Addressing walkability of Kochi corporation area with a focus on inland water transportation

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Abstract. Kochi Corporation area is one of the most densely populated corporations in Kerala. The haphazard growth results in least importance on pedestrians. Walking is a healthy culture, which is inevitable in our daily lives. When we consider other modes of transportation, waterborne transportation has the least negative impacts. Here, nearly fifty percent of Kochi corporation area is surrounded by water and has the potential to develop ferry routes. Through the ferry routes we can access the major nodes of the city. However, due to lack of walking infrastructure and proper connectivity, there is a decline in the walking culture. Identifying the scope of walkability in Kochi Corporation area helps to develop a walkable city, which can be an efficient contributor to sustainability. When we blend walking and ferry routes in an urban core, it gives in a ray of hope for sustainability. This paper looks into interlinking the potentials of urban ferry stations and walkability of Kochi Corporation area; thereby aiming to improve the connectivity and built environment of streets near ferry stations. This also looks into providing a safe and healthy built environment of Kochi Corporation area thereby playing a major role in balancing sustainability.

1. Introduction
Kochi is a city where development is consistently taking place and it is evidently visible from the past few years. The surrounding regions also have major role in the growth of this city. The city is getting crowded and elevates the vehicular usage, which results in rise in pollutions. In this phase of development we should emphasize more on the provisions of non-vehicular rather than vehicular services. Inappropriate consideration of pedestrians in Kochi makes a fear and uneasiness to walk in the minds of people. This indirectly inclined to an adverse manner towards the quality of life. Walkability is an essential step for sustainability. The new proposal of the Kochi water metro shows the future potential of water transportation services. They expanded the 21 current ferry stops of State Water Transportation Department into 38 numbers in three different phases.

It is vital to bring in a sustainable and healthy life style through different parameters of walkability and through re-establishing underutilized ferry transportation services in Kochi. Kochi corporation area has the potential to enhance the current ferry services in a sustainable manner through linking it with the walkability.

2. Walkability Concept
The concept of walkability conveys how good for the built environment is to walk. Pedestrianisation is a main factor to create a sustainable city. The notion of pedestrianisation developed due to the over dominance of automobiles in cities, together with traffic congestion, energy cost, environmental concerns, pollution etc. are the consequences. The major objectives of pedestrianisation are to achieve
environmental, economic and social sustainable and walkability helps in achieving these three objectives in a balanced manner. Based on the dominance of vehicle, pedestrianisation can be classified into three. They are full time pedestrianisation, part time pedestrianisation and traffic calming streets. In the General Theory of Walkability by Jeff Speck, four main conditions must be satisfied for achieving favourable condition for walking: it must be useful, safe, comfortable, and interesting. According to Indian Road Congress standards the footpaths are divided into three zones; frontage zone, pedestrian zone and furniture zone.

Walkability creates a better environment, which attracts more people. The ease of connectivity with their destination determines the success of such initiatives. Land use helps in creating the different styles of walking pattern. These walking concepts enhances environmentally, economically and socially.

The prominent walkable cities in the world are New York, Hong Kong, Paris, Vienna etc. In the city of Vienna, the idea of walkability was developed and incorporated within the Smart city framework strategy and Urban development plan 2025 (STEP). Therefore, this integrated idea of development created an overall positive outcome. With these strategies, a new culture of walking was cultivated. Nearly 77 percent of all Viennese walk every day and the average distance of one trip is 800 meters. The modal share of walk only trips in Viennese reached 28 percent. The overall modal share in walking increased to 66 percent with these initiatives. Development in pedestrian friendly infrastructure resulted in the transformation of car zone streets into pedestrian zones. They activated the character of lifestyle, which resulted in a healthy and environmental friendly community [1].

3. Advantages of Inland Water Transport Network
Waterborne transportation is a natural transportation corridor with less physical restrictions. It offers the fixed travelling time and pleasant experience through the journey when compared to other transit modes. Waterborne transport contributes to the overall redevelopment and mobility schemes and contributes to reducing congestion on land. In Kerala, Kochi has potential to develop inland water transportation as a strong mode of transportation in public transport. IWT is cost effective, environmental friendly and fuel efficient [2].

4. Existing Profile of Kochi Corporation Area
According to 2011 census the population of Kochi Corporation area is 6,01,574 across an area of 94.88 sq.km and 74 wards. The corporation area comprises of mainland, three islands i.e. Fort Kochi and Mattancherry, Willingdon Island and Thanthronni thuruth as well as the small portion of Vypeen. The corporation area is flanked by the IT hub Kakkanad and Special Economic Zone Vallarpadam. Their connection to the corporation area is by means of road as well as water; road being the main flow of access gives in way for vehicular congestion in the city. Hence they have a major role in the inflow of traffic to the city. A proper and well laid out management of water network system would have helped to reduce the load of the road and also to connect with the major points of Kochi corporation area.

