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Pedestrian Planning in Kollam City

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Abstract: ***With the increase in economic growth and rapid urbanization have resulted in many transportation crises. The unprecedented growth and use of private vehicles have led to severe congestion, high accident rates, air pollution and greenhouse gas emissions. Urban settlements like core CBD and heritage towns which were planned for pedestrians, are worsely affected. Environment in such areas are degraded affecting the health of the people causing many diseases. Hence, pedestrian safety is an integral part of overall transportation system. Vehicular traffic is directly effecting on the pedestrian's movements, safety and comforts. Increased pace of vehicular movement in all parts of the city have led to increased accidents and reduced safety to the pedestrians. Hence the safety of pedestrians is of great concern in a busy city such as Kollam. This study discusses the issues currently affecting the pedestrian environment in Kollam by using various types of traffic surveys. This paper focuses on the pedestrians and methods to develop walking culpture, pedestrian routes and pedestrian friendly places in Kollam city and provides guidelines and proposals for Pedestrian Planning in Kollam city.***

Keywords: Kollam, Pedestrian Plan, Walkability, Policies

1. Introduction

Pedestrians are an important component of road users. They are also considered as the most vulnerable road users in the entire traffic stream. A pedestrian is any person who is travelling by walking for at least part of his or her journey. A 'pedestrian' is a person on foot, or in or on a contrivance equipped with wheels or revolving runners that is not a vehicle [5]. This can include an able pedestrian, a person pushing a pram, a person on a skateboard, a person in a wheelchair and a number of other users. Every trip starts and ends as a walking trip. Walking requires less space as compared to other modes of transport. Walking is considered as a foundation for sustainable city Moreover, walking is quite economical, costing much less than the auto and public transport, both in direct user cost and public infrastructure costs. Walking provides numerous benefits, not only for individual health, but also for economic development, neighborhood vitality and environmental sustainability [3]. In spite of the benefits and importance of walking, road facilities in urban areas are still a significant source of harm to pedestrians. Pedestrian safety is a major issue in many urbanized areas throughout the world.

2. Need for the study

The draft Development Plan for Kollam City Region has identified the need for improving the pedestrian environment on a street-by-street, neighborhood-by-neighborhood basis, on priority and to promote non-motorized transport[1]. People often do not walk when walking itself does not include a good experience with heavy motor vehicle traffic and crowded narrow lanes. Safe and convenient non motorized travel provides many benefits, including reduced traffic congestion, reduced air and noise pollution, road and parking facility savings, economic development, increased social interaction, financial savings, increased public health and a better environment. This also gives opportunities for planning of additional planting areas and improving street furniture and landscaping. Pedestrian plans establish the programs, policies, design criteria, and projects that will further enhance pedestrian safety, comfort and access in their neighborhoods

Road accidents too have been on the rise in Kollam according to the road accident statistics of the Kerala Police. In 2017 there were 1,262 accidents recorded in Kollam City in which 141 people died and 1,343 people were injured. The study also identified 29 accident-prone locations in Kollam, most of which are located on the radial roads.

3. Objectives and scope

The aim of the study is to prepare the guidelines and proposals for improving the existing pedestrian accessibility by enhancing safety in Kollam Coorporation.
The main objectives are;

- To study various principles, techniques and concept for improving pedestrian facilities and its importance in the present urban scenario.
- To delineate the study area and examine the existing spatial conditions, pedestrian accessibility, actvity pattern & user group.
- To analyse the existing issuses and potentials of the study area.
- To prepare Planning strategies, recommendations for improving the pedestrian accessibility in Kollam City.

The study can be used to develop and propose pedestrian-focused solutions for cities and can rise awareness and generate interest amongst policy makers and city officials and help them to improve walking in cities.

4. Literature Review

Pedestrian plans establish the programs, policies, design criteria, and projects that will further enhance pedestrian safety, comfort and access in their neighborhoods. A pedestrian master plan is a public document developed through public participation, visioning and analysis of current condition, laying out a communities vision for future pedestrian activity. Establishing a pedestrian plan will benefit communities to encourage walking and in turn become healthier and more livable community.

