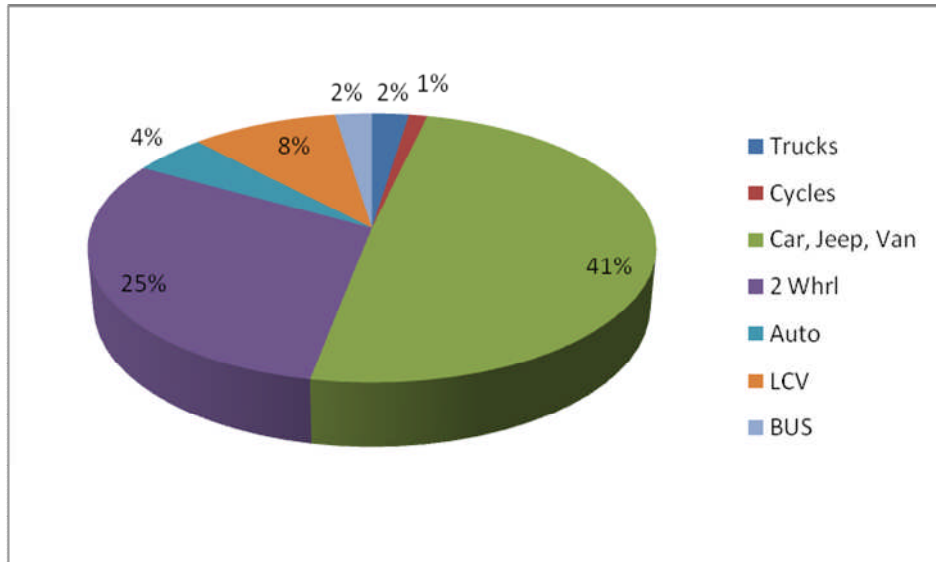
Fig 4: Composition of Traffic at North Railway Over Bridge (Banerji Road)



Source: Comprehensive Study for Transport System for Greater Kochi Area, Rites Ltd, 2001

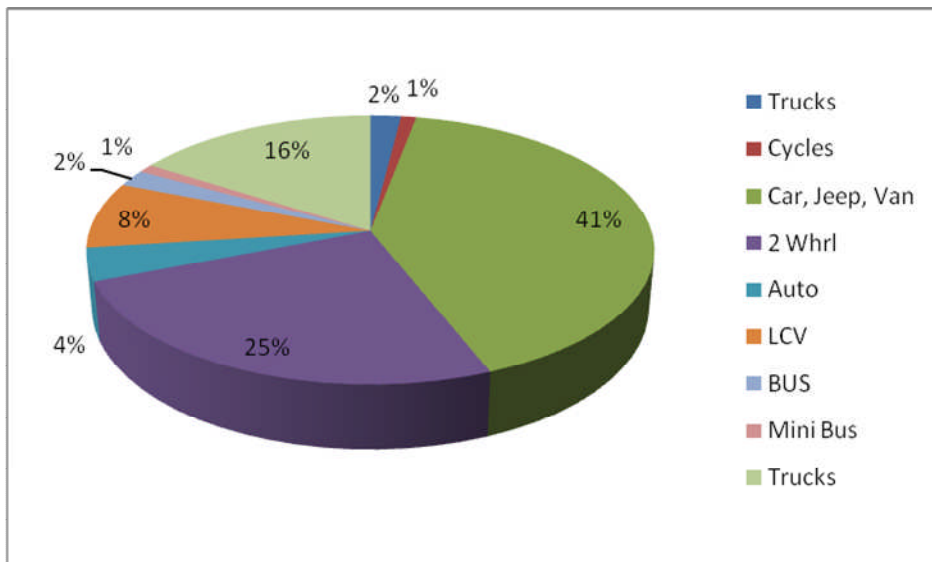
¹² Passenger Car Unit is a metric used in Transportation Engineering, to assess traffic-flow rate on a highway. A common method used in the USA is the density method. However, the PCU values derived from the density method are based on underlying homogeneous traffic concepts such as strict lane discipline, car following and a vehicle fleet that does not vary greatly in width. On the other hand, highways in India carry heterogeneous traffic, where road space is shared among many traffic modes with different physical dimensions. Loose lane discipline prevails; car following is not the norm.

Fig 5: Composition of Traffic at South Railway Over Bridge



Source: Comprehensive Study for Transport System for Greater Kochi Area, Rites Ltd, 2001

Fig 6: Composition of Traffic at Bypass ROB (Vytila)



Source: Comprehensive Study for Transport System for Greater Kochi Area, Rites Ltd, 2001

From the analysis of the outer cordon survey conducted by NATPAC 2006 to understand the inter-city passenger and goods movement by taking an account of the traffic partner at main entry parts of the city located on inter-city corridors, it came to light that 48,966 vehicles passed through Edappally on NH 47, followed by 35,497 vehicles through Petta on Tripunithura Road and 31,662 through Kakkanad Road. NH 47 towards Allapuzha and Aluva Perumbavoor Road are other points with high traffic. About 41 per cent of the total vehicles passing through the locations were two-wheelers followed by 26 per cent of cars and 6.5 per cent of passenger auto-rickshaws.

Sluggish Traffic Movement in Kochi City

Heavy traffic, low carriage, lack of proper footpath for pedestrians and on-street parking place are contributing to the delay in the runtime. Studies conducted by RITES 2001, NATPAC 2006 and Professor Rajagopal in 2008 reveal that the city traffic moves at very slow speed during peak hours. The average speed during peak hours on 66 per cent of the important roads in the city is less than 30 km/hr. The slow movement of traffic poses a great menace to the ecological system of the city, especially from heavy carbon emissions and noise pollution from vehicles.

Table 6: Distribution of road length by peak and off-peak hour journey speed in Kochi city

Journey Speed	Peak Period		Off Peak	
	Road length in Km	Percentage	Road length in km	Percentage
<10	7.1	4.37	0	0
10-20	47.45	29.24	14.6	9
20-30	53.55	33	39.2	24.2
30-40	40.6	25.01	63.3	39
40-50	10.8	6.65	34.6	21.3
>50	2.8	1.73	10.6	6.5
Total	162.3	100	162.3	100

Source: NATPAC study report, May, 2006.

Public Transport Operations

Travel demands of the majority of people in and out of Kochi are met by the bus transport system. At present, there are 635 buses catering to the inter-city transport demand. In view of the anticipated intra city demand, based on population and other allied socio-economic factors, it is expected that the total trips by 2021 will be about 700 bus trips daily.

**Table 7: Percentage Distribution of Private Buses According To
Kilometre/Day**

S. No.	Kilometre	Percentage of buses
1	< 200	10
2	201 – 250	14
3	251 – 300	68
4	301 – 350	8
	Total	100

Source: NATPAC study report, May, 2006.

Table 8: Projected Purpose-wise Trip ends

Year	Work	Education	Other	Total	Non-home based	Intra city	Intercity	Total
2000	818559	400831	149653	1369043	116520	1456510	251600	1708110
2011	1155500	555600	311100	2022200	181998	2204198	352672	2556870
2021	1564100	756800	454100	2775000	277500	3052500	488400	3540900

Source: Rites Primary Survey, 2000

Bus Terminals of Kochi City

There are two major inter-city bus stations in the city. One at Kaloor for private buses and the other one is the Kerala State Road Transport Corporation



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(KSRTC) bus terminal near the South railway station.

The KSRTC inter-city bus terminal is located in the core of the city. There are a total of 466 buses operating from here, out of which 424 belong to KSRTC and 12 each from the neighbouring states of Tamil Nadu and Karnataka. 756 daily trips are undertaken in various directions. Approximately 40,000 passengers access this bus terminal daily.

The existing terminal buses cater to various nearby towns/cities such as Kottayam, Thrissur, Angamali, Trivandrum, etc, as well as long distance destinations, such as Bengaluru, Coimbatore, Kanyakumari, etc.

As the inter-city bus terminal is located in the city's core, there is a lot of traffic congestion on the main arterial roads, i.e. MG Road, SA Road and Banerji Road. A large number of people come to the bus terminal through various private modes, further aggravating the problem.

Most of the private inter-city and intra buses use the Kaloore bus terminal as a major stopover. As already mentioned above, there are about 630 intra city private buses and 2,300 inter-city buses that pass through the city.

The buses access the city through various routes, namely,

1. The city buses come from Vytilla to Kaloore through M G Road, which is a distance of seven km and, on an average, takes approximately 40 minutes to cover.
2. The inter-city buses from Kottayam side are not allowed to come to the Kaloore bus stand. They instead come to the Karshaka Road on the eastern side of the Ernakulam Junction Railway station. This distance is approximately three km and takes about 20 minutes
3. The inter-city buses from Allapuzha side come to the Kaloore bus stand through Ponurni via Kathrikadavu Road, which is a distance of five km and takes approximately take 30 minutes.

4. The KSRTC buses come to the KSRTC bus stand through M.G. Road from Vytilla, which is a distance of six km and takes 40 minutes¹³

Bus Routes:

Table 9: Major Routes of Inter-City Private Buses Operated From Kaloor Bus Terminal in Kochi

Sl. No.	Origin	Major destination	No. of buses	No. of trips
Towards Cherthala direction				
1	Ernakulam	Cherthala, Eramalloor Poochakkal,	85	750
2	Pukkattupady	Eramalloor, Arookutty, Kelitreon Ferry	12	90
3	Kakkanadu	Eramalloor, Arookutty, Kelitreon Ferry	15	120
		Sub-total	112	960
Towards Thrippunithura direction				
4	Kakkanadu	Perumbavoor, Vaikkam Piravam	12	75
5	Ernakulam	Perumbavoor, Piravam, Koothattukulam, Pattimattam, Muvattupuzha,	148	744
		Sub - Total	160	819
		Total	272	1,779

Source: NATPAC study report, May, 2006.

Accumulation of Goods Vehicles inside the City

87,000 types of goods are transported in more than 26,000 trips everyday through Kochi. There is a want of a proper goods terminal. The location of major trade and commercial centers, such as the wholesale market at Broadway and petroleum siding near the High Court attracts a large number of trucks through the major arterial roads. Consequently several goods vehicles are observed parked near the high court area, which is certainly indicating that the city attracts traffic beyond its holding capacity.¹⁴

¹³ Interview with Motor Vehicle Inspector, Mr. Sajan, RTO

¹⁴ Comprehensive Study for Transport System for Greater Kochi Area, Rites LTD, 2001.
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**Table 10: Distribution of Goods Vehicle Trips through Outer Cordon Points
According To Pattern of Movement in Kochi City**

Sl. No.	Purpose	Vehicle			No.	Total Percent
		Truck	Mini-truck	Goods auto		
	I. TOTAL TONNAGE					
1	Internal to Internal	652	52	13	717	0.89
2	Internal to Internal	16990	5206	922	23118	28.61
3	External to Internal	22584	7224	1296	31104	38.5
4	External to Internal	22.379	3.206	273	25858	32
	Total	62.605	15688	2504	80797	100
	Per cent	77.48	19.42	3.1	100	
	II. VEHICLE TRIPS - TOTAL					
1	Internal to Internal	85	37	54	176	0.67
2	Internal to Internal	3414	3156	2744	9314	35.65
3	External to Internal	4298	3950	2897	11145	42.66
4	External to Internal	3379	1547	567	5493	21.02
	Total	11176	8690	6262	26128	100
	Per cent	42.77	33.26	23.97	100	
	III. VEHICLE TRIPS - LOADED					
1	Internal to Internal	50	27	47	124	0.62
2	Internal to Internal	2350	2311	2039	6700	33.38
3	External to Internal	3694	2953	1994	8641	43.05
4	External to Internal	2994	1198	414	4606	22.95
	Total	9088	6489	4494	20071	100
	Per cent	45.28	32.33	22.39	100	
	IV. VEHICLE TRIPS - EMPTY					
1	Internal to Internal	35	10	7	52	0.86
2	Internal to Internal	1067	845	705	2614	43.16
3	External to Internal	604	997	903	2504	41.35
4	External to Internal	385	349	152	886	14.63
	Total	2088	2201	1767	6056	100
	Per cent	34.48	36.34	29.18	100	

Source: NATPAC study report, May, 2006.