According to 2009 land use report, the highest category is residential of 73.07% after that commercial 3.07% as well as public & semi-public category 6.45%. The least category was agriculture/ dry cultivation and park/ open spaces were 0.97% and 0.15% respectively.

The Kochi corporation area has a good road network system, strong rail network, well-connected metro corridor and well-connected inland water transportation. The major National Highways in Kochi corporation area are NH66, NH85 and NH 966B. Other major roads in Mainland are Park Avenue rd, Shamnugham rd, Abraham Madammakkal rd, Banerji rd, MG rd, Chittoor rd, Kaloor-Kadavanthara rd, Sahodhara ayyapan rd, Vyloppilly rd, Ernakulam- Ettumanoor rd etc. There are five railway stations out of which Ernakulam North/Town, Ernakulam South/Junction and Edappally railway stations are the active stations. Old Railway Station situated in Mangalavanam and Cochin Harbour Terminus situated in Willington Island are currently not operational. Now Kochi Corporation has decided to revive the Old Railway station and Cochin Harbour Terminus as a part of developing it
as heritage stations. The metro stations inside corporation are Edapally, Changampuzha Park, Palarivattom, JLN Stadium, Kaloor, Town Hall, M.G Road, Maharaja’s College, Ernakulam south, Kadavanthra, Elamkulam, Vyttila, Thaikoodam. The inland waterways network of Kochi consists of backwaters, canals, lagoons and estuaries. The State Water Transport Department (SWTD), Kerala Shipping and Inland Navigation Corporation (KSINC) and some private operators are the major service providers in Kochi. According to SWTD, currently there are five operational routes connecting the 21 jetties, which are operational.

Figure 1. Map shows the ferry location, road and inland waterways of Kochi Corporation Area

5. The Major Transit Nodes and Roads
In Kochi Corporation area the major transit are Vyttila hub, Kaloor private bus stand Ernakulam KSRTC bus stand/depot, Ernakulam jetty KSRTC bus station, Ernakulam town railway station and Ernakulam south railway station. Almost all transits in Kochi Corporation area are in closer proximity with ferry stations.

The major nodes are High court junction, Kaloor junction, Palarivattom junction, Edappally junction, Pipeline junction, Vyttila junction and Kadavanthara junction. Highcourt junction and Vyttila junction are very close to their nearby water ferries.

Table 1. Major activities along the main roads

| Commercial activities                          | Educational institutions                      | Public offices                                       |
|-----------------------------------------------|----------------------------------------------|-----------------------------------------------------|
| Marine Drive, Banerji Road, MG road, Sahodaran Ayyappan road, Broadway, Kaloor and Kadavanthara | St Theresa College, Maharaja College, Law College, St Albert College etc. are in Park avenue and Banerji road. | Corporation office, Revenue Tower, High Court, General Hospital, District court, Corporate offices etc. are in Foreshore, Park avenue, Shanmugham road etc. |
Some roads make a strong loop inside the corporation as well as serves as major nodes. In the case of Islands also it can be noticed that the offset of the edge as major roads. In Willington Island, there are mainly two roads, which are parallel to the edge of the island. Same pattern can see in Fort Kochi, Mattancherry, Thopumpady and until Edakochi. In Fort Kochi and Mattancherry the roads are interconnected in grid pattern.

In Kochi Corporation area the major walkways are Queen’s walkway, Marine drive, Panampilly walkway, Willington Island park and Willington Island walkway and Fort Kochi beach walkway.

6. Study Methodology
The major role of walkability and water transportation is that they bring in sustainability as well as indirectly enhance the quality of urban life. In this study the attempt has been to connect both the sustainable factors for a combined outcome.

As a preliminary study, focus was on the general characters of Kochi Corporation area it includes the overall study on major roads, existing walkways, rail network system, metro network inside the Kochi Corporation area and last but not the least ferry points of Kochi Corporation area. From the analysis, the major nodes, main corridors and strong points inside the corporation were identified. Based on these, the ferry points for the detail study were chosen. These studies helped to understand the requirements and the characters of walking style in Kochi Corporation area.

A primary study was conducted in the selected ferry to understand the current situations as well as the requirements of the pedestrians. It was done through conducting a survey on 30 ferry passengers and 30 pedestrians in every study area to understand their demands. The land use distribution around each of the selected ferries within 800m and 1200m radius with respect to 10 and 15 minute walk was considered. A detailed study helped to understand the potential for walkability from the ferries, connecting the major activity areas of the city.