4.1 Principles of Pedestrian Planning

This section discusses the six main principles of pedestrian planning

Safety: A safe pedestrian route implies that pedestrians are well protected from road hazards such as moving vehicles. Dangerous conditions can be mitigated by addressing three root causes of pedestrian-vehicle crashes: vehicle speeds, pedestrian-exposure risk, and driver and pedestrian predictability.

Security: "Security" refers to providing an environment where pedestrians are not susceptible to robberies, sexual harassment, or other crimes. The physical design of streets, parks, buildings, and the relationships therein play a role in increasing the number of "eyes on the street," which in turn can increase security

Directness: "Directness" involves a pedestrian path that minimizes the distance travelled to access the public transport station available from any location to the BRT station. The level of directness is also influenced by pedestrian crossings and other design details at the micro level.

Legibility: The "legibility" of an area refers to the ease in understanding the street environment. The selective use of signage and maps contributes to a system's legibility. Local-route signs along the pedestrian path both help customers find the BRT station and help pedestrians emerging from the station reach their destinations.

Comfort: The steepness of inclines, presence of weather protection, condition of the walking surface, and protection from noise and air pollution all affect the level of comfort enjoyed by pedestrians.

Universal Access: "Universal access" refers to designs that allow customers with mobility limitations to access the system. The main considerations in accessible design are removing physical barriers, avoiding excessive customer volumes that impede timely access, providing a safe route, and minimizing conflicts and detours.

4.2 Planning Guidelines

Pedestrian networks should be planned to:

- Minimize walking distances between land uses
- Provide a clear route to entrances of large developments (rather than surrounding car park areas)
- Avoid conflicts with vehicular movements where possible
- Provide appropriate pedestrian crossing facilities on busy roads
- Provide paths on most streets (with the exception of lightly trafficked local streets), preferably on both sides.

Pedestrian networks should be planned in combination with land uses to provide residential access to mixed use centres and bus routes within a 400m walk, and access to train stations within 800m of strategic and secondary activity centres. Pedestrian networks should be designed with passive surveillance and good lighting to provide an attractive and safe walking environment

4.3 Existing Policies Related To Pedestrian Facilities

The National Urban Transport Policy (Ministry of Urban Development – MoUD) has amongst its objectives. Bringing about a more equitable allocation of road space with people, rather than vehicles, as its main focus. Encourage greater use of public transport and non-motorized modes by offering Central financial assistance for this purpose.

The Persons with Disabilities Act: (Equal Opportunities, protection Of Rights and Full Participation) Act, 1995 also lays down provisions to help ensure that people with disabilities can have easy access to the streets. The Act, among other things mentions that the appropriate Governments and the local authorities shall, within the limits of their economic capacity and development, provide for: Installation of auditory signals at red lights in the public roads for the benefit of persons with visual handicap; Causing curb cuts and slopes to be made in pavements for the easy access of wheel chair users; Engraving on the surface of the zebra crossing for the blind or for persons with low vision; Engraving on the edges of railway platforms for the blind or for persons with low vision

The National Policy on Urban Street Vendors, 2009, approved by the Central government, recognizes street vendors (or micro-entrepreneurs) as "an integral and legitimate part of the urban retail trade and distribution system." The national policy gives street vendors a legal status and aims at providing legitimate vending/hawking zones in city/town master or development plans**.**

4.4 Recommended Policies

Complete Street Policy: Complete streets incorporate infrastructure for walking and cycling, including signage, ramps and other facilities for the physically challenged. They also include urban furniture like covered bus stops, street lamps, trees and vegetation according to the context .Complete roads promote safety for all road users, and incorporate all of the principles of universal accessibility. A complete street is welcoming to pedestrians, bicycles, wheelchairs and motorized vehicles.

