

Study of Parking Facilities in Commercial Area- Surat

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Abstract

This study will be conducted for investigation and evaluation of problem related to present parking facilities at Surat ring road (Sahara to Udhana Darwaja). We perform license plate method for collecting the data of current conditions for improving services and the way that can be implemented are discussed. To solve the existing parking problems, we want to shift vehicles parked at On-street to any other available parking facilities like, under bridge parking, SMC parking lots, and other commercial buildings. From that, it reduced the on-street parking and vehicles get more width to move on road from the road so that traffic should decreases. It also developed the policy measures for on-street parking such as parking is permitted for short term, parking meters for parking charges and angled road marking for better parking.

Keywords: *- Parking study in Commercial Area, Parking problem in textile market in Surat.*

INTRODUCTION

The growing population of India has created many problems and one of them is parking problem which we face every day. Parking problem is major problem as especially in congested area such as CBD

(central business district) of any city. India have experienced large increase in the total numbers registered vehicles from about 0.3 million on the 31 march, 1951 to about 145 million as on 31 march, 2011. The total registered vehicles in the India grow

at Compound Annual Growth Rate of 9.9% between 2001 to 2011 years.

During 2001 to 2011 growth rate of registered motor vehicles was almost three times the growth rate of a road network. Delhi have the largest registered motor vehicles, followed by Bangalore (37.9 Lakh), Hyderabad (30.3 Lakh) and Pune (20.9 Lakh). These five cities accounted for 49.3% of the total vehicles of the 35 million plus cities. Amongst the top five cities in terms of the total number of registered motor vehicles the highest Compound Annual Growth Rate of 12.94% was recorded by Pune.

Parking problem scenario in India

- Limited Parking space
- Traffic Congestion at Kerbs, Sub-Roads, Arterial Roads
- Long Queue for Entry at Parking Lots
- Lack of Driver Navigation System inside the Parking Space
- Lack of Parking Information

PROBLEM STATEMENT

Nowadays parking is very big problem as especially in CBD (central business district) of any city. Due to the lack of parking space in CBD vehicles are park at On-street parking because of that the width

of the road decrease and traffic problem are occurred. In textile market Surat the traffic problems and parking is increased. To solve these problems in textile market On-street parking should be decrease and other parking facilities should be constructed. The available parking facilities are not fully utilizing for that some parking policy measures should be taken for both On-street and Off-street parking.

STUDY AREA

Surat previously known as Suryapur, is a well-developed commercial city of the India state of Gujarat (**North Latitude of 21°15' and East Longitude 72°52'**). The diamond city's glitter has been noticed by the world Surat ranks fourth in a global study of fastest developing cities conducted by the city mayor foundation. It is also administrative capital of Surat district and one of the fastest growing cities in India.

The city of Surat in Gujarat is known for its textile trade, diamond cutting and polishing industries and since 1994, for the plague. Today, it is estimate that population of Surat city in 2018 was 60.6 **Lakh**, and in 2019 population is **68.7Lakh** ^[19] which spread over the 327 km² area.

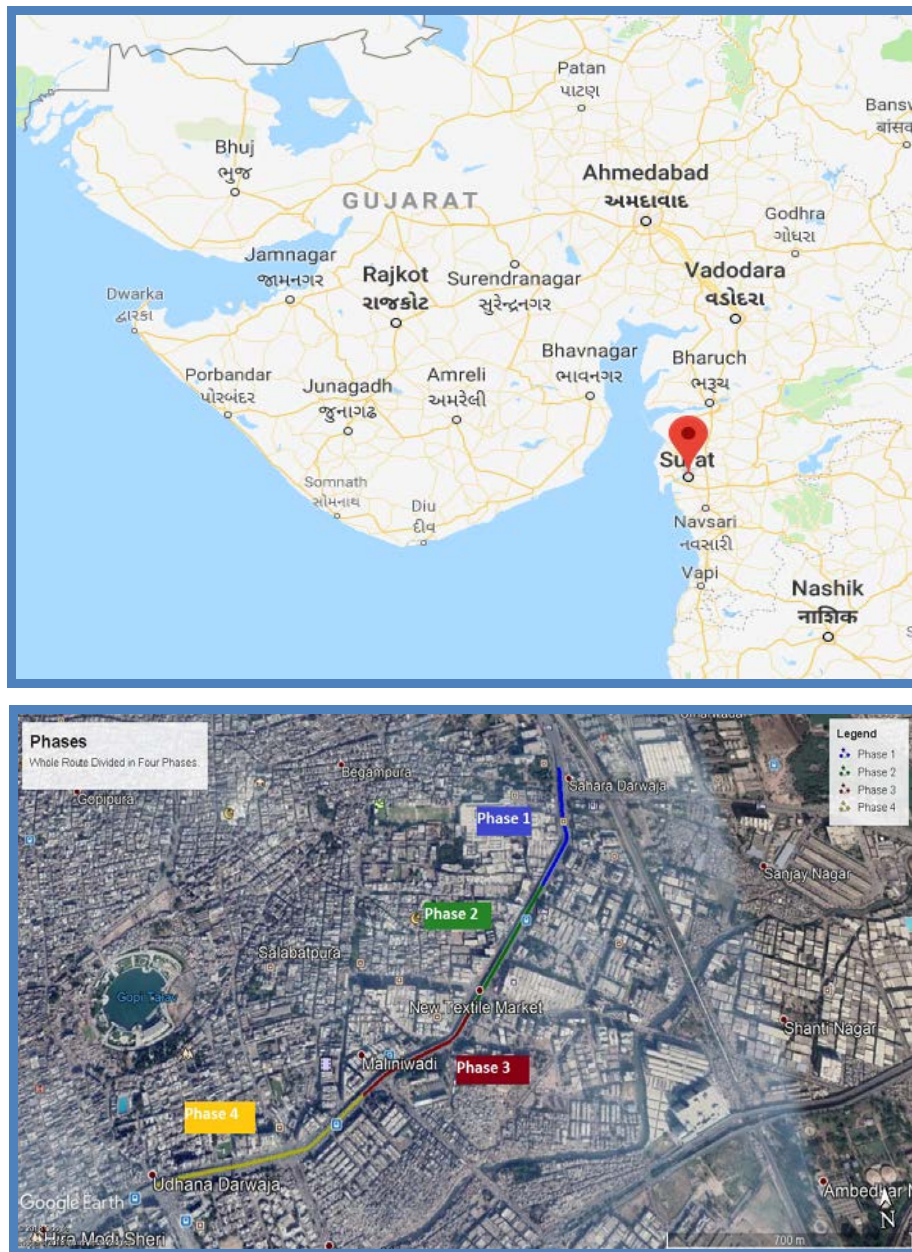


Figure 1: Location of route

For the better Data Analysis of the parking and understand the problems, we divided the whole route in to four different phases.

- **Phase 1:** - (Sahara Darwaja to Vanaspati Creation Pvt.), Length: - 506 meters.
- **Phase 2:** - (Vanaspati Creation Pvt. To New Textile market), Length: - 507 meters.
- **Phase 3:** - (New Textile market To Surat BRTS Cell), Length: - 442 meters.
- **Phase 4:** - (Surat BRTS Cell to Udhana Darwaja), Length: - 442 meters.

- **Phase 4:** - (Surat BRTS Cell to Udhana Darwaja), Length: - 665 meters.

METHODOLOGY

The study involves collecting secondary data from various sources and primary data collection conducting actual fact-finding surveys. In primary data collection various locations visited and observe actual status of parking on site. The status of parking was physically observed on site. The data collection formats prepared after reconnaissance survey and selection of method for survey. Detailed survey of the parking lots carried out during peak and non-peak hours. During this survey we measure, the provision of parking services, required parking as per actual demand is worked out.

The methodology involved the following tasks:

1. Review of earlier study reports, parking guidelines and codes, existing and proposed development plans and schemes pertaining to the study area, if available.
2. Design and conduct primary surveys.
3. Analysis of data.
4. Suggest implementation to satisfy the demand.

DATA COLLECTION

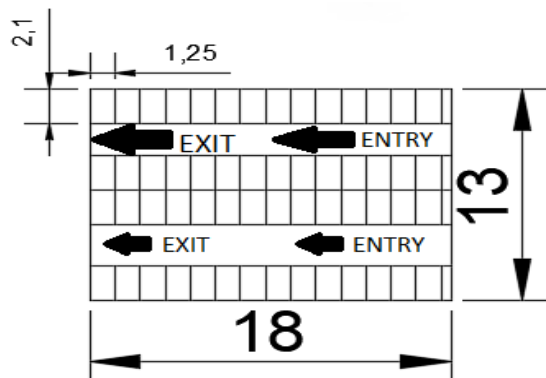
The data collation was carried out from Sahara Darwaja (Point A) to Udhanaarwaja (point B). From the survey data find out the peak hour and number of vehicles parked at the parking facilities.

- **Parking demand analysis in terms of capacity of each parking lots**

Type of Vehicles	Parking angle	Stall width(m)	Stall length(m)	Aisle width (One-way aisle)
4-Wheeler	90°	2.5	5	3
2-Wheeler	90°	1.25	2.1	1.5
3-Wheeler	90°	2	3	2.5
LCV	90°	2.5	5.5	3
HCV	90°	3.75	7.5	4

(Source: IRC Codes) ^[14 &15]

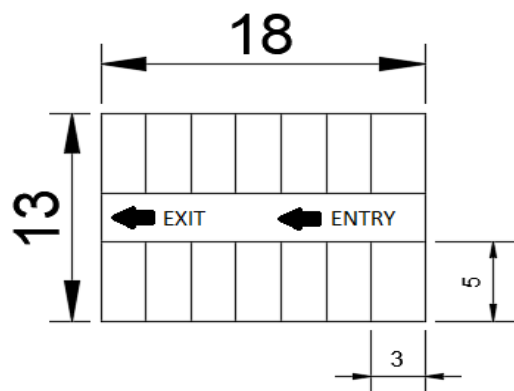
For Under Bridge parking



2-Wheeler

Parking capacity for 2-wheeler in under bridge parking

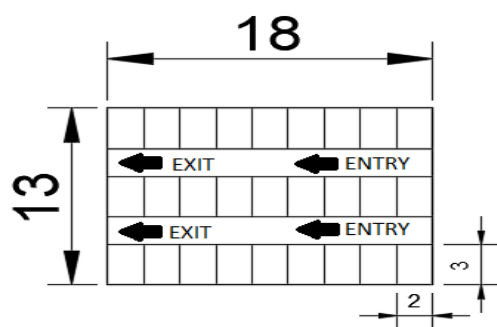
Maximum capacity: - 60 2-Wheelers.



