SUPPORTING SUSTAINABLE MOBILITY
UNDER SMART CITY MISSION

CITY REPORT:
GWALIOR

ICLEI Local Governments for Sustainability

SHAKTI SUSTAINABLE ENERGY FOUNDATION

SUPPORTING SUSTAINABLE MOBILITY
UNDER SMART CITY MISSION

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GWALIOR

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About Shakti Sustainable Energy Foundation
Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support renewable energy, energy efficiency and sustainable transport solutions.

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MESSAGE

Greetings!

Urban areas in India act as catalysts of economic growth as they play a significant role in contributing towards national income, employment generation and productivity in their region of influence. Yet, city governments in urban areas continue to lag behind in capacity and have poor infrastructure, resulting in substandard quality of life for end users even today. In order to address the above challenge, Government of India identified Smart City Mission as an integral source of funding amongst its on-going flagship programs to tackle the infrastructural gaps and capacity of urban local bodies.

We are glad to provide our support in association with Sandeep Gandhi Architects in the mobility and built environment sector to four cities which are being developed as Smart Cities. This has been a unique initiative by engaging with the project cities and giving inputs to the smart city proposal, assisting in initiating specific mobility projects, carrying out assessments and studies looking at feasibility and impact of projects, citizens and community engagement based pilots that converted into tender development in line with the Smart City Proposals.

I would like to express our gratitude to Shakti Sustainable Energy Foundation for initiating the approach of assisting the city governments with regard to mobility and built environment. I would also wish to thank the mobility and built environment sector experts, government officials, members of Smart City Special Purpose Vehicle, municipal staff of the project cities for their continuous support provided towards completion of this report.

(Emani Kumar)
Deputy Secretary General, ICLEI – Local Governments for Sustainability &
Executive Director, ICLEI South Asia

ACKNOWLEDGMENT

At the beginning, ICLEI- Local Government for Sustainability- South Asia would like to thank 'Shakti Sustainable Energy Foundation (SSEF)' for providing us this opportunity to provide handholding support to the city of Gwalior (Madhya Pradesh) to deliver city scale action plans under transport and built environment through its grant program. .

We are highly obliged and acknowledge our sincere thanks to Mr. Vinod Sharma,IAS, Commissioner, Gwalior Municipal Corporation for all assistance, support and necessary guidance towards the successful completion of the projects under the grant program.

Our honest and deepest gratitude to Tejaswi Mahip, CEO,Gwalior Smart City Development Corporation Limited for his constant guidance, valuable suggestions and criticisms during the entire project duration, without which the projects/ proposals would not have streamlined to its present form.

We would also like to acknowledge our sincere thanks to the current and former officials which include Mr. Abhay Gupta, CFO (GSCDCL) and Mr. Ankit Sharma, executive engineer, GSCDCL for all the assistance and necessary support towards the successful completion of the projects under the grant program.

Our special thanks to Mr. Sudheendra Bajpai, Team Leader, KPMG India (PMC for Smart City Projects) and his whole team for their constant support and necessary assistance during the entire duration of project.

We also acknowledge our sincere thanks to the all the officials from UADD, Government of Madhya Pradesh for their inputs, suggestions, constant and necessary support during the entire project duration.

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1 BACKGROUND

The Ministry of Urban Development's (MoUD) Smart cities initiative provided an opportunity to envision, plan and develop projects for improving the livability in 109 cities selected to be developed as Smart Cities over a period of time. Urban built environment and transport happen to be the core of this program, even though the program only focuses on an identified area for aiming improvements along with pan city initiatives including systemic changes. Currently the smart cities mission focuses mainly on Area Based Development (ABD), while the other ongoing schemes such as AMRUT (another flagship mission of GoI) focuses on the remaining city improvements where the funds are allocated for various service sectors. It is observed that the interventions planned at the area level are beneficial but scaling up to the whole city later might become an issue as the cities are continuously sprawling. Hence there is an urgent need to assist the cities in formalizing an integrated action plan in line with the defined vision for smooth implementation of the proposed mobility components of the plan and future scaling up of the same for the entire city.

Additionally, built environment is also a major component under the smart cities mission; however it is also observed that though there are numerous policies and codes notified under the building sector in India to guide the development in built environment, there is very less knowledge available to the stakeholders on the implementation of the same at

the city level. Hence, most of the cities though being developed under the Smart City Mission have not been able to show improvement in the built environment sector. Therefore, there is a need to help the cities to understand the implementation of measures in order to reduce the emissions from this sector. This can be done by developing an action plan and creating awareness along with the capacity building exercises including the stakeholders from government and the private sector.

ICLEI- South Asia - Local Governments for Sustainability, which aims to build and serve a regional network of local governments to achieve tangible improvements in regional and global sustainability through local initiatives, together with its partners SGA Architects worked and supported 4 Indian smart cities of Udaipur, Kakinada, Visakhapatnam and Jaipur during 2015-16 with the grant support from Shakti Sustainable Energy Foundation (SSEF). Successful engagements with the city and state governments during implementing this grant provided for close insights into the existing gaps and needs that require addressing as the cities proceed into implementing their smart city proposals.

After successful implementation of phase I of the grant, ICLEI – South Asia was granted the second phase of the handholding support project by Shakti Foundation in February 2017 to support four cities to deliver city scale action plans under transport and built environment. The cities in the second phase included three cities from the prior engagement i.e. Udaipur, Visakhapatnam and Kakinada and a new city i.e. Ludhiana from Punjab was added to the handholding support. In the process, Kakinada was dropped due to inactive engagement and Gwalior was added for the handholding support.

The proposed initiative aims to develop and showcase an integrated and comprehensive approach to address urban transport issues and promote sustainable built environment by implementing nationally recommended steps and strategies. With the background of ongoing national efforts to develop 109 smart cities with complementary funding from programs such as AMRUT, HRIDAY, Housing for all (and few other programs) and expected active involvement of state government for undertaking implementation, the proposed project was scheduled to support four city governments to understand the 'Smart' aspects of urban mobility and built environment, as relevant to their local conditions and make available existing resources for utilisation towards implementing the same for the entire city.

1.1 OBJECTIVE

The project aims to deliver city scale action plans under transport and built environment sector for four Smart Cities. The primary intended outcome of the project is to build capacity of the city level authorities for smart built environment approach thus achieving the sustainable transport targets and promoting green and efficient buildings. The project also aims to provide handholding support and build state level preparedness of the cities for implementing the Smart city program.

