



IMPACT OF PARKING PRICING & REGULATIONS ON USER BEHAVIOR

A case city of Ahmedabad

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Regulating parking is important “to maintain balance between the supply and demand management”.

How should parking be regulated ?



Parking on-street

- Parking pricing
- Demarcation of parking
- Time restrictions
- Bicycle parking
- Time limits



Parking off-street

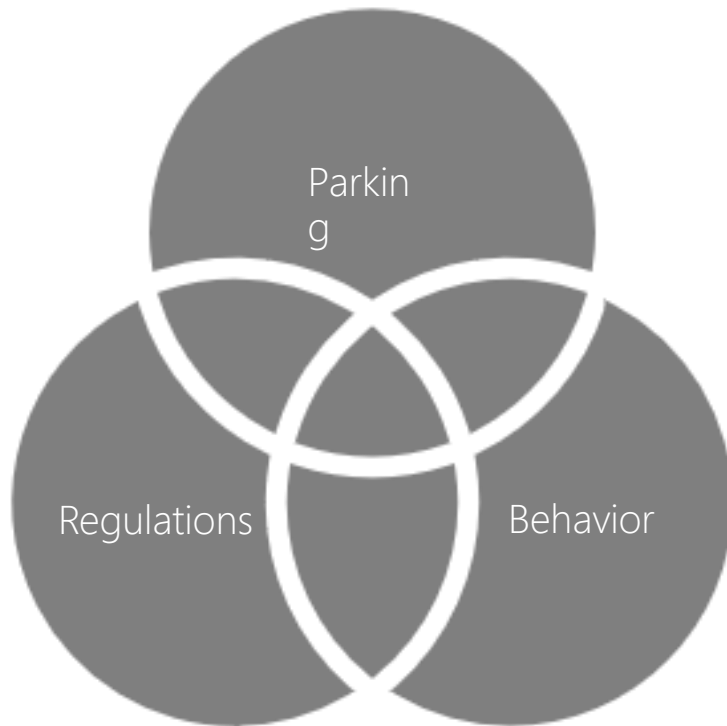
- Restrict the supply of parking
- Demarcation for on street
- Parking minimum and maximum
- Parking in periphery
- Multilevel parking

Consequence

Increase in illegal & haphazard parking on the streets

Leading To

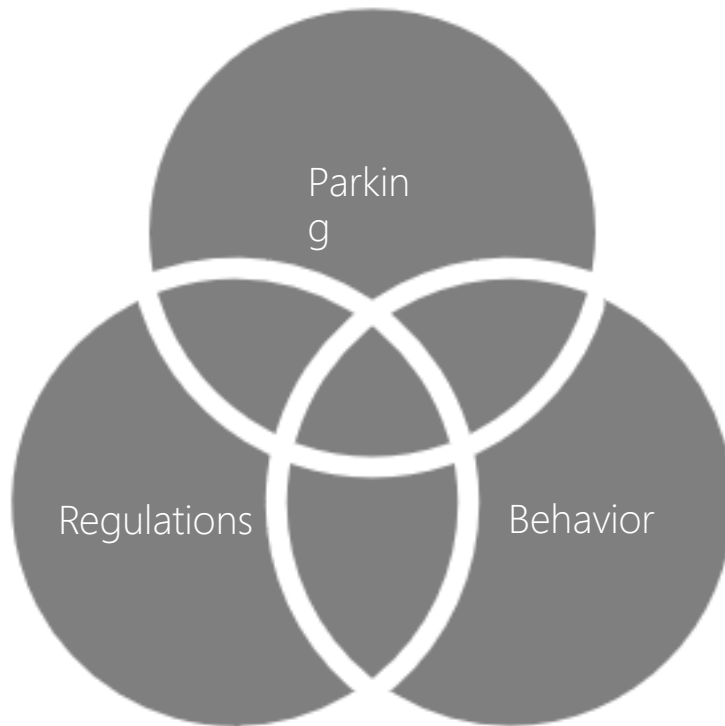
- Reduced traffic speeds
- Congestion
- Changes in modal choice
- Loss of revenue



- Parking behavior and decision-making mechanisms must be studied in order to balance the spatial-temporal distribution of parking and formulate parking management rules.
- It is the responsibility of the authorities to integrate the management and enforcements at different levels.

“The problem is not in regulating the parking but understanding people’s attitude towards parking regulation and awareness before formulating any policy.”

- In India, some attempts are made for parking regulations but based on the organic characteristic and mixed land use nature of the cities, implementing regulations related to parking becomes more important compared to other cities.
- For Ahmedabad attempts are being made to reform the parking regulations and yet people continue to behave in a similar manner therefore there is a need to change the approach before formulating parking regulation.