Promote mixed development: Land use patterns that integrates street and pathway, connectivity and ensure the

proximity of housing, schools, transportation hubs, jobs and community resources to one another have been shown to positively impact how much community members walk. Increasing the number of retail destinations, parks and recreation facilities within walking distance of public transit and housing encourages walking , just as increased walking also leads to economic growth.

Pedsetrian only districts: Re – allocate road space by narrowing roads and widening sidewalks for streets with pedestrian importance.

Education: Provide at least one event annually that promotes pedestrian safety and walkability, such as " Walk to School Day".

5. Research Methodology

The study is carried out in four stages and city level studies are done.

In stage 1, The study was focused to understand the importance of pedestrian Planning in the present urban scenario. Literature review of various journals studying the principles and guidelines of the pedestrian planning, pedestrian friendly developments, pedestrian issues in urban areas etc. In stage 2, Secondary data collection is conducted. The data collected involves old master plans of Kollam city, aerial maps of the study area and transportation studies in Kollam city. These data were collected from town planning office Kollam and road feasibility studies from NATPAC. Study area delineation is done based on the pedestrian generators within a walkable distance, accident rates, walkability and pedestrian volume.

In stage 3, Kollam city profile, land use, road network and pedestrian activity nodes are studied. Primary surveys are conducted to analyze traffic volume, pedestrian volume, pedestrian vehicular conflicts and existing pedestrian infrastructures. In Stage 4, Detailed analysis of different components of study area was done. Existing pedestrian infrastructures and pedestrian generators map prepared for study area was analyzed to find the issues and potentials. Strategies and recommendations are provided based on the issues in the study area.

6. Site Study

6.1 Kollam City

Kollam is the fourth largest city in Kerala and the fifth largest in terms of corporation area. Pathanamthitta, Alappuzha and Thiruvananthapuram are the neighboring districts to Kollam as shown in Fig. 1 Regional setting of Kollam.

The Kollam urban area includes suburban towns such as Paravur in the south, Kundara in the east and Karunagapally in the north of the city. Other important towns in the city suburbs are Eravipuram, Kottiyam, Kannanallur and Chavara. Administrative divisions - The District has five taluks; namely Kottarakkara, Kunnathur, Pathanapuram, Karunagapally and Kollam.

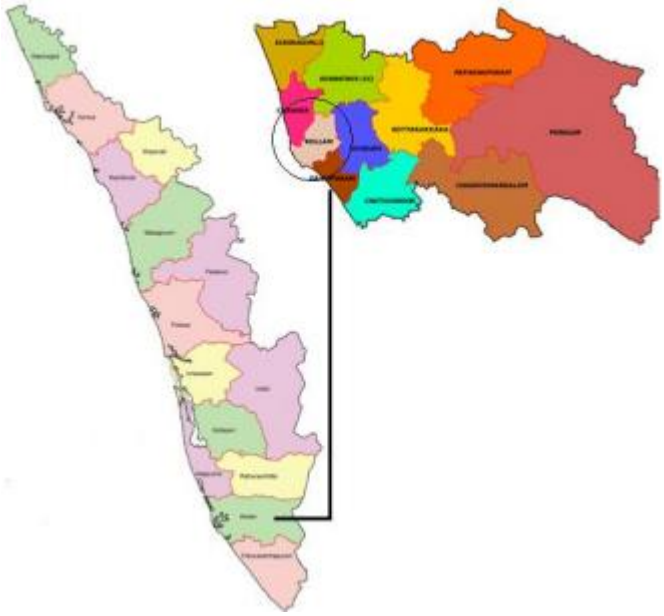

Figure 1: Regional Connectivity of Kollam

6.2 Connectivity

The district has comparatively good regional connectivity due to the two National Highways (NH-66 and NH-208) having a length of about 135-kmwithin the district, and the railway route network with Kollam as the railway junction. Earlier, water way was the major transport mode of the district due to the presence of T.S canal, backwaters, Kallada River, Ithikkara River and Achankovil River. The transport network structure in the district has two major corridors, with road and railway routes running parallel to each other. First, is the North South Corridor connecting Thiruvananthapuram and Alappuzha, running parallel to coastline and passing through Kollam. The second corridor runs through centre of the district and connects Kollam to Shenkottah and acts as a main spine of traffic movement in the district