1.2 SMART CITY HANDHOLDING SUPPORT: ENGAGEMENT PROCESS

The engagement process mainly included engaging with Gwalior Smart Cities Development Corporation Limited (SPV), Gwalior Municipal Corporation and Project Management Consultants (PMCs) for the Smart City Limited on successfully implementing the proposed projects under the Smart Cities Proposal. The initial engagements with the selected cities were carried out through the state government and city governments, by the means of city specific Memorandum of Understanding (MoUs). The MoUs were signed in order to finalise the activities to be carried out under the support in consultation with GSCDCL

2 CITY PROFILE

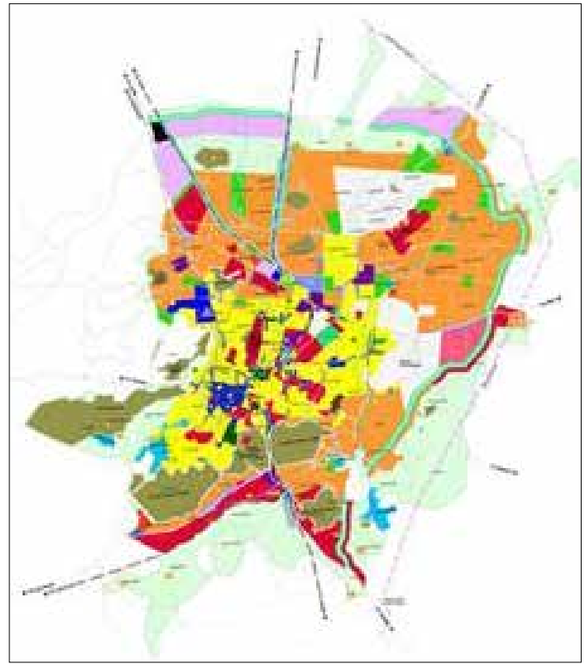
Gwalior is a one of the major cities in Madhya Pradesh. It is situated on the Delhi-Agra-Bombay route and developed all around the foothills of Gwalior Fort. The presence of Gwalior fort makes it an important tourist city of India. It is the fourth largest city in the state spreading over an area of about 289 square kilometers (Figure1). The city serves as the administrative headquarters of Gwalior district and Gwalior division. The city economy is dependent on trade and commerce. Additionally the city is base of Indian Air Force and Indian Arms cantonment.

While Gwalior Municipal corporation limit covers area of 289 sqkm , the planning area of Gwalior spreads over 826.53 sq. km. Gwalior Planning area is overlooked by Gwalior Development Authority (GDA). The city is divided into four regions: Laskhar East, Lashkar West, Gwalior City and Morar.

2.1 CONNECTIVITY AND STRATEGIC LOCATION

In terms of connectivity, the city is well connected by road and rail nationally and regionally. The city is located in the influence area of strategic transport corridors of India. It lies on the North-South corridor and about 50km north of the East-West corridor. The Delhi-Mumbai Industrial corridor influence area lies about 50km to the west of the city which further enhances the city's importance. The presence of Delhi-Mumbai dedicated Freight corridor to the west and the Ludhiana-Kolkata dedicated Freight corridor to the east of the city would further strengthen movement of cargo in the region. It is strategically located between major tourist destinations lying on the Delhi-Mathura-Agra-Jaipur-Ranthambore-Gwalior-Shivpuri, Orcha-Khajuraho tourist circuit.

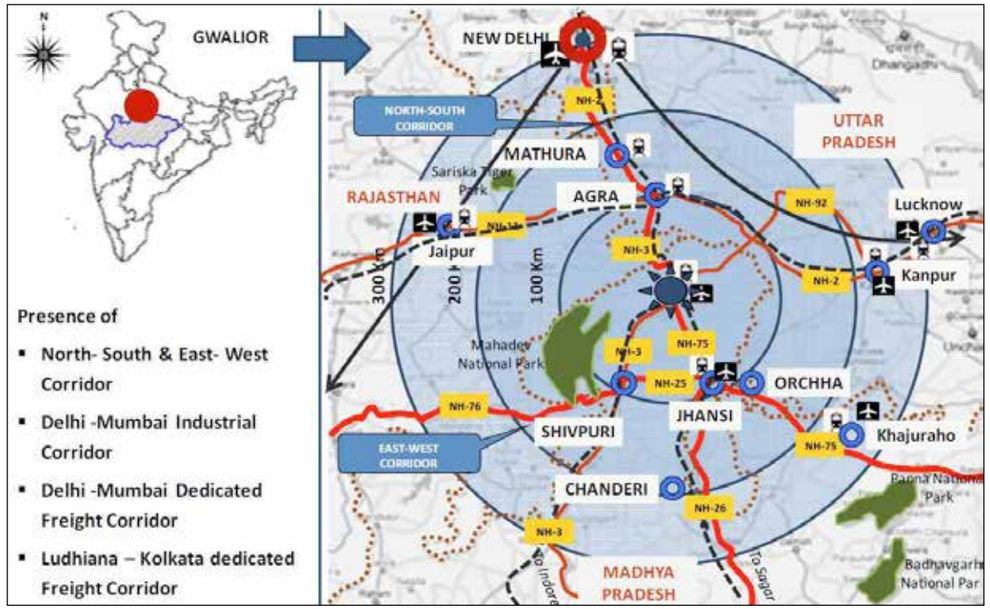
Figure 1: Map of Gwalior City (Source – Directorate of Town & Country Planning Madhya Pradesh)



The city lies on the broad gauge railway line connecting Delhi to Bhopal. A narrow gauge line connects the city to Sheopur. The station is located on the main Mumbai-Delhi and Chennai- Delhi rail link. Gwalior has a domestic airport providing services to the region.

The airport is located to the north east of the city at a distance of about 8km from the city centre.

Figure 2: Location, Linkages and Regional Setting of Gwalior (Source: Gwalior Municpal Corporation)



2.2 POPULATION AND DECADAL GROWTH RATE

As per the census 2011, the population of Gwalior city was 10.54 lakhs which was projected to reach 14 lakhs in year 2021. Population density of Municipal area is 8,014 persons per km. Over the last decade the annual average population growth rate of the city has been observed increasing from 19.73 % in 2001 to 27.50 % 2011. The population and decadal growth rate of Gwalior city is listed in (Table 1).

Table 1 Population Growth trend - Gwalior

Years	Population	Compound Annual Growth Rate (%)	Decadal Growth Rate (%)
1981	539020	2.28	32.72
1991	690765	1.16	28.15
2001	827026	2.23	19.73
2011	1054420	--	27.50