4-Wheeler

Parking capacity for 4-wheeler in under bridge parking

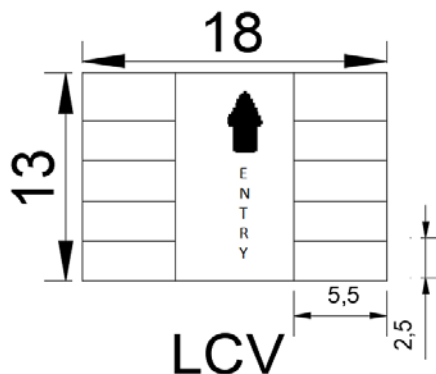
Maximum capacity: - 14 4-wheelers



3-Wheeler

Parking capacity for 3-wheeler in under bridge parking

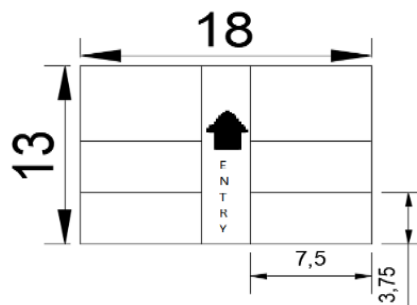
Maximum capacity: - 27 3-Wheeler



LCV

Parking capacity for LCV in under bridge parking

Maximum capacity: - 10 LCV

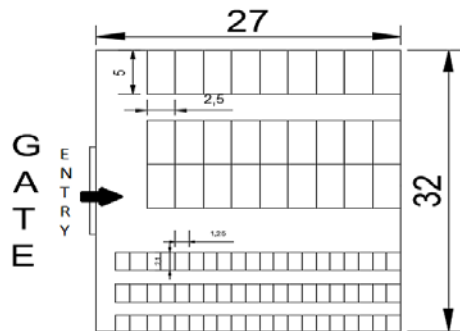


HCV

Parking capacity for HCV in under bridge parking

Maximum capacity: - 6 HCV

For SMC Parking lots



SMC Parking Lot

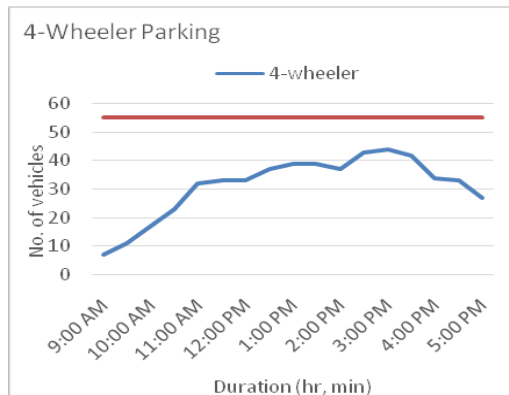
Parking capacity for SMC parking lot

Maximum Capacity: - 27 4-wheelers.

Maximum Capacity: - 60 2-wheelers.

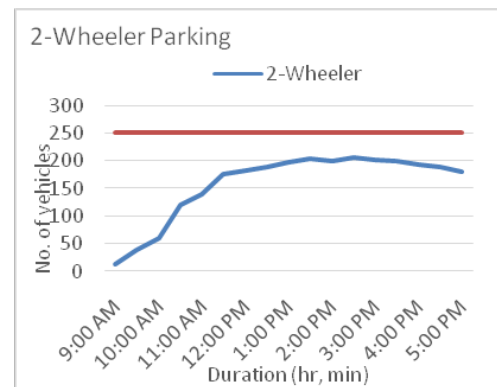
Phase 1

Jash Market



Demand and Capacity on Jash market for 4-wheeler

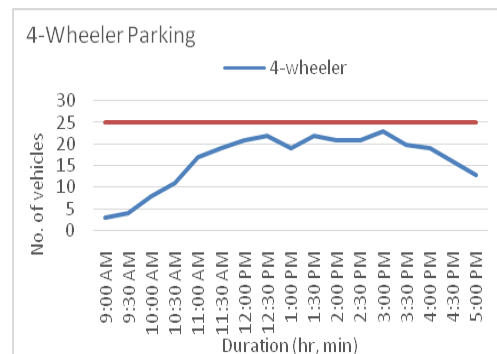
Flowchart shows that 4-W parked are less than the capacity. Supply on this parking space is 55 vehicles and demand are 44 vehicles. Peak hour for this parking space is starting from 2:00 PM to 4:00 PM.



Demand and Capacity on Jash market for 2-wheeler

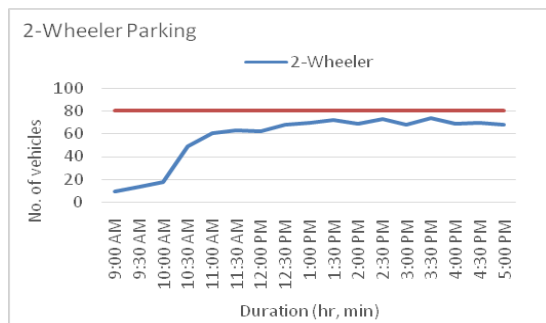
Flowchart shows that 2-W parked are less than the capacity. Supply on this parking space is 250 vehicles and demand are 205 vehicles. Peak hour for this parking space is starting from 1:00 PM and 4:00 PM.

J.J Market



Demand and Capacity on J.J market for 4-wheeler

Flowchart shows that 4-W parked are less than the capacity. Supply on this parking space is 25 vehicles and demand are 23 vehicles. Peak hour for this parking space is starting from 1:00 PM to 3:30 PM.

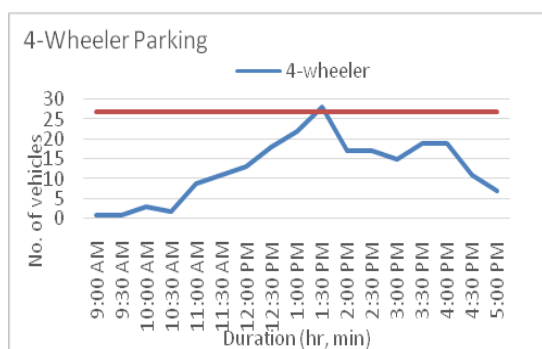


Demand and Capacity on J.J market for 2-wheeler

Flowchart shows that 2-W parked are less than the capacity. Supply on this parking space is 80 vehicles and demand are 74 vehicles. Peak hour for this parking space is starting from 12:30 PM and 5:00 PM.

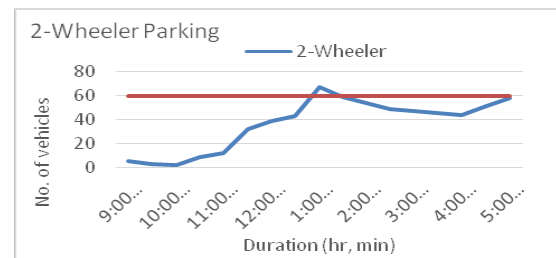
Phase 2

SMC Parking lot



Demand and Capacity on SMC Parking lot for 4-wheeler

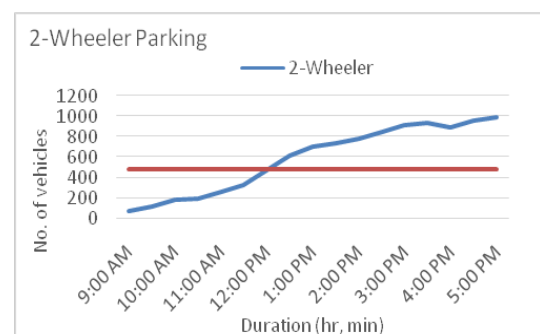
Flowchart shows that 4-W parking reach to its capacity only for few times. Supply on this parking space is 27 vehicles and demand are 28 vehicles. Peak hour for this parking space is starting from 1:00 PM to 2:00 PM.



Demand and Capacity on SMC Parking lot for 2-wheeler

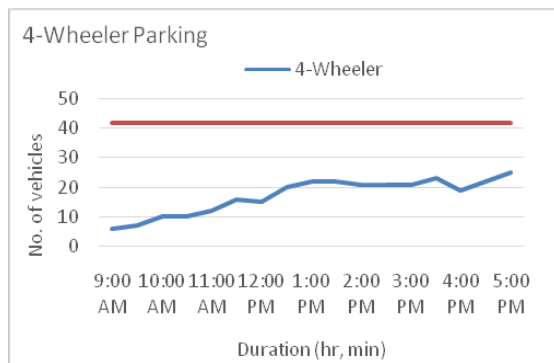
Flowchart shows that 2-W parked are more than the capacity. Supply on this parking space is 60 vehicles and demand are 67 vehicles. Peak hour for this parking space is starting from 12:30 PM and 2:00 PM.

Under Bridge Parking



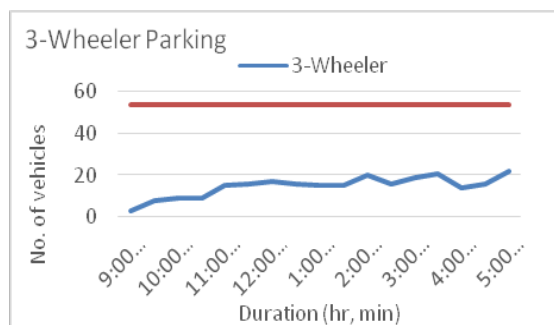
Demand and Capacity on Under bridge parking for 2-wheeler

Flowchart shows that 2-W parked are more than the capacity. Supply on this parking space is 480 vehicles and demand are 993 vehicles. Evening hour are peak hours for Under bridge parking.



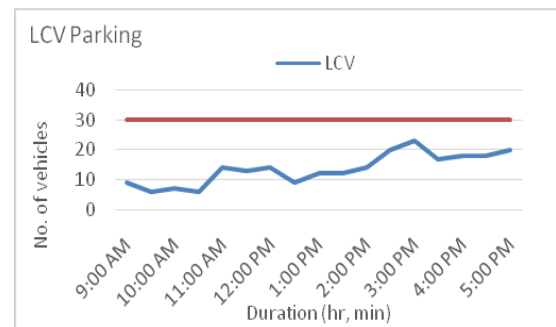
Demand and capacity on Under bridge parking for 4-wheeler

Flowchart shows that 4-W parked are less than the capacity. Supply on this parking space is 42 vehicles and demand are 25 vehicles. Peak hours for parking start from 3:00 PM to 5:00 PM.



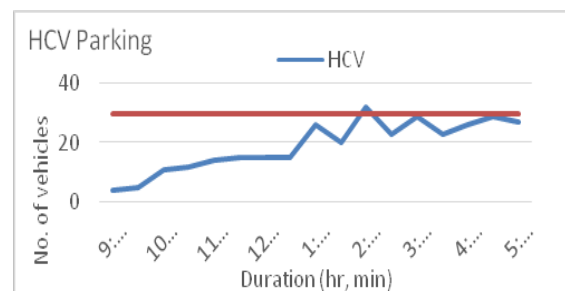
Demand and Capacity on Under Bridge parking for 3-wheeler

Flowchart shows that 3-W parked are very less than the capacity. Supply on this parking space is 54 vehicles and demand are 22 vehicles. Peak hours for parking start from 2:00 PM to 3:30 PM.



Demand and Capacity on Under Bridge Parking For LCV.

Flowchart show that LCV parked are less than capacity. Supply on this parking space is 30 vehicles and demand are 23 vehicles. Peak hours for parking start from 2:30 PM to 3:30 PM.

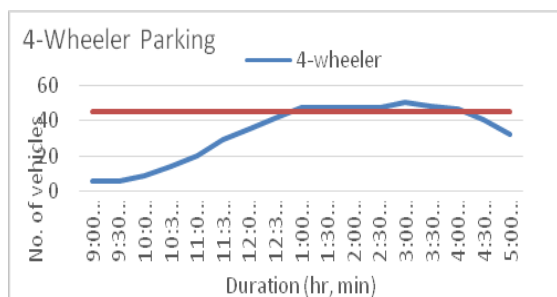


Demand and Capacity on Under bridge Parking for HCV.

Flowchart shows that HCV parked are more than capacity. Supply on this parking space is 30 vehicles and demand are 32 vehicles. Peak hours for parking are 2:00 PM.

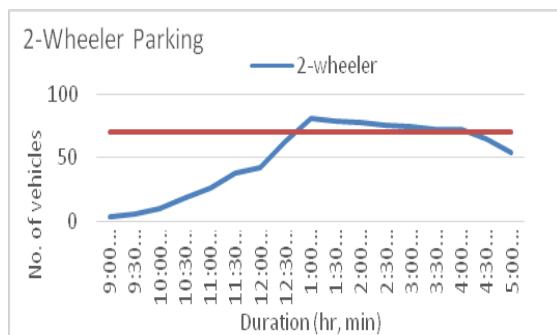
Phase 3

Indian market



Demand and Capacity on Indian Market for 4-wheeler.

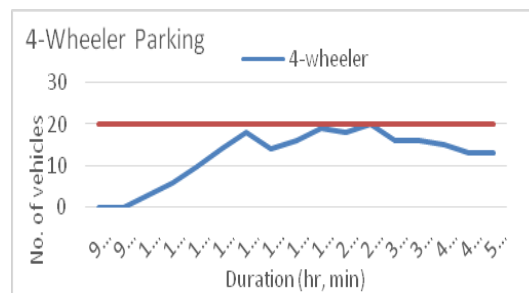
Flowchart shows that 4-W parked are more than Capacity. Supply on this parking space is 45 vehicles and demand are 50 vehicles. Peak hours for parking are Start from 1:00 PM to 4:00 PM.