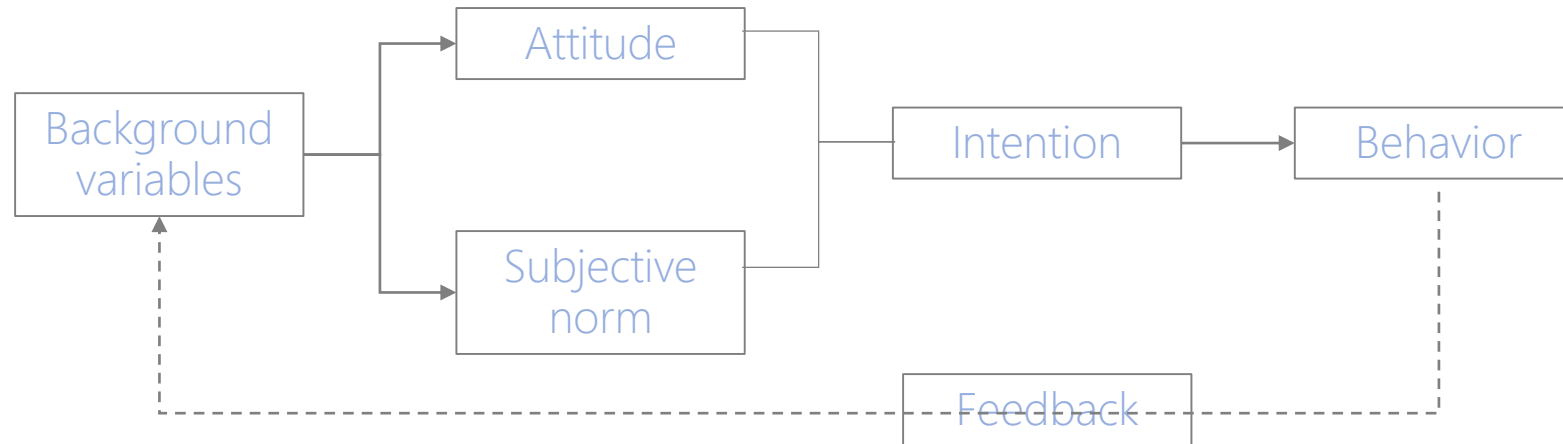
Aim

To analyze the impact of parking pricing and regulations on user behavior in Ahmedabad.

Objective

1. To review and identify different parking regulations, interventions, and their role in parking management.
2. To model the factors influencing the duration of parking for the case city of Ahmedabad.
3. Identify and assess the factors influencing parking durations that may be considered during policy formulation.





- Most used models in the literature to investigate pro-environmental behavior.
- Behavioral intentions are influenced by the attitude about the likelihood that the behavior will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome.
- From attitudes toward the behavior, subjective norms it is possible to predict intentions to perform a variety of behavior with high accuracy.

Determinants considered for study:

1. The attitude (opinions of oneself about the behavior);

E.g., Awareness about the no parking zone and yet continue to park there

2. The subjective norm (opinions of others about the behavior);

E.g., If enforcement is made stricter, preference of people related to parking.



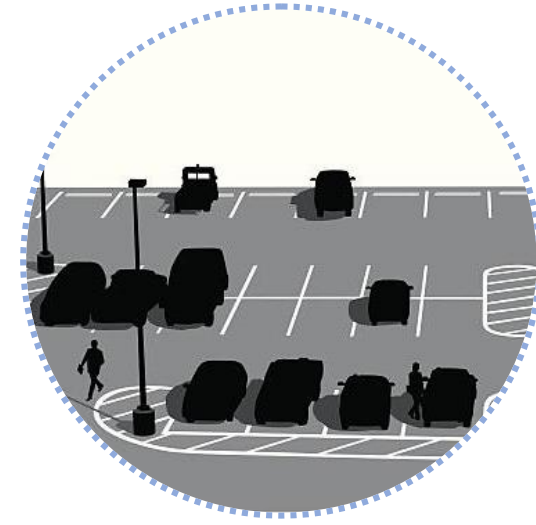
Awareness

- No parking and regulated parking zone
- Nearby parking location
- Fines in the city



Attitude

- Park in no parking zone
- Do not park in parking location
- Enforcement taken lightly



Behavior

- Habitual parking e.g., Continue to park in similar location on daily basis.