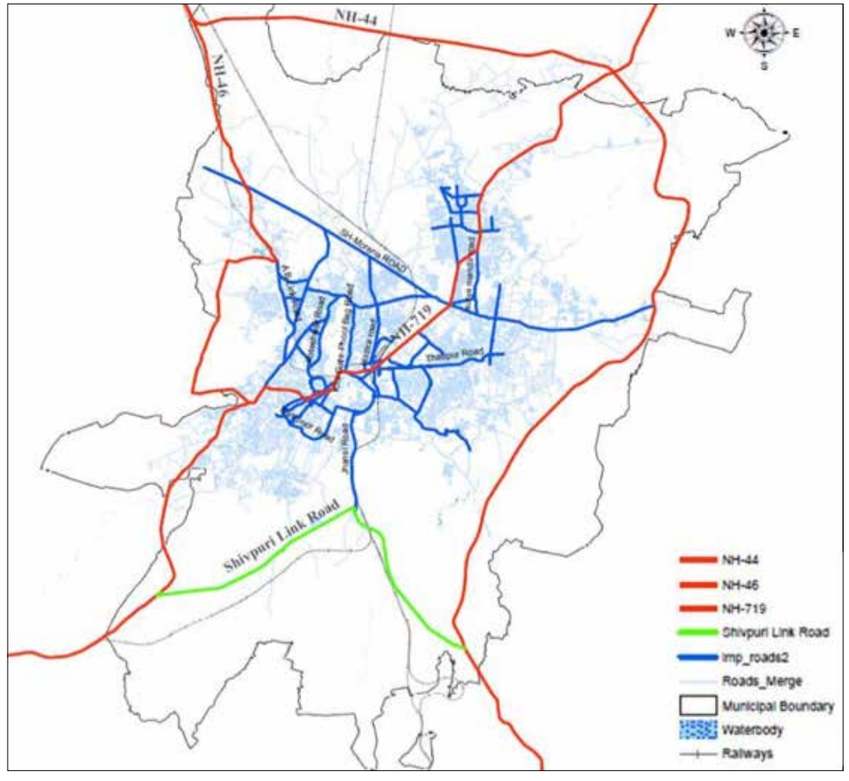
3 TRAFFIC AND TRANSPORT PROFILE

Gwalior has a good regional linkage through railway links and road connectivity with all major cities across India. However, like any other medium-sized cities in India, the urban transport scenario in Gwalior is chaotic, characterized by heterogeneous traffic competing for road space. Due to absence of public transport system, the larger population share of city is dependent on private vehicles. In addition to private vehicles, Intermediate Public Transport (IPT) caters to mobility demand. IPT in the city includes tempos, auto rickshaws, TATA magic, taxis and e-rickshaws.

3.1 ROAD NETWORK

The road hierarchy in Gwalior consists of National Highways, State Highways, Arterial road , Sub arterial road and collector roads. The city road network is a combination of radial and grid network with a total

Figure 3: Major roads in Gwalior City



road network length of 782 kms. The state highways comes under the jurisdiction of Public Work Department (PWD), whereas the national highways are maintained by National Highways Authority of India (NHAI).

Table 2 Existing Road details

Type of Road	Length in Kms
National Highway	68
State Highway	15
Arterial / Sub artrial	105

Source - (City Development Plan 2011, Gwalior)

There are 10 arterial roads, 16 sub-arterial roads, 30 collector roads and 18 other roads, which connect the whole city with residential areas and commercial areas.

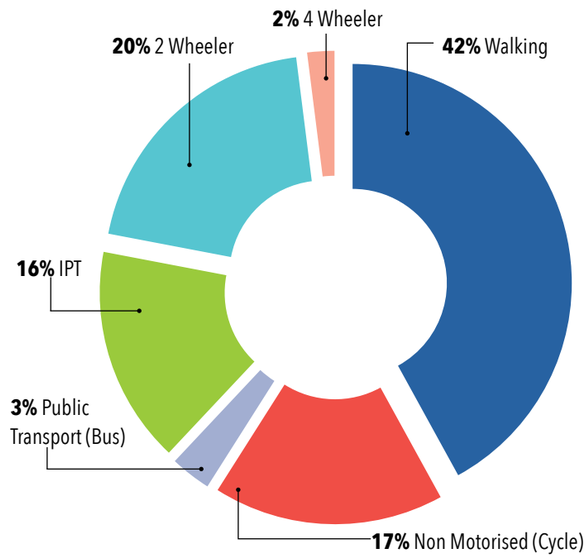
3.2 VEHICULAR GROWTH

Over the years the city has experienced a rapid growth in private vehicles (2 wheelers and 4 wheelers). The Table presents the growth of the vehicle

3.3 MODAL SPLIT

The modal spilt in figure 4 highlights the high number of NMT trips at 59 percent. Inspite of large number of vehicles , it is evident that private vehicles are catering to demand of merely 22 percent. This highlights the need to improve NMT infrastructure in order to retain large number of NMT users.

Figure 4: Modal spilt in Gwalior



3.4 PUBLIC TRANSPORT (PT)

Gwalior lacks formal public transport system. In absence of city bus service, IPT caters to needs of shared mobility in the city.

3.5 INTERMEDIATE PUBLIC TRANSPORT (IPT)

In absence of formal public transport, IPT plays a vital role to cater to mobility demand. The main modes of

Table 3: Registered Vehicle Trend in Gwalior

Years	Two Wheelers	Three Wheelers	Four Wheelers	LCV	HCV	Mini buses	Buses	MAV	Total
2003-04	15990	299	2284	51	610	390	9	2	19635
2004-05	18142	338	2670	132	457	331	47	0	22117
2005-06	18623	387	2183	107	403	294	73	80	22150
2006-07	19446	520	2320	178	775	252	40	768	24299
2007-08	18774	842	2546	144	201	367	88	302	23264
2012-13	18825	844	2553	144	202	368	88	303	23328

Source - (City Development Plan 2011, Gwalior)

Top: IPT in Gwalior City
Bottom: On street Parking – Gwalior

IPT in Gwalior are auto rickshaws as well as shared vehicles like, Tempos and Tata Magic which ply in the city as well in the nearby villages.

At present, the most predominant IPT vehicle in Gwalior is the Tempos popularly known as Vikram service. As per RTO data, there are total 826 registered tempos in the city. These are operational on 14 routes out of the 23 assigned by the RTO. On the remaining 9 routes, low demand has resulted in negligible interest from Auto drivers. Apart from the tempos, the city has more than 8000 autorickshaws and 450 Tata Magics.

3.6 PEDESTRIAN AND NON-MOTORIZED TRANSPORT (NMT INFRASTRUCTURE)

Non- motorized modes within Gwalior city are mainly comprised of walking, cycles and horse driven Tongas. The Tongas are mainly used in Bada area for passenger movement. About 20% of trips in Gwalior are made by cycle and 0.38% by Tongas. Additionally, around 45% of commuters prefer to walk for work, education and other activities. However, pedestrian facilities such as footpath etc. are not adequately provided throughout the city.

3.7 PARKING FACILITIES

Due to large number of private vehicles, the streets have been occupied by on-street parking, which is presently unorganized creating congestions and traffic jams over the main road stretches of city. Though, parking facilities are provided in the city they are inefficient to cater the current demand. There are 20 designated on street parking locations operational in Gwalior. Out of these 14 are being privately operated through tenders and 6 are being operated by GMC. Additionally, there are 11 operational off-street parking locations in the city. 6 are in the Maharaja Bada area which has been selected for Area Based Development under Smart Cities mission.