7. Water Connectivity of Kochi Corporation Area
Presently there are nine ferry points and 14 water metro proposals. The ferry services are started from Ernakulam jetty, High court jetty and Vyttila jetty. In addition to the passenger services, Jhankar and Ro Ro services are provided from Fort Kochi to Vypeen under the Kochi Municipal Corporation.

| SWTD Jetties of Kochi Corporation Area | Vypeen, Fort Kochi, Mattancherry, Willington island Terminal, Willington Island Embarkation, EKM jetty, High court jetty, Thanthonni thruth, Vyttila jetty |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Metro Proposal In Kochi Corporation Area | EKM jetty, High court, Vypeen, Fort Kochi, Mattancherri, Willington Island terminal, Thoppumpady, Edakochi, Thevara, Thykoodam, Vyttila, Amrutha hospital, Vaduthala, Thanthonni thruth |
| Water Metro Proposal Within 200m Boundary of Kochi Corporation Area | Eroor jetty Korumkotta |

Table 3. Table shows the perimeter of water boundary in Kochi Corporation Area

| Region | Perimeter of Boundary (km) | Water Route (km) |
|--------|----------------------------|-----------------|
| Mainland | 47km | 27km |
| Thanthonni thruth | 4km | --- |
| Fort Kochi & Mattancherry | 26km | 11km |
| W. Island | 15km | 3km |
| Vypeen | 1 km | -- |
| TOTAL | 93 km | 41km |

In Kochi Corporation area, nearly 50 percent of boundary can be served with Ferry
Figure 2. Graph shows the details of ferry passengers

8. Detailed Study of Selected Ferry Points
Ernakulam ferry and High court ferry are the major ferry points in the mainland, which connects the major activities of the city. Vyttila ferry is very close to Vyttila hub and two metro stations. Thalykoodam jetty covers the Chambakkara area and Pettah junction, which are few of the main active areas in the Corporation. Amrita hospital jetty is near the premises of Amrita institute, which is in close proximity to Edapally railway station also. Thevara jetty is another one, which serves access towards Panampilly nagar and Thevara junction. It can also connect with Pallimukk junction. Vaduthala jetty and Thanthtonni thuruth jetty are mainly situated in residential areas. Thanthooni thuruth is one of the islands in Kochi corporation area that doesn’t have any road connection to it. Therefore, people from here depend only on ferry routes. Willington Island has two ferry points on either side. Most of the area of walking circles of these ferries are overlapping and are not fully accessed by the public.

Figure 3. Map shows the selected ferries for detailed study
From the analysis, it can be understood that Ernakulam and High Court Ferry are closer to different modes of transportation; followed by Vyttila ferry. Accordingly, Ernakulam ferry, High court ferry, Vyttila ferry and Fort Kochi were selected for detail study.

8.1. Ernakulam ferry
Ernakulam ferry is located near the Park Avenue road. It connects to Fort Kochi, Mattancherry, Embarkation, Terminal and Vypeen through boats. People who used ferry were spread over the Broadway, Corporation office, G. Hospital, MG road, Kakkanad, and Vyttila etc.

**Table 4. Details Ernakulam ferry**

| Land use & Major points | Main Purpose of trip | Analysis |
|------------------------|----------------------|----------|
| Commercial is 38 %, Semi/public 18% Residential 34 %, Open space 10 % (By ignoring the wet land, industrial and transportation area). It is in proximity to 3 metro stations, namely M.G Road, Maharaja's College and Ernakulam South and 2 bus station i.e. KSRTC bus terminal and KSRTC jetty bus station. Roads are well connected but the walking infrastructures are which makes it unsafe for the pedestrians. |

Above 90 percent of the ferry passengers who were surveyed, like to walk from ferry to their destination, if there is proper walking infrastructure. Presently, the ferry station is also not friendly for differently abled. There is no continuous footpath with street furniture. Unlevelled paths, lack of tactile pavers, encroachments of vendors etc. were major scenes of this bustling area. This place is very active due to the presence of institutional, public and commercial land use pattern.

8.2. High court ferry
High court ferry is located in marine drive walkway. It connects to Mulavukadu, Thanthooni thuruth and Bolghatty from the mainland. People who used ferry were spread over Marine drive, Kaloor, Broadway, High court, MG road etc.