Traffic Growth: A Threat to the Environment of the City

Air Pollution



The growing number of vehicles cause considerable ecological damage through emissions and noise from internal combustion engines. The Air Quality Index (AQI) readings were 237 at Edappally, 167 at Palarivattom, 141 at Ernakulam North, 165 at Ernakulam South, 161 at Vytilla, 194 at Tripunithura, 93 at Aluva and 102 at Kalamasserry. An AQI up to 50 is regarded as

good while the 51-100 range is considered moderate. A reading exceeding 100 is considered unhealthy for sensitive groups, such as those having lung diseases. The air is unhealthy for the people if the reading is in the range of 151-200. AQI in the 201-300 range indicates very unhealthy air. A reading above 300 is hazardous.

15



The Central Pollution Control Board (CPCB) lists Kochi among one of the highly polluted cities in the country. Kochi was placed 13th in the list of cities with high levels of Suspended Particulate Matter (SPM) and Respirable Dust Particles (RDP).¹⁶ Buses are the greater contributors to SPM and RDP since they run on diesel engines. Diesel engines emit 1400 times SPR and RDP than petrol engines. Preventing 2,766 long-distance buses from entering the city would definitely help in reducing the carbon foot print in the city and act as a boon to the environment of the city.

Noise Pollution

The noise pollution in the city is rising at an alarming rate and buses are the biggest contributors to the pollution. A study conducted by two officials of the Pollution Control Board in

¹⁵ [http:// in population:www.hindu.com/2006/01/13/stories/2006011321840500.htm](http://inpopulation:www.hindu.com/2006/01/13/stories/2006011321840500.htm)

¹⁶ <http://www.hindu.com/2004/06/22/stories/2004062215220300.htm>

2008 found that on a typical working day 142 buses pass through Pallimukku junction between 9.45 am, out of which 104 buses honked their horns. About 319 instances of honking were recorded during this period; most bus drivers honked more than once. From this data, it was deduced that a policeman doing an eight-hour duty is exposed to the sound of horn about 1,200 times. If a bus horn honks, it creates 92-94 decibels (dB) of sound, and hearing it repeatedly can cause hearing loss. Noises which are below 75 dB are harmless. But constant exposure to noise levels of 80-85 dB can increase the risk of hearing loss. The magnitude of sound of a two-wheeler horn is between 81 and 85 dB, and that of a car horn is between 83 and 88 dB. The study also recorded that 96 cars out of 203 cars that passed during the two-hour study period at the Pallimukku junction honked the horn. Undoubtedly the magnitude of sound created by honking of the buses is quite higher than the other type of vehicles¹⁷.

To conclude, for any futuristic traffic and transport urban planning, it is imperative to consider the following points;

- Scalability: use technology and services already available as much as possible.
- Solution should not be only for rich or poor, but for everyone.
- Solutions should not depend on policy changes
- Good planning from the Government and private sector is very important. But hubs should not solely be depended on long-term and mega-sized plans
- Niche markets are the key. For example, different feeder vehicles for different customers' choice.
- Freedom to collaborate and innovate among all stakeholders is the key and will be a catalyst for multiplying new solutions

The following are the benchmarks for the implementation and evaluation of any traffic and transport planning:

- Awareness of options and benefits (important in the period before ridership figures show)
- Qualitative responses – Best Practices
- Ridership (in particular modal shift)
- Vehicle-Miles of Travel (VMT) reduction (as distinct from modal shift)

¹⁷ <http://www.hindu.com/2008/10/06/stories/2008100657780300.htm>
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- Congestion
- Accessibility indices (possibly using origin destination stats and place of work figures)
- Air quality (this is over a long term and the tricky part is having a base line)

The transport system of Kochi is in doldrums. It is characterized by congested roads, increased incidences of accidents, sluggish traffic movement and vehicular pollutions. The large numbers of long-distance (mofussil) buses have been significant and contribute to the present chaos. At the same time, they have been great losers in the process. They have been losing large amounts of money and time, which could be easily saved for the benefit of the service owners (KSRTC & private owners) and the public at large.

These factors have been constantly pointing toward the shifting and integrating of KSRTC bus stand and the Kaloor Private Bus Terminal and converting it to a Mobility Hub at a strategic location near NH 47, especially at the land currently owned by the Agriculture Department and KeraFed at Vytilla. The same need has also been constantly reckoned by various studies conducted over the years on the transport system of Kochi. Some of them are;

1. Comprehensive Study for Transport System for Greater Kochi Area by Rites Ltd , 2001
2. NATPAC Traffic Report, 2006
3. City Mobility Plan by KSUDP , 2007
4. City Development Plan by Kochi Corporation, 2007
5. Study on Traffic and Transport by Prof. V. Rajagopal, SCMS, 2008

Thus, it has been realized that there is the need for a central bus terminus to ensure a better functioning of the public transport system and the proposed site at the Vytilla junction has evolved as the natural choice for the Mobility Hub.

Strategic Importance of the Proposed Site for Mobility Hub

Vytilla Junction-the New Epicentre of Greater Kochi

Vytilla is a bustling residential and commercial area situated towards the eastern city limits of Kochi, about three km from M.G. Road. The Edappally-Aroor by-pass road that passes through Vytilla and Tripunithura is 10 km south-east. Vytilla is also home to hospitals like Welcare Hospital and Mother & Child



Hospital. Banks like the State Bank of India, State Bank of Travancore, Punjab National Bank, Corporation Bank, Vijaya Bank, Bank of Baroda, Federal Bank, and South Indian Bank have branches in this area. Famous schools such as Toc H Public School, St. Rita's H.S Ponnuruni, C.K.C.L.P.S are also located very close to Vytilla. There are several supermarkets (prominent among them include V-Mart and the Margin Free Market chain of mini-super markets) in this area, in addition to several Mom & Pop stores and pharmacies. Eateries like K.R Bakes, Aryaas, Best Bakers, Delight Bakers and traditional 'thattukadas' are also decent hangouts. There has been a mushrooming of commercial complexes near the area, for example the Oberon Mall and upcoming malls like the Forum Mall and Gold Souk.

The Vytilla Junction, the biggest and among the few planned ones has played a major role in ushering the development of the neighboring areas. Then proposed site for the mobility hub is located at the Vytilla Junction, making it the most preferred one. The site touches the NH 47 so there is no need to build extra roads.

The areas surrounding the site have the potential to have a major bus stand, a railway station and a boat jetty, thus becoming an integrated hub of transport.

Sufficiency of Space

The proposed site for the mobility hub is indisputably the best. A mobility hub requires a vast acre of land, which only the proposed site fulfills. The site offers a sprawling 25 acres of land to develop 71 buses bays and 150 ideal bus parking for long and short distance buses. While accommodating 900 cars and 120 auto-rickshaws in its parking lots, it has the potential to host a world-class mega shopping mall, food courts, cultural center and health club, a hotel, a 50m swimming pool, a water front and a boat jetty in a total buildup area of 13,70,000 sq.ft build up area, making a vibrant and attractive place of transit, work, shop and civic interaction. There is no land close to the proposed site that offers scope for such a huge mobility hub.

Low Investment

The envisioned mobility hub will require a large amount of investment. All other lands close to the Vytilla junction are private. Acquiring private land is a great challenge, and, if private land is bought through acquisition, then investment of the hub will sky rocket. The process of acquiring private land through acquisition would also a take long period, which will delay the start and completion of the project, adding unnecessary extra cost to the planned investment. But this problem can easily be avoided as the proposed site belongs to the State Government. It can be given freely for the development of the hub. Also, the site is so close to the NH 47 that there is not need to buy extra land to build roads. This will also cut down the investment.

Connectivity

The site for the mobility hub is well-connected with all other routes. It serves as a meeting point for all inter-city and intra-city roads, making it the most ideal location for the hub. The site is connected to the city through the Sahodaran Ayyapan Road. It is also connected to Edapally, Kakkanad (location of Info Park, Smart City, Civil Station etc) providing hassle free transition to various directions of Greater Kochi. The passengers could easily get down at the bus terminal at the hub and use the Mass Transit System like the inter-city bus, auto, taxi, metro train to enter the city.

The site is also well-connected with major cities like Allapuzha, Coimbatore, Idduki, Kottayam and Thrissur through National Highway 47, which passes by touching the site, offering connectivity with National Highway 17 and National Highway 49.

It is also well-connected to the sea port and the airport is approximately 25 km from the junction. The National Waterway 3 is also located very near to the site, and it is connected to Kollam and Kottapuram.

Integration with Mass Rapid Transit Systems

Vytilla Junction is one of the locations chosen for developing the metro station that will provide connectivity within and around the city area. Vytilla would also form a major role in the Mass Rapid Transit System, as proposed by Rites Ltd in 2001. It is estimated that the proposed bus terminal would cater to 2.5 lakh passengers. The proposed metro rail would also pass through the Vytilla Junction and be connected to Alwaye and provide connectivity within the city to daily commuters, tourists and travellers. Also, the proposed metro station, which would be built near the proposed hub site, would make it easy for them to access the metro. A study conducted earlier by city administrators says that 80 per cent of railway passengers who alight in both the railway stations of the city move eastwards, crossing both North and South R.O.Bs. This signifies the importance of a railway station near to Vytilla that can ease out city traffic.