4 EXISTING INITIATIVES BY CITY AUTHORITIES/ SMART CITY PROJECTS

Improved urban mobility is one of the priority sectors for Gwalior under Smart Cities Mission. The city has a vision to develop Gwalior as connected and accessible city. The strategy adopted by Gwalior under Smart cities mission includes improving physical linkages within the city for enhanced connectivity to reduce the trips by private vehicles by developing efficient public transport system with E-rickshaws for last mile connectivity. The strategy also includes improvement of NMT infrastructure at neighborhood level. Below is list of the priority initiatives undertaken by city for sustainable mobility:

- Parking Management in Maharaja Bada area
- Opertionalising E-rickshaw
- Opertionalising Public transport i.e. City Bus service
- Junction improvement

4.1 PARKING MANAGEMENT

As stated earlier, the absence of formal public transport system has resulted into high ownership of private vehicles. This increase in vehicular ownership has led to increase in parking demand. Currently, there exits a supply-demand mismatch of parking space in the city, making demand management as one of the primary challenges faced by the city. If sustainable solution to this issue is not thought, in the long run the increasing demand shall outstrip the supply which will result into further encroachment of streets by vehicles.

4.1.1 Initiative by City Authorities

While Gwalior Development Authority (GDA) is responsible for formulation of parking standards, the Gwalior Municipal Corporation has to ensure implementation and demarcation of parking lots, fixations of parking fee and management of parking infrastructure. The traffic police is responsible for enforcement of parking rules. To tackle with the increasing parking demand, GMC is identifying new areas for off-street parking. The authorities have proposed mix of multilevel parking, surface off-street parking and On-street parking in different places in the city, under the guidance of Madhya Pradesh Urban Parking Management Rules, 2018

Additionally, Gwalior Smart City Development Corporation Limited (GSCDCL) is planning to develop underground Smart parking system. As per Smart city proposal, development of 2 Smart Multi-level parkings have been proposed in the ABD area (Maharaj Bada) with a capacity of 545 ECS. and Gandhi market and Bhesha Chowkey with total 1000 ECS with real time occupancy display.

4.1.2 Need for New Approach

Maharaja Bada area being the central business district, attracts large number of visitors. Areas like, Sharafa Bazaar, Daulatganj Road, Dal Bazaar, Jayenderganj Road, Patankar Bazaar, Lohia Bazaar have high parking demands. The average share of short, medium- and long-term parking demand is 7716 ECS. As per the secondary data analysis, it has been ascertained that 485 ECS of parking space was required for Maharaj Bada area. The same has been forecasted to grow at the rate of 6% per year.

Therefore, in addition to MLCP, the city needs to develop parking policy along with parking management plan for area. In absence of onstreet parking policy, the streets will continue to be encroached by vehicles creating bottleneck for pedestrian as well as vehicular movement.

4.1.3 Activities suggested/ carried and its Outcomes-

As per the secondary data analysis, it has been ascertained that 485 ECS of parking space was required for Maharaj Bada area. Due to absence of proper management strategies, the vehicles are being parked on street in front of heritage structures, which include buildings like Town Hall, SBI building and Post Office at Maharaj Bada, and outside Gorkhi Gate.

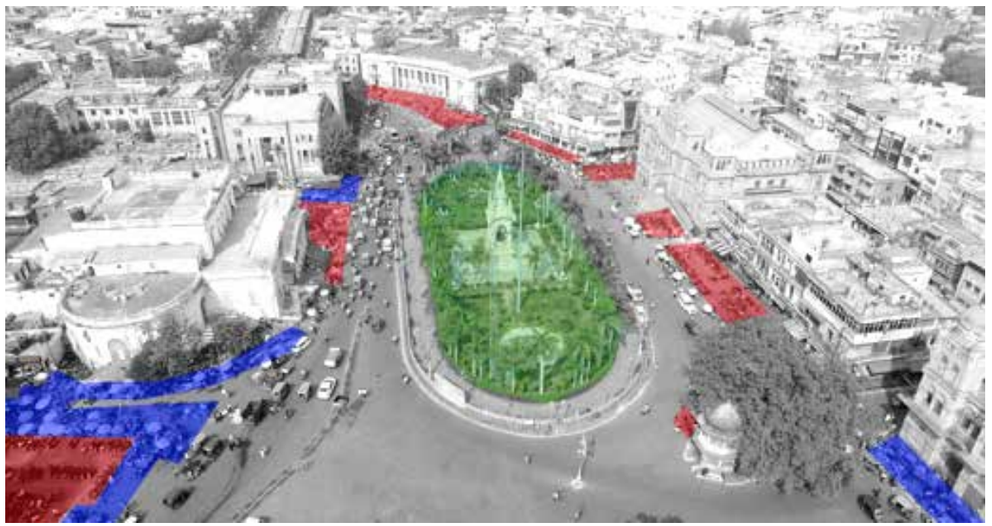
To address the issue of parking spill over, two parking locations have been proposed at MahaBada, namely, Scout & Guide Office & Gandhi Market. The approximate area & location details of the proposed parking lots are provided below

Location name	Area (Sq.mt)	Capacity (ECS)
Gandhi Market	6,000	600
Scout & Guide Office	2,925	290

The capacity of the parking lots have been worked out on the assumption that 3 storeys of parking will be developed at each of the proposed parking lots and parking area for each ECS of parking space has been taken as 30 sqmt.

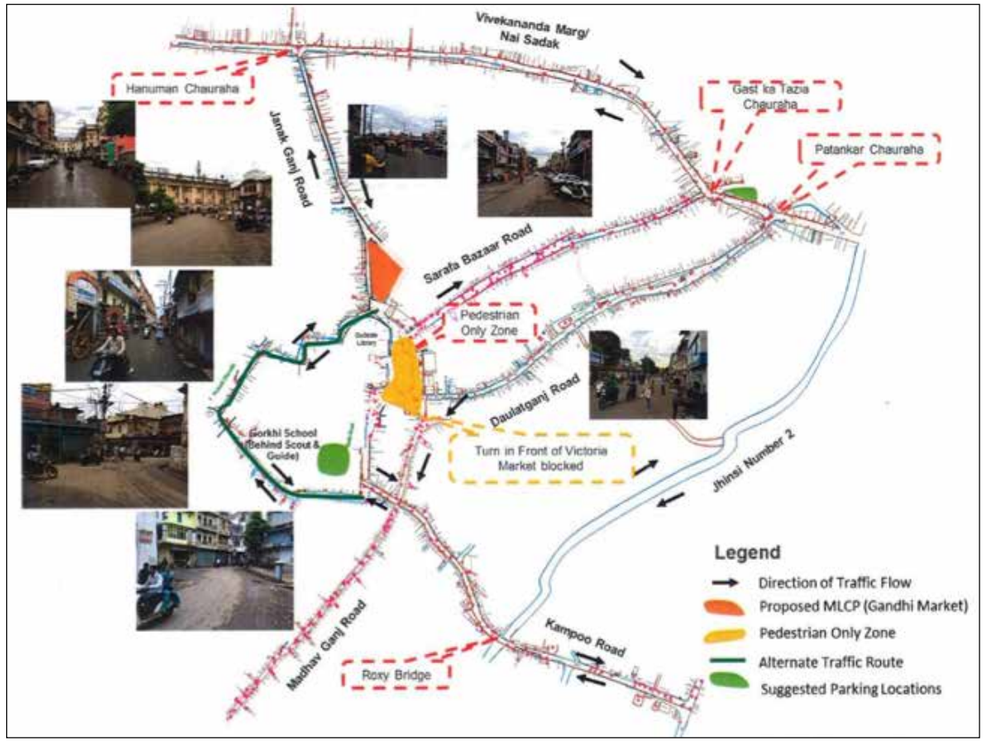
In above context, City Associate assisted GSCDCL to prepare draft parking policy and parking management plan for Maharaja Bada area. The parking management plan will provide enabling framework for MLCP to be developed in Maharaja Bada Area. The parking policy has been developed as per the provision of Madhya Pradesh Urban Parking