Demand and Capacity on Indian Market for 2-wheeler.

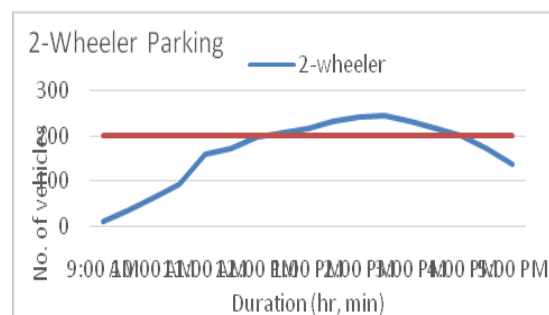
Flowchart shows that 2-W parked are more than capacity. Supply on this parking space is 70 vehicles and demand are 81 vehicles. Peak hours for parking starting from 1:00 PM to 3:00 PM.

The Emperia Building



Demand and Capacity on the emperia building for 4-wheeler.

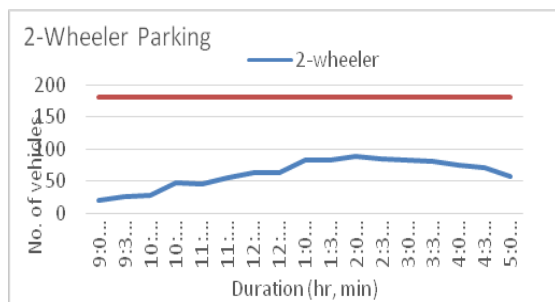
Flowchart shows that 4-W parked are same as the capacity. Supply on this parking Space is 20 vehicles and demand are 20 vehicles. Peak hour for parking start from 1:30 PM to 3:00 PM.



Demand and Capacity on Indian Market for 2-wheeler.

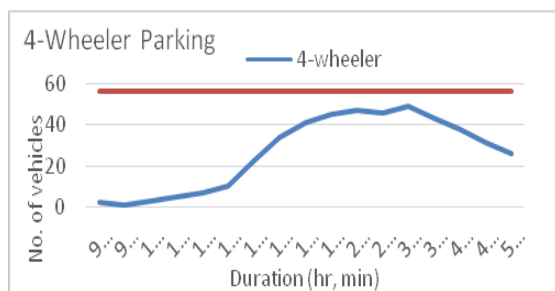
Flowchart shows that 2-W parked are more than capacity. Supply on this parking space is 200 vehicles and demand are 246 vehicles. Peak hours for parking starting from 1:00 PM to 3:00 PM.

Under Bridge Parking



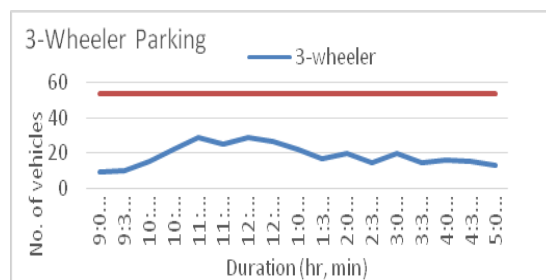
Demand and Capacity on under bridge parking for 2-W.

Flowchart shows that 2-W parked are less than the capacity. Supply on this parking space is 180 vehicles and capacity 88 vehicles. Peak hours for parking starting from 1:00 PM to 3:00 PM.



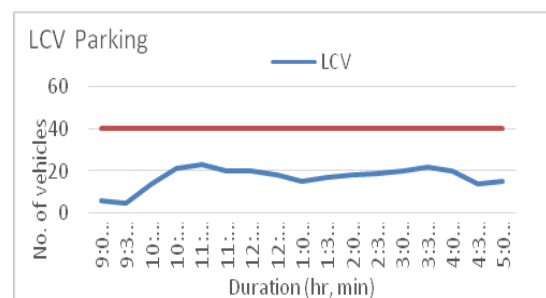
Demand and Capacity on under bridge parking for 4-W.

Flowchart shows that 4-W parked are less than the capacity. Supply on this parking space is 56 vehicles and demand are 49 vehicles. Peak hours for parking starting from 1:30 PM to 3:00 PM.



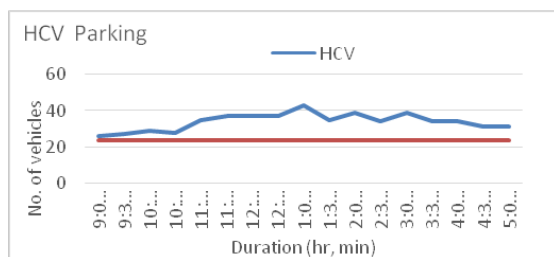
Demand and Capacity on under bridge parking for 3-W.

Flowchart shows that 3-W parked are less than the Capacity. Supply on this parking space is 54 vehicles and demand are 29 vehicles. Peak hours for parking starting from 10:30 PM and 12:30 PM.



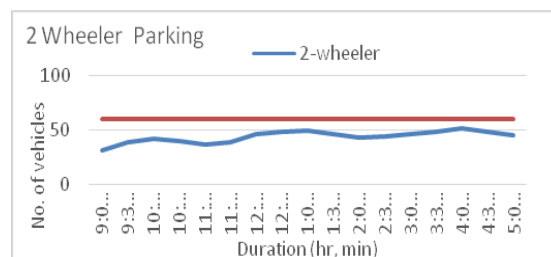
Demand and Capacity on Under bridge parking for LCV.

Flowchart shows that LCV parked are less than capacity. Supply on this parking space is 40 vehicles and demand are 22 vehicles. Peak hours for parking start from 10:30 PM to 11:30 PM.



Demand and Capacity on Under bridge parking for HCV.

Flowchart shows that HCV parked are more than capacity. Supply on this parking space is 24 vehicles and demand are 43 vehicles. Peak hours for parking start from 12:30 PM to 3:00 PM.

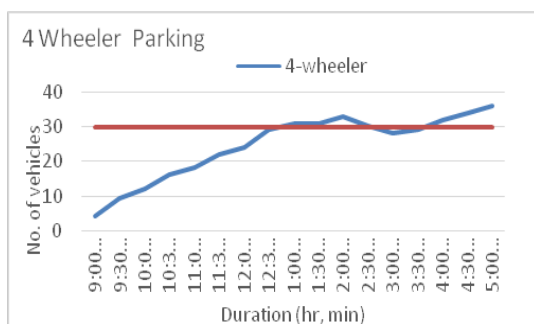


Demand and Capacity on Impire state building for 2-W

Flowchart shows that 2-W parked are more than capacity. Supply on this parking space is 50 vehicles and demand are 52 vehicles. Peak hours for parking start from 3:30 PM to 5:00 PM.

Phase 4

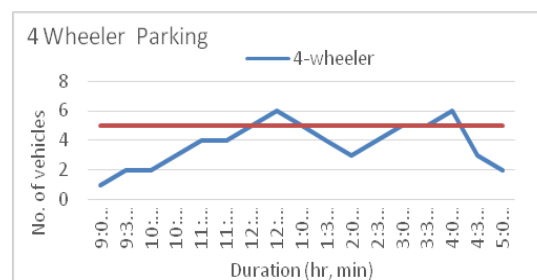
Impire state building



Demand and Capacity on Impire state building for 4-W

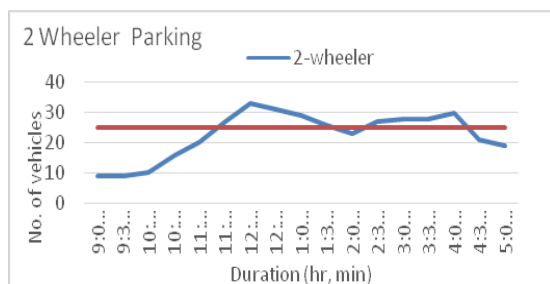
Flowchart shows that 4-W parked are more than capacity. Supply on this parking space is 25 vehicles and demand are 33 vehicles. Peak hours for parking start form 1:30 PM to 5:00 PM.

SMC parking lots



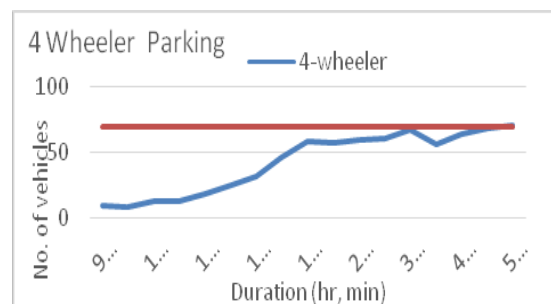
Demand and Capacity on SMC parking lot for 4-W

Flowchart shows that 4-W parked are more than capacity. Supply on this parking space is 5 vehicles and demand are 6 vehicles. Peak hours for parking are 4:00 PM.



Demand and Capacity on Impire state building for 2-W

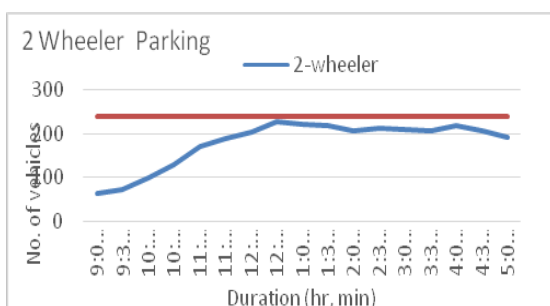
Flowchart shows that 2-W parked are more than capacity. Supply on this parking space is 25 vehicles and demand are 33 vehicles. Peak hours for parking start from 11:30 PM to 1:30 PM.



Demand and capacity on Under bridge parking for 4-W

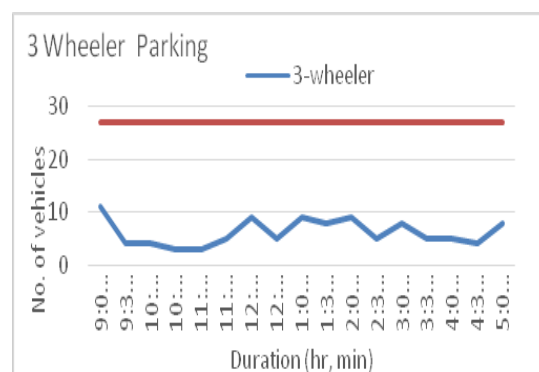
Flowchart shows that 4-W parked are more than capacity. Supply for this parking space is 70 vehicles and demand are 71 vehicles.

Under bridge parking



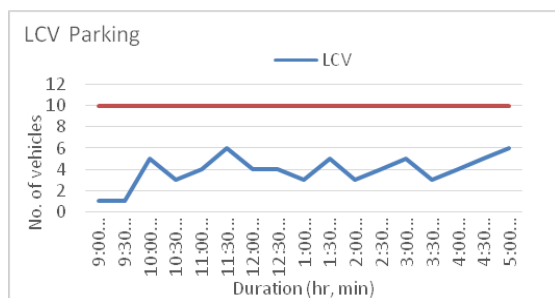
Demand and Capacity on Under bridge parking for 2-W

Flowchart shows that 2-W parked are more than capacity. Supply for this parking space is 180 vehicles and demand are 227 vehicles. Peak hour for parking is 12:30 PM.



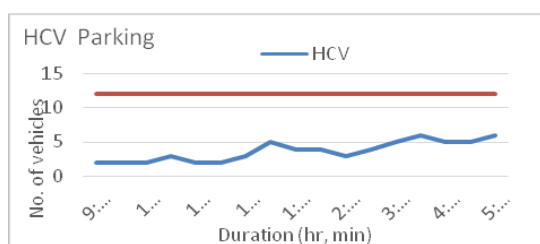
Demand and Capacity on under bridge parking for 3-W

Flowchart shows that 3-W parked are less than capacity. Supply for this parking space is 27 vehicles and Demand are 11 vehicles.