Fig 7: Map of Inland Waterways

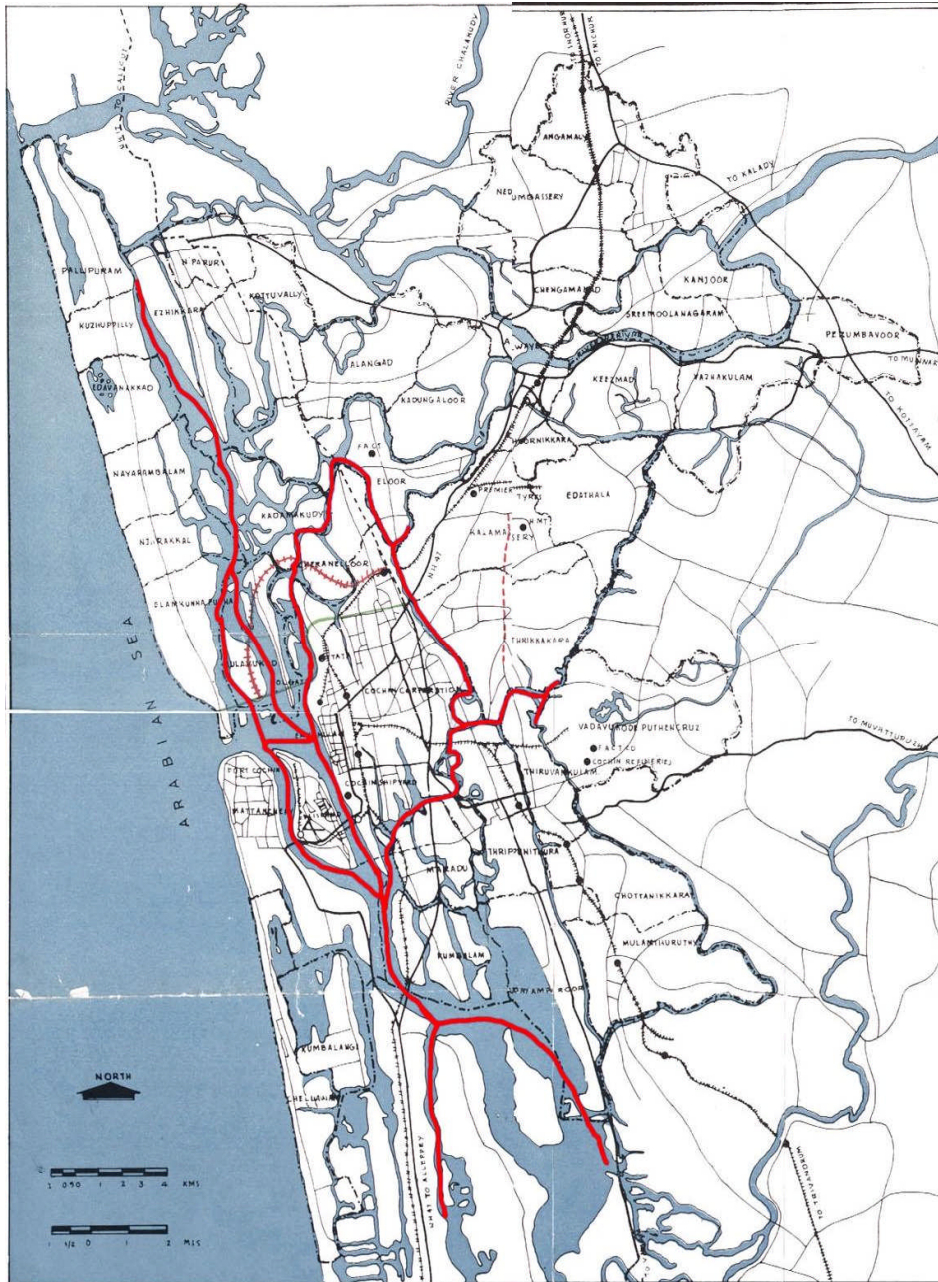
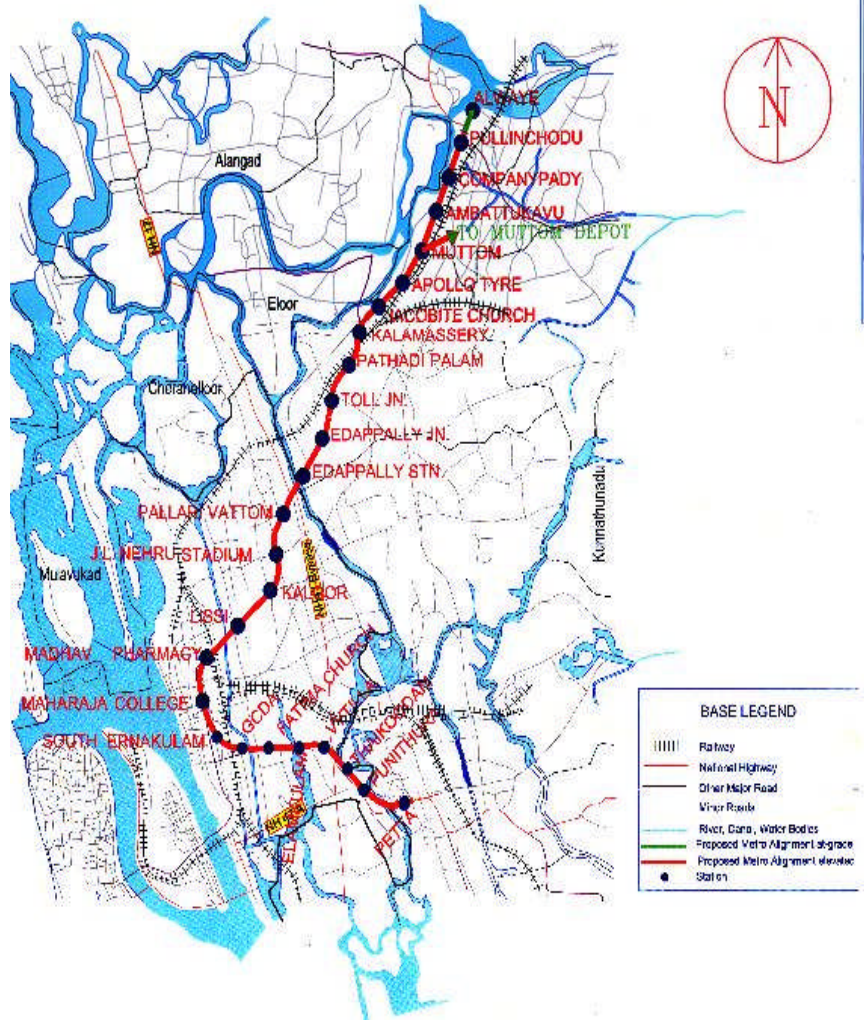


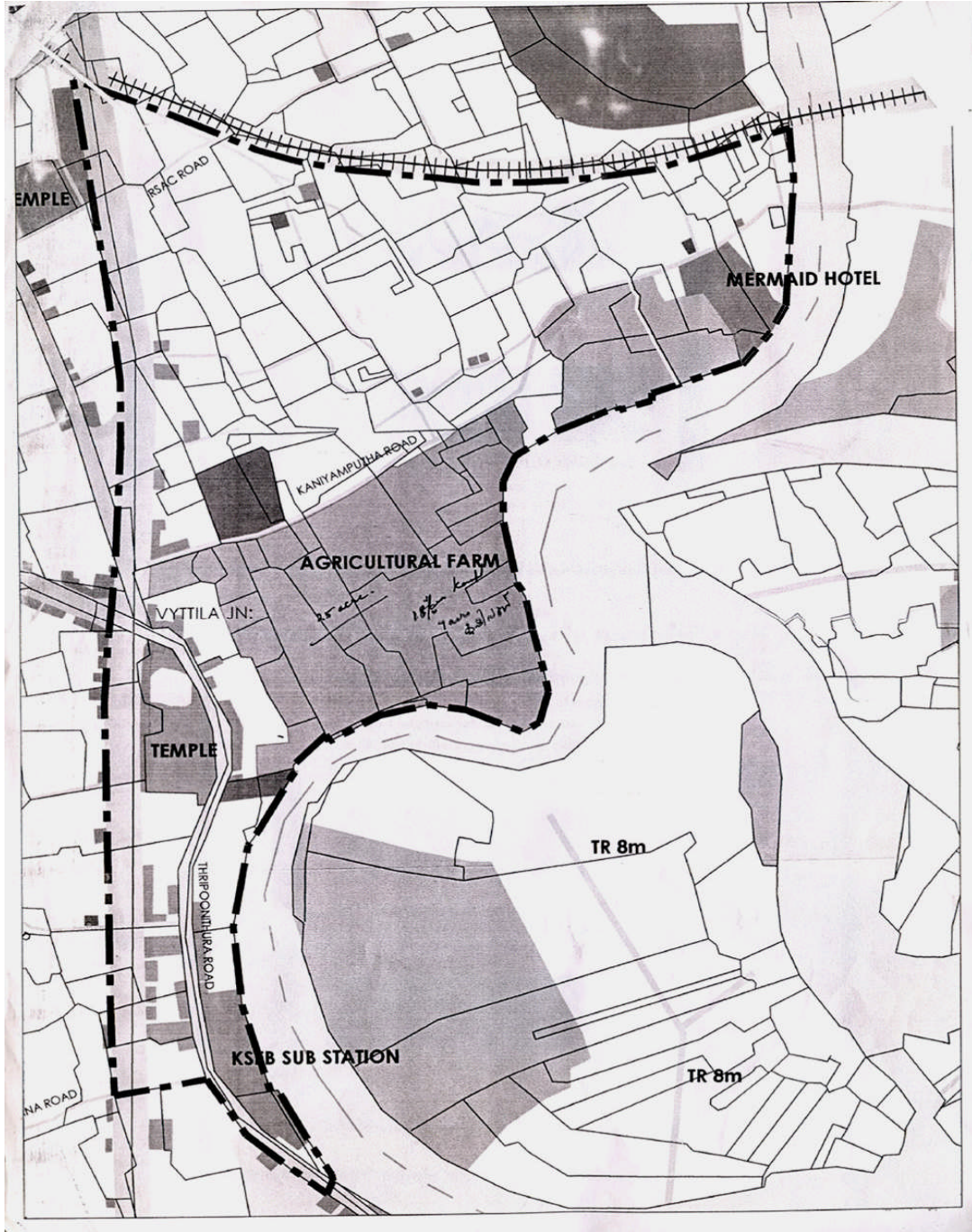
Fig 8: Kochi Metro Rail Key Plan

KEY PLAN KOCHI METRO (ALWAYE- PETTA CORRIDOR)



Source: Greater Cochin Development Authority

Fig 9: Sketch of the proposed Vytilla Mobility Hub



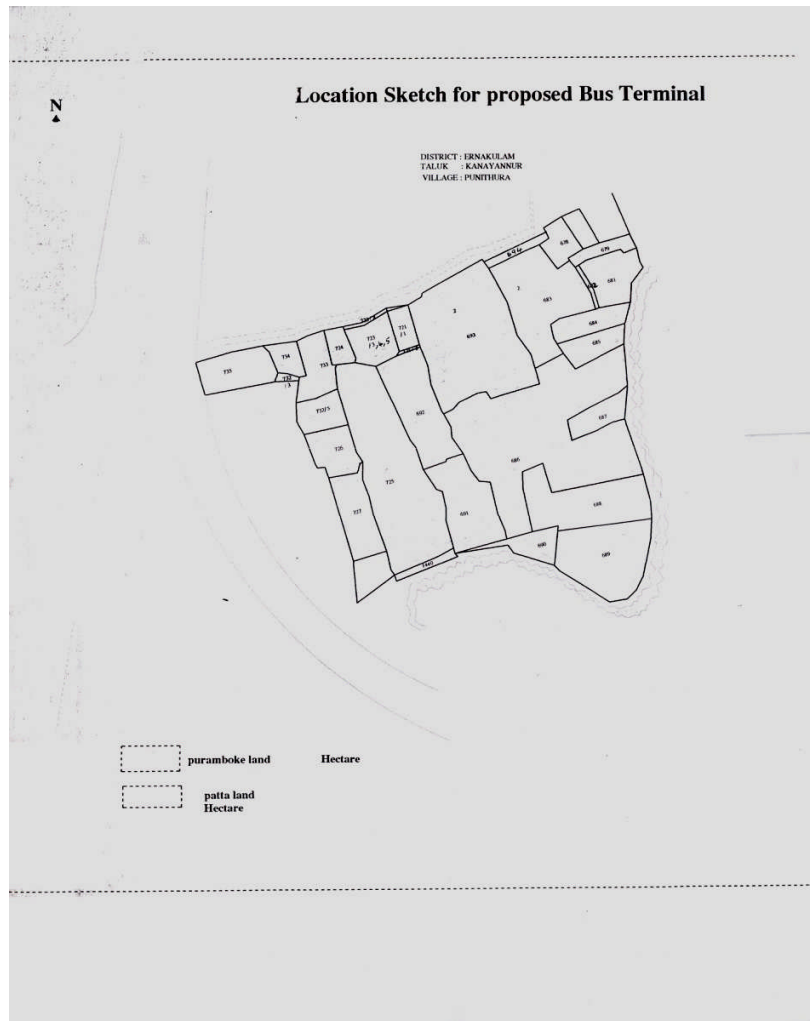
In the proposed site near Vytilla Junction, eight hectares belongs to the Agriculture Ministry, Government of Kerala, while 17 hectares belongs to KeraFed. The entrance and exit points of CII- Kerala | Centre for Public Policy Research | Kumar Group

the site are connected to National Highway 47, Eroor (via Kaniyampuzha Road connecting Vytilla and Eroor) and Tripunithura (via Vytilla Thripunithura Road).