Parameters	Key Takeaways
Parking	<ol style="list-style-type: none">1. It is crucial to regulate parking to meet the increasing demand and at the same time to use it as a push measure to support sustainable transport.2. To solve the parking supply issue, the planning authorities along with local bodies will have to rework the structuring of the framework at the city level.3. To solve the parking demand issue, enforcement needs to be made stricter. Amongst which regulation and pricing have proved to be effective in reducing the demand.
Behavior	<ol style="list-style-type: none">1. Driver's decision changes based on the location, duration, awareness, and attitude toward the parking.2. Impacts observed by regulating parking: shift to neighborhood parking, adjacent parking, off-street parking or another mode of travel, or pay and park.3. Parking behavior is very complex to understand; therefore, it is crucial to capture information, and thus using the revealed preference method would be ideal.
Policy & Regulations	<ol style="list-style-type: none">1. From the various case studies identified, parking pricing strategies and regulating the zone have significantly impacted the change in the driver's behavior.2. Parking characteristic is different (on-street v/s off-street) ; therefore, pricing strategies should be formulated accordingly.3. By providing free parking for cycling and incentivizing, parking can be used as a push measure to promote sustainable transport.

Hazard Based Duration Model: (Cox Regression)

Aim: To understand the threshold of parking in terms of its time (duration)

Eg: To analyze the duration of car parked in a particular area or time devoted for parking.

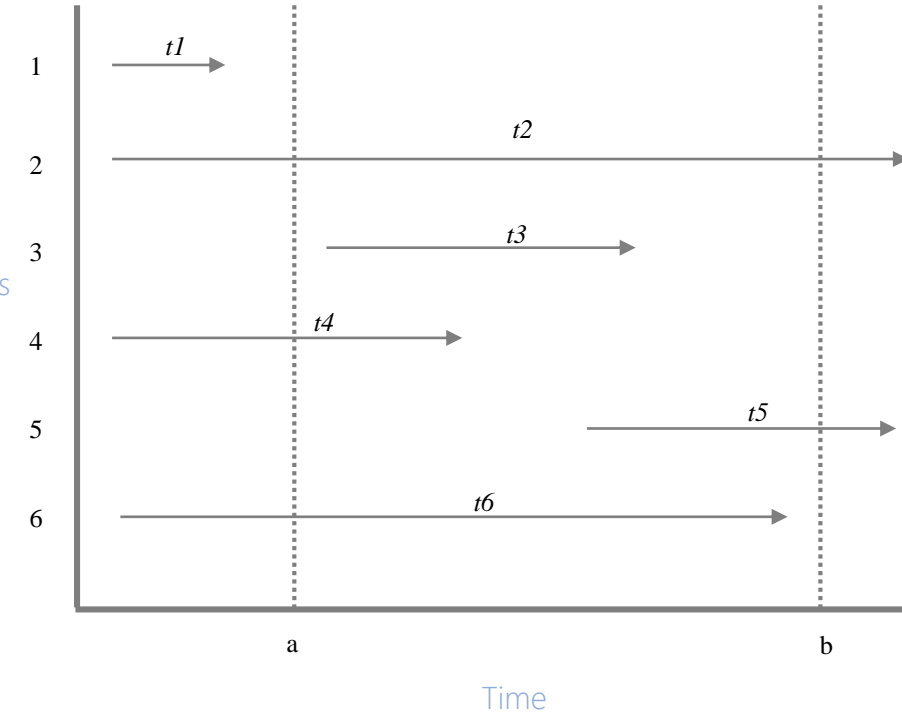
Left censoring

Event has been "completed" and duration of that individual will be within that range (\geq) the range of the duration the event has occurred

Right censoring

Data lies between the start of the event and completion of the event. Occurs when survival time is "incomplete"