Demand and Capacity on under bridge parking for LCV

Flowchart shows that LCV parked are less than capacity. Supply for this parking space is 10 vehicles and demand are 5 vehicles.



Demand and Capacity on under bridge parking for HCV

Flowchart shows that HCV parked are less than capacity. Supply for this parking space is 12 vehicles and demand are 6 vehicles.

RECOMMENDATION AND CONCLUSION

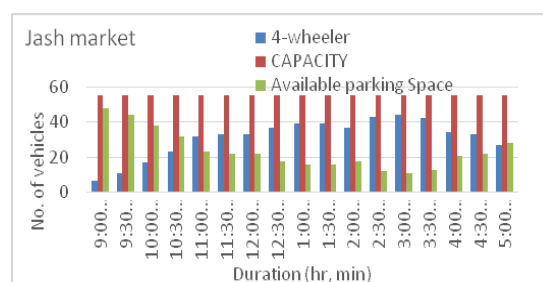
• Recommendation

Phase 1

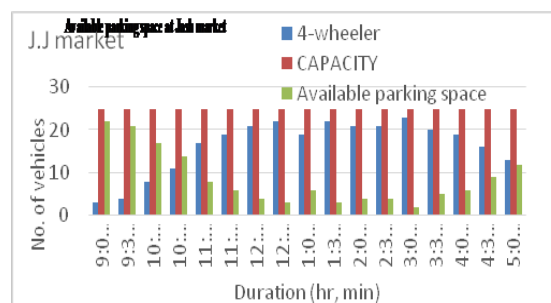
Due to the on-going construction work of fly-over, we can't able to take data of on-

street parking. But, the parking space available J.J textile market and Jash market. So, we provide parking facility of on-street parking to this market areas.

4-Wheeler

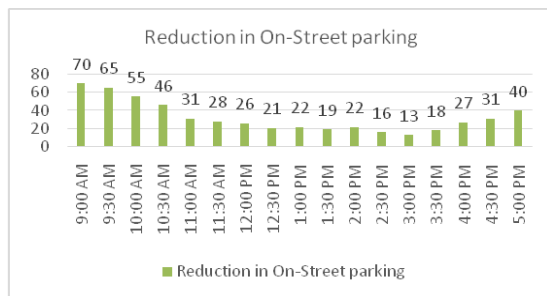


Available parking space at Jash market



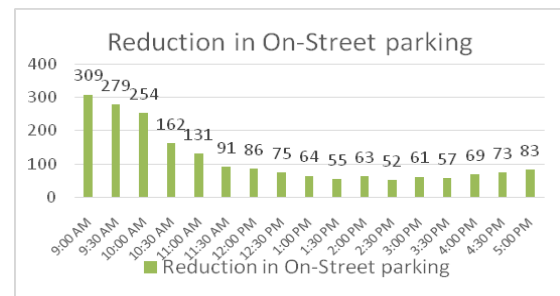
Available parking space at J.J market

From above flowchart 34 and 35 shows that parking availability for 4-W in phase 1. Where we can shift the 4-W which are parked at On-street at that particular time interval.



Reduction in On-Street parking for 4-W

Above flowchart shows that reduction of on-street parking if we shifting the 4-W parked at on-street to the Available off-street parking space. But both the parking space are at the left side so it reduces on-street parking to the left side only. For right side on-street parking vehicles shifted to the under-bridge parking.

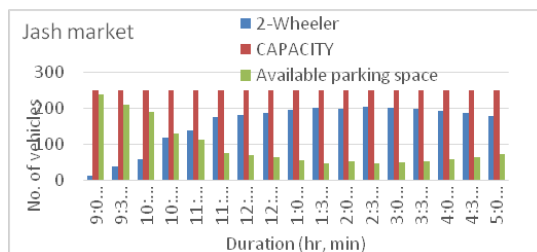


Reduction in On-street parking for 2-W

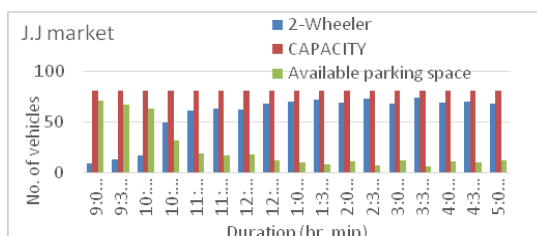
Above flowchart shows that reduction of on-street parking if we shifting the 2-W parked at on-street to the Available off-street parking space. Similar to 4-W parking this reduction of 2-W only for left side and for right side on-street parking of 2-W are shifted to under bridge parking.

Phase 2

2-Wheeler

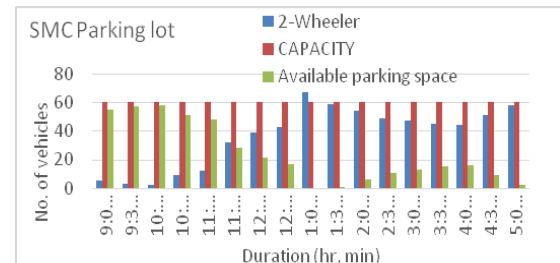


Available parking space at Jash market



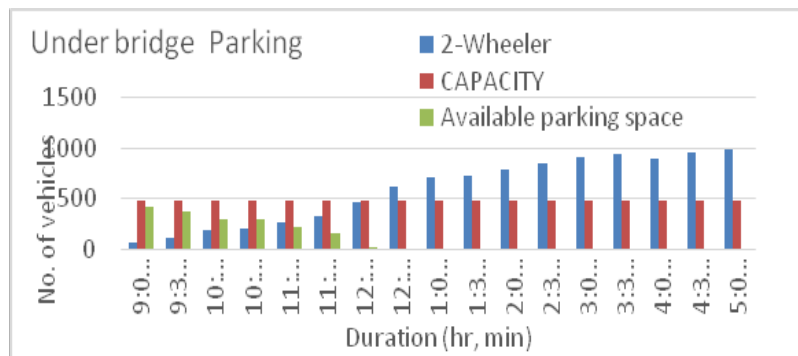
Available parking space at J.J market

2-wheeler



Available parking space at SMC parking lot

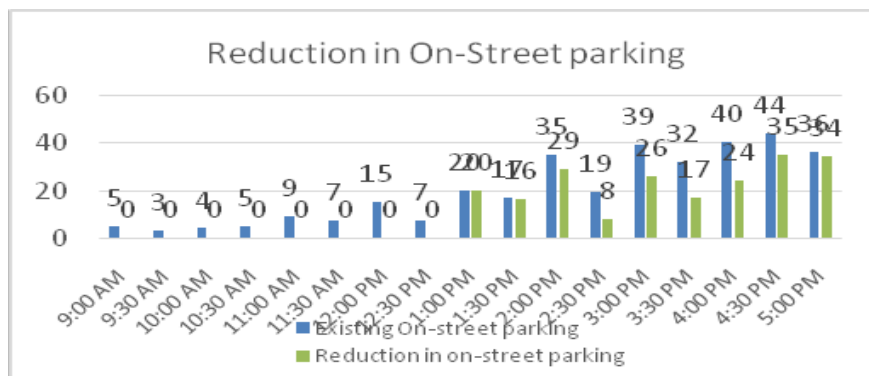
Above flowchart shows the space available for the parking for 2-W in SMC parking lot which is left side of the road.



Available parking space at Under bridge parking

Above flowchart shows the space available for parking of 2-W in under bridge parking. Which is fully utilise after 12:30 PM.

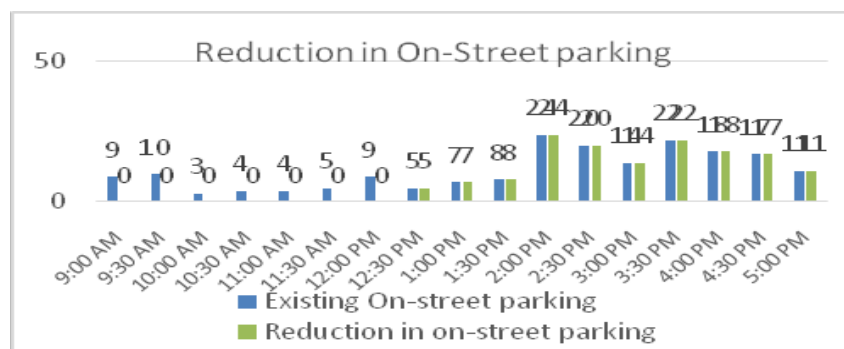
Left side on street parking



Reduction of on-street parking on left side

Above flowchart shows that reduction of 2-W parked on left side on-street parking which are shifted in SMC parking lots.

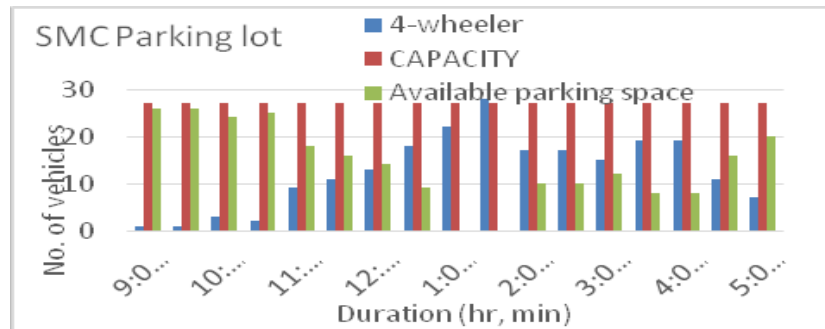
Right side on street parking



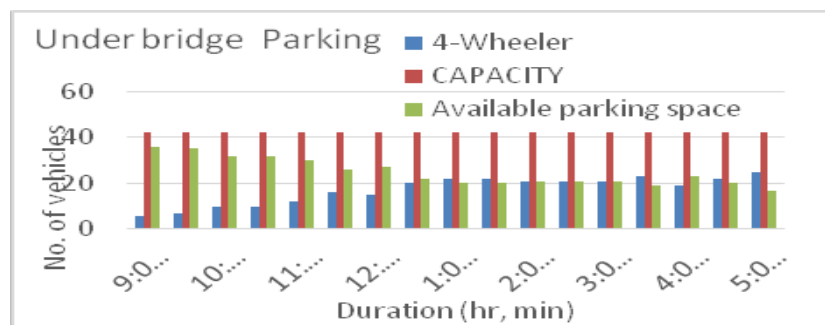
Reduction of on-street parking on left side

Above flowchart shows that reduction of 2-W parked on left side on-street parking which are shifted in Under bridge parking

4-wheeler

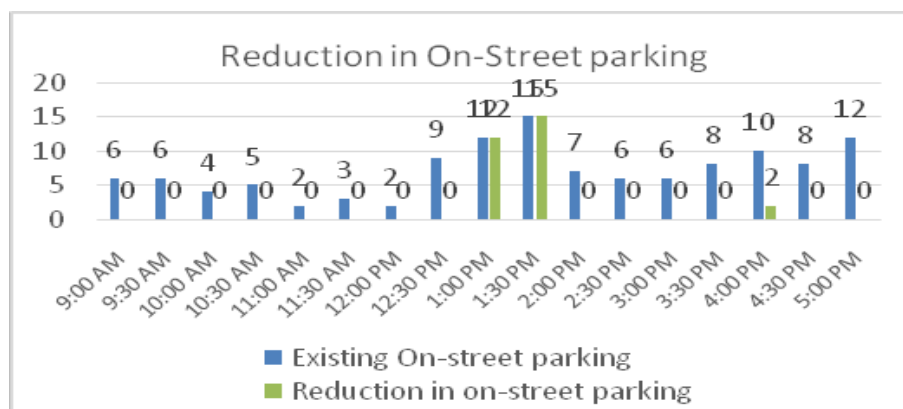


Available parking space at SMC parking lot



Available parking space at Under bridge parking

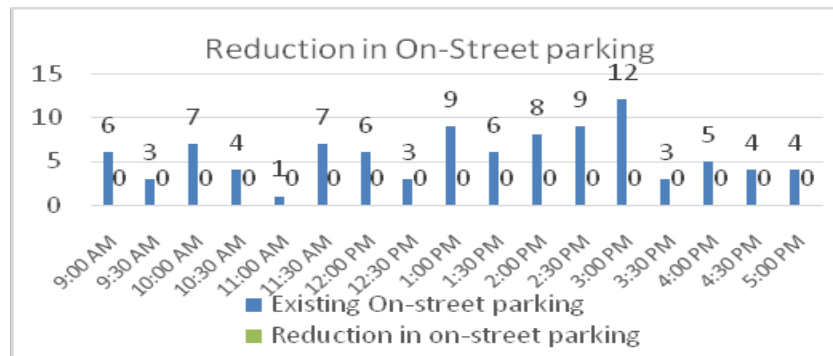
Left side on street parking



Reduction of on-street parking on left side

Above flowchart shows that reduction of 4-W parked on left side on-street parking which are shifted in SMC parking lots.