Major issues noticed in this lively area are, there is no continues footpath with street furniture, unlevelled paths, lack of tactile pavers, encroachments of vendors, no proper width etc. High court premises are very active due to the presence of public offices, institutional and commercial corridor.
Table 5. Details of High court ferry

| Land use & Major points | Main purpose of trip | Analysis |
|-------------------------|----------------------|----------|
| Commercial is 20 %, Semi/public 17 %, Residential 52 %, Open space 11 % (By ignoring the wet land, industrial and transportation area). | | |

(From the primary survey of pedestrians)

8.3. Vyttila ferry

Vyttila jetty is very active due to the calm and less traffic travel as well as less time travel compared to road. It is connected to Kakkadan through Eroor jetty. There is a good percentage of movement in Vyttila jetty; mainly commuters to Civil station, Infopark, Rajagiri college etc. also, the daily wage workers. Vyttila is connected with Sahodaran Ayyapan road, Edappally, Kakkanadu, Tripunithura etc.

The percentage of Commercial is 23 %, Semi/public 10 % Residential 62 %, Transportation 5 % (By ignoring the industrial area). It is in close proximity to two metro station namely Vyttila junction and Thykkoodam as well as to Vyttila hub. Vyttila is a major connector to different places.

8.4. Fort Kochi ferry

Fort Kochi is connected with water and road; ferry service being a good experience. This place can be explored by foot as well as bicycle. Majority of the streets are not much wide, hence the bus ways are in different directions while entering and exiting the place.

It is the major attraction for foreigners as well as the locals. Thus, it is always active. There are no proper footpaths for pedestrians in the bus routes also. Generally, the walking style in Fort Kochi is leisure. Therefore, the needs for the pedestrians should be consider more.

The percentage of Commercial is 17 %, Semi/public 22 %, Residential 56 %, Open space 5 %. It is close to one bus terminal i.e., Fort Kochi bus terminal. Many streets are well connected to this area.

9. Inferences

Roads are well connected but the walking infrastructures are weak in some streets are Cannon Shed rd, Hospital rd, Banerji road, Chittoor rd, SA rd, Church rd, Paradise rd etc., which create unsafe to pedestrians. Once proper walking infrastructures are provided through the major nodes like High court junction, Seematti junction, Gandhi statue junction, Jos junction, Vyttila junction etc. with Ferry points of the corporation, the Corporation can enjoy the benefits of both ferry and walkability, which marks golden line for achieving sustainability.

In Ernakulam and High court ferry is the network of commercial, institutional, public and open spaces. So apart from residential population, others are attracted and move here with different needs. Thus, it is the point of amalgamation of different kind of walking styles. Hence, it results in an inclusive approach, which is challengeable. In the case of Vyttila ferry, floating population is high due to the presence of transportation hub and according to land use, the residential population is high. Here, it’s more like busy walking character in main roads. In Fort Kochi also residential and floating
population are considerably high. However, the predominant walking style is leisure due to the attraction of tourism.

We should ensure inclusive walk spaces accessible to all; provide safe and well networked streets that enhance the comfort of all users which results into a walkable city.

10. Strategies for Walkability in Kochi Corporation area

Strengthening the grid of different parallel transportation corridors through walkability helps to connect the major points of corporation area. Many ferry points (High court, Ernakulam and Thevara) of main land are in a lake edge and are parallel to the roads (Park avenue, Shamugham road, MG road, Chittoor road), railway line and metro rail. In the case of Fort Kochi and Mattancherry Island also this pattern of parallel corridor of ferry path and road can be identified.

From the studies it is understood that it is possible to enhance walkability through better walking facilities for different walking which depends on land use patterns and the characters of the activities. Creation of multi-functional roads need to be considered which can act as flexible spaces which create more interest in people through providing cultural exhibition or talks, gyms etc. It is also vital to strengthen and develop green areas and open space networks along designated locations. This network intends to offer the public high-quality open spaces. The gradual establishment of this network helps everyone to be in closest proximity to open spaces, which are distributed along the locality. Differently abled friendly access to the ferry stations is another major intervention required which will incorporate the high tide and low tide water level changes at the ferry points.

11. Conclusion

Kochi Corporation area has potential to connect different modes of transport, especially the road and water through an integrated pedestrian network. This holds key to developing a city with reduced dependency on vehicles encouraging people to walk around the core urban areas. It had been observed through primary studies that people are ready to walk if we provide a safe environment. Urban planning and design exercises with a focus on walkability should be able to bring in desired results to create an integrated transport network and people friendly and sustainable development.

Acknowledgment

The authors would like to thank the interview participants, personally, for their assistance to this research. We also appreciate the assistance of State Water Transportation Dept., Water Metro and Town Planning Dept. of Ernakulam.

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