6.3 Road Network

Two National Highways pass through Kollam city: 1) National Highway 66 (NH-47) from Salem to Kanyakumari cuts across the city north to south. 2) NH-66 connects the city with other cities such as Thiruvananthapuram in the south, Aleppy and Kochi in the north. NH-66 has a length of about 13 km, passes through the core city of Kollam. The traffic movement is affected by the local trips. Average width of the road varies from 12m-30 m while carriageway is about 8-15 m. The iron bridge over the Kollam thodu with a width of 7m is a major bottleneck in this road. In the absence of a bypass, through traffic plies along major radial roads. NH 47 is being major corridors with high inter-city vehicular traffic entering / leaving the city. However, a bypass with a width of 45 m is proposed from Mevaram to Kavandu. National Highway No.744 connects Kollam to Punalur and further to Madurai in Tamil Nadu. It has a length of 7 km

within the KMC limits but the width of the road varies from 15-16m with a carriageway of 8-12m

Figure 2: Road network map of Kollam Coorporation

The road density in the city is about 1.1 km /1000 persons. The city has 80% of motorable traffic uses the arterial and sub-arterial roads. The core area of the city is sandwiched between the sea and the Ashtamudi Lake and the average land available is about 1 km, but mixed land use is prevalent in these areas due to traffic congestion along the NH and the local roads.

6.4 Study area

6.4.1 Study Area Delineation

Study area is delineated based on the parameters which are identified by studying the literature reviews and case studies such as Pedestrian generators, road crashes, walkability, traffic volume and pedestrian volume. By analyzing these data of Kollam corporation area and delineated the study area considering the priorities. CBD area is chosen as site area for study since it is the location of prime importance with all pedestrian generators with in walkable distance. Due to the heavy traffic volume and high mobility of people in the city centre, roads in Chinnakada Round and the radial roads connecting to it were chosen for the study. Taking Chinnakada Round as the centre, the roads to Highschool Junction in the East, to Pallimukku in the West, to Kadappakada Junction in the North, and to beach road in the South were designated as the study area. All major nodes, traffic generating points, open spaces etc could be seen within the dileaneated site area. The Site area comes to about 4.7 sq km.The area has dominant commercial land use and the pedestrian movement will be maximum . The major junctions that captures the major chunk of people in the study area are High school junction, Chinnakada, Kadappakada, Railway Station junction, College junction and Pallimukku.

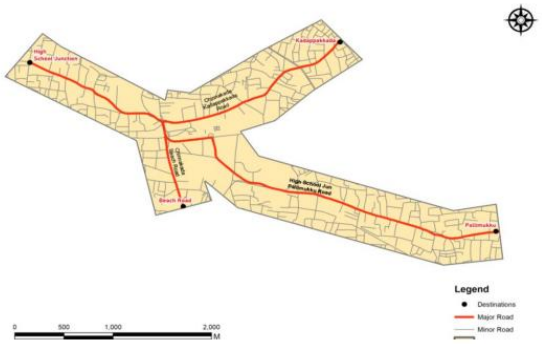

Figure 3: Base Map of the study area

6.4.2 Land Use

The land use aspect of pedestrian planning is so important and integral to enabling and encouraging walking trips The existing land use of the area gives the spatial representation of activities Land use of the area is highly commercial and residential. It can be seen that commercial landuses are concentrated in city core(chinnakada) Public and semi Public uses are also distributed in the core area. Public and semi public buildings include government offices, hospitals etc