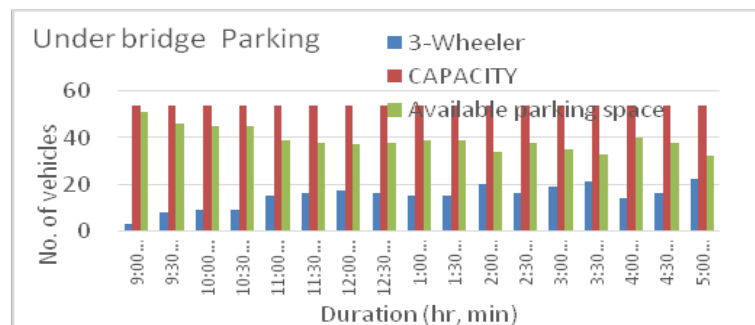
Right side on street parking



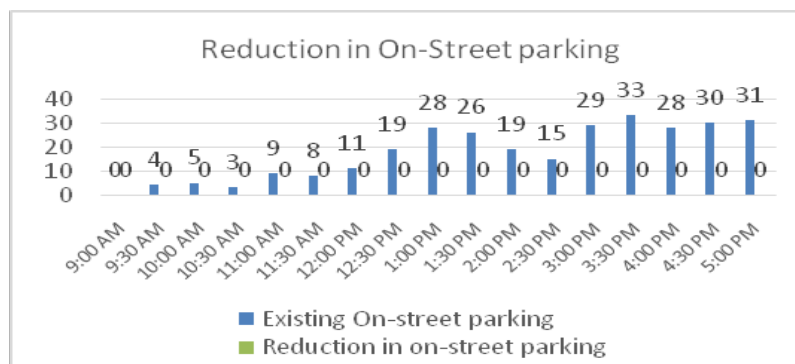
Reduction of on-street parking on right side

Above flowchart shows that reduction of 4-W parked on left side on-street parking which are shifted in Under bridge parking. In this the 4-W become zero on right side if they parked at under bridge.

3-Wheeler



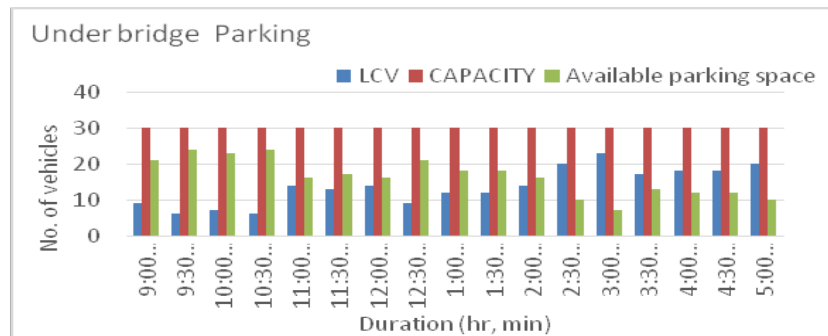
Available parking space at Under bridge parking



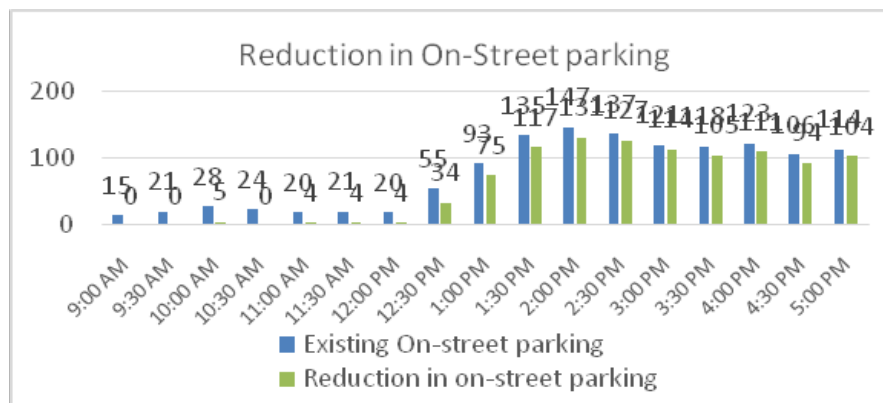
Reduction of on-street parking on bothside

Above flowchart shows reduction of 3-W parked on on-street. If the under-bridge parking can be fully optimized it will reduce the 3-W parking on on-street.

LCV (light Commercial vehicle)



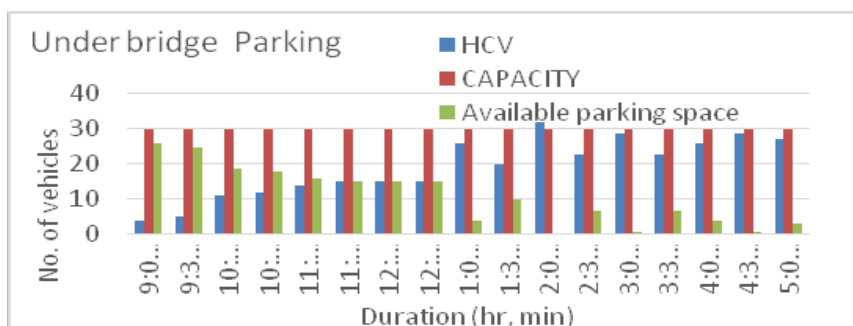
Available parking space at Under bridge parking



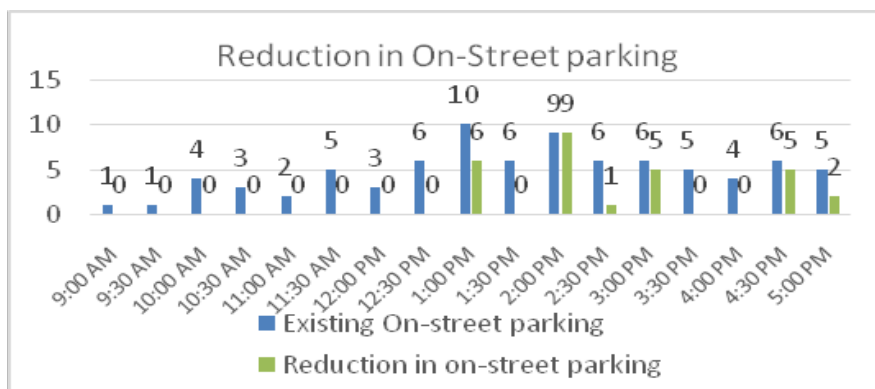
Reduction of on-street parking on both side

Above flowchart shows the reduction of LCV parked on on-street parking both side of the road.

HCV (Heavy Commercial vehicle)



Available parking space at Under bridge parking

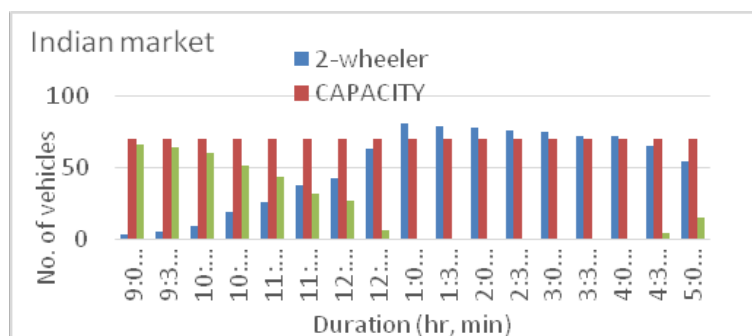


Reduction of on-street parking on both side

Above flowchart shows the reduction of HCV parked on on-street parking both side of the road.

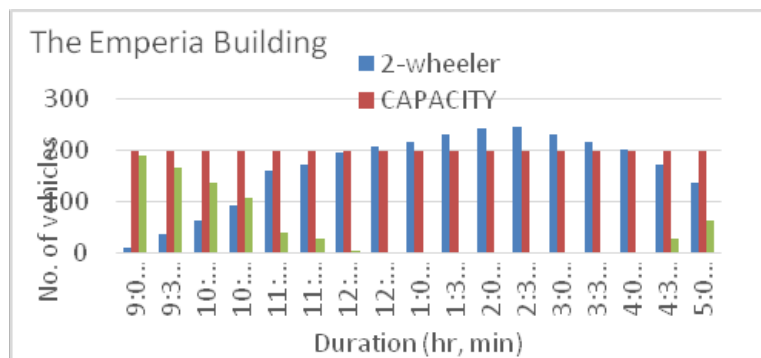
Phase 3

2-Wheeler



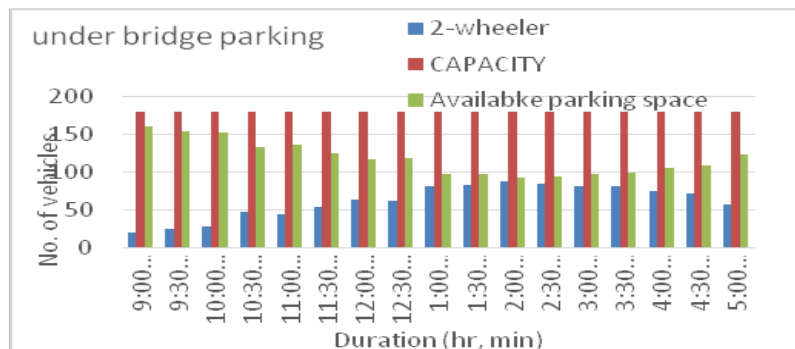
Available parking space at Indian market

Above flowchart shows the parking space available for 2-W at Indian market. Which right side of the main road.



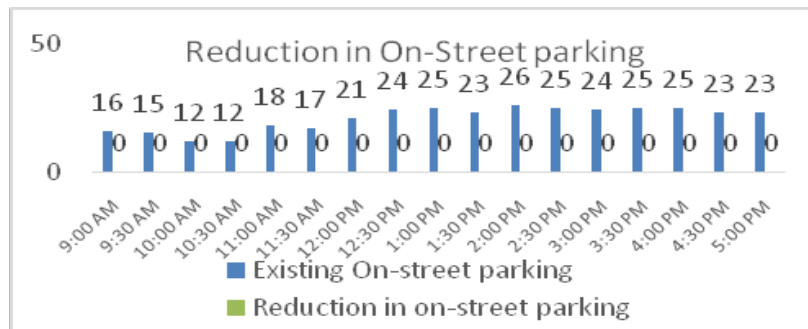
Available parking space at Emperia building

Above flowchart shows the parking space available for 2-W at Indian market. Which right side of the main road.