Proposed Vytilla Bus terminal

Fig 10: Location sketch for proposed bus terminus

Public transport occupies lesser road space and causes less pollution per passenger per km than personal vehicles. Besides, it is a more sustainable form of transport and can be a fundamental solution to the ever-growing congestion. The Ministry of Urban transport advocates investment in transport systems that encourage greater use of public transport and non-motorized modes, instead of personal motor vehicles. Investment in Public Transport in Kochi city demands proper planning and distribution for the city bound inter and intra city public transport. The proposed bus terminal at Vytilla is well-suited and can be benchmarked with global standards because of the geographical and proximity to the national transportation highways.



Stake of Agriculture Ministry

In the proposed site for the mobility hub, the options are to own the site, or to be a co-developer and own 20 per cent of the commercial built up area, which can be rented, leased or utilized by the Ministry itself. Different provisions can be specified for transship terminal, city centre mall and parking lots, according to the desired objectives. The lease rentals income will increase over a period of time. The proposal to develop the area into a Bus Terminal provides an opportunity to develop direct marketing avenues for agricultural products, as it will increase the flow of potential customers. Added to this is the development of a nearby Truck Terminal near Kundanoor. Detailed study reports of the projections are given under the plan details.

Thus, the above factors provide ample evidence that the proposed site is unquestionably the best one for the mobility hub.

Vytilla Mobility Hub: The Gateway of Kerala¹⁸

Our vision for the proposed site is more than just a bus terminal, but rather a mobility hub for Kochi, which is futuristic and technology driven and is able to cater to the ever-growing traffic and transport demands of the city and thus get transformed into the Gateway of Kerala!

A mobility hub encompasses the following characteristics;

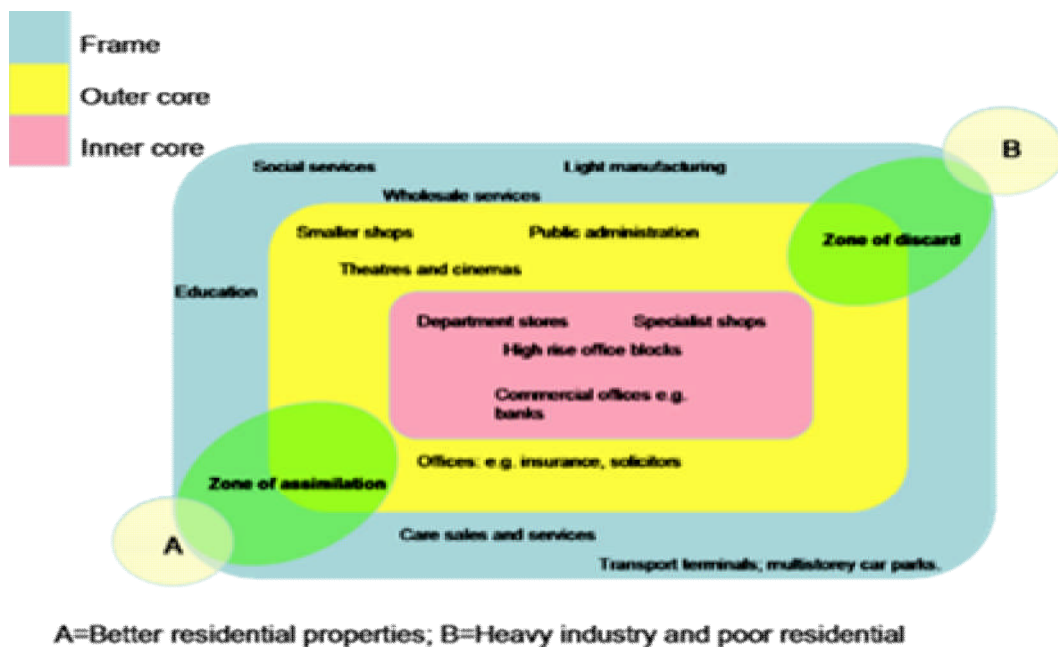
- A place of connectivity, where different modes of transit, from walking to metro, come together seamlessly;
- A place in the urban region where there is an attractive, intensive concentration of employment, living, shopping and enjoyment around a transit interchange;
- Easily accessible for those who begin or end their trip on foot or riding bicycles;
- A place where the transit rider is treated like a coveted consumer, with choices about how he or she moves around the region;
- A safe, convenient, attractive place where the city interacts with its transit system.

¹⁸ <https://ozone.scholarsportal.info/bitstream/1873/9889/1/279285.pdf>
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All of this should occur within an urban setting designed for the way people and families would like to live, work and enjoy themselves. At the same time, the mobility hub is only one part of the equation. Because the transit system is the key connector to and between mobility hubs, the mix of land uses in the surrounding area is crucial to making it a destination conducive to transit choice. In other words, when developing the mobility hub concept for the Kochi, we need a fundamental shift in thinking – away from land use patterns designed primarily for cars. That is why a mobility hub in Vytilla is so important. They are the connection points in a transit-oriented metropolis – a concept very different from the car-based cities and towns we see today.



Fig 11: New Mobility Hubs Network operated from Vytilla Bus terminal

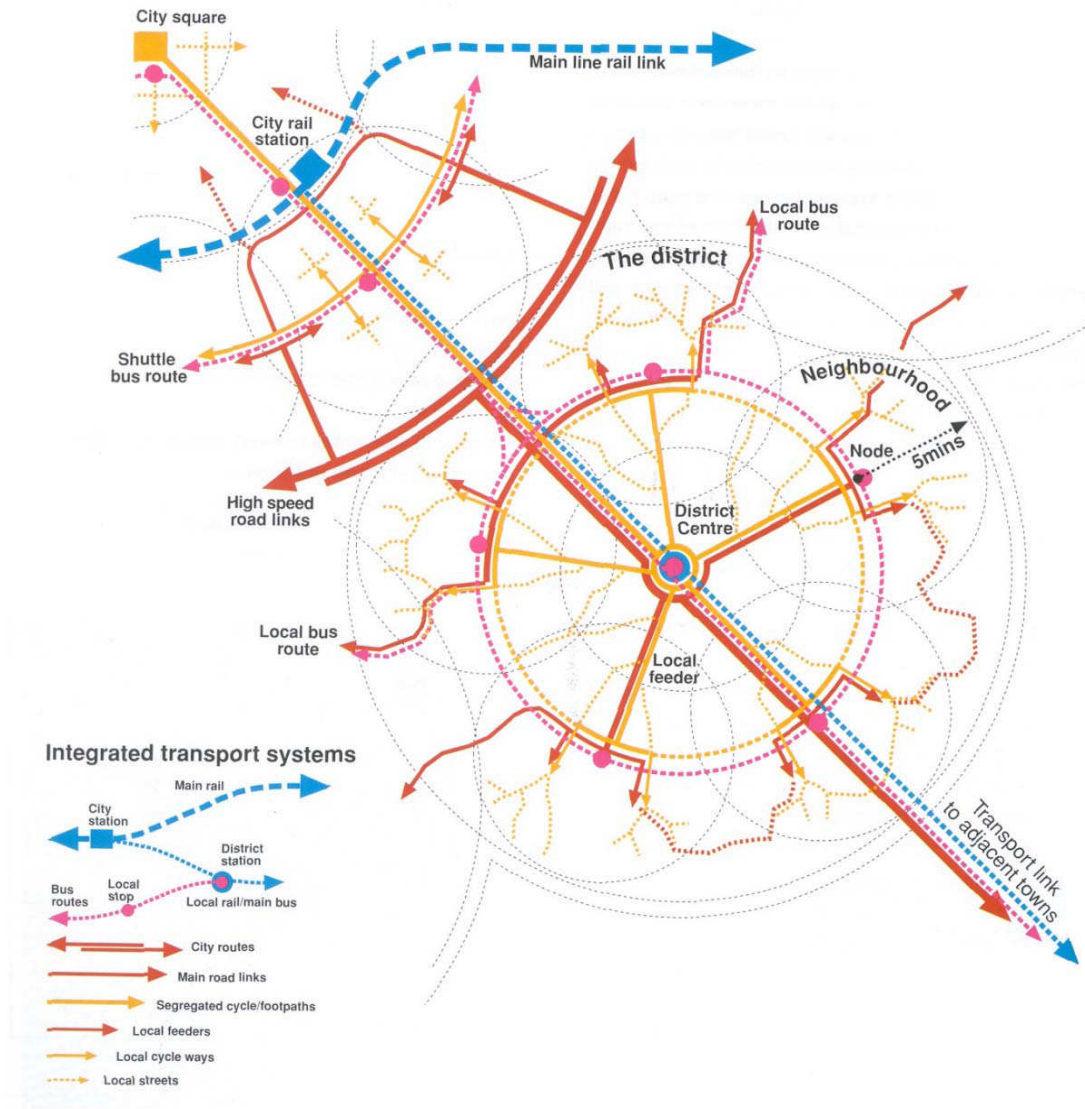


Hub-and-Spoke model¹⁹

The Vytilla bus terminal shall be developed as a Hub for all transport modes to the city. All inter-city buses shall either terminate or pass through the terminal. This includes the buses coming from other districts; inter-state and intra-city buses. There are two circular routes proposed from Vytilla to cater to the requirements of public transport. These routes will connect to the outskirts of CBD and thus other circular services are offered there as well.