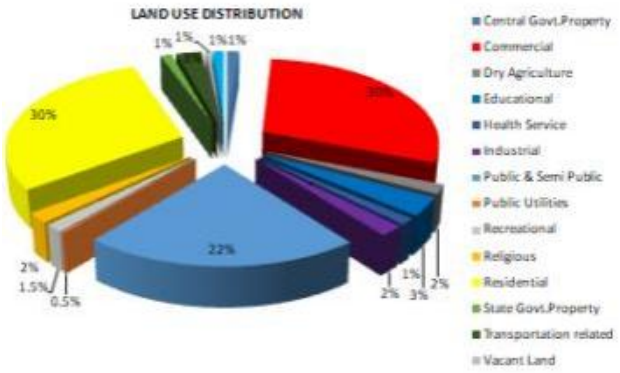

Figure 4: Distribution of Land use split up

6.4.3 Pedestrian Generators

There are numerous factors that contribute to where people walk. These factors include pedestrian generators that draw people to a destination such as schools, parks or tourist attractions transit stops that have high concentration of people . Developing a vibrant pedestrian environment is one of the goals of the pedestrian plan

Table 1: Pedestrian Potential Demand

Priority	*Built Uses*	*Catchment Area*	*Score*
High	Transit Stations, Market/ open space, Park, Hospital	Up to 400 m	10
		400- 800 m	7
		Above 800m	4
Medium	Schools/ colleges. Apartment/High residential area, community centres	Up to 400m	7
		400- 800m	4
		Above 800m	1
Low	Local bus stops, cafes,/restaurants, Over- bridge	Up to 400m	4
		400-800m	1
		Above 800m	0

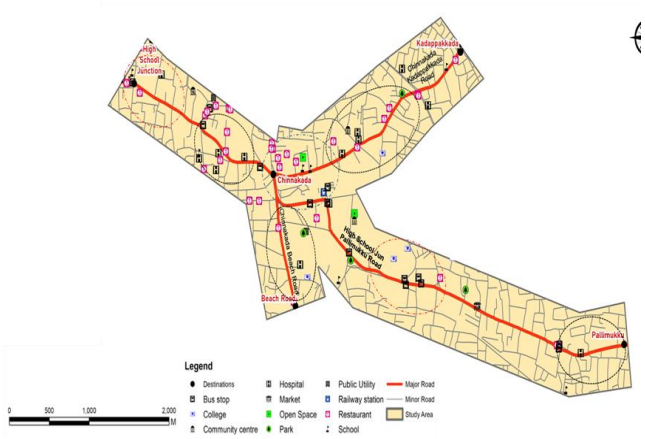

Figure 5: Location of pedestrian generators in the study area

6.4.4 Pedestrian Characteristics

Provision of pedestrian facilities is very important to ensure the safety of pedestrians who are the most vulnerable among the road users. In urban centers, pedestrian flows can be significant, and they must be accommodated in planning and design of traffic facilities and controls.

(a) Pedestrian Volume

The pedestrian cross and lateral movements were taken at major locations in Kollam town.The pedestrian volume count is shown in table 2

Table 2: Pedestrian Volume Count

Intersections	*Peak time*	*Pedestrian Volume*
Pallimukku	8.45- 9.45	425
Kappalandimukku Jn	9.45-10.45	1197
SN College Jn	16.30-17.30	1086
Railway Station Jn	8.15-9.15	1371
Chinnakada Jn	8.45-9.45	2440
Taluk Kachery Jn	16.00-17.00	1207
High School Jn	8.45-9.45	1212
Kadappakada	9.30-10.30	1126
Beach road	16.30-17.30	956

Since the pedestrian activity is high in the core area, Pedestrian Volume count is high in Chinnakada and Railway Station Junction.

6.4.5 Traffic Conditions

Pedestrian along cannot be considered ignoring the traffic condition of the plan. Traffic condition gives information about the demand for people to reach destination, road conditions, vehicular congestion, road type etc

(a) Traffic Volume

Major intersections in the study area and its immediate surrounding were identified and classified traffic volume count survey was conducted for all movements at these junctions. The data helps in identifying the traffic issues at the intersections, critical movements etc.