Available parking space at Under bridge parking

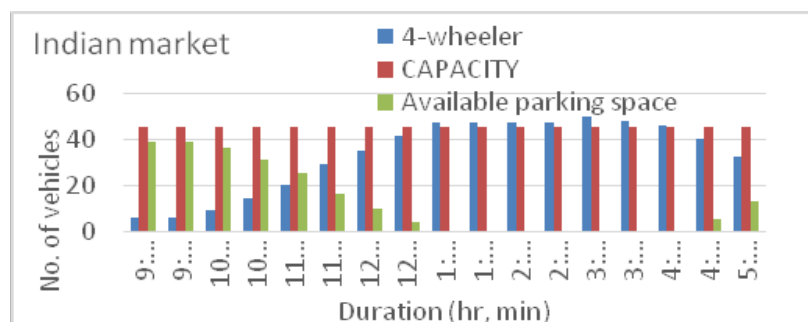
On-street parking



Reduction of on-street parking on both sides

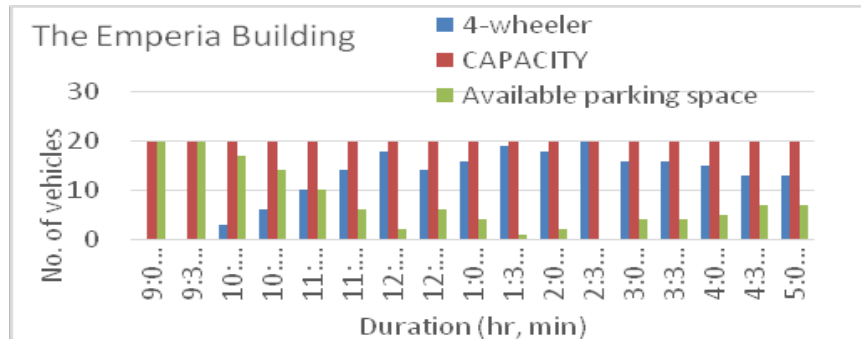
Above flowchart shows that reduction of 2-W parked on left-Right side on-street parking which are shifted in Under bridge parking. There is no more space for 2-W parking at Indian textile market and the emperia building therefor all 2-W shifted in under bridge parking.

4-Wheeler



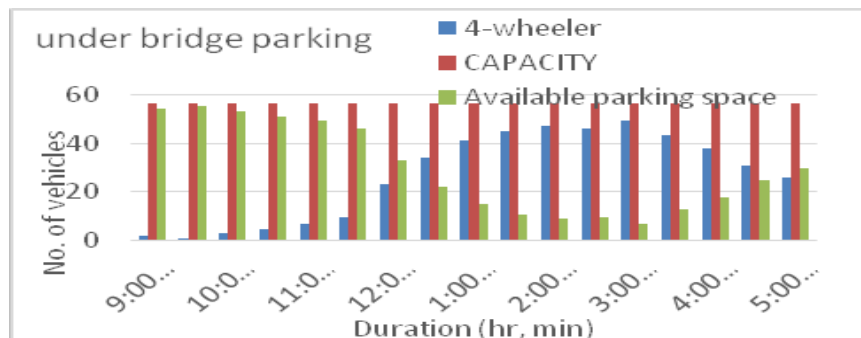
Available parking space at Indian market

Above flowchart shows the parking space available for 4-W at Indian market Which is right side of the main road.



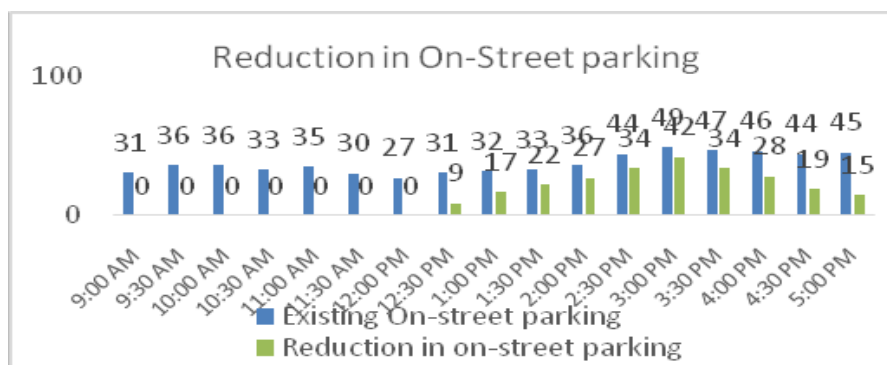
Available parking space at the emperia building

Above flowchart shows the parking space available for 4-W at Indian market Which is right side of the main road.



Available parking space at Under bridge parking

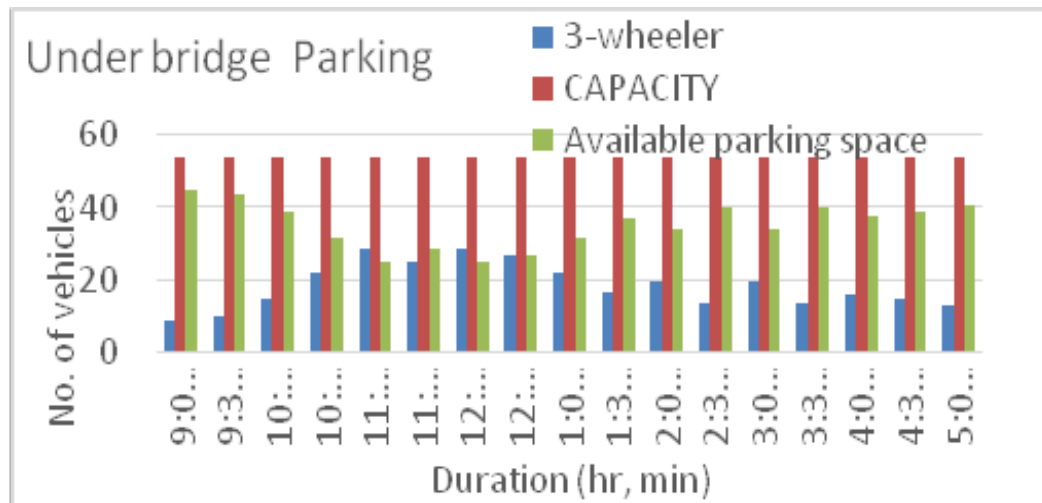
On-street parking



Reduction of on-street parking on both sides

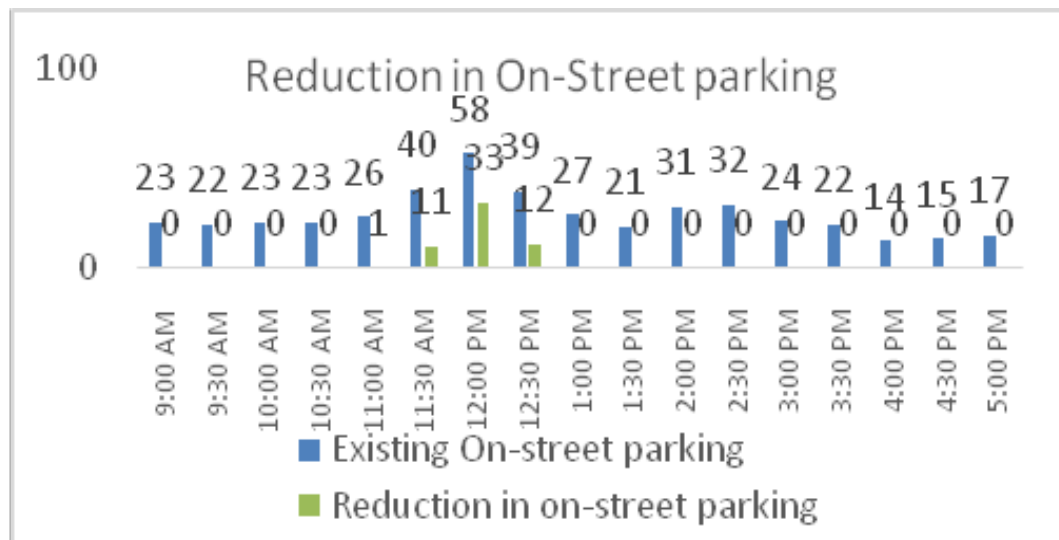
Above flowchart shows that reduction of 4-W parked on left-Right side on-street parking which are shifted in Under bridge parking. There is no more space for 4-W parking at Indian textile market and the emperia building therefor all 4-W shifted in under bridge parking.

3-Wheeler



Available parking space at Under bridge parking

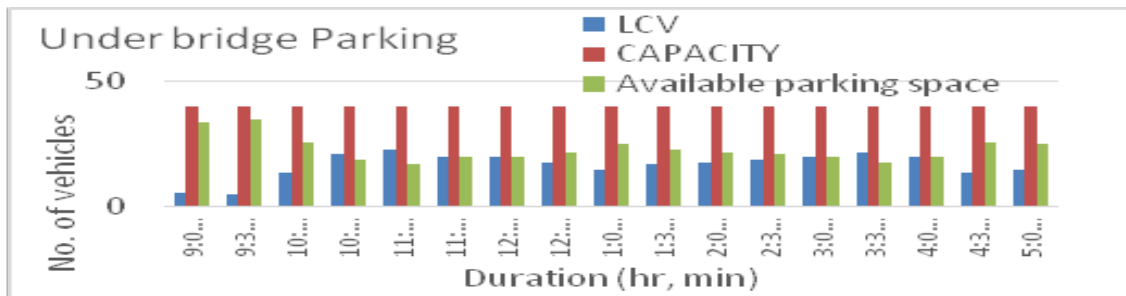
On-street parking



Reduction of on street parking on both sides.

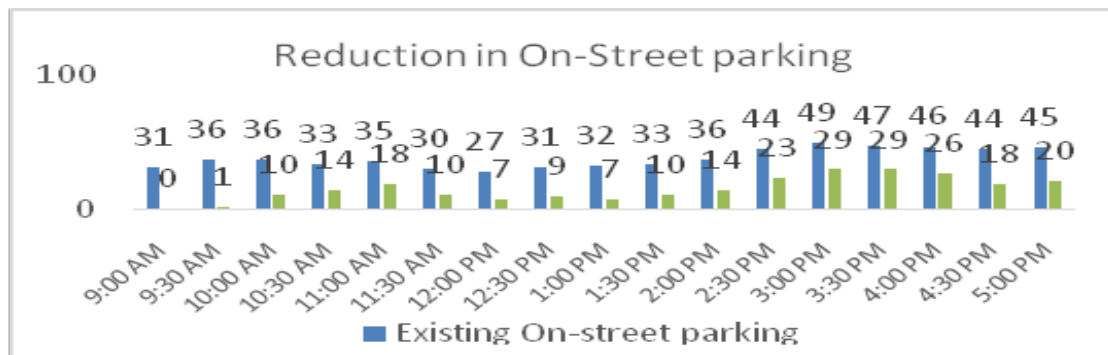
Above flowchart shows reduction of 3-W parked on on-street. If the under-bridge parking can be fully optimized it will reduce the 3-W parking on on-street.

LCV (light Commercial vehicle)



Available parking space at Under bridge parking

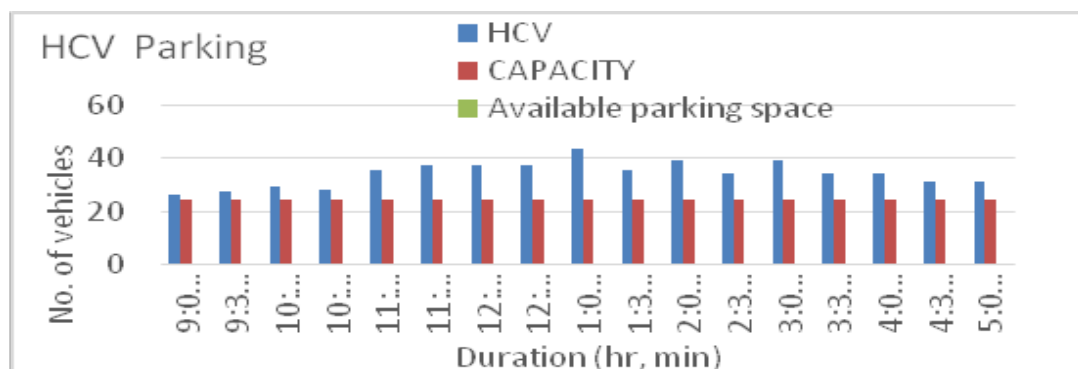
On-street parking



Reduction of on-street parking on both sides

Above flowchart shows the reduction in LCV parked on On-street when the under-bridge parking is fully optimized.