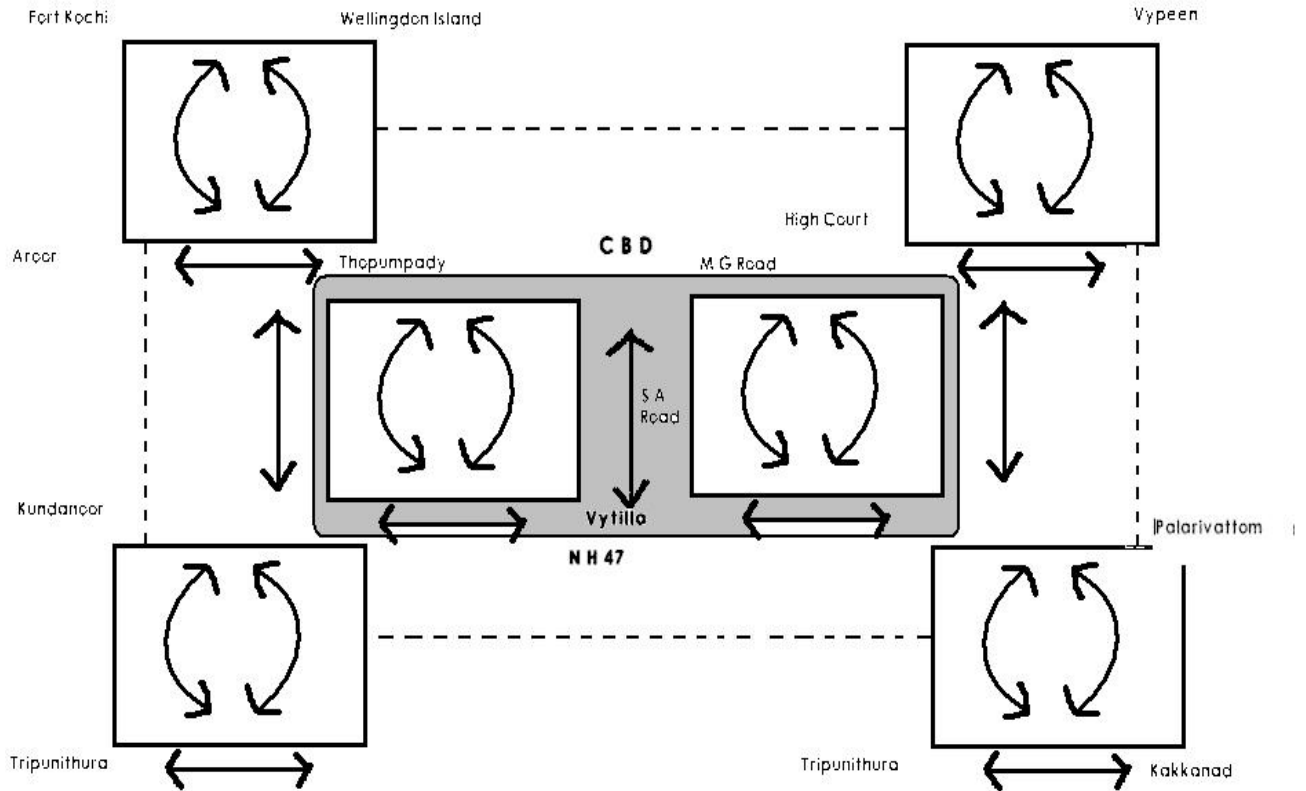
¹⁹ The hub and spoke model is a system which makes transportation much more efficient by greatly simplifying a network of routes.

Fig 12: A model for Hub - and - Spoke Model



Source: <http://www.dto.ie/ifp.pdf>

Fig 13: Proposed City Bus Routes



- a. Vytilla → Kundanoor → Thoppumpady → MG road → SA road → Vytilla
- b. Vytilla → Palarivattom → MG Road → SA Road → Vytilla

All the other buses coming from these two mobility hubs²⁰ - Palarivattom and Thoppumpady shall take NH 47 for their destination keeping the minimum distance to hit the national highway. These terminals will be called as two main 'spokes' of the hub system.

²⁰ Mobility hubs connect a variety of sustainable modes of transportation and services through a network of physical locations or “mobile points” throughout a city or region, physically and electronically linking the elements necessary for a seamless, integrated, sustainable door-to-door urban trip (MTE, 2004). Hubs are practical for cities in the CII- Kerala | Centre for Public Policy Research | Kumar Group

Vytilla is the mobility hub for Kochi city. This mobility hub offers public transport system connecting Thoppumpady and Palarivattom on a frequency of both intra and inter hubs operations mode. Intelligent transport systems can be developed at hubs at Thoppumpady and Palarivattom. Thoppumpady can be a hub for places like Fort Kochi, Wellington Island, Aroor, Edakochi, Perumppadappu, Mattancheri, Palluruthy, Chellanam etc. Palarivattom can be connected with Vypin, Kakkanad, North Parur, Tripunithura etc.

Further steps

- Identify the corridor based on passenger travel data.
- Identify a network of hubs on this corridor for seamless transfer points
- Develop solutions based on the indicators for entire corridor to achieve indicator measures
- Propose integrated solution with sub-components:
 - Bus
 - Bus stops and depots
 - MRTS and trains (if any in the corridor) and their stations
 - Car
 - Taxi, auto, share auto connectivity and discipline
 - Cycle
 - Pedestrian facilities, traffic calming to avoid accidents
 - Parking and park and ride

developed or developing world because they can be customized to fit local needs, resources, and aspirations. Hubs can link and support a variety of diverse elements:

- multiple transportation operators, modes, and services
- taxis and car-sharing of a variety of vehicle types and sizes
- “slugging” (Slug-Lines.com, 2006)
- free or fee-for-use bicycle sharing (Bikeshare/CBN, 2006)
- walkable, bikable, and transit-oriented spatial design and development (Kelbaugh, 1997)
- cafes and meeting places
- Wi-Fi amenities
- electronic fare-payment options and pricing mechanisms for all transportation modes and services
- satellite-enhanced, real-time, urban traveller information for all modes of transportation provided at on-street kiosks and by pda

A New Mobility Hub in the Vytilla Bus terminus has the advantageous positioning of operating as a self-sustained model, forecasting the growth potential of the city.

Urban Growth Centres

The Government of Kerala and Corporation of Kochi have already identified urban growth centres within the GCDA. It has been specifically mentioned in the CDP and in JNNURM projections. It is within these urban growth centres that the greatest concentrations of jobs and housing, as well as other destinations and attractions are to be focused. In the future, many, but not all, of those growth centres contain one or more higher-order transit station, defined as being served by the subway, MRTS, Metro, and Bus Rapid Transit (BRT). Each centre varies greatly in terms of current density, growth potential and measure of urbanity.

Transit Stations

As mentioned earlier, Vytilla is on the fringes of the national highway. A flyover and an elevated corridor are proposed to ease out the congestion and improve the upward mobility in the city. Mobility can also be utilized for parking of inter-state private buses and goods carriages.

Regional Destinations

There are also several other key regional destinations that must be considered. In determining what kinds of mobility hubs make the most sense in various locations, we can think about which stations, and the areas around them, can make the greatest contribution to a highly mobile region, and what characteristics those places should have. Vytilla is best suited for the futuristic planning purposes of transportation requirements in city.

Nearby towns like Muvattupuzha, Piravom, Cherthala, Thripunithura and Alwaye are going to benefit out of this Mobility Hub. Easy access to these centres from the hub would help these areas to grow on a faster mode and can be developed as satellite towns of the growing Kochi city.

Feeder system

Hubs need to be viewed in a holistic manner. Vytilla mobility hub being the city mobility hub, feeders systems like auto rickshaws, taxi services, rented two wheelers and rented cycles will be incorporated. Unlike in the western countries, Indian transport is heterogeneous in nature and has a generic value system culturally imbibed into it. Taking off 2,500 buses from city will increase the demand for alternate vehicles that can at the same time decongest and decrease the pollution in the system. Salaried employees in the higher income bracket like in IT sector can disembark and embark near their companies or campuses and can be picked up by other feeder vehicles. Here, electric vehicles and cycles could be provided for the short distance trips in and out of the campus. These feeder systems can be coordinated amongst the hubs using better technology and controlled from the mobility hub in Vytilla. Eco-friendly feeder system like modernised cycle-rickshaws like in Amsterdam could be introduced at the hub.



Cycle Rickshaws in Amsterdam

Airport/ Railway station shuttle service

The Airport/ Railway station shuttle service tracks passenger arrivals and departures at airport and railway stations and customers are met at the entrance. Shuttles serve hotels, businesses and homes with door-to-door service. The airport/railway station shuttle vans carry seven to 10 passengers to and from airports and train stations. The Vytilla mobility hub can be used as the operating base station for shuttle service, as it provides transit terminal for other modes of

transport, including the feeder system. This way, airport and railway systems are also connected to the mobility hub by road.

Smart Cards

Prepaid card similar to Octopus card ²¹in Hong Kong could be introduced with the mobility hub



for hassle-free and cashless transactions for travel, retail and restaurants. Vytilla Mobility hub would be the first of that kind in Kerala to introduce Smart Cards. It is a pocket-sized card with embedded integrated circuits that can process data. A smart card would be an ideal option for all the proposed site utilities like buses, MRTS, Metro, cars, feeder systems etc. The same card can be used for shopping, dining, etc.

Revenue Generation Model

Vytilla Mobility will be built on 25 acres of land with facilities for bus parking and necessary amenities for the passenger traffic. The remaining area can be utilized for the following as per the revenue generation model.

The mobility hub opens enormous opportunities for business and vendors to become a part of the developmental shift in Kochi city. Keeping up with international standards and offering high-class services to investors and stakeholders, the model helps generate income and can break even at the earliest. Mobility Hub can be showcased as the transport nagar model²² cum Mobility Hub.

²¹ <http://www.hong-kong-travel.org/Octopus.asp>

²²

Revenue Generation for the Local Government:

The Vytilla Mobility Hub has ample scope for generating income for Urban Local Bodies. They could generate good income from different types of taxes. For example, the corporation could gain Rs 8,6,431.20 alone if it considers levying building tax at the current rate of Rs per sq mt at the hub.

Income from Building Tax

Area occupied by hotel - 3,00,000 sq. ft.