Figure 5: Parking spaces at Maha Bada



Source: Tractebel Engineering

Figure 15: Proposed Circulation plan at Maha Bada (Source: Tractebel Engineering)



Source: GSCDCL

Management Rules, 2018 which provides cities with flexibility to create its own parking policy to efficiently manage parking demand. These rules will apply to planning and management of parking activity on,

- public on-street parking areas;
- public off-street parking areas;
- multi-level parking area; and
- private parking areas owned and operated by private entities; within the jurisdiction of municipal area

The rules further mandates ULB's to prepare and notify a parking plan for the municipal area to regulate the parking and halting of vehicles within that area. As per the rule the parking management plan should categorize into;-

- Parking area;
- No parking zone;
- Parking restricted area; and
- Pick up and drop off area

4.1.4 Key Challenges and Broad Level Findings

The unorganized on-street parking along the streets is eating up the road space leading to reduction in carriageway. There is no pricing system for parking on the streets and two wheelers and car are parked illegally on footpaths. Congestion, gridlocks and traffic at a virtual standstill are common scenes in most parts of the Maharaja Bada. Parking spaces are hard to find and parking itself causes hardships to vehicular movement and pedestrians. There is also no well-defined policy to provide parking for bicycles, non-motorized vehicles etc. There is unsystematic way of parking management and having encroachment is the main issue on the streets and the roads. Few of the aspects which needs to be addressed are:

- Introduction of dynamic pricing to reduce peak demand:
- Enforcement of parking policy
- Promoting short-term parking

4.1.5 Learning and Way Forward

The Parking policy developed for Gwalior highlights the importance of parking management and how it can help to reduce the traffic bottleneck in important parts of the city. The proper systematic and strategic parking will assist Gwalior to reclaim space for NMT movement. However, in absence of efficient policy to regulate on street parking, the construction of MLCP may not be useful. Therefore, Parking policy has been prepared for Maharaja Bada Area. The Policy needs to be adopted by Gwalior Municipal Corporation and it will provide mechanism to control the unregulated parking on street.

4.2 PUBLIC TRANSPORT (PT)

With a vision to promote clean and efficient mobility in the city, Gwalior plans to operationalize efficient public transport system on PPP mode under Smart Cities Mission. Gwalior Municipal Corporation has already tendered the project for the construction of 100 Bus stands on routes. The buses are planned to be operated as part of Smart Cities Mission and hence GSCDCL is responsible for identification of operator.

4.2.1 Initiative under Smart City Projects

GSCDCL has invited proposal from eligible firms for "Selection of Bus Operator for Bus Transport System in Gwalior (on cluster basis) on Procurement Operate and Maintain Basis". The initiative plans to operationalise city bus service on priority corridor in the city. City Associate is providing assistance to


दैनिक भास्कर

तैयारी • अब दो रूट पर चलेंगी बसें, कुल चार मार्गों के लिए बसें चलाने की प्लानिंग

एयरफोर्स स्टेशन से गुढ़ागुढ़ी नाका तक नया रूट फाइनल, इस पर दिवाली बाद दौड़ेंगी 2 सिटी बसें

स्मार्ट सिटी कंपनी ने 30 सितंबर को इंट्राविसटी बस की शुरुआत की थी

शहरी रोड साइड्स को रोशन में लगी बसें

Top: Print media report on bus service

Bottom: Proposed Smart City Bus Stand and Intra-city bus

GSCDCL for the execution of project. The assistance includes technical advisory in bid management as well as route prioritization and selection of appropriate bus shelters which are designed to provide universal accessibility. The bus service has been proposed to be launched on 2 pilot routes which will be used to scale up initiative at larger level of city.

Need for New Approach

Due to segregated trip distribution, private vehicles are preferred mode of transport. The trip patterns doesn't offer high ridership on any single corridor. Therefore, Gwalior Smart Cities Development Corporation limited decided for mini buses instead of standard 12 meters variant. The smaller buses will ensure high frequency. The bus service is also complemented with bus shelters which are designed on the principles of universal accessibility.

4.2.2 Activities suggested/ carried and its Outcomes

Due to lack of response from operator, GSCDCL decided to improvise and re-float the RFP on Gross Cost Model with assistance of Project IA. The project IA initiated discussions with various private operator for the same. Based inputs from City Associate, GSCDCL improvised the technical and financial parameters to evaluate various bids. ICLEI South Asia on behalf of GSCDCL attended State Level Technical Committee, Urban Administration and Development Department (UADD), Government of Madhya Pradesh for the approval of city bus project and finalization of operator on gross cost model.

Considering revised strategy private bus operator was identified and selected for operations of bus service.

4.2.3 Challenges and Broad Level Findings

GSCDCL had faced the issue related to identification of the Bus Operator to implement this project. The local operators and operators from the other regions were not interested during the tender process. Additionally, bus terminals, lack proper boarding and alighting platform for the passengers. The integration of city bus service with other mode is yet to be planned. In absence of last mile connectivity, the envisaged ridership may not be achieved by city bus service

4.2.4 Current Status

Presently, GSCDCL has signed the agreement with the private bus operator. The operator has started the Intra and Inter-City bus operations in Gwalior. Initially, the operator procured Two (2) Intra and Two (2) Inter City buses for operations in the city. The remaining buses shall accompany for full fledge operations. The operator has already given the order to manufacture for the remaining buses. Gwalior Municipal Corporation has started construction of bus terminal near old bus stand. The GMC has started construction of this bus shelters.

4.2.5 Learning and Way Forward

The organized public transport system with intra and inter-city bus service will help to promote the usage of public transport in urban areas and enhance access in other cities and rural areas. The city bus service should expand the transportation network creating a better connectivity. However, officials need to ensure that the service is affordable and reliable.

Before city plans to procure bus , it is useful to do pre-planning which includes, route rationalization, identification of location of bus shelters, design of bus shelters and integration with IPT and NMT. In order to improve the public transport of the city, the first task should be identifying the priority corridor and to gauge the travel requirements in that corridor. Once the priority (high demand) corridors have been identified, the city should assess travel demand on these corridors. travel demand estimation, parameters like population per capita trip rate and modal split has been used to estimate total trips performed on daily basis in Gwalior. Inputs from all the stake holders including officials, public representatives, operators and experts should be taken. Then finalizing the road map and strategies should be drawn after incorporating their comments and suggestions

For city bus service in Gwalior, the next step is to plan for integration of bus service with other modes to provide seamless last mile connectivity.