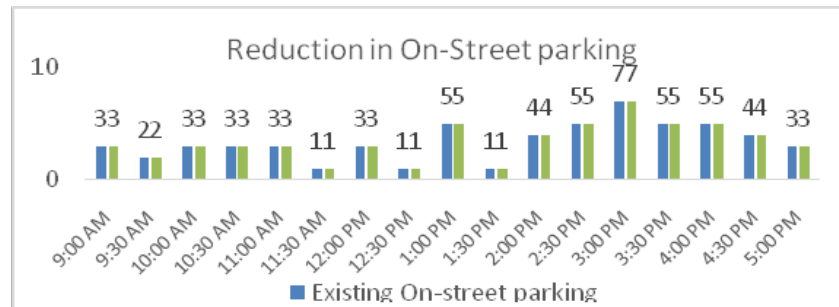
HCV (Heavy Commercial vehicle)



Available parking space at under bridge parking

Above flowchart shows that the parking spaced is fully optimized and there is no space for more vehicles.

On-street parking

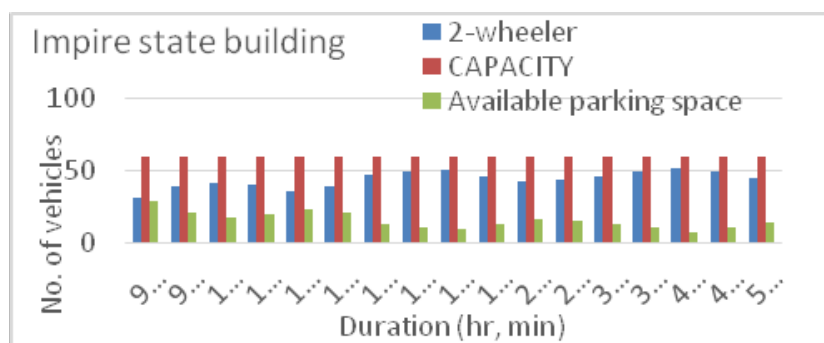


Reduction of on-street parking on both sides

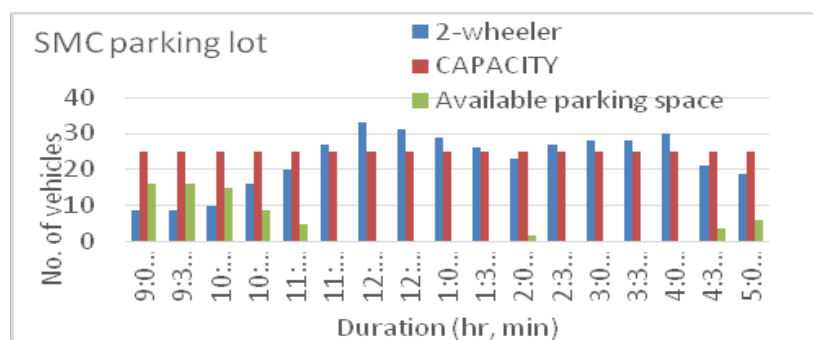
Above flowchart shows that there is no reduction on On-street parking because of the under-bridge parking is fully optimized.

Phase 4

2-Wheeler

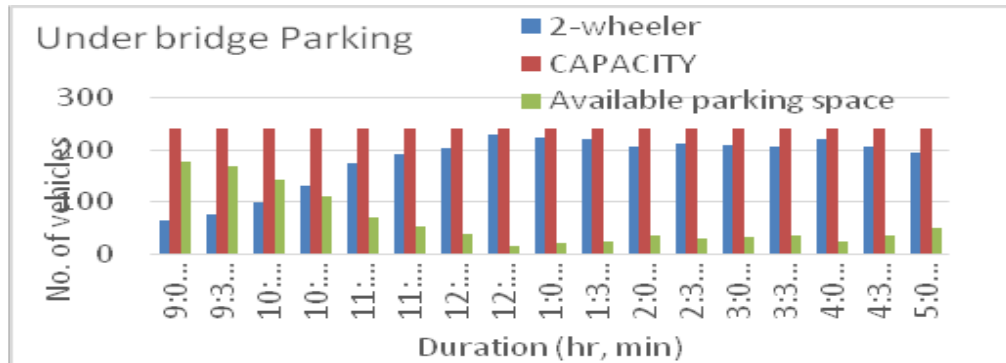


Available parking space at Impire state building



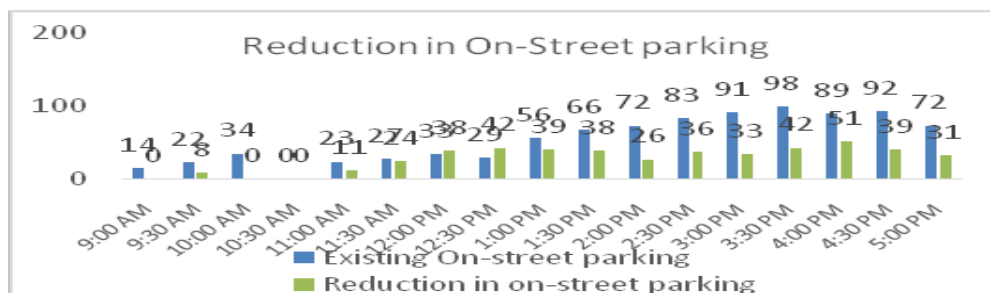
Available parking space at SMC parking lot

Above flowchart 68 and 69 are almost fully optimized so there is less space for parking for 2-W which are parked on On-street parking. This parking space are right side of the main road.



Available parking space at Under bridge parking

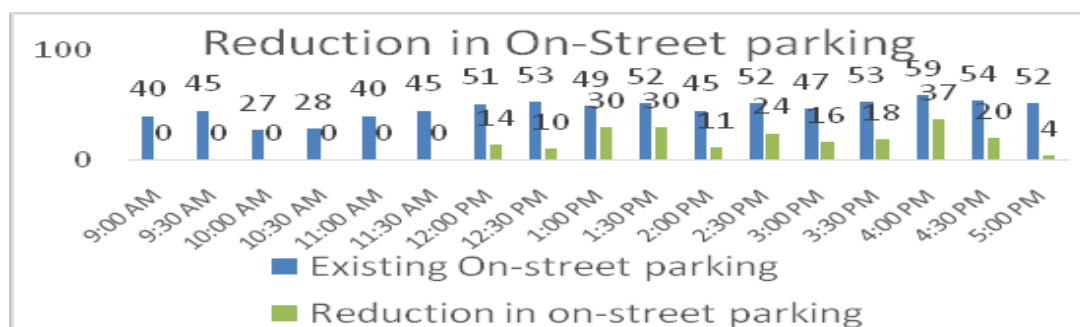
On-street parking (right side)



Reduction of on-street parking on right side

Above flowchart shows the reduction in 2-W parked on On-street parking on right side of the road. Which are shifted to Impire state building and SMC parking lot.

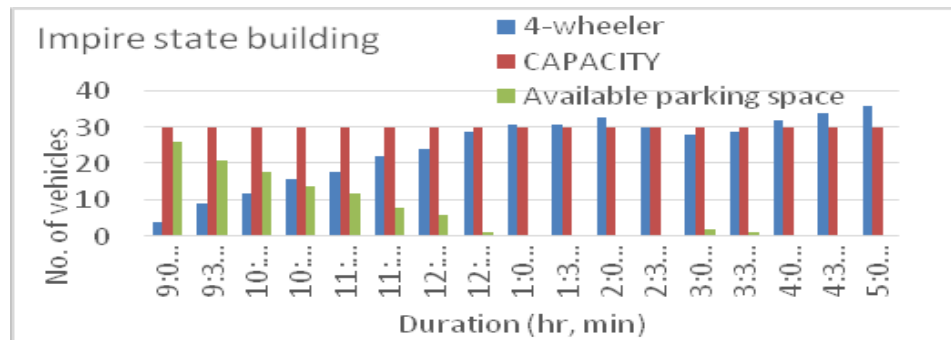
On-street parking (left side)



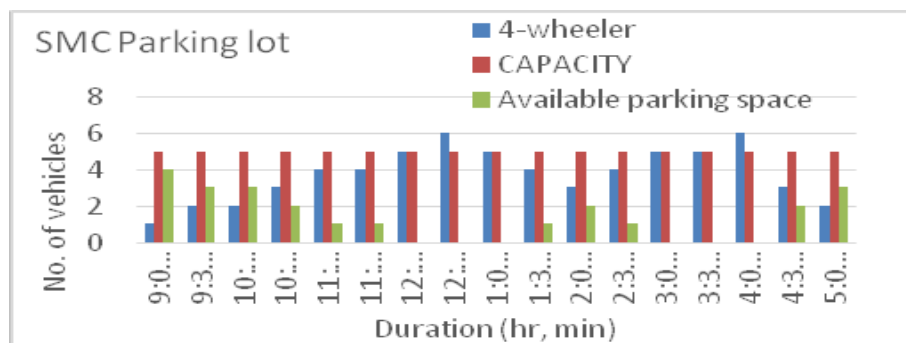
Reduction of on-street parking on left side

Above flowchart shows the reduction in 2-W parked on On-street parking on left side of the road. Which are shifted to Under bridge parking.