Building tax from hotel= Rs 4, 18,215.60

Area occupied by Mall - 2,50,000 sq.ft

Building Tax from Mall = Rs 3,48,513.00

Area occupied by office - 6,00,000 sq.ft

Building Tax from Office Space – Rs 8, 36,431.20

Total: Rs 16, 03,159.80

Other types of taxes that the Corporation may consider to levy at the Mobility hub are as below:

Taxes levied by ULBs are:

Property tax

Profession tax

Entertainment tax

Additional Entertainment tax

Advertisement tax

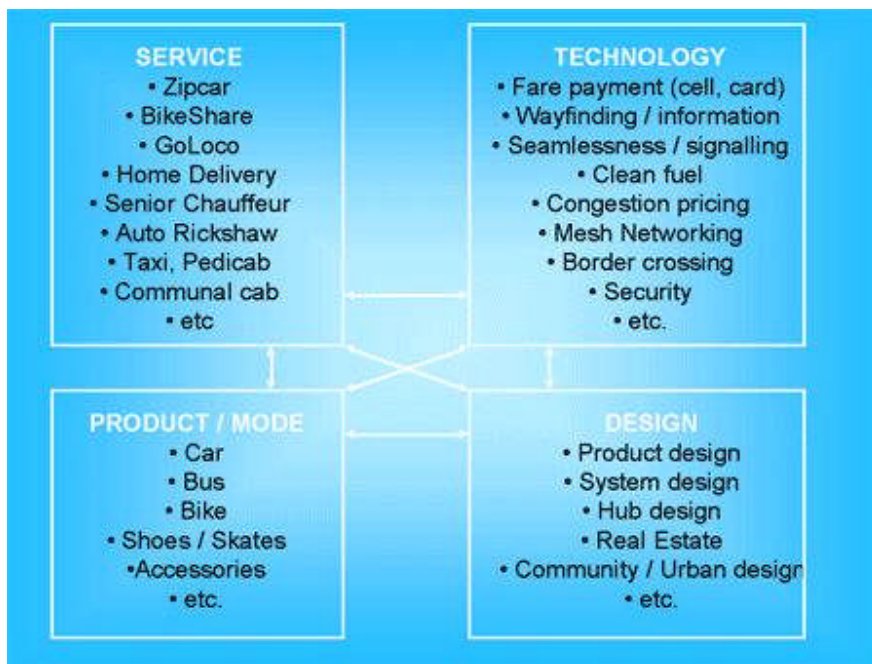
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Show tax

Timber tax

Duty on transfer of properties (Surcharge)

Fig 14: Services offered in a Mobility Hub



1. Goods yard and Transship terminal

The Southern Railway line passing via Kottayam passes near the Vytilla bus terminal. It is only a few metres from the Mobility Hub. A railway link can develop bus terminus into a mobility hub, as mentioned previously.

2. Parking lot

There are more than 100 buses to Bengaluru and Chennai from Kochi every day. Substantial number of them is private carriages. The mobility hub can include interstate private bus terminus like in Koyambedu in Chennai. This would generate substantial income.

All private vehicles including cars, autos and two-wheelers can be provided with parking space where they can connect to the bus terminals and metro station. Capacity load can be the biggest in the State so that it can be another revenue generating model.

3. City Centre Mall

Vytilla being the commercial gateway can be developed as a city centre mall. Shopping mall can be built fully air-conditioned with sky scrapper model. This built in-area can be leased out and retailers can be attracted to open their shops in the mall. Food malls, textiles shops and the jewellery can be other attractions.²³

Proposed Project Plan

The mobility hub in Vytilla is planned in 25 acres of land adjacent to Vytilla Junction. Given the real estate value in Vytilla Junction, it is a good investment for stake holders to reap the benefits and reinforcing their commitment to the social development of Kerala by building a standard model. Besides being projected as the solution to the traffic and transport problems in Kochi urban area, Vytilla Mobility hub is also planned as City Centre Mall with a convention centre, shopping avenues, recreation areas, parking lots and so on. This is modelled on the lines of the proposed bus terminal in Thampanoor in Trivandrum, which is funded by the Kerala Transport Development Finance Company.



The proposed site consists of 25 acres of land with a long river front on the east and south.

²³ City Center Mall functions as a shopping and commercial destination, a place where people live, a community meeting point, a place of work and a commuting hub for thousand of resident, workers and students each day.
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Accessibility and connectivity

It has one established road on the north boundary that is now being widened by the P.W.D. This road has to be widened to 18 metres as per the master plan. Property has direct access to Vytilla-Tripunithura road which is running adjacent to the projects. This road is to be widened to 27 metres as per master plan. It is highly essential to establish direct access from this road also for better traffic solutions.

A boat jetty planned on this river front will connect surface transport with water transport. The metro station right in front of the property can be connected to the bus station by an overhead connection. A new railway station can be planned in Vytilla and it can even be connected to the new transportation hub through a mono rail. So finally the transportation hereby will be a transit point between various modes of transport such as road, water, metro and rail.

Potential

The property has enough potential to develop into a transportation hub and for leisure activities because of its proximity to water and a long water front. The leisure zone with green space, play areas, marine walk, food court, handicrafts shop, hotel, cultural and conference centre, an Olympic size pool and health club can be a great asset to the eastern side of Kochi that is fast growing.

Bus Station

The property has the space to establish a state-of-the-art transportation hub catering to long inter-state, inter-city and intra-city buses. The bus station can be developed with two separate platforms and loading bays for these buses. The platforms can be inter-connected by an affordable mall with sky light and green spaces. The mall will have one semi-basement, ground floor and two floors above, making it easier to access. The mall will have unobstructed entry on two ends with taxi and auto parking. Pedestrian entry into the platform also will be through these entries, preventing people from entering through bus-operating areas. This will also give commercial appeal to the mall, while ensuring safety.

The bus station will have a semi-basement car parking under the platform and terrace car parking over the platform. The bus parking can be covered with cantilevered canopy making it an all-weather station.

Buses are parked in an angle on the direction of traffic and part of the bus bays can be reserved from unloading and the other part for loading. There are idle parking areas for buses adjacent to loading bays and will have fuel point and maintenance checkpoints and small repair rooms. No major workshop areas are envisaged within this property and can be established elsewhere, if needed.

Offices

Offices can be developed into a separate block with its own direct access from the junction and separate car parking. This can be a tall building with 16 or 17 floors, with a central atrium. The offices can be partly air-conditioned or with provision for air conditioning.

Cultural and convention centre

With adequate car parking and open spaces, a cultural and convention centre can be developed in the water front, adding value to leisure areas.

Health Club and Swimming pool

An Olympic size swimming pool that is now lacking in Kochi, with adequate health facilities can be a good attraction for tourists.

Hotel

The projected circular portion of the water front area can be set aside to establish a medium tariff hotel, similar to many such hotels near Trivandrum bus station.

Boat Jetty

A boat jetty can be developed for regular passengers, as well as tourists. This jetty can be connected to the bus station through an elevated tube connection with provision for a motorized walk way.

Walk way

A pedestrian walk way can be developed along the water front similar to the one in Veli, Trivandrum. The gallery on the land side of the walk way will be a great leisure zone for tourists.

Multi-level Parking Systems

Automatic and mechanical multi-level car parking system is which is quite popular in parts of Europe, Japan, Korea and South-East Asia car parking capacity by utilising vertical space, rather than expand horizontally could be introduced in the Vytilla Mobility Hub. These systems make creation of extra parking capacity feasible. For instance, car parking space meant for two cars can accommodate three cars.

So far, three types of mechanised car parking systems -- puzzle, tower and mini -- have been operating in India. In each of these, the car is always parked or retrieved at one level only, and the stationary vehicle is carried to different levels in steel pallets. Introduction of fully automatic systems can cater to higher capacities per unit. Since conventional multi-level car parks have a clear height of 9 ft to 10 ft above each level, they can accommodate Small Utility Vehicles also.

These systems are user-friendly since their configuration and position of the pallet is in such a manner that it takes half to two-and-half minutes from the press of a button to an approaching car to the drive way level to park a car on it or drive away the car parked on it. One has to club towers with ad revenues or with some other alternatives like commercial activities so that the revenue keeps flowing to the owners who implement car parking systems.



Multi-level Car Parking System



Multi-level Parking System for Cycles in Amsterdam

Parking facility for bicycles could also be incorporated in the hub to encourage people to adopt eco-friendly mode of transportation.

Restrooms

The hub will have restroom and retiring rooms with attached bathroom and dressing for the passengers and commuters utilizing the hub. These rooms will incorporate the 'universal design' to cater to the differently abled people. Rooms of different segments like AC, non-AC could be built, catering to different income groups

These restrooms could be leased out or global private players could be invited to build and maintain these.



FLEET SHOWERS CABIN

Development Methods

While the authorities develop the bus station, mall, office, boat jetty, parks, walk ways, etc, the hotel property, cultural and convention centre, health club and swimming pool can be developed through private participation.

Various options are suggested to develop Mobility Hub. Special Purpose Vehicle (SPV), Private Pubic Partnerships (PPP) and Joint Ventures (JV) are some of them.

Special Purpose Vehicle²⁴

A special purpose vehicle (SPV) in form of a company or a trust, sponsored by the State Government could be floated for the mobility hub project. This will encourage investors to participate in the project, thereby bringing in the required capital for the hub.

Key features desired in an ideal SPV

- ✓ An SPV must be capable of acquiring, holding and disposing of assets.
- ✓ It would be an entity, which would undertake only the activity of asset securitization and no other activity.

²⁴ <http://rbidocs.rbi.org.in/rdocs/PublicationReport/docs/10796.doc>.
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- ✓ It must be bankruptcy remote, i.e. the bankruptcy of the Originator should not affect the interests of holders of instruments issued by the SPV.
- ✓ It must be bankruptcy proof. i.e. it should not be capable of being taken into bankruptcy in the event of any inability to service the securitized paper issued by it.
- ✓ It must have an identity totally distinct from that of its promoters/ sponsors/constituents/ shareholders
- ✓ The investors must have undivided interest in the underlying asset (as distinguished from an interest in the SPV which is a mere conduit).
- ✓ It must be tax neutral i.e. there should be no additional tax liability or double taxation on the transaction on account of the SPV acting as a conduit.
- ✓ The SPV agreement may not release its employees or trustees from their responsibility for acts of negligence and a willful misconduct.

Instrument issued by the SPV should have the following characteristics:

- ✓ Be capable of being offered to the public or private placement.
- ✓ Permit free or restricted transferability.
- ✓ Permit issuance of pass through or pay through securities.
- ✓ Represent the amounts invested and the undivided interest or share in the asset (and should not constitute debt of SPV or the Originator).
- ✓ Be capable of being classified as senior/subordinate by differentiation in ranking of security or in receiving payments.
- ✓ May be issued in bearer form or registered in the holder's name, may or may not be endorsable and may be issued in definitive form or book entry form.

Public Private Partnership

PPP model could be successfully used for the project. It not only encourages the private party to take part in developing infrastructure, but also helps to maintain the quality and timely completion of the project. The Kochi international Airport is a good example of this. CIAL is

cited as one of the most successful PPP models implemented in India. Few models of PPP have been discussed below. They could also be taken into consideration for the final decision of the implementation of the project.

Advantage of PPP:

- ✓ Procurement of a public service from the private
- ✓ Sector on a long-term basis
- ✓ Transfer of risks from public to private sector
- ✓ Private sector management skills
- ✓ Construction, operation, maintenance and finance
- ✓ Transfer back to public sector at end of concession, normally 20-35 years

For projects undertaken by Special Purpose Vehicle (SPV) on a Public-Private Partnership (PPP) format, the project has to demonstrate an internal rate of return (IRR) greater than the cost of capital raised for the project. In doing so, the project should provide an economic rate of return greater than the cost of capital and the proposed minimum DSCR should not be less than 1.25²⁵.

Build-Own-Transfer Model

The logic behind the build-operate-transfer (BOT) model is quite simple. In the BOT model, the Government will have the right to own the hub, while the third-party vendor (private company) will build the hub, hire the employees, gets the operation running for a period of 3-5 years and then will hand over the operations to the State after the set period. During the contract period, the vendor and the client work closely with a senior client representative monitoring the operations. At the time of the transition, the vendor is suitably compensated. It will reduce the Government's risks involved in the project and would also allow the participation of globally recognized infrastructure private companies to maintain world class standards.

