

NAVIGATING THE GANGES: EXPLORING THE ROLE OF INLAND WATER TRANSPORT IN ENHANCING ACCESSIBILITY, AFFORDABILITY AND ACCEPTABILITY IN VARANASI (1138)

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Abstract. As the world population continues to grow, increasing congestion on road and rail transport systems in urban areas demands to explore alternative modes of transportation. Inland water transport (IWT) is one such mode with potential to alleviate congestion and provide additional mobility options for urban residents, but its citizen acceptability has been a major challenge.

This research paper examines the potential of IWT as a viable passenger and freight transportation option in the city of Varanasi, India. Through mixed methods approach, it correlates various impact factors such as transit nodes, land use, tourism, environmental factors, and citizen acceptability in terms of accessibility and affordability.

This research highlights the importance of addressing urban infrastructural challenges, when planning for IWT, and provides insights for urban planners and policymakers to explore River Ganges as a transportation corridor.

Keywords: Water Transport, accessibility, affordability, linkages.

1. Introduction

Inland Water Transportation is an inter-modal transportation for moving goods and passengers through water network. Water Transport is one of the oldest modes of Transport. Since ancient civilisations, water transport was widely used in India. From Mauryas and Guptas Era to the Colonial Era, need of moving bulky goods to the ports the inland water transportation developed until Industrial Revolution. During the revolution, Rapid Urbanisation, Slower vehicle speed, lack of Innovation gave a major blow to Development of Inland Water Transport. With the increasing demand of alternative transport modes to achieve sustainability, Water transport has come out as a preference due to many reasons, be it low emissions, reducing congestion, being comparatively cheaper etc.

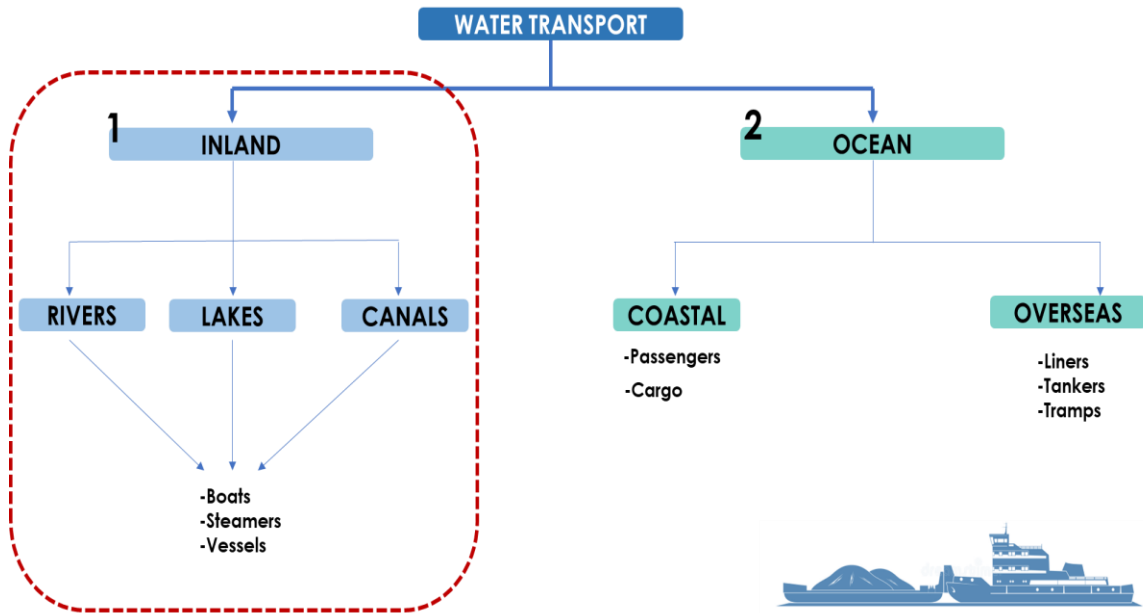


Figure 132. Flowchart showing Water Transport typology

Source: Author

1.1. Problem Statement and Need of the Research

Ever since the Water channels started being exploited for transportation purposes in various countries across the globe, there are major planning challenges that needs to be addressed with respect to the dynamic urban growth pattern corresponding to different geographies. European cities like Venice (Italy), Amsterdam (Netherlands), Lucerne (Switzerland) etc. have utilized the Water Transport better than Asian cities due to geographical advantages and thus improving citizen’s acceptability for IWT as a mode.

In populated countries like India where urbanization rate is 35-36% (India@100 Report by IFC), and limited infrastructure, there are various planning challenges that impact the accessibility, affordability and acceptability of Inland Water Transport in cities. The mismatch between Urban Development and transport arteries, Variation in degree of dependence on water in different cities etc. are some of the issues that impact the acceptability (Hoyle et. al., 1993). This research hence, aims to address such issues affecting the citizen’s acceptability in Indian Scenario in Varanasi, India.

1.2. The Case City: Varanasi, India

Varanasi, one of the oldest cities which is also Banaras or Benares or Kashi is a city on the east of Ganges River in the Purvanchal region of Uttar Pradesh in India. The city is also called Cultural City of India. It is also the headquarters of the Varanasi Division

which contains 4 districts (including Varanasi). The city is known worldwide for its many ghats. The city with a huge tourist potential has a very good connectivity in terms of transit stations. It is connected by air through one international airport namely Lal Bahadur Shastri International Airport. For Railways, it is connected via three railways stations i.e., Varanasi Cantt. Railway Station, Banaras Manduadih Railway Station and Kashi Railway Station. The city has only one bus terminal at present. For Waterways, the city has one IWAI Terminal located on National Waterway-1 and India's first Multi-Modal Terminal to be set up in Ramnagar across Assi Ganga Ghat.

However, the existing Public Transport is found to be congested in the city. The Bus Service Load Factor is more than 1.5 which proves the saturation of Road ways. The PCU count is more 5000 along the major roads. The V/C Ratio is more than 2 on certain networks and especially within Old City Area. Thus, to solve the problem of congestion on roads and in public transport, The Master Plan of Varanasi proposes alternate mode of Transport like Metro, Electric Buses, Ropeway and Inland Waterways being one of the alternate modes has its own impact on the Urban Scenario which needs to be studied in detail and suitable recommendations can be made.

2. Aim & Objectives of the Research

This aim of this research is *“To strategize planning for maximising the acceptability, accessibility and affordability of inland water transport (IWT) in Varanasi.”*

The objectives of the Thesis are as follows:

- a) To assess the existing conditions of Inland Waterways in Varanasi w.r.t Feasibility, pollution, Land use, tourism, public & freight transport etc.
- b) To identify and analyse significant parameters for increasing the accessibility and acceptability though integrating the existing modes with inland waterways in Varanasi.
- c) To identify the infrastructural requirements of various waterway vessels and routes.
- d) To develop planning strategies for Inland water transport to maximize the service potential.

3. Data Collection and Methodology

Based on the Indicators identified in various literature reviews, Various indicators have been identified for the research to analyse the feasibility of Inland Water Transport and the scope of improving the accessibility and affordability of IWT service. For analysing the indicators, both secondary and primary data were collected from different sources such as Kashi Geo Hub Portal, Varanasi Development Authority, RITES, Department of Transport Planning, School of Planning and Architecture, New Delhi etc.

The methodology consists of analysing selected parameters using qualitative and quantitative methods like spatial analysis using GIS and in depth analysis of user survey done in the city.

3.1. Data Analysis

Analysis Framework: For the analysis of Inland Water Transport in Varanasi, the framework has been divided into three major parts namely Operability, Existing scenario and Accessibility analysis has been done. The parameters have been identified under each head and hence been mentioned in the figure given below.