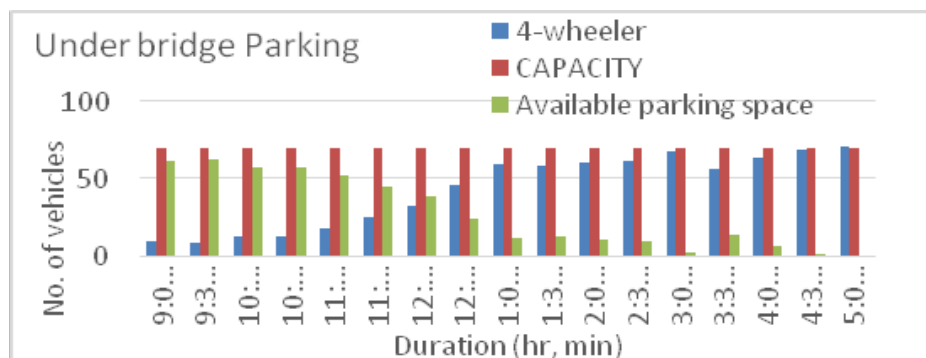
4-Wheeler



Available parking space at Impire state building

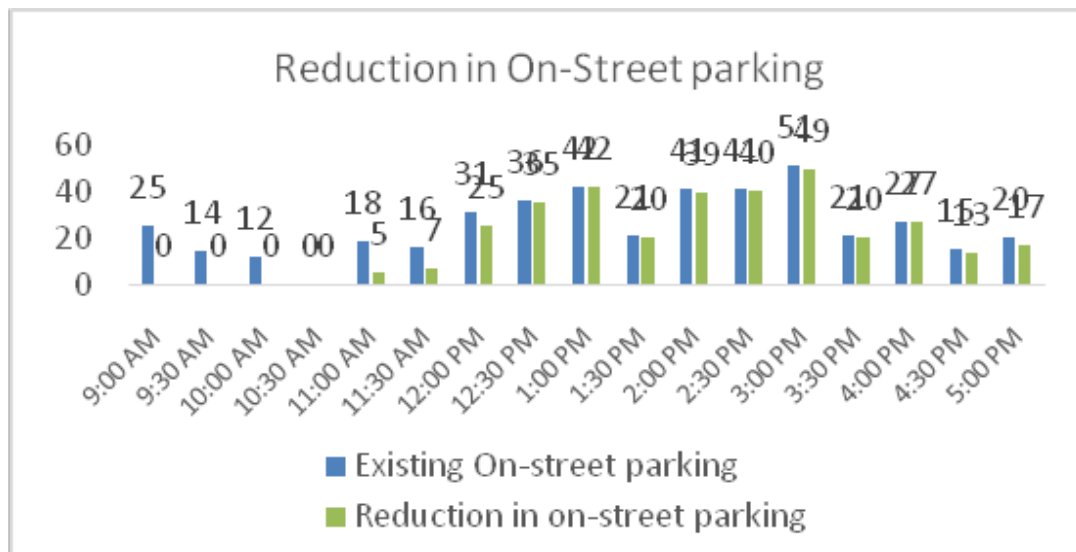


Available parking space at SMC parking lots



Available parking space at Under bridge parking

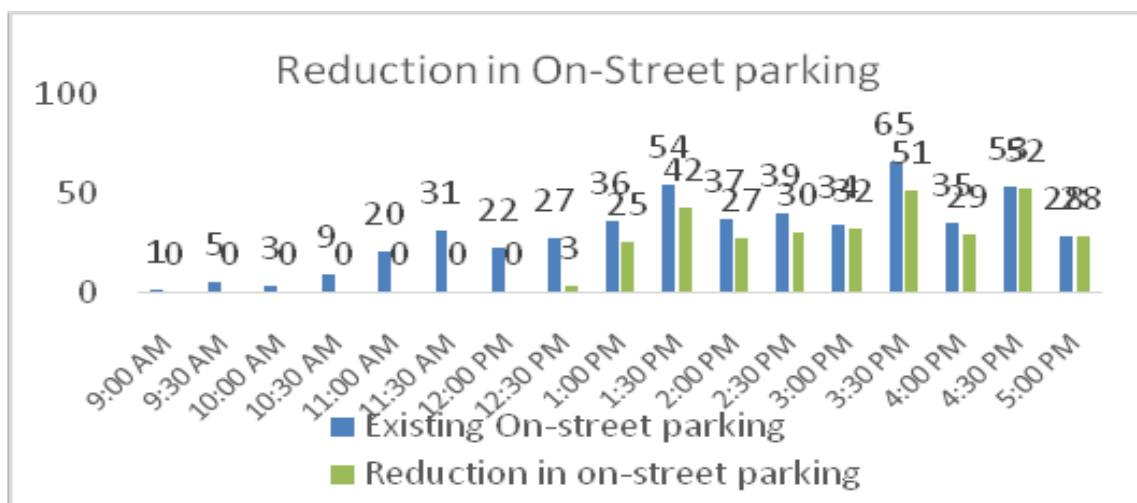
On-street parking (right side)



Reduction of on-street parking on right side

Above flowchart shows the reduction in 4-W parked on On-street parking on right side of the road. Which are shifted to Impire state building and SMC parking lot.

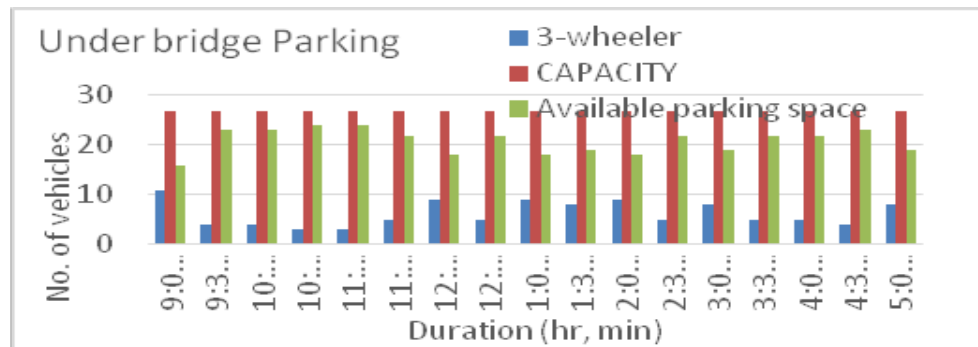
On-street parking (left side)



Reduction of on-street parking on left side

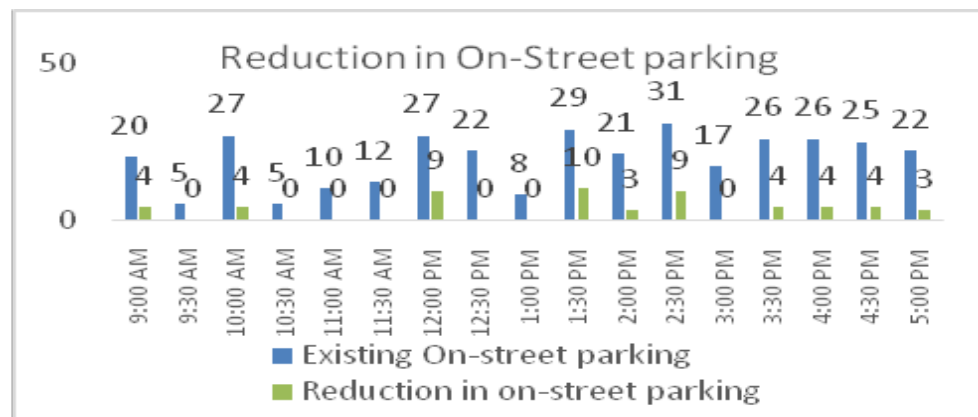
Above flowchart shows the reduction in 4-W parked on On-street parking on left side of the road. Which are shifted to Under bridge parking.

3-Wheeler



Available parking space at Under bridge parking

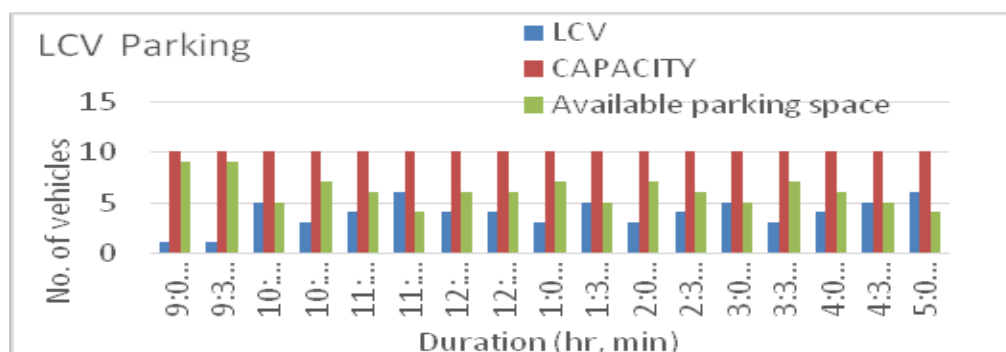
On-street parking



Reduction of On-street parking on both sides

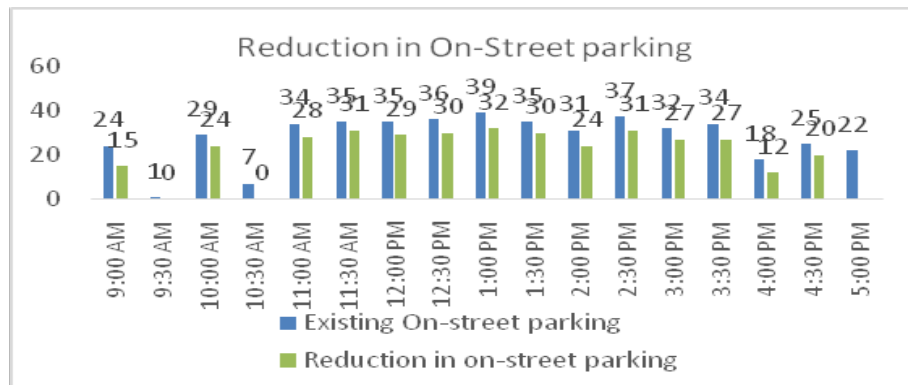
Above flowchart shows that reduction in 3-W parked on On-street parking. Which are reduces by shifting the 3-W on Under bridge parking.

LCV (light Commercial vehicle)



Available parking space at Under bridge parking

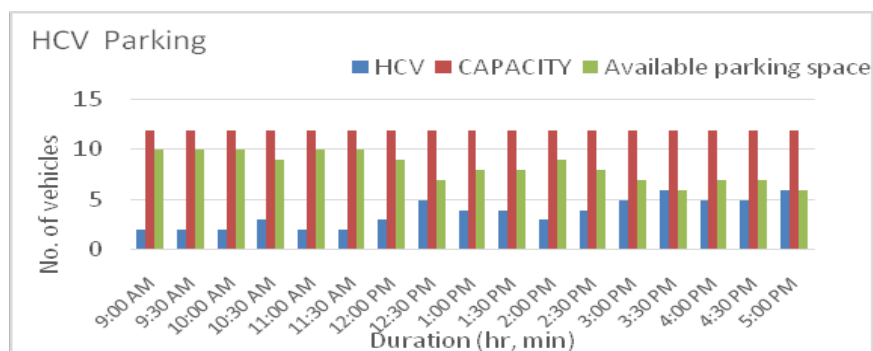
On-street parking



Reduction of On-street parking on both sides

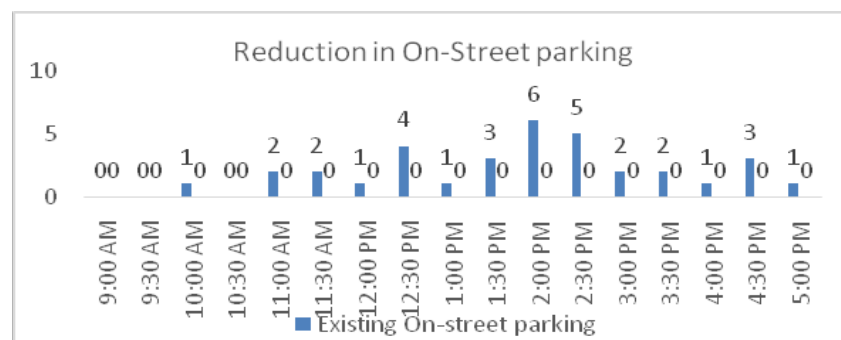
Above flowchart shows that reduction in LCV parked on On-street parking. Which are reduces by shifting the LCV on Under bridge parking.

HCV (Heavy Commercial vehicle)



Available parking space at Under bridge parking

On-street parking



Reduction of On-street parking on both sides

Above flowchart shows that reduction in HCV parked on On-street parking. Which are reduces by shifting the HCV on Under bridge parking.

SUGGESTIONS FOR IMPROVEMENT OF ON-STREET PARKING

- Use of Appropriate traffic management measures will help to come out from some ill effect of On-street parking. for that, should be a comprehensive parking policy for the city.
- The regulatory measures are generally of 2 types, One the parking is allowed for certain time period for free or payment otherwise parking is prohibited, but it allows to picking up or setting down the goods passengers. When a controlled parking scheme is planned, the zone boundaries should be delineated and suitable traffic signs are installed.
- The measures will be successful only if the streets are welled designed and the carriageway marking are adequate. also parking location are provide at desirable location and parking is not permitted for another place.

- In parking, angle parking seems to be better than parallel parking.
- Regulation of parking by charging fees has the desirable effect of curbing long-term parking, while encouraging short term parking. One method of collecting the charges is by installing parking meters.

CONCLUSIONS

- Parking is not a small problem. If it is not solved carefully now, then it will become a huge problem in the near future.
- Parking takes considerable street space leading to the lowering of the road capacity. Hence, speed will be reduced, Journey time and delay will also subsequently increase.
- The operational cost of the vehicle increases leading great economical loss to the community. According to the parking study on existing traffic condition on the road network it is must and required to remove on street parking system for efficient transportation system.

- Sometimes careless manoeuvring of parking and no-parking leads to accidents and it also affect the transportation.
- To reduce the parking of vehicles we can implement the following.

1. For short term measures pay and park method will be done at peak hours to control and regulate the parking.
2. For long term measures Off street parking have to be provided near CBD areas for vehicles like 2-wheeler and 4-wheeler, within the radius of 1 Km.

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