²⁵ <http://jnnurm.nic.in/nurmudweb/toolkit/Toolkit-4.pdf>
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Build-Own-Operate-Transfer (BOOT)

The Government can grant a franchise to a private partner to finance, design, build and operate the hub for a specific period of time. Ownership of the facility is transferred back to the public sector at the end of that period.

Design-Build-Finance-Operate/Maintain (DBFO, DBFM or DBFO/M)

Under this model, the private sector designs, builds, finances, operates and/or maintains a new facility under a long-term lease. At the end of the lease term, the facility is transferred to the public sector. In some countries, DBFO/M covers both BOO and BOOT.

Strategic Infrastructure Partnerships /Joint Ventures:

Some 50 per cent capital required by the projects could be raised by Private Finance Initiatives (PFI) and 50 per cent could be raised under conventional design and build procurement.

Local Asset Backed Vehicles

Local Asset Backed Vehicles (LABVs) are funds combining locally-owned public sector assets and equity from institutional investors, established to finance the delivery of regeneration and related schemes. These vehicles tend to have their own boards and management teams, and are constituted as limited partnerships, on a 50/50 ownership basis between the public and private sectors. Projects are delivered under a business plan with returns made by the LABV shared between the partners on an agreed basis.

Key strengths:

- ✓ Potential to lever significant private sector assets
- ✓ Flexible structure of partnership frameworks
- ✓ Ability to maintain public sector influence via a shared ownership structure

Prudential Borrowing

Introduced in Wales (UK) in 2004, Prudential Borrowing allows Councils to borrow without specific Governmental consent, as long as they remain within their own affordable borrowing units. The funding is targeted on capital investment schemes. In this model, the future revenue streams are used as security for loans, with transport and housing being major areas of investment under Prudential Borrowing. The schemes are managed through the use of future key indicators – affordability, prudence, capital expenditure, external debt and treasury management.

Key Strengths:

- ✓ Potential to obtain loans at relatively cheap interest rates when compared to other sources of finance
- ✓ Flexible model that can be used in a wide variety of procurement scenarios
- ✓ Allows authorities to 'invest to save' where expenditure will be repaid from future revenue savings

Community Interest Companies (CICs)

It is a new potential vehicle for delivering local-based partnerships. It is a Limited Liability company designed specifically to benefit community. It can be partnerships between local authorities, businesses and other stakeholders. It can enfranchise local service users (for example, by giving them a share/right to vote). In this approach, the assets are "locked" within company and cannot be distributed at less than the market value. The profits are either retained or subject to a cap on dividend payment.

Key strengths:

- ✓ Set up for benefit of the community
- ✓ Quick and relatively simple to set up
- ✓ Asset lock and cap on dividends
- ✓ Independent regulation
- ✓ More flexible than a charity
- ✓ Can borrow funds
- ✓ Can grow via share issues

Build-Operate-Transfer (BOT) and Public-Private-Partnerships (PPP) help in improving infrastructure efficiency and solving Government financial deficiency problem, and therefore have attracted great attention. During the last two decades, BOT/PPP is becoming one of the most prevailing ways for infrastructure development in India.

Fig 14: Sketch of the proposed mobility hub

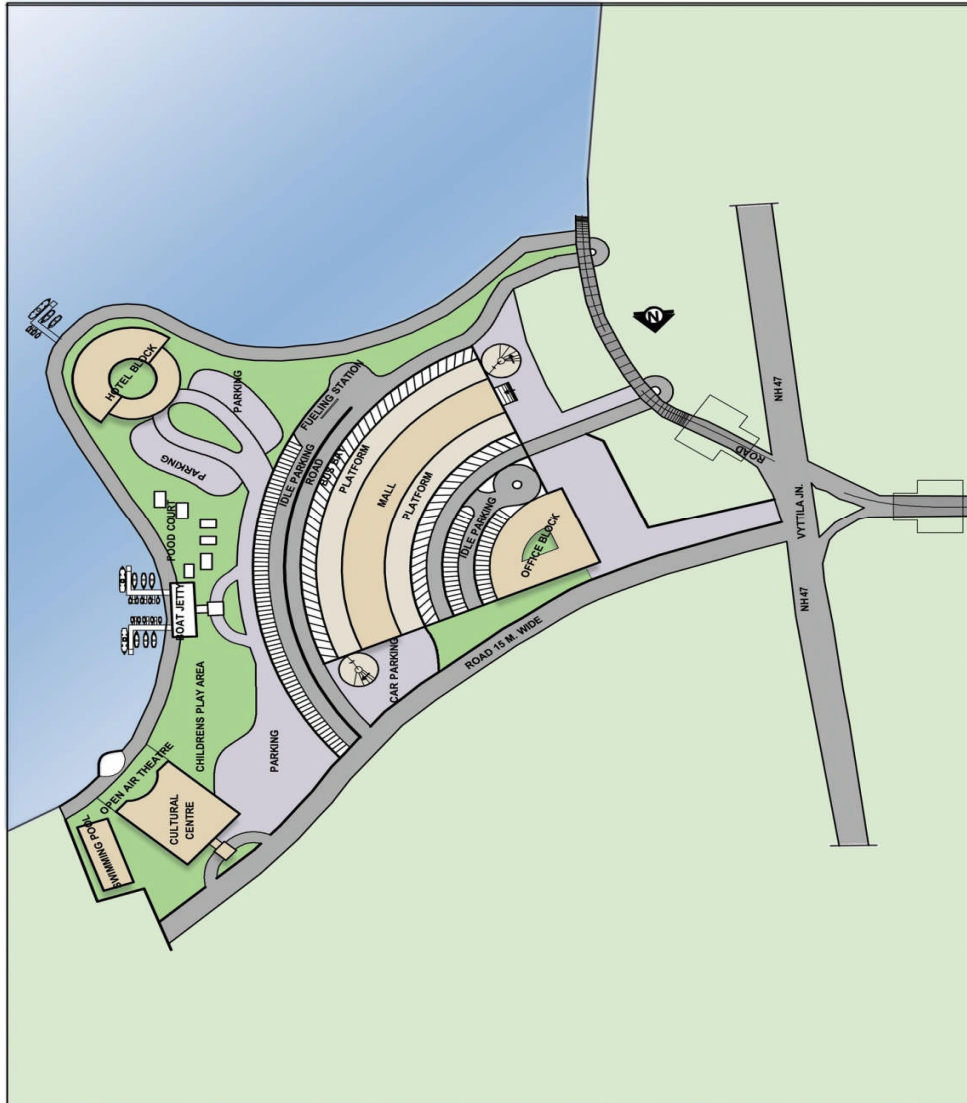


Table 11: Details of Parking Facilities (in Nos)

A	Long Distance Buses	
1	Bus Bays	26
2	Idle Bus Parking	75
B	Short Distance Buses	
1	Bus Bays	45
2	Idle Bus Parking	75
C	Taxi parking	
1	Taxi Parking	80
Total Buses		301
D	Bus Station and Mall	
1	Basement	300
2	Terrace	300
E	Hotel	
1	Hotel Car parking	100
D	Water Front Facilities	
1	Genera Car parking	100
E	Cultural Centre	
1	Open Parking	40
2	Basement	60
Total Car parking		900
H	Auto Parking	
1	Auto parking	120
I	Boat bays	
1	Large Boats	2
2	Medium Boats	6

3	Small Boats	10
J	Hotel Boat Bays	
1	Large boat	1
2	Medium Boats	2
3	Small Boats	3

Table 12: F.A.R Calculation

Sl. No	Particulars	Area
1)	Total Land	25 acres (approx)
2)		10,90,000 sq. ft.
3)	Assumed Global F.A.R	1.5
4)	Total Buildable Are	16,35,000 ft.
5)	Area occupied by waiting platform for bus bays and connected facilities	1,25,000 sq. ft.
6)	Area occupied by hotel	3, 00,000 sq. ft.
7)	Area occupied by cultural centre and health club	75,000 sq. t.
8)	Area occupied by Mall	2,50,000 sq.ft
9)	Area occupied by office	6,00,000 sq.ft
10)	Miscellaneous	20,000 sq.ft
11)	Total Area	13,70,000 sq.ft

F.A.R Achieved

1.256

Say

1.25

If F.A.R is raised to 2, which is permitted in proposed location, there would be an increase of 8, 000, 000 sq.ft that would have a positive enduring impact on the revenue generation model.

Table 13: Total Cost

Table 14: Total Income

Sl. No	Particulars	Amount (Crore)
1)	Bus Station and mall (Mall area – 2,50,000 sq. ft)	100
2)	Office	100
3)	Part A/C cost for office	12
4)	Miscellaneous	5
5)	Land Development cost and Landscape	4.5
6)	Consultancy, construction management, marketing etc	25
7)	Acquiring of land for access from Tripunithura road	3
8)	Purchase of alternate land for Agricultural Department at a suitable space 25 acres	7.5
9)	Development cost of the above land	2.5
10)	Over Head connection from Metro and the boat Jetty	5
11)	Boat Jetty	2
	Total	265

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Sl. No	Particulars	Amount (crore)
1	Mall 80% area to be given on long lease @ Rs. 5000 / sq.ft (2 Lakh sq.ft x 5000)	100
2	Sale of land of cultural centre 3 acres at 8 lakh/Cent	24
3	Office 80% space to be given on long lease : 4.8 lakh x 4000	192
4	Hotel 2.5 acres of land on long lease	25
	Total Income	341

Say

340 Crore

Note: Returns form car parking not calculated

Table 15: Internal Rate of Return (IRR)

IRR is calculated based on JNNURM funding option

	Stand alone Kerala Govt Project	Supported by JNNURM
Amount incurred in Building the infrastructure	265	265
Capital brought in by the operator	100	100
Amount taken in Loan	165	0 ²⁶
Loan period ²⁷	3	3
Interest rate	12%	0%
Loan Interest yearly ²⁸	19.8	0.0
Loan : Capital repayment yearly	83	0
Total Loan Repayment yearly	102	0

²⁶ If funds can be obtained from JNNURM, then no borrowing is required

²⁷ Loan will be repaid by the end of the construction phase

²⁸ This outflow can be saved by opting for JNNURM

Year 1	Income 1: Amount received as lease income	0.0	0.0
	Income 2: Amount received from sale	0	0
	Income 3: Interest income	0	0
	Income 4: Grants	0	0
	Expense 1: Capital brought in by operator	50	50
	Expense 2: Expenditure incurred in loan repayment	19.8	0
	Expense 3: Yearly recurring expenditure	0	0
	Profit / Loss after interests	-69.8	-50.0
	ROCE first year (ROI on total investment)	0%	0%
	ROI first year (ROI on direct invested amount)	0%	0%

Year 2	Income 1: Amount received as lease income	79	79
	Income 2: Amount received from sale	61.5	61.5
	Income 3: Interest income	0	0
	Expense 1: Capital brought in by operator	25	25
	Expense 2: Expenditure incurred in loan repayment	102	0
	Expense 3: Yearly recurring expenditure	0	0
	Expense 4: Payback to Agri dept	0	0
	Profit / Loss after interests	13.5	115.8
	ROCE Second year (on total investment)	5%	44%
	ROI (return on capital by the operator)	13%	116%