Observations

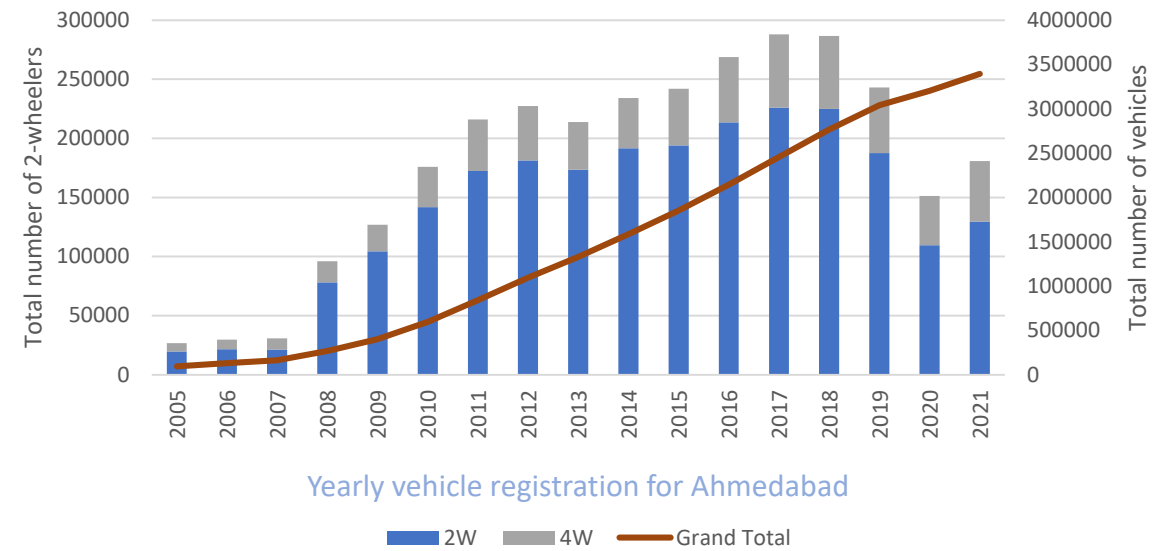
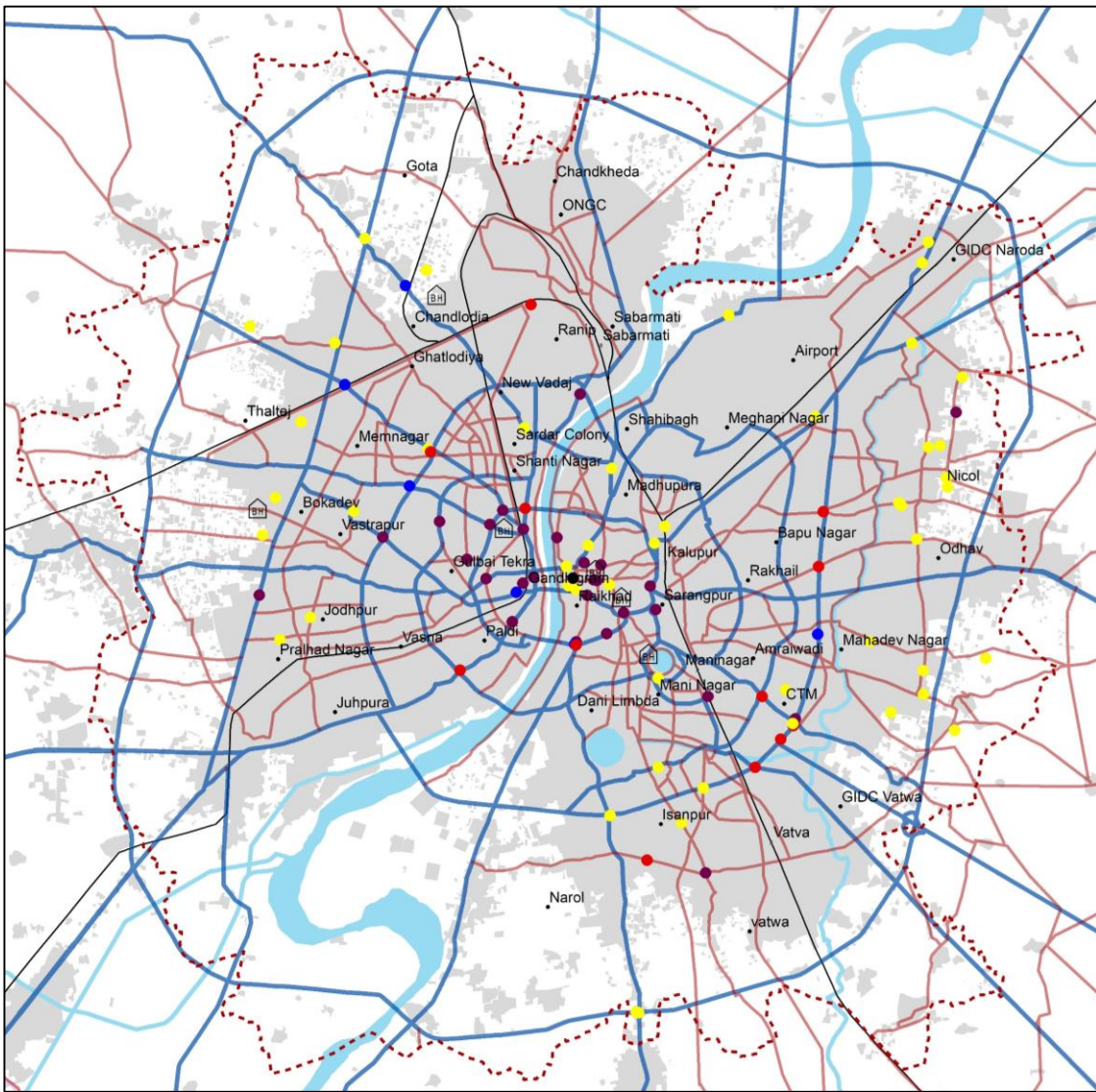


Objective:

Checking the significance and factors affected due to duration.