Table 3: Traffic Volume Count

Name of Intersections	*No: of arms*	*Peak time*	*Peak Traffic*
Pallimukku	3	17.15 -18.15	6849
Kappalandimukku Jn	4	10.00-11.00	6374
SN College Jn	3	18.00-19.00	5101
SBI YMCA Jn	3	16.45 -17.45	3175
Railway Station Jn	3	10.45-11.45	3041
Chinnakada	6	11.00-12.00	9521
Taluk Kachery Jn	4	11.00-12.00	7652
High School Jn	4	11.15-12.15	5461
Kadappakada	3	9.15-10.15	7470
Beach road	3	8.45-9.45	2500

Inspite of higher peak hour capacity, high traffic volume was found in Chinnakada, and Kachery Junction

(b) Pedestrian Vehicular Conflict

The intensity of pedestrian-vehicle conflicts represented by PV2 value (where P is the number of pedestrians crossing a link during peak hour and V is the number of vehicles passing through the link during peak hour) was analyzed. For a road section with central median refuge, value of PV2 greater than 2x108 and for a road section without central median refuge, PV2 value greater than 108 indicates a higher level of conflict and warrants controlled pedestrian crossing facility. It implies that a divided carriageway could be considered to have reduced impact of PV2 value by 50%. Based on the above criterion, the critical locations where pedestrians are in sharp conflict with vehicular traffic have been identified

Table 4: Pedestrian Vehicular Conflict

Intersections	Peak time	Total	Vehicle	PV2 Value
Kadappakada	9.00-10.0	181	4075	30.6
Shankers Jn	9.30-10.30	304	2168	14.29
Chinnakada	8.45-9.45	315	2570	20.92
RailwayStation	8.15-9.15	339	1271	5.48
SN College Jn	16.45- 17.45	615	4441	121.29
Kappalandimuku	8.45- 9.45	1003	3757	141.57
Pallimukku Jn	18.00-19.00	197	3120	19.18
TalukKachery	8.30-9.30	320	2696	23.26

99% of loactions has high PV 2 value. Ernakulam arm of Chinnakkada intersection had high PV2 value (231.69x108). This cross movement was due to the presence of bus bay on Ernakulam arm. The second and third highest values were observed between Kappalandimukku and SN College. These two values were contributed mainly by SN College and Fathima matha College.

(c) Volume Capacity Ratio

The traffic volume observed at different road stretches were compared with the capacity of road sections, to calculate the volume - capacity ratio (V/C ratio) of different road sections within the study area.

a) V/C Ratio ≥ 1.0 → Severe congestion
b) V/C Ratio 0.75 to 1.0 → Moderate congestion
c) V/C Ratio 0.5 to 0.74 → Limited congestion
d) V/C Ratio < 0.5 → No congestion

Table 5: Volume Capacity Ratio

S No:	*Section*	*Volume*	*Capacity*	*V/C Ratio*
1	Pallimukku – Madanada Jn	5075	1200	4.2
2	Madannada Jn- Kappalanimukku	5857	1200	4.9

3	Kappalanimukku- SN College Jn	4600	2900	1.6
4	SN College ROB Jn -YMCA Jn	3031	2900	1.0
5	YMCA Jn - Railway Station Jn	2423	1200	2.0
6	Railway Station Jn - Chinnakada	4123	1200	3.4
7	Chinnakada - St. Joseph Jn	6340	2900	2.2
8	St. Joseph Jn - Taluk Kacheri Jn	4328	2900	1.5
9	Taluk Kacheri Jn - High School Jn	5791	2900	2.0
10	Chinnakada Jn – Shankar Jn	2528	1200	2.1
11	Shankar Jn- Kadappakada Jn	3502	1200	2.9

All the sections have V/C ratio > 1. showing severe congestion. Madanada – Kappalandimukku section shows highest V/C ratio of 4.9, Followed by Pallimukku – Madannada (4.2).