Year 3	Income 1: Amount received as lease income	79	79
	Income 2: Amount received from sale	61.5	61.5
	Income 3: Interest income	0	0
	Expense 1: Capital brought in by operator	25	25
	Expense 2: Expenditure incurred in loan repayment	102	0
	Expense 3: Yearly recurring expenditure	0	0
	Expense 4: Payback to Agri dept	0	0
	Profit / Loss after interests	13.5	115.8
	ROCE Third year (On total investment)	5%	44%
	ROI Third year (On Own Investments)	13%	116%

Year 4	Income 1: Amount received as lease income	79	79
	Income 2: Amount received from sale	61.5	61.5
	Income 3: Interest income	0	0
	Expense 1: Capital brought in by operator	0	0
	Expense 2: Expenditure incurred in loan repayment	0	0
	Expense 3: Yearly recurring expenditure	0	0
	Expense 4: Payback to Agri dept		
	Profit / Loss after interests	140.8	140.8
	ROCE Third year (On total investment)	53%	53%
	ROI Third year (On Own Investments)	141%	141%

Year 5	Income 1: Amount received as lease income	79	79
	Income 2: Amount received from sale	61.5	61.5
	Income 3: Interest income	0	0
	Expense 1: Capital brought in by operator	0	0
	Expense 2: Expenditure incurred in loan repayment	0	0
	Expense 3: Yearly recurring expenditure	0	0
	Expense 4: Payback to Agri dept		
	Profit / Loss after interests	140.8	140.8
	ROCE Third year (On total investment)	53%	53%
	ROI Third year (On Own Investments)	141%	141%

Consolidated			
	Income 1: Amount Received as Lease	317.0	317.0
	Income 2: Amount Received from Sale	246	246
	Income 3: Interest Income	0	0
	Total Income	563.0	563.0
	Expense 1: Capital brought in by operator	100	100
	Expense 2: Expenditure incurred in loan repayment	224	0
	Expense 3: Yearly recurring expenditure	0	0
	Expense 4: Payback to Agri dept	0.0	0.0
	Total Expenditure	324.4	100

Profits	238.6	463.0
ROCE (ie (Profit+Interests) / Total investments) per year	22%	35%
ROI (ie, Profit / Investment brought in by operator) per year	48%	93%

Other Savings are

KSRTC's Savings on fuel

Private Buses' savings on fuel

Man Hours saved

Reduction of Pollution

Reduction in congestion in cities

Consequential savings of man hours and fuel due to reduction in congestion

IRR shows that it is large enough to qualify for Global tendering to get the best contractors in place. The benefits are extremely high to the society, and a financially viable project under the scheme.

Joint Venture with Agriculture Department

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Advantage to Agriculture Department

If Agriculture Department opts for a Joint Venture, the following are the benefits;

1. Agriculture Department will get 20 per cent of built up area of Commercial area and Office area.

2. Approximate area allotted to Agriculture Department

a. Commercial area 20 per cent of 2,50,000 sq.ft = 50,000 sq.ft

b. Office area 20 per cent of 6,00,000 sq.ft = 1,20,000 sq.ft

3. Approximate value and gain for Agriculture Department

a. Commercial area 50,000 x 5,000 Rs/Sq.ft = 25 crore

b. Office area 1,20,000 x 4,000 Rs/Sq.ft = 48 crore

Total = 73 crore

Benefits of Vytilla Mobility Hub

1. Employment opportunities

Total commercial area projected: 6, 25, 000 square feet

If we consider one employment opportunity for every 150 square feet, this would produce around 4,000 opportunities.

In addition, it would create indirect employment opportunities to another 5,000 persons during constructions and related works.

2. Social Benefits

Safe Roads: The incidences of traffic have been rising over the years. As per statistics, 4000 accidents occurred in 2007. Mostly of these, accidents are due to over crowding of the vehicles on the roads. Taking 2,766 buses off the congested roads would definitely help in reducing accidents in the city. Interestingly, though most road accidents occur as a result of over speeding, the congestion in Kochi city often cause them. The Vytilla bus terminal can decongest the roads, leading to more space and carriage width to vehicles.

Reduction of Air and Noise Pollution: Kochi is one of the highly polluted cities in India. Vehicles are the major contributions of air pollution. Aligning the transport system would allow smooth movement of the vehicles at desired speed, thus helping in reducing the carbon foot print in the city.

The magnitude of noise created by buses is around 92-94 decibels (dB), making them a significant contributor of noise pollution. By taking off 2,766 buses from city, it can be reduced to 60-65 db.

Decongestion of City Roads: The KSRTC and Kaloor inter-state/city bus terminal is located in the heart of the city and 5,756 bus trips are undertaken in various directions. There is a lot of traffic congestion on the main arterial roads, i.e. MG road, SA road and Banerji Road. A large number of people come to the bus terminal through various private modes, which further aggravates the problem. The shifting of the bus will decongest these road and help in smooth movement of the traffic.

Reduce commute times: The inter and intra city commuting time will be greatly reduced as long-distance buses would not be stranded in city traffic. Terminating these buses at Vytilla would help save the time that is currently spent in the city traffic. On the other hand, the intra-city buses can move smoothly as they will have enough space in city roads.

Inter and intra city connectivity: The proposed bus terminus lies in an area well-connected to various cities like Allapuzha Coimbatore, Idduki, Kottayam and Thrissur, through NH 47, 17 ad 49. It is also cell connected to the CBD area through S A Road and currently there are a number of city buses plying near the site daily thus ensuring inter and intra city connectivity.

Connectivity with Metro Rail: The proposed metro rail connecting 25.3 km from Alwaye and Pettah passes through the proposed bus terminus site at Vytilla. The metro rail proposal also has a plan of coming up with a station at Margin Free Market at Vytilla, which is very close to the proposed bus terminal. The passengers could easily take the metro rail to the city. This would also help in reduction of traffic congestion in the city.

Hassle-free intra-city commuting: People coming to the city with their vehicles could park them at the mobility hub and enter the city and travel within conveniently using the MRT and the feeder system. Private vehicles will reduce since the number of vehicles entering the city would greatly reduce. People would be encouraged to use the parking space in the hub and use the MRT and the feeder systems.

Provide Public Space: Mobility hub has been developed around the concept of 'rights of common'. The water front, cultural center, health club, shopping mall, etc, which will be developed at the mobility hub, will provide great opportunity for recreational and civic interaction.

Growth of Tourism: The mobility hub will improve the transport system the city. It has a potential of becoming a major tourist destination, thus give a boost to the tourism industry of the State.

Inland water transport: The Kaniyampuzha canal runs along the proposed site. This canal could serve as an inland water transport carrying passengers from the proposed bus terminus to the city. It will also help ease the pressure on road-based transport

Provide space for the intra-city buses: The roads currently used by long-distance buses are high-demand corridors. By 2021, the intra-city travel demand will need more than 770 buses to ply within the city. Once long-distance buses terminate outside the city the high-demand corridors will be free for additional intra-city buses, thus reducing the demand of usages of private vehicles on those corridors

3. Economic Benefits

The revenue generation model has been designed keeping in mind the share of both the Agriculture Department and the KeraFed. They will gain huge amount of revenue by leasing out parking space, office and shopping area.

Savings on Fuel Expenditure: There is an annual wastage of 5,51,880 litre of diesel by KSRTC buses as they enter and leave the city travelling around six km within the city. This could easily be avoided if the buses terminate at the proposed Vytilla bus terminus, saving Rs 17,660,160 per year. Similarly private bus owners could save Rs 11,680,000 if the bus terminal comes up at Vytilla.

Savings for KSRTC

Total no. of KSRTC buses: 442

The total no. of trips per day by KSRTC buses: 756

Average distance traveled within the city: Six km

Total distance traveled by KSRTC per day (756 nos x 6 km): 4,536 km

Average mileage per liter of diesel: Three km

Total consumption of diesel within the city per day (4536/3 km per litre): 1512 litre

Rate of diesel per litre: Rs 32.00

Total expenditure of diesel per day (1512 x 32): Rs 48,384.00

Annual expenditure on diesel: Rs 17,660,160.00

Savings for Private Bus Owners

Total no. of Private bus: 2,300

Average no. of trips per day: 5000

Average distance within the city: Six km

Total distance traveled per day within the city (5000 x 6): 30000 km

Diesel consumption per day (30000/3 km per litre): 10000 litre

Average expenditure per day on Diesel (10000 Lt x 32): Rs 32,000

Average Annual expenditure on Diesel: Rs 11,680,000.00

Man Hours Savings

Currently there are 424 KSRTC buses with 756 trips operating daily from the KSRTC bus terminal near the south railways junction and 2,300 private buses with 5,000 trips operating from the Kaloor bus terminal. These buses travel take around 30 to 45 minutes carrying on an average 25 passengers as they terminate and originate from the existing terminal, culminating in a loss of 71,950 man hrs, which could have been utilized to generate an annual income of Rs 82,06,79,687.5.

- The average distance to reach KSRTC and Kaloor bus terminals from different entry points of the city: Six km
- Average time taken by the private and Government buses to reach the bus terminals within the city: 30 minutes
- The total no. of trips per day by KSRTC buses: 756
- Total no. of trips per day by private buses: 5,000
- Total no. of trips by govt and private buses: 5,756
- Average no. of passengers entering and leaving the city: 25 persons
- Total no. of person entering and leaving the city per day (5756 x 25): 1,43,900
- Loss of man hour per day (143900 persons x 30 mins/60): 71,950 hrs
- Total loss of income per day (71950 x Rs 31.25²⁹): Rs 2,248,437.50
- Total loss of income per year (2248437.50 x 365): Rs 820,679,687.5

²⁹ Assuming average minimum wage as Rs 250.

Table 16: Savings per annum

Particulars	Saving per annum (millions) (Rs)
KSRTC	17.66
Private Buses	11.68
Man hour	820.68
Total	840.02

Fig: Ariel View of the Proposed Vytilla Mobility Hub



Conclusion:

Like any other city of the modern world, Kochi also experiences similar urban problems such as traffic-choked streets to grime and pollution, making life in the city often less than desirable. Vytilla Mobility hub has evolved as the natural remedy and envisioned as a long-term transport solution for the city.

No other location in Kochi Urban Area can match with Vytilla in satisfying the benchmarks required for a mobility hub of international standards with the value additions of a technology driven hub facilitating intelligent transport system. The proposed site at Vytilla is the ideal location close to the proposed metro rail station and touching national highways, which are two principal elements of connectivity. This means that not much additional investment is required for the connectivity plans in the future. The land area of 25 acres adjacent to inland water transport canal offers an excellent opportunity to build a multi-transport model, mandated by the mobility hub. In addition, there is no requirement to acquire additional private land to develop the mobility hub as the proposed site is owned by the State and can be easily be transferred for construction. Kochi city, as history reminds us, has the tendency to shift eastwards. From the time of Portuguese occupation, Kochi has an urban civilization moving further eastwards, starting from Mattancheri to Kakkanad (city administrative office). Vytilla is the only well-connected location and is easily linking centuries by connecting Fort Kochi and Kakkanad these days clocking almost equal time. Vytilla is growing as the locus of the Central Business District with emerging business centres and high-density residential and floating population. The city is still growing towards Tripunithura with both Government and private institutions planning to shift their operations. Given the topography of the district, Vytilla can be rightly argued as a destination for the next generation development.