4.3 INTERMEDIATE PUBLIC TRANSPORT (IPT)

In absence of city bus service, Gwalior is dependent on the intermediate public transport for mobility needs. At present, the most predominant IPT mode in

Gwalior are the Tempos popularly known as Vikram service. As per RTO data, there are total 826 registered tempos in the city. These are operational on 14 routes out of the 23 assigned by the RTO. On the remaining 9 routes low demand has resulted in negligible interest from Auto drivers. Apart from the tempos, the city has more than 8000 autorickshaws and 450 Tata Magics

4.3.1 Initiative by City Authorities

The city authorities have taken steps towards the improvement of intermediate public transport. To provide connectivity to the transport deprived areas, strategies have been laid out. As part of this, GMC provides subsidy to electric rickshaws under NULM scheme which is directly beneficial to buyers. The aim of this scheme is to promote clean mobility in the city. The authorities are also planning to develop the dedicated parking bays for IPT in the city. Additionally, the concerned authorities are proposing to ban old model diesel tempos and auto-rickshaws which are operating in the city. The RTO will ensure that the permit of old diesel tempos and auto rickshaws are not renewed.

this the city also proposed revitalization of Maharaja Bada area under area-based development by inducing E- rickshaws in the area in order to reduce pollution in the most important heritage area in the city. Similarly, promotion of E-loaders on the same principles to provide cleaner alternative for movement of goods.

In line to the above intention, GSCDCL proposes to operationalize 100 E-rickshaws and 50 E-loaders. As part of the above strategy, GSCDCL will act as a facilitator for large purchase order where up to 150 Beneficiaries will be connected to the supplier through a single purchase agreement. It will be mutually beneficial for the buyer as well as the supplier. A single large purchase order will assist supplier to set up the service center and charging stations in the city. Apart from better service from supplier, buyers will be benefited through subsidy facilitated by GSCDCL through NULM scheme. For this, ICLEI SA helped in identifying the routes in which E-rickshaws will be operating (Figure 5).The following initiatives were addressed in order to operationalize E - rickshaws and E- loaders :

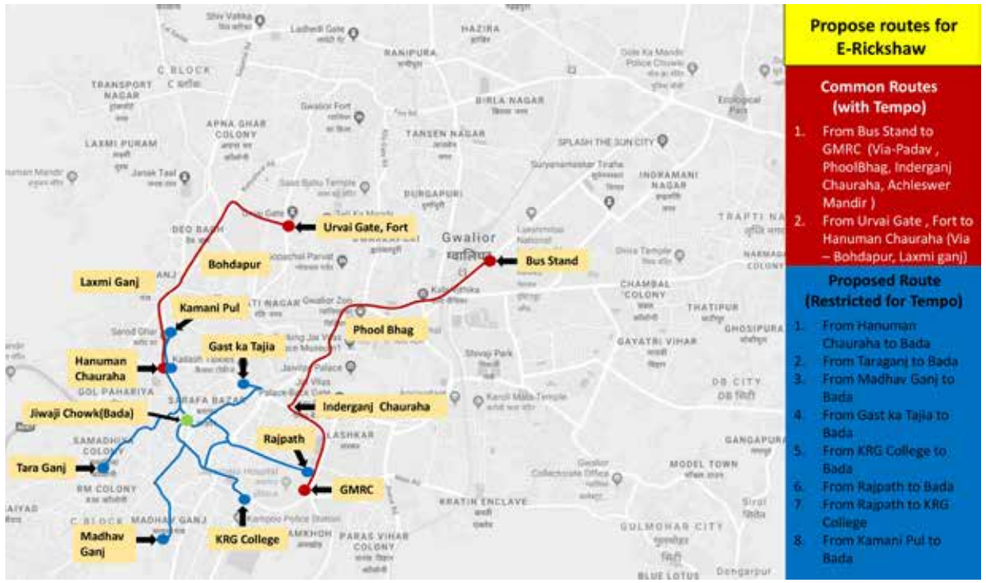
Pre-bid meeting with E-rickshaw Vendors

4.3.2 Initiative under Smart City Projects

Gwalior Smart City envisages a clean and green mode of Intermediate public transport in city. For this, the city plans to promote E-rickshaws in city. Along with

- Identify the beneficiary/buyer eligible for getting applicable subsidy under National Livelihood Mission (NULM) program of Government of India, being managed by Gwalior Municipal Corporation.

Figure 7: Proposed routes for Operations of E-rickshaw in the City



News coverage in local newspaper about proposed e-rickshaw route


दैनिक भास्कर

महाराज बाड़ा | प्रदूषण व ट्रैफिक जाम से निजात दिलाने के लिए 100 ई-रिक्शा व 50 ई-लोडर चलेंगे

ई-रिक्शा के लिए बनेंगे 7 रूट, जहां से मिलेगा, वहीं तक आएंगे टेंपो व ऑटो

दाल बाजार और लोहिया बाजार में चलाए जाएंगे ई-लोडर

टेंपो व ऑटो से आए फिर यहां से मिलेंगे ई-रिक्शा

4.3.3 Need for New Approach

Presently, the city has shared tempos; auto rickshaws, Tata Magic as major transportation modes for commuting. Due to old age of fleet, these modes are creating air pollution in the city. Most tempos are running on diesel and are in obsolete condition. Additionally, the city plans to pedestrianize Bada area. Therefore, to promote clean vehicles as a source of last mile connectivity city plans to introduce E-rickshaws as a new mobility approach within the city.

4.3.4 Activities suggested/ carried and its Outcomes

ICLEI SA assisted GSCDCL to operationalize E-rickshaws with supporting infrastructure and policy framework. As part of strategy , GSCDCL will focus on developing infrastructure for E-rickshaw which includes One (1) service station and Eight (8) charging stations along with dedicated parking areas and pick-up bays along the operational routes. The strategy to promote E-rickshaw and E-loader is in line with national electric mobility mission. The following are the activities undertaken:

- Action Plan of E-rickshaw: The Action plan assisted GSCDCL with step by step procedure to be followed to develop E-rickshaw Ecosystem.
- Operational Model of E-rickshaw: Based on Capex and Opex requirement, the model assisted GSCDCL to decide on the mode of procurement and operations.
- E-rickshaw policy: To assist GSCDCL to control the E-rickshaw operations in city
- Technical specification for E-rickshaws, Charging station and service stations
- Stakeholders meeting to identify financial institution to provide low interest loan for E-rickshaw procurement
- Identification of routes for operation: Routes are identified as per their feasible locations where average speed will not be affected to riders and will also help to reduce congestion and air pollution in that area.
- Select most appropriate supplier for E-rickshaws and E-loaders in transparent manner.
- Facilitate the land requirement for setting up infrastructure such as service centres and charging stations.
- Facilitate the available subsidies through Gwalior Municipal Corporation.
- Provide guarantee to bank providing financial loan to buyers.