Figure 2. Figure showing parameters Analysis

Source: Author

3.1.1. Operability of Inland Water Transport in Varanasi

The rivers in Varanasi have already been assigned three waterways namely National Waterway-1 for Ganga, National Waterway 108 for River Varuna and National Waterway 12 for River Varuna. However, for operation of Inland Waterways, the river channel shall have a depth of minimum 2 m. Thus, the Viability of IWT operation on River Varuna and Assi was checked by IWAI and it was found that River Varuna is feasible for IWT operation whereas River Assi is not found suitable for the same due to the Depth and width required.

Feasibility of IWT along River Varuna: The Varuna River is a minor tributary of the Ganges River in Uttar Pradesh, India. It originates at Phulpur in the Prayagraj district and merges into the Ganges near Sarai Mohana in the Varanasi district.. The river has an Optimum width of 40-45 m along the whole stretch in Varanasi Urban Area. It also maintains an optimal depth throughout the seasons for operation of Class I Inland Water Transport without any dredging requirements. 52 percent of the stretch has been found feasible for the same purpose.

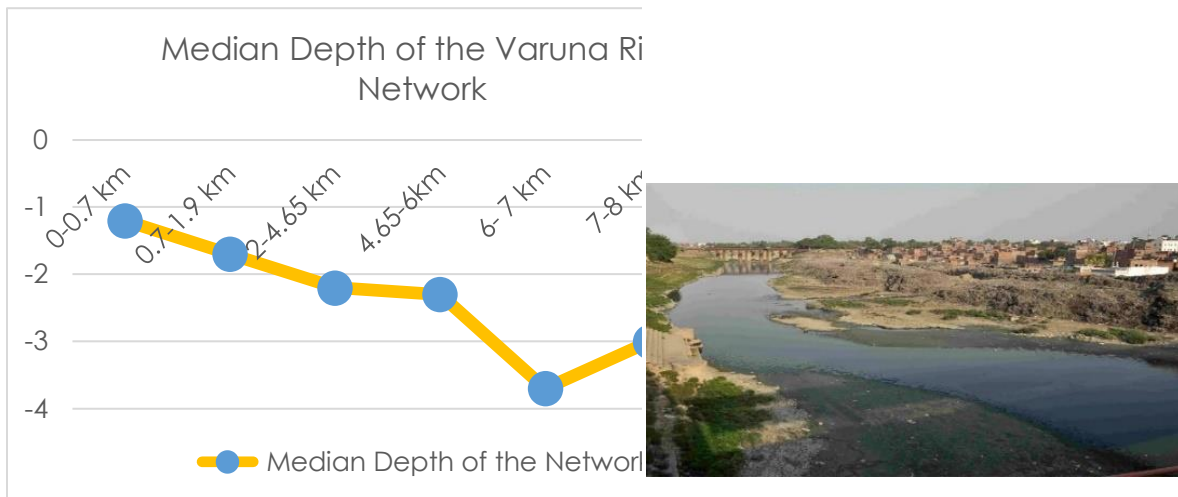


Figure 4.34 Depth of River Varuna along its chainage in Urban Area

Source: IWAI

Feasibility of River Assi: The total 5.5 km length of the river flows through the Varanasi city. Assi River is carrying drainage & sewage waste to Ganga. Numerous narrow nallas are being conjoined to Assi with untreated waste, for which the river is called as Assi Nala. The 6- to 10-meter-wide river confluence at Assi Ghat, which has historical values. Assi Ghat is the southernmost Ghat in Varanasi, where



pilgrims bathe before paying their homage to Lord Shiva in the form of huge lingam.

However, when IWAI surveyed the stretch, the river was found unsuitable for IWT operation. Even the River width was not suitable for the said purpose. It would require huge amount of dredging for seasonal operations. Hence, it has been scoped out of our study.

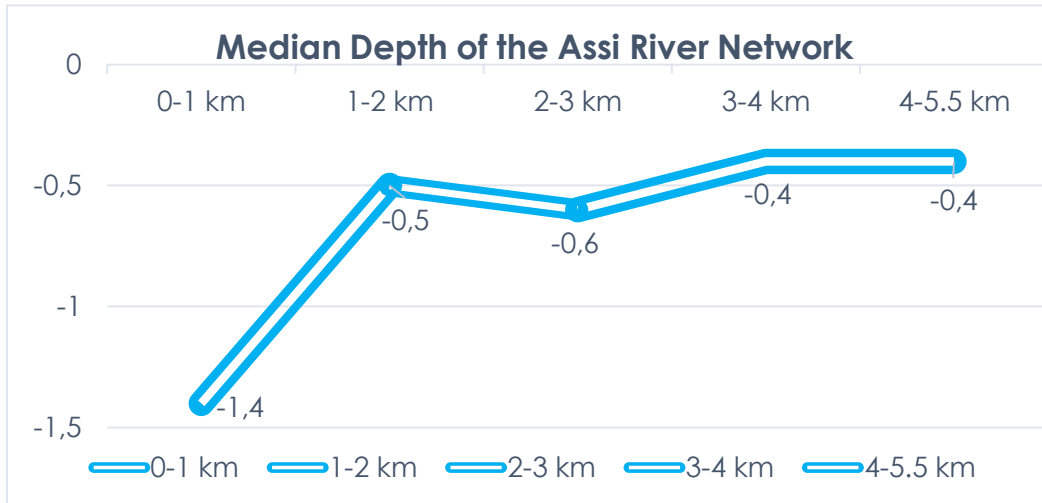


Figure 5. Depth of River Assi

Source: IWAI.

3.1.2. Existing Scenario of Inland Water Transport along Ganga

The Water Transport along Ganga is one of the oldest in India. Since ancient times, people have been using Water Transport for religious purposes and recreational purposes. Hence, there is optimal ridership in the water transport along Ganga in Varanasi. At present, with around 800 boats being operated in the city and a ridership of approximately 45000, the stretch is one of the busiest stretches of Ganga.

The Stretch is also used for Freight Transport. Varanasi has only one Freight Terminal at Raj Ghat identified by Inland Waterway Authority of India as a part of National Waterway I, The City of Varanasi has a variety of freight commodity which comprises of Food Grains, Silk, Handicrafts and General Commodities. The city has four major industrial areas producing different items and is also

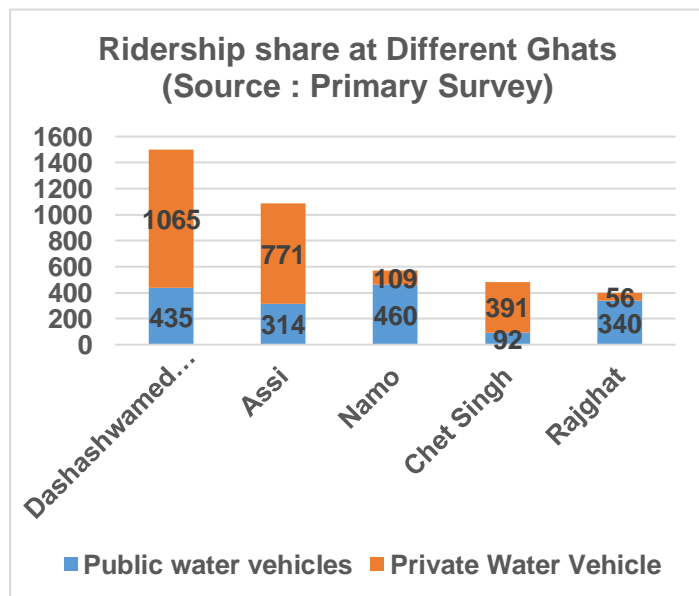


Figure 635. Ridership share at different Ghats along Ganga

Source: Primary Survey.

in close proximity with Ramnagar Multi-modal Transport and Ramnagar Industrial Area. As per RITES, The Freight carriage from Varanasi is 1.2 million tons per year which is projected to increase up to 2.5 million tonnes in the year 2031-32.

Despite of so many resources, 98 percent of the ridership share belongs to tourists. Only 2 percent of the riders are using the water transport for non-recreational purposes and facing the congestion on road. Out of the tourists also, majority of the tourists utilize it for religious/pilgrimage purposes as it can be seen in Figure 19. It is also used for crossing River from Cities like Mughal Sarai, Chandauli. It is also used for mobility along the river commute from districts like Ghazipur, Bhadohi, Jaunpur etc.

Along Ganga, the ridership share varies and it depends on the Ghats. Only the Tourist Ghats like Dashashwamedh Ghat and Assi Ghat has the highest ridership share per day. In terms of the Ownership of the water transport vehicle, The Public Vehicle share is also more at the newly built Ghats than the heritage Ghats. The heritage Ghats still has the maximum number of Vehicle and private ownership. This implies that the usability of private vehicles is more than that of public vehicles.

Private Water Transport Vehicles in Varanasi are sufficing the demand supply gap and are manually operated which is comparatively time taking. Also, Diesel run vehicles are contributing to the sustainability issue. Thus, There is an effort from the government to convert the diesel run vehicles into CNG which will be cheaper and sustainable in terms of operation. Currently, 53 percent of the Boats are manually operated and only 11 percent are operated by CNG. The Water Transport system in Varanasi

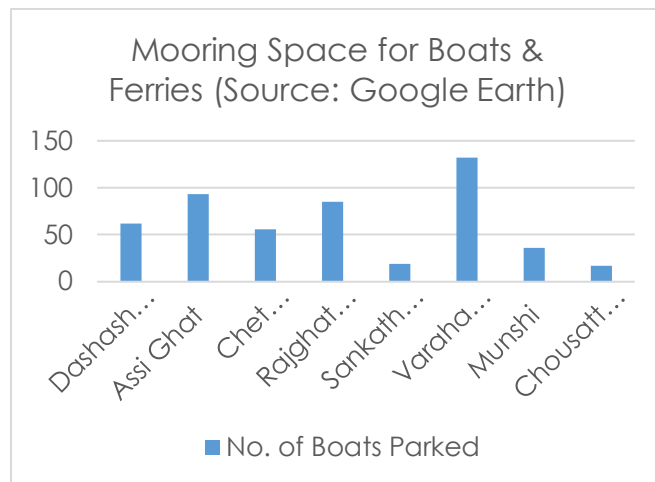


Figure 736. Mooring Space for Boats along Ghats
Source: Primary Survey.

is one of the disorganized sectors, Due to which there has been issues with mooring spaces along the Ghats. Everyone wants to park their boats in front of the tourist ghats leading to chaos along the ghats.

3.1.3. Infrastructural Facilities along Ghats

Despite of an existing waterway system in Varanasi, its usage is restricted only to tourists. And the citizens are not utilizing it to its maximum potential. This issue is due to the absence of infrastructure along the Ghats of Ganga. There is a huge shortage of modal integration facility along major Ghats of Varanasi like Non-Motorized Transport access

route to the area. 90 percent of the Ghats have access route of ROW less than 10 metres. Access route to the Ghats having road width more than 12 metres have encroachments of Informal sector along the Ghats. 56 of the 84 Ghats have encroachments by the informal sector along the Ghats. The lack of pedestrian paths or footpaths are also a major accessibility issue. Apart from the connectivity issues, there is also lack in Maintenance, Repair and Operations facility along the Ghats for the boats terminating there. There are also Lack of Basic amenities like Washrooms, Drinking Water facility, Waste management system along access routes to Ghats.

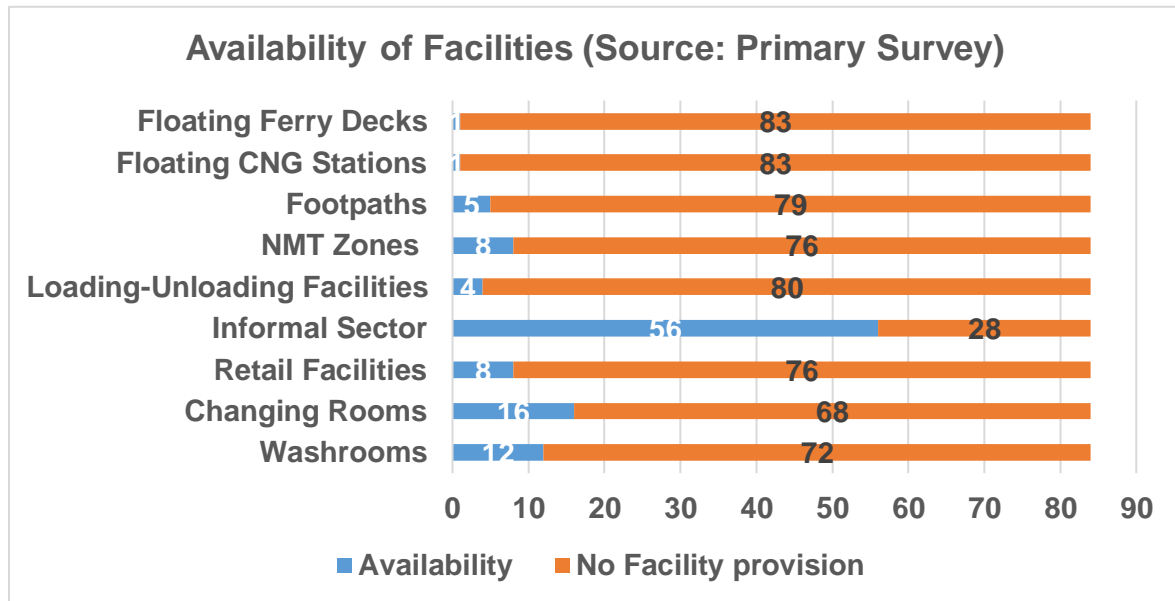


Figure 837. Infrastructural Facilities along Ghat
Source: Primary Survey

3.1.4. Tourist Potential along Water Channels in Varanasi

Varanasi has a huge floating population in terms of tourists. As per the data provided by the Department of Tourism, Uttar Pradesh, The city had a total in flow 71 lakh tourists in the city. Out of which, 69 lakhs were domestic tourists and 3.5 lakhs international city flowing into the city for cultural studies and spiritual enlightenment purposes. The gradual growth of tourists in the city is shown in figure 26 and 27 below.

Most of the tourists utilizing Water Transport at present are the people whose tourism purpose is either pilgrimage or heritage. However, Tourists with different purposes also use water transport for recreation etc. If we see the map 2 given below, all the pilgrimage site are located near the bank of Ganga and in the old City area. Major Tourist destinations also lie along Water Channels and with 500 m buffer radial distance. Moreover, the very famous Panchkoshi Yatra also has its route along Ganga and Varuna. This implies, IWT can be effectively utilised for Tourism mobility in the city and it will also

enhance the tourism experience in the city.

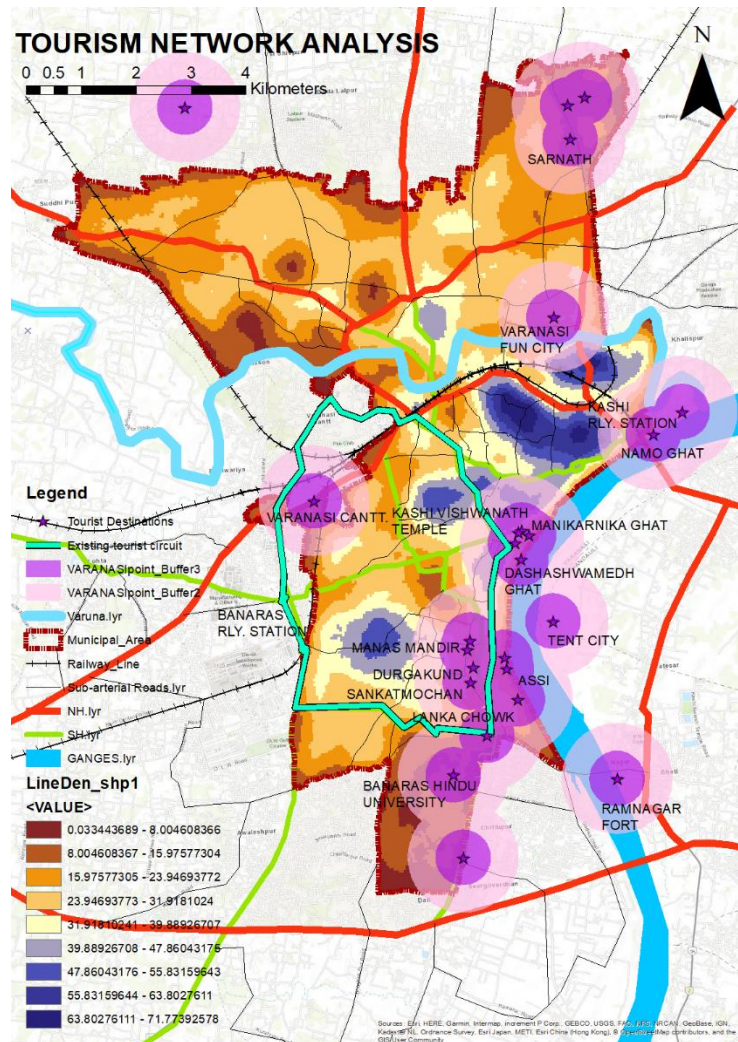


Figure 9. Map showing concentration of tourist sites near River network
Source: Author.

3.1.5. Spatial Character along the Water Channels in Varanasi

The spatial character along River Ganga is characterized by large built-up density and huge number of floating population inflow along the Ghats. The area is also characterized by narrow streets leading to most of the Ghats. The Densely built character along the ghats with only 3 percent undeveloped land creates Land management issue for any kind of redevelopment of Ghats and converting them into waterway terminals.

Since, there is not much development along River Varuna within Varanasi Municipal Boundary, the places have become a crime spot in absence of openness, crowd and

Visibility along the water channel. This is a major issue related to User safety in the city which also affects the accessibility of the inland water terminals. In addition to this, the spatial character of the spaces along river does not contribute to the user experience. Slums along water channel within the flood plains is responsible for deteriorating water quality and affects the accessibility adversely. Around 12 percent of the total area in slums are along or on water channels which is a major issue. The slums are a barrier to infrastructural provisions, abandons the sense of safety and people are unlikely to take such routes.

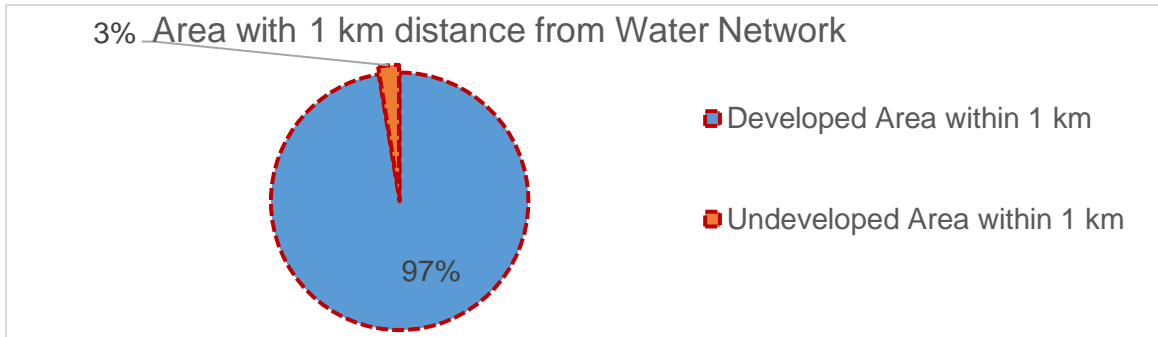


Figure 10. Pie charts showing Land use and Landcover along Water Channels
Source: Author.

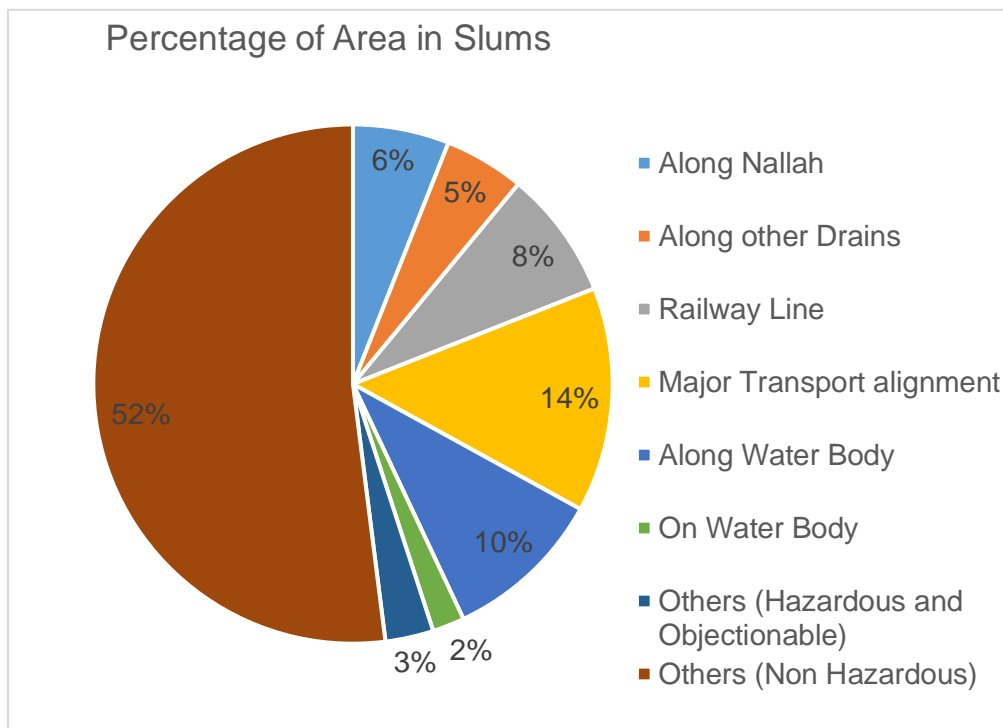


Figure 11. Pie chart showing percentage of area in slums

Source: Osmania University Survey, 2018.

3.1.6. Network Characteristics along water channels in Varanasi

Overview

The road network in Varanasi is characterized as narrow roads and heavy traffic leading to congestion on streets. The city has three railway stations namely Varanasi Cantonment, Banaras Railway Station located at Manduadih and Kashi Railway Station in the Old city area. Out of these three Varanasi Cantonment Railway Station is the busiest and Manduadih Railway Station is the recent one and hence the most technologically advanced. Since, Varanasi Cantt. Rly. Station is the busiest one it is also connected to the only intercity bus terminal in the city.

OD Location	Capacity	V/C Ratio
OD-1	3000	0.22
OD-2	2400	2.75
OD-3	2400	1.85
OD-4	2000	1.05
OD-5	3500	0.875
OD-6	2400	1.277
OD-7	1200	1.269

Figure 12. V/C Ratio along the OD locations

Source: Author.

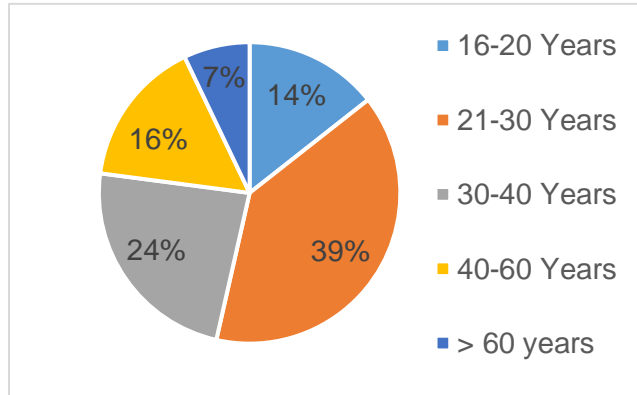
The city of Varanasi has grown outwards towards the west using the crescent shape of the river Ganga. This growth was facilitated by the growing transport network in this direction. As we move outwards it is observed that road spaces and their hierarchy with respect to road design and function starts to emerge. There are only 4 signalized intersections in the city which is a major on-road safety issue leading to black spots. Apart from the signalized intersection, the existing road usage is not very effective and thus, the resulting congestion.

Congestion on Roads

The roads in Varanasi were found extremely congested. Since, the hierarchy of roads is not followed, even the arterial roads have width less than 18m. Thus, as per the survey conducted in 2022 by the Department of Transport Planning, SPA Delhi, seven OD cordon points were identified and the PCU was recorded. Then, the V/C Ratio was calculated and it was found that except for OD-1 which is located near Pandeypur and Sarnath, all the roads were found to be heavily congested having V/C Ratio greater than one. Maximum PCU was recorded from OD-2 which is the route from Mughal Sarai. Mughal Sarai or the Deen Dayal Upadhyay Nagar being a major transit hub generates maximum traffic inflow into the city of Varanasi.

Along the water network, 80 percent of the roads is less than of width less than 10 meters. the usage of existing roads contributes to the congestion and acts as barrier in

optimizing speed and time. Only 58 percent of the land use for roads is utilized in carriageways, rest 25 percent is utilized in on-road parking and 13% of the area is encroached and 4 percent is utilized in median. The encroachment on roads is a major issue on roads along water network.



Source: Author.

The Average Speed to move around the city is very slow. The Speed Delay survey recorded on Monday at 11:00 am IST also shows that most of the routes along the water network of River Ganga are having speed less than 10 km/ hr. Along River Varuna, the speed is comparatively better with a speed range between 11 km/hr to 20 km/hr but not on par for a city like Varanasi having a floating Population of 69 Lakhs. The condition is so miserable that, 22 percent of road network has speed less than 10 km/ hr and 46 percent of road network has the speed between 11-20 km/hr.

Based on the factors like Trip Frequency, NMT Zones, ROW of Roads, Parking Area, Speed Delay Analysis and V/C Ratio the Zonal Accessibility Mapping has been done and the Map 28 depicts the Zones. Areas like Godowlia, Sarnath have been found accessible due to high trip frequency along the routes of IPT from the Cantonment area and also the road width is more compared to the other collector streets.

3.1.7. User Survey Analysis

The User Survey was conducted to understand the User Patronage for Inland Water Transport in Varanasi. Since, it was very necessary to understand the consumer behaviour before any service has to be implemented. This User Survey covers three types of users namely:

- Citizens of Varanasi
- Tourists of Varanasi
- Industrial Clusters in Varanasi

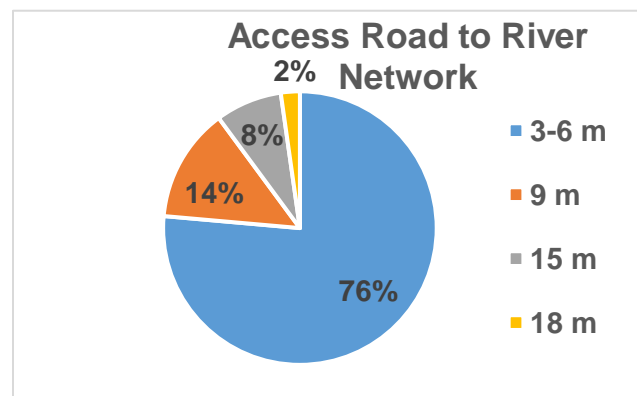


Figure 14.38 Pie Chart showing Age group of the samples recorded for citizen's survey

Source: Primary Survey

3.1.8. Citizens Survey Analysis

The Citizens Survey in Varanasi was done through Stratified Sampling Method where Citizens from certain localities were floated the questionnaire to fill it and the results are drawn after cross tabulation of the answers. In the survey maximum samples from the age group of 25-30 years was recorded followed by the age group of 30-40 years whereas majority of the samples were either a businessman or a public sector employee.

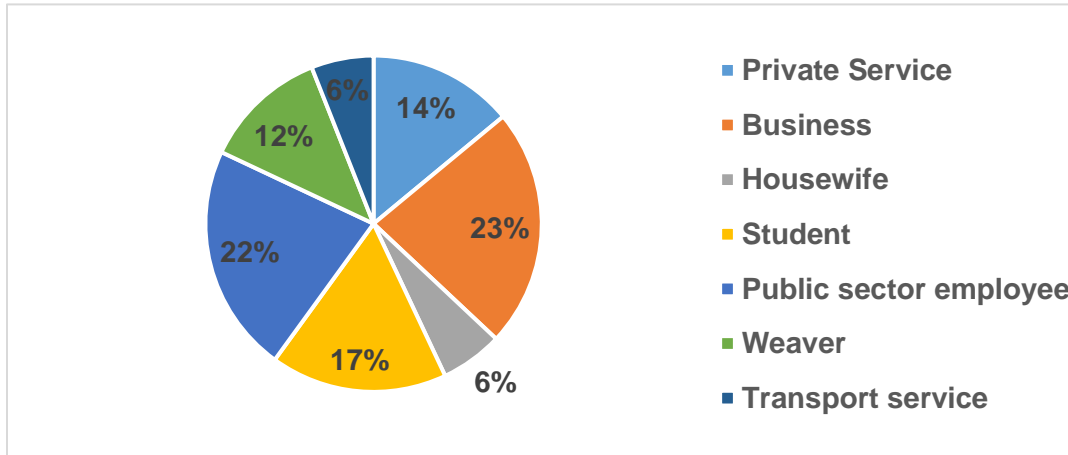


Figure 15. Pie Chart showing Occupation of the samples recorded
Source: Primary Survey.

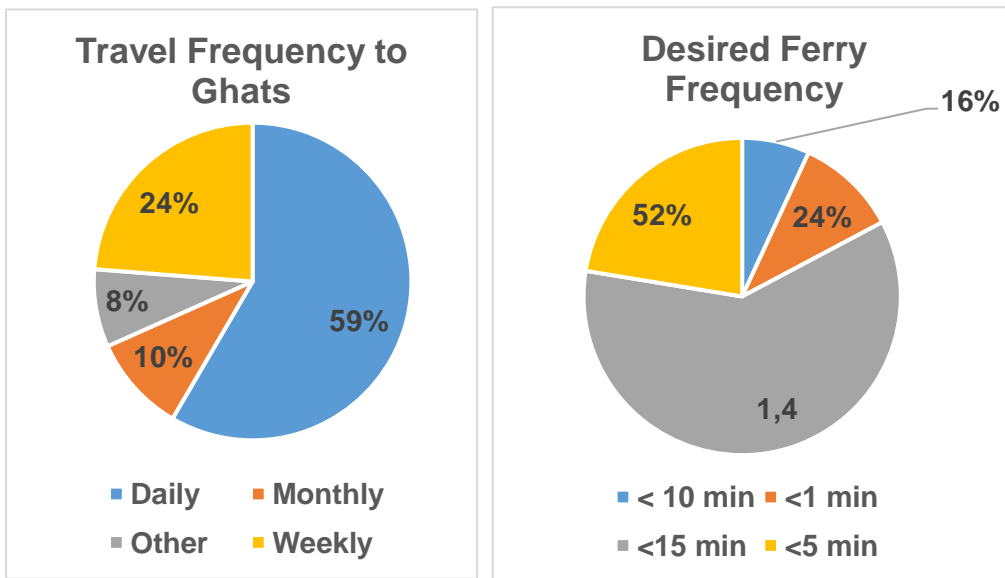
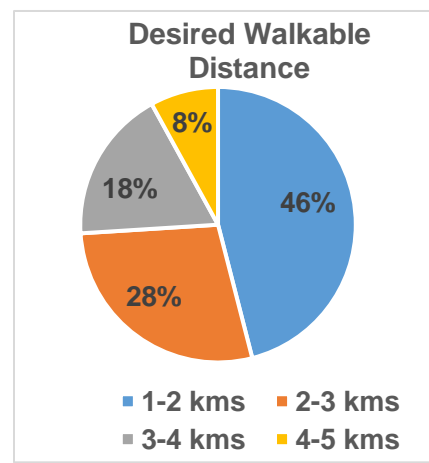


Figure 16. Pie charts showing the desirability on service levels

The survey results clearly shows that 78 percent of



the samples are willing to shift to Inland Water Transport if provided given that the accessibility and affordability criteria is fulfilled as the average time of travel in Varanasi for a trip is 30-40 minutes which is more than the average. Also, The Desired Walkable distance recorded for the samples is 1-2 kilometres. 46 percent of the survey samples are ready to walk a kilometre to avail the water transport facility. The survey shows that people who are willing to shift have no certain desirability in terms of the type of Ferry. However, the alignment towards motorised boats is more irrespective of the ownership of the vehicle. On tabulating the amount, the samples were willing to pay, the results range between 100-120 per trip cost.

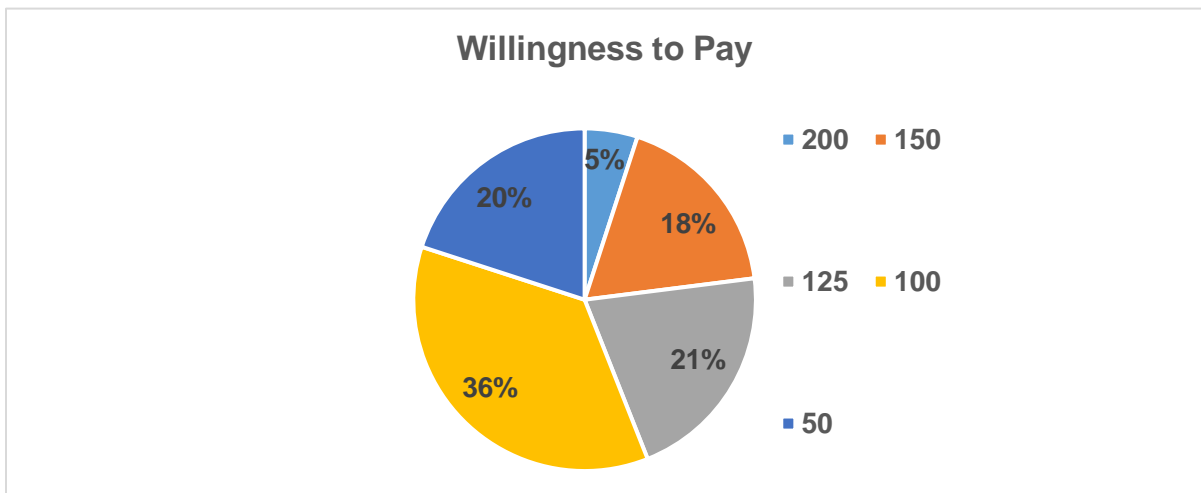


Figure 1839. Pie chart showing Willingness to pay for Samples
Source: Primary Survey.

3.1.9. Tourist Survey Analysis

The Tourist Survey was done using Random Sampling Method along the Ghats of River Ganga. Responses of both types of tourists i.e., Domestic and International tourists were recorded and analyzed for inclusive results. The survey was done in the form of interview and focus group discussion to gain a better understanding of User Patronage. Most of the samples visiting the Ghats were visiting for pilgrimage purpose or Heritage and Culture exploration.

Both the type of tourists have similar demands like basic amenities, infrastructural demands like drinking water, washrooms etc. There were also demands for shaded terminals due to extreme climate of Varanasi.

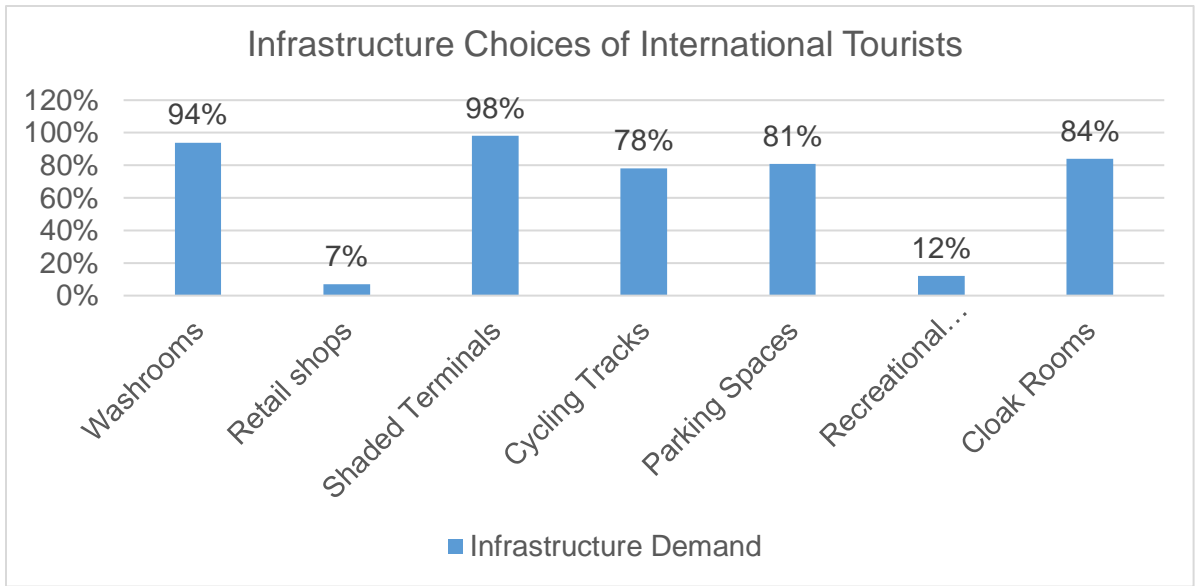


Figure 19. Bar chart showing Infrastructural Requirements Tourists
Source: Primary Survey.

International Tourists have slightly different Infrastructural Demands than that of Domestic Tourists. Since, they have already experienced water transport in different countries, they prioritized their Infrastructural needs in terms for Shaded terminals for climatic accessibility, Washrooms, Cycle tracks for ease of access. One of the Major Demands was of Cloak Rooms to enhance the utilization of Water transport for Recreational purposes.

3.1.10. Industrial Cluster Survey

The industrial cluster survey was done in the Maheshpur Industrial area which is the prime industrial area comprising of Micro, small and Medium Enterprises (MSME) and Lallapura area which is the hub of silk weavers in Varanasi.

However, the Household industries of Handloom and Handicraft were demanding or NMT Access to the streets since there houses only had availability of NMT mode due to narrower lanes along their residences whereas the Industrial clusters demand for motorized vehicles due to weight of the commodity.

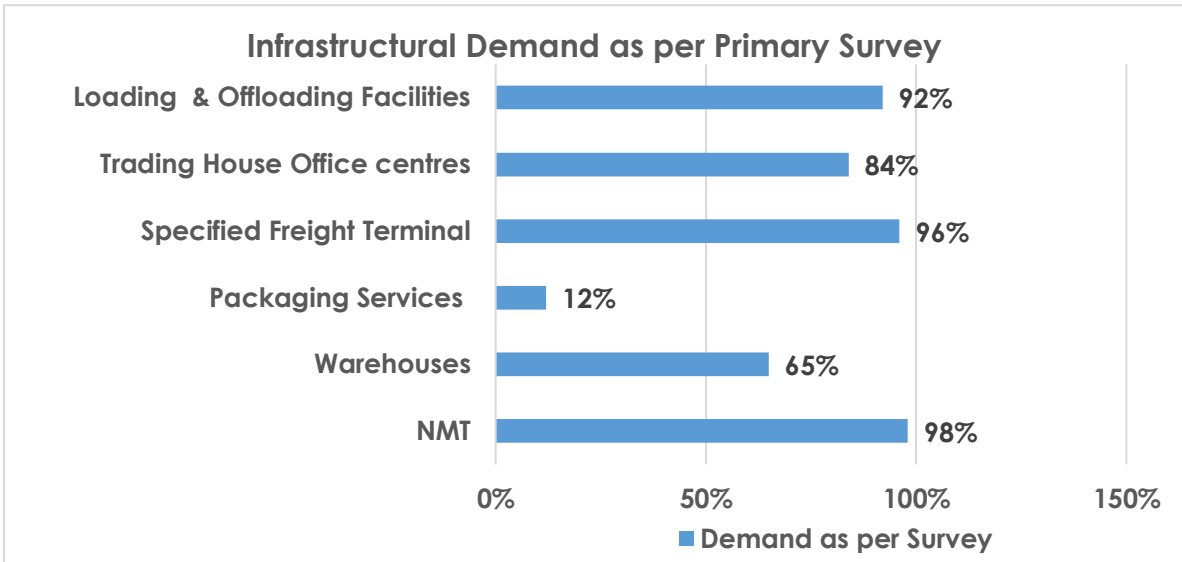


Figure 2040. Bar chart depicting Infrastructural demands on Terminals by the ITC Sector
Source: Primary Survey.

Major Demand was for Loading and Unloading spaces along the terminals followed by trading house offices at freight terminals so as to avoid multiple movements and have a single window clearance. Specified Freight terminals are also in demand as the freight timings can also be different without getting in conflict with passenger mobility across the Water Channels.

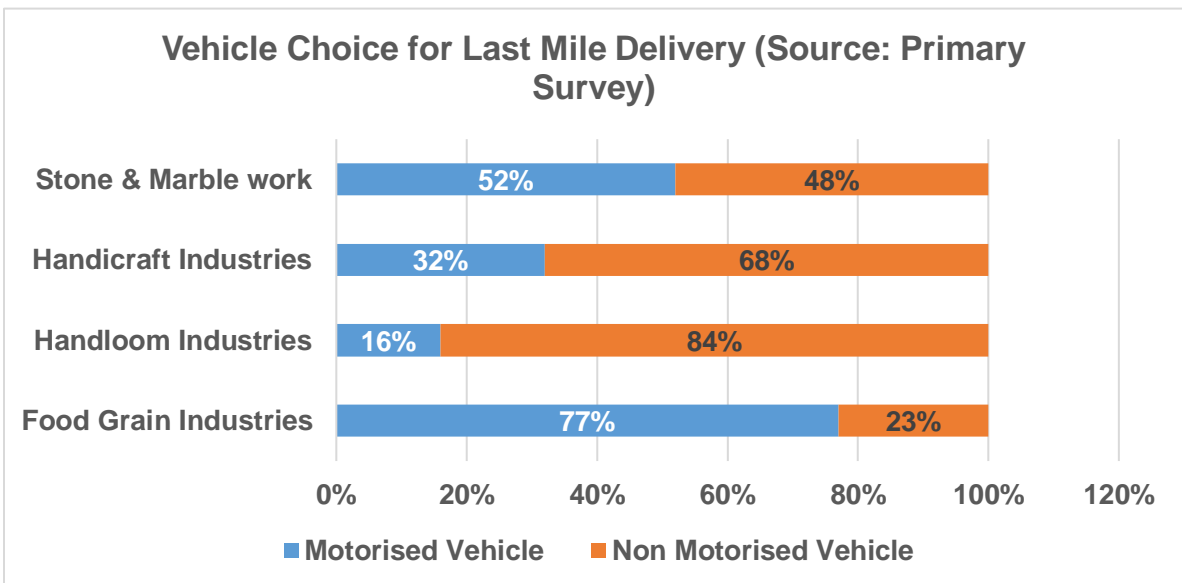


Figure 2141. Vehicle Choice for Freight Last mile Delivery
Source: Primary Survey.

4. Recommendations

On analysing the various influential parameters in case of Varanasi, recommendations are drawn for any land locked territory, particularly in Indian scenario. The recommendations focus on enhancing accessibility, affordability and eventually enhancing citizen's acceptability through sustainable measures. The recommendations have been made on two dimensions i.e., Spatial Recommendations and Policy Interventions.

4.1. Spatial Recommendations

4.1.1. Operability

a) Dredging for maintaining River Water Depth

Based on the analysis of Water levels, the Ganga was found feasible for IWT operations all through the seasons, whereas the river stretch of Varuna was found inoperable due to shallow water levels during the summer season. The river stretches or the Sangam of River Varuna and Ganga was found inoperable due to pollution from slums. Thus, Two Dredging Channels, One of 1.2 km and other of 1 km has been proposed along Ganga. The Dredging Channels A and B has been marked on the maps given below.

b) Stream Flow Management

The Stream Flow is from Varuna to Ganga but since the access route is (as it is a part of National Waterway-1, The focus is consuming less energy and time to access from Varuna to Ganga, Hence A Lock is proposed at the Ganga Varuna Sangam area to support the vehicle and reduce the energy/fuel consumption. Also, High speed CNG Water Transport vehicle is proposed to be operated along the route. The Lock location is marked on the map.

c) Prohibition of Untreated Water Drainage along the channels

There shall be strict prohibition on Untreated water Drainage into the rivers and hence, control the pollution along the river channels.

4.1.2. Modal Integration

a) Upgradation of Kashi Railway Station

Considering the Modal Integration factor, Only Railway Station in proximity to the Water channel is the Kashi Railway Station, The Railway Station should be upgraded to accommodate and serve the waterways as well for both passenger and Freight Transport.

b) NMT Zones and Dedicated Parking Area

NMT Zones should be located within 500 m of the IWT Terminals. Two-wheeler Parking shall be provided within 500 m buffer and four-wheeler parking shall be located within 1

km buffer. Moreover, All the terminals with Freight facility shall have a minimum of 0.1 ha of Parking space.

c) Pedestrian Access

All the terminals shall have a pedestrian access route without any encroachment a clear 1.8 m path shall be provided on the roads with ROW more than 10 m and the access routes with ROW less than 10 m access shall be fully pedestrianized during IWT Operation Period.

4.1.3. Terminal Point Locations

The terminal points shall be located where maximum trip purpose is fulfilled along both the rivers. Freight and Passenger terminals has been classified based on accessibility of the terminal. They have been recommended with a good mix of land uses are present such as Tourism spots, educational spots, Healthcare institutions etc. The terminal locations are namely Nagwa, Bhadaini, Gayatri, Dashashwamedh, Gaay, Adikeshav, Namoghat, Panchganga, Prabhu Ghat. Along River Varuna, four terminals for Passenger terminals has been identified namely PWD, Daniyalpur, Konia, Azad Nagar Ghat. For Freight Terminals, Basavari, Cantonment Area, Jalalipura Terminal, Khajuri Terminal along Varuna and Namoghat Terminal, Nagwa Ghat Terminal, Darbhanga Terminal, Bhadaini Ghat, Nagwa Ghat along Ganga Terminal are identified so that it is accessible by Motorised Transport and Water – Road Linkage could be done.

4.1.4. Infrastructural Provisions

- a. Basic Amenities including drinking water facilities, waste management facilities, cloak rooms and washrooms along the access routes along water channels to enhance user experience and increase service utilization.

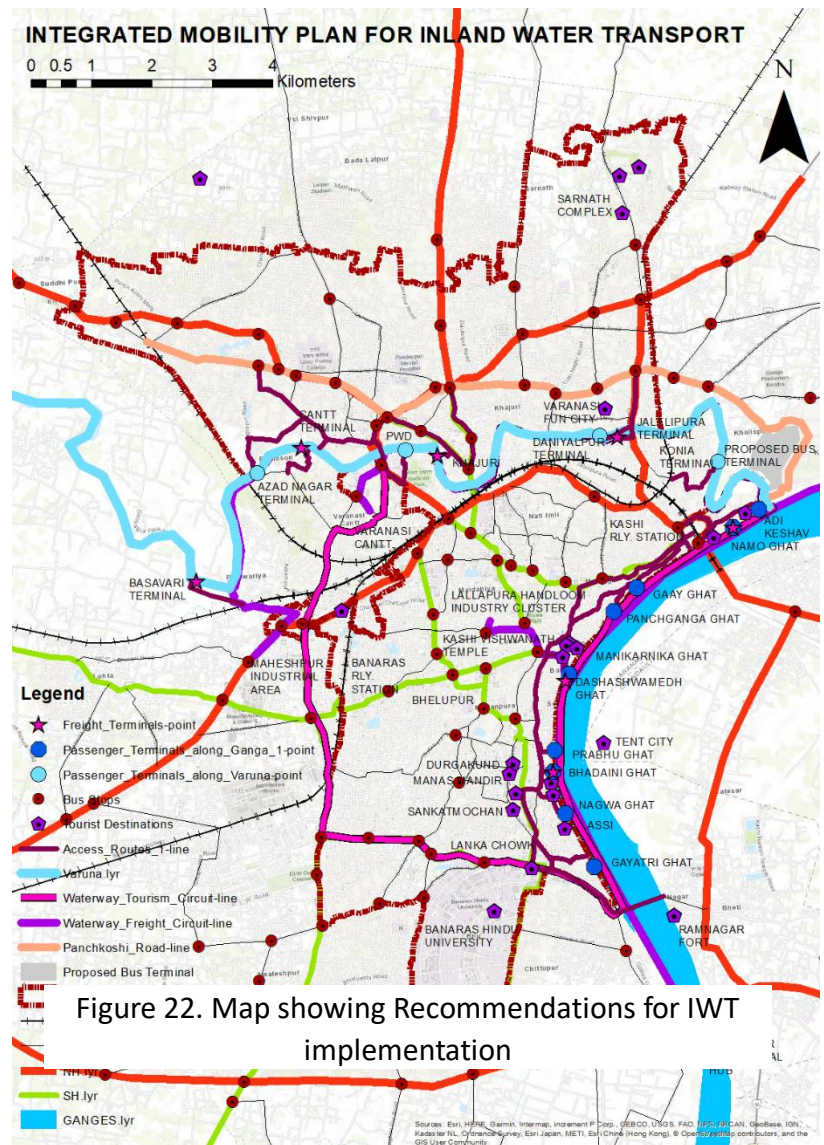


Figure 22. Map showing Recommendations for IWT implementation

- b. *Street Lights along the marked access routes* in Map shall be provided to ensure safety for all gender along the terminal access routes.

4.1.5. Urban Waterway Freight Terminal

The routes from Industrial Clusters to waterway terminals up to Ramnagar Multimodal Terminal shall be underlined. Separate timings for Freight movement which is after 8:00 pm in the evening till 1:00 am midnight through the underlined route via Raj Ghat Terminal. Darbhanga Ghat terminal is proposed to be a specialised Handicraft and Handloom terminal.

4.1.6. Tourism Waterway Circuit

Since all the tourist sites are located within 1 kilometre distance of the water channels, A tourist circuit through waterways has been proposed. The proposed circuit shall also be used for the annual Panchkoshi Yatra as the route of yatra is along the Water Channels.

4.1.7. Removal of encroachments

Encroachments are a major cause of on-road congestion. Thus, it shall be removed from the access routes and Proper Vending Zones shall be provided on Terminals to secure their livelihood. This shall also help in easing out the waiting time on terminals. The routes along which encroachments has to be removed is highlighted in the map.

Policy Interventions

- *Governance Hierarchy for accountability:* Proper Governance Hierarchy under IWAI is proposed. The IWAI is on the central level for policy guidelines. In absence of State Water Transport Committee, Varanasi Development Authority (VDA) shall be accountable on regional/divisional level. The implementation of Engineering Works shall be looked after by Uttar Pradesh Public Works Department (UPPWD) and a new department called Department of Waterways shall be constituted under Varanasi Nagar Nigam (VNN) for planning guidelines on city level.
- *Proper Ticketing System* at all the terminals with ticket counter provisions so that there shall be uniformity in fare charging all across the city and hence, enhancing affordability.
- *Regularising the Ferry System:* All Ferries and Boats shall be registered with Municipal body to have count. It will be responsibility of the municipal body to allocate mooring spaces to all the water transport vehicles.
- *MRO facilities at specified terminals:* Maintenance, Repair and Operations Facility shall be provided along terminals. Provision of floating MRO facilities along water channels is a necessity along the operational network.
- *Prohibition of Bathing along Terminals:* Bathing is prohibited along the terminals,

Only Religious Ghats will have bathing facilities but before getting into the water body, people shall take bath in the changing rooms provided and then, only use the water for ritualistic.

5. Conclusion

Inland Water Transport as an alternative mode can be one of the successful attempts to solve the problem of on-road congestion in urban areas. Being proven as one of the sustainable and comparatively cheaper mode, it is conditional to operational variables like Regularising IWT services, Vehicle maintenance, IWT vehicle parking, freight management along river arteries etc. The accessibility factor of Inland Water Transport as a consumer service is impacted by variables such as the spatial character along water channels, access routes to the terminals and infrastructural facilities along it, it also depends on the extent of exploitability of water transport through last mile connectivity. Any terminal shall be covering a variety of trip purposes to ensure cost effectiveness of the service. The service routes shall be such to entertain maximum trip purpose. On the other hand, multiple usability of terminals shall be ensured through vending zones and involving stakeholder participation for land management so that it does not adversely affect the economy. Hence, IWT is a service which can be made accessible mostly through subjective tools rather than objective one as it involves analysis of geographical conditions, pollution, spatial and network character, user demand, safety and more importantly consumer behaviour.

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