Outcome:

Understand the threshold and time at which the parking maximum is happening and factors affecting the parking decision.

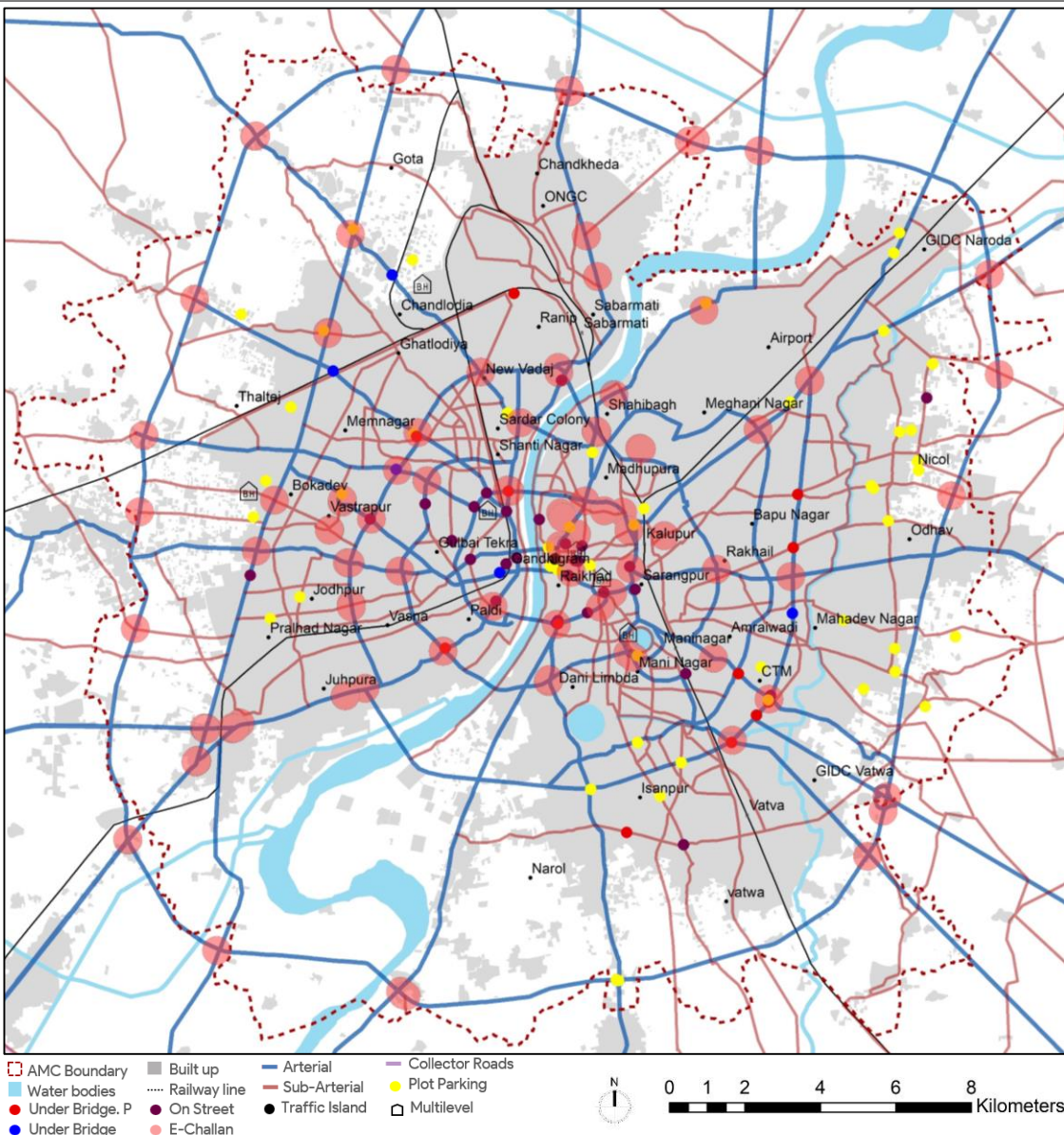


32,031
Existing Parking Supply
(2-Wheeler and 4-Wheeler)