4.3.5 Key Challenges and Broad Level Findings

E-rickshaw procurement was challenging task as the selection of E-rickshaws and E-loaders are mainly dependent on the technical parameters like their specifications, built quality, battery capacity, warranty, after-sales service and model. The city authorities had limited understanding of technical standards and norms in order to procure the appropriate model. Apart from these, route rationalization of the E-Rickshaws was also a major challenge.

4.3.6 Current Status

Gwalior Smart City Development Corporation Limited has signed the agreement with the Entice Impex Pvt Ltd (E-rickshaw vendor) for the supply of E-rickshaws and E-loaders, construction of charging centers, service station and their comprehensive warranty & maintenance in Gwalior. GSCDCL also proposes to act as a guarantor for the loans to be taken by the beneficiaries. The banks are agreed to provide financial loans to identified beneficiaries at the seven percent (7%) interest rate. The location has been identified for the construction of charging centers and service stations at various places in the city.

4.3.7 Learning and Way Forward

As a next step to the e-rickshaw pilot project Gwalior should develop a 5 to 10-year action plan/road map for the city to transform its IPT fleet to low carbon based on national and regional context. The action plan will include options to integrate the IPT system with public transport and recommend possible funding options to support it. Based on the learning and key takeaways from pilot phase of e-rickshaw project in Maharaja Bada area, the action plan would assist city to overcome various identified barriers such as regulatory, technical as well as infrastructure. Some of the specific aspects which need to be closely considered are:

- Impact of Charging on Grid Infrastructure :

When it comes to faster adoption of e-rickshaws, the lack of charging infrastructure is amongst the major barriers. India already has a peak electricity shortage of 3.7% (Press Trust of India 2014), with regular power outage being a concern in many cities. Over next few years, with rapid adoption of e-rickshaws, Gwalior

may experience an increase in the load on existing electric grid by 0.5 MW per thousand e-rickshaws. If a large e-rickshaws fleet is charged during peak-load hours, it will require the additional energy / power generators and will involve considerable infrastructure investment. A detailed grid supply-and-demand analysis will need to be carried out to arrive at the optimum electricity usage policy for a city. An analysis of load profile can show if low demand during off-peak hours can cater the need of large e-rickshaw fleet. Some loads like consumer (residential and office) electricity demands are instantaneous and need to be catered in real-time. However, an E-rickshaw charging schedule can be controlled (by dynamic tariff) since they can be charged most economically during off-peak times.

Therefore, the city should assess the local distribution network capacity and shortage probability due to recharging needs and patterns. It will assist the city to formulate electricity usage policy and tariff structure for charging of e-rickshaws.

- Battery swapping technology and Standardization of charging infrastructure

There is a need to develop and standardize the charging infrastructure so that use of e-rickshaws can be promoted. Charging, and possibly fast charging, infrastructure must be deployed or retrofitted in public spaces and petrol pumps. It is also critical to develop standard frameworks for the charging infrastructure (including voltage norms and access). The standardization process will promote the battery swapping technology. “Battery swapping” is a way forward to promote electric rickshaws and electric vehicles. by bringing down upfront capital cost and reduced operational cost and charging time.

- Parking space

Parking space is scarce and expensive within the cities. If some parking spaces along with charging facilities could be reserved for e-rickshaws, it might incentivize adoption of E-rickshaws. It would also help to address the barrier of driving range/limit for e-rickshaws.

- Fast changing Technology: Make policy to regularize E-Autos

As explained above, low output power and vehicular speed perception of one of the barriers for e-rickshaw. Therefore, Gwalior should promote the more powerful version called as e-Auto. The 3-seater-Auto has speed upto 45 km/h. However, the absence of clarity on the vehicle specification needs to be addressed before it can be plied in city.

- Training of drivers - Mechanical exploitation of batteries

It is observed that due to rash driving and lack of training to drivers, the vibrations and shocks sustained during the daily operation of e-rickshaws causes mechanical defects in the battery. These defects might also lead to short-circuits in the cells. Therefore, professional training to drivers regarding handling electric rickshaws is useful.

4.4 JUNCTION IMPROVEMENT

As part of the hand holding support, GSCDCL suggested project team to work on design for redevelopment of Roxy pul junction. Following this, project team submitted a schematic plan for the Roxy pul junction. The plan was conceived based on the photo documentation and activity mapping. Subsequently, traffic analysis was done for the Roxy Pul junction, based on which the conceptual design were shared with city authorities.

4.4.1 Initiative by City Authorities

GMC initiated the process of road widening and improvement of junctions at various locations in the city diagnosed with congestion problems. The Smart City proposal includes strategies to improve road network infrastructure and junctions. For this, Gwalior Municipal Corporation has selected 3 arm and 4 arm junctions for improvement of traffic problems as highlighted in Figure 8.

4.4.2 Initiative under Smart City Projects

GSCDCL initiated the project for improving the road networks and junctions. Following Junctions were identified within the ABD area for improvement:

1. Inderganj Junction
2. Achileshwar Junction
3. Roxy Pul Junction
4. Ooth Pul Junction
5. Huzrat Pul Junction
6. Jiwaji Chowk Junction (Bada)

4.4.3 Need for New Approach

Traffic condition in the area was found to be severe on many major corridors. The effective capacity of road section reduced was found to be reduced due to unorganized on-street parking. The level of service of road sections almost reached its threshold limit. To understand the existing traffic conditions and level of services in traffic and transportation for Gwalior, the survey has been conducted by the GSCDCL. It was observed that the junctions lacked geometrics which created congestion and conflicts and moreover unauthorized parking and hawkers spill over caused encroachment at the junction. Thus, this raised a need for up-gradation of junction along with existing road network aided with footpath, cycle tracks and other required interventions.

4.4.4 Activities suggested/ carried and its Outcomes- Plans, Discussions, Pricing, Policies

After analyzing the traffic character around the ABD area and in Junctions, there is a need to develop the traffic circulation plans and provide sustainable solutions to make them congestion free and good for pedestrians. It is proposed for up-gradation of existing road network to full section development including footpath and cycle tracks as per street design guidelines, junction improvement, provision of pedestrian crossings and signalization with Area based Traffic Control. The following solutions have been proposed:

- Redesign the splitter islands along the approaches of the rotary for smooth entry of vehicles and traffic calming

Figure 8: Proposed Junctions for Improvement in the City

- Increase turning radius on the left turning
- Design footpaths along both sides of approach roads
- Design zebra crossings with refuge islands on splitter islands
- Reduce the radius of the central island
- If signal warrants are met, signalization of the junction by installing overhead mast arms on the Central Island and supplementary pedestal poles on the splitter island.