6.4.6 Existing Pedestrian Infrastructures

As part of the study, detailed inventory of road system in the study area was carried out to assess the availability of road infrastructure and pedestrian facilities. Existing infrastructures identified in the study area are footpaths, crossing points, seatings and bus stops. Some of the issues identified for footpath networks are foot path lacks continuity at many locations and are encroached by parked vehicles and hawkers. Crosswalk issue includes crossing points are identified only on major junctions. Some bus stops does not have the seating facilities

7. Analysis

The major traffic and transportation problems faced in the study area are heavy movement of vehicular traffic along the highway causing accidents, heavy congestion during the peak hours. From the analysis of pedestrian cross movements, traffic volume, pedestrian vehicular conflicts, volume capacity ratio and existing infrastructures, analysis were done on safety issues. It was found that safety issues affects high school Junction to Pallimukku road stretch because of the highest PV2 Value and Volume capacity ratio. PV2 value is very high in Chinnakada, College junction and Kappalandimukku Junction leading to road crashes and congestion. All the roads in the study area has V/C ratio > 1 leading to severe congestion and conflicts

Pedestrians are seen in the core city areas; pedestrian traffic is heavy on routes along the Chinnakkada, Beach road and railway station road and at taxi and bus stands. Roads in the study area lack essential pedestrian facilities such as footpath and pedestrian crossing. In general footpath is available from Kappalandimukku- High school Jn stretch of north-south corridor, continuity is missing in many locations. Chinnakada to Kadappakada road section has no footpath or crossing points. Foot paths are encroached by parked vehicles and hawkers. Road markings are not visible in certain areas. Medians or refuge islands are not provided at intersections. Inadequate parking amenities results in on-street parking in core area and causes congestion.

8. Recommendations

- Sidewalks must comfortably carry two people walking side-by-side in one direction at a time. the minimal width for a sidewalk is 1.5m. With higher volumes of pedestrians in commercial and school districts, sidewalk widths should be at least 3m
- Sheltered walkways should be provided to protect from extreme weather conditions.
- Street furniture should be placed in an appropriate position on sidewalks so that it doesn't offer hindrancesfor smooth pedestrian flow.
- Parking should be prohibited even for shorter time(including emergency parking) on sidewalks.
- Switch boxes from telephone and electricity companies should not place on walkways that effectively decrease the width of sidewalks especially in the city center areas.
- Harmony of walkway colors and construction materialsshould be well maintained.
- Bins and litter bags should not be placed in the busystreet corners of walkways.
- Municipality authority should take the responsibility forregular maintenance of sidewalks.
- Pedestrian crossing at signalized intersection are found to be very effective however it is necessary to ensure provisions of sufficient green time for the crossing pedestrian, particularly crossing wide roads. Signalized Pedestrian Crossing should be provided within 100M from all Bus stops.
- Provision of a pedestrian underpass (sometimes referred as subway in India) is an engineering measure towards reduction of accidents.
- Bench seating with pergola should be provided become pause points for people to sit, relax and become 'Eyes on the street'.
- tree planting has always been one of the top priorities be it to enhance the streetscape or to provide shade for pedestrians.
- Dustbins to be placed in the pedestrian pathways to discourage littering. Colour coded dustbins enable segregation of wet and dry waste.

9. Conclusion

Pedestrian movement is considered to be one of the important components of urban transport system. CBD of Kollam is compact with all necessary facilities, at walkable distance but lacks pedestrian infrastructure facilities. Based on all the pedestrian opinions and analysis, various recommendations and pedestrian facilities are proposed on the selected intersections. Required basic facility of pedestrians required are zebra crossing, pedestrian sign & signal for safety, foot-path widening and foot-over bridge People of Chinnakada have walking culture especially for shopping and enjoying recreational activities. Encouraging people to walk instead of using private vehicles is most necessary for a city. The pedestrian Planning can become the basis for the developments in the city towards a more walkable city. The Pedestrian Plan proposes a Pedestrian network covering all high pedestrian volume roads in the city core. It provides a continuous, safe and comfortable pathway for pedestrians to walk within the city core.

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