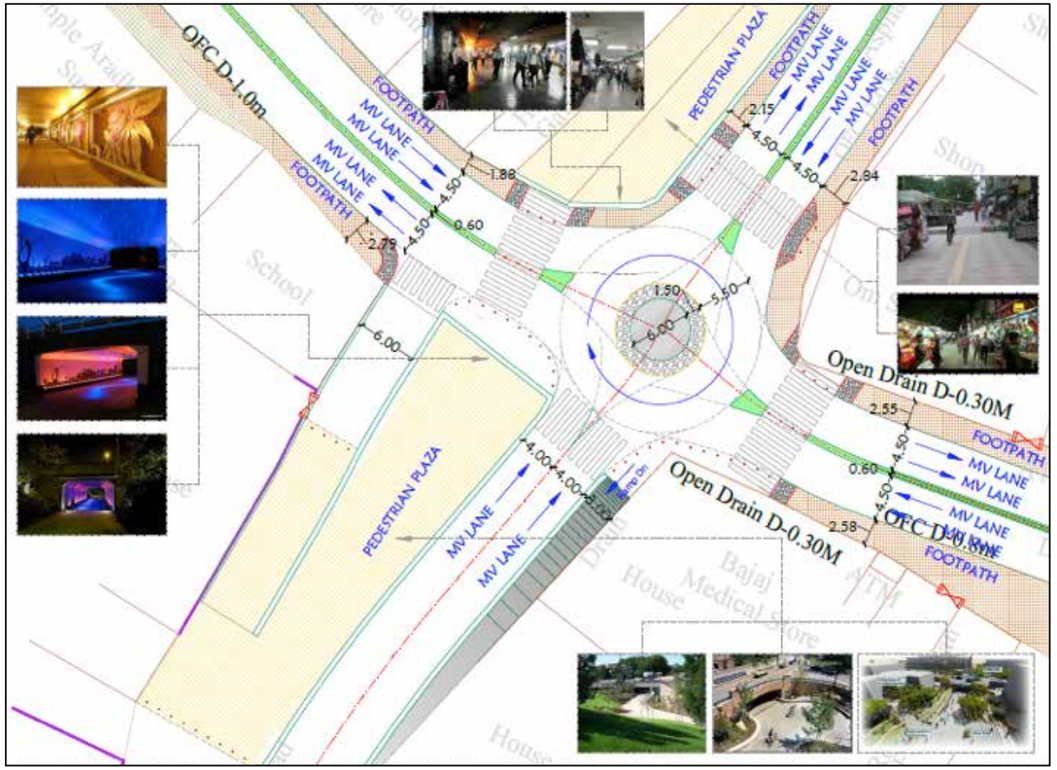
As a part of junction improvement plan, out of suggested junctions, Roxy Pul junction was selected to showcase the impact of passive design solution. As highlighted in Figure 9 below, the project team retained the subway converting it into pedestrian plaza (Added pictures for visualization) whereas; the junction is treated with a mini roundabout to channelize the traffic.

4.4.5 Key Challenges and Broad Level Findings

Maharaj Bada, is the biggest shopping and tourist attraction center. All the roads are congested due to unplanned activities. Average Daily Traffic has been observed to be ranging from as 32,857 vehicles (34,113 PCUs) to 55,178 vehicles (54,968 PUCs). Two wheelers form a major part of the overall traffic composition with their percentage ranging from 56% at Nai Sadak to 70% at Daulatganj Road. Two wheelers are followed by Auto rickshaws in overall composition ranging from 12% at Roxy Pul junction to 25% at Jiwaji Chowk (Maharaj Bada). Form this survey; the problems can be summarized as follows:

- Lack of Junction Control and Management
- Lack of Rotary and Signal Management
- Insufficient Parking space, unorganized and unauthorized parking

Figure 9: Proposed Junctions improvement plan at Roxy Pul



- Discontinuity of road separators
- Road crowding due to Utilities including electric poles and transformers
- Improper Signage and Road Marking
- Poor Enforcement of One-way traffic
- Narrow roads and encroachments on Row
- Encroachments and its consequent traffic issues
- Poor public transport management

4.4.6 Current Status

The GSCDCL is working on the redevelopment of road network circulation and junctions in ABD area. The tender is under finalization for up-gradation of the existing road network to full section development including footpath and cycle tracks as per street design guidelines, junction improvement, provision of pedestrian crossings and signalization with Area-based Traffic Control. The Project team have submitted the Roxy Pul design to GSCDCL officials and had a discussion with PDMC engineers for implementing the Roxy Pul circulation plan. The traffic police department and Superintendent of Police (SP) of the city have given responsibility to make some junctions barrier-free. The Roxy Pul junction has been considered for priority interventions which includes Learning and Way Forward

4.4.7 Way forward and learnings:

1. Frugal solutions (active and passive) are fast and effective.
2. Simple and quick solutions developed based on principles of sustainable mobility works well without involving any major financial implications or infrastructural interventions.
3. Capacity constraint is not an issue - congestion is being caused due to friction between fast- and slow-moving vehicles.
4. There is dire need of equitable allocation of space for each road user.
5. There is a possibility that passive solutions or providing segregated infrastructure (for example space constraint or any physical barrier which exists on site) won't solve the issue.

5 OVERALL LEARNING FROM THE CURRENT ENGAGEMENT

Urban mobility is the important topic of discussion among the city stakeholders, and is one of the primary components of SCPs. While the city has been able to seek assistance from the project team ICLEI SA successfully, at the same time it has been a great learning experience for the project team in dealing with various govt. agencies and departments, its officials, and political representatives as well on day to day basis. The challenges, limitations, learning's from the engagement are listed below.

- Learn from pilot projects

It is important to conduct pilots for all the projects (if the conditions permits), irrespective of the scale and size of the projects. Pilot demonstrations provides an opportunity to make necessary modification(s) in the proposals, based on the actual ground condition, which might have been missed or gone unnoticed while drawing the proposal. The learning from E-rickshaw pilot will be helpful for city to scaling the service at larger area more effectively.

- Advance resource planning while executing projects

It is important to plan and put in place all the project requirements and resources (infrastructure, man, machinery etc.) beforehand to avoid last minute hassles on ground as more often than not the inadequate provisions will not allow the project implementation in a way it was envisaged, leading to possibility of the project failure because of poor resource planning.

- Involvement of all the concerned stakeholders

For success of any project, it is imperative to have inclusive and participatory planning that includes dissemination of project information/ proposals to all the related stakeholders- governmental and non-governmental. The level of information which needs to disseminate to different groups depends on the complexity of the project/ activity and on the level of understanding of each group. For eg. decision makers along with execution, monitoring and enforcement team should know the proposed interventions in detail while media, electric media, and general public may be briefed on the overall proposal to avoid any last minute surprises/ chaos and also for their acceptance to gain necessary support and cooperation.

- Adopt process driven project and not person driven project

As the shuffling of officials is common and sometimes frequent across government offices, it is important to have process driven projects, the progress of which is free of inter and intra department transfers of officials, hence will not see any delays in project progress.

- Communication and Outreach Activities

Communication & Outreach (C&O) activities before and during the implementation of the any project is one of the most important factors in success of the project. The C&O activities should be treated as serious and important factor by the city authorities for greater success and desired outcomes of the project and not just a resource draining exercise. Users should be told and made aware about any new initiative and its benefits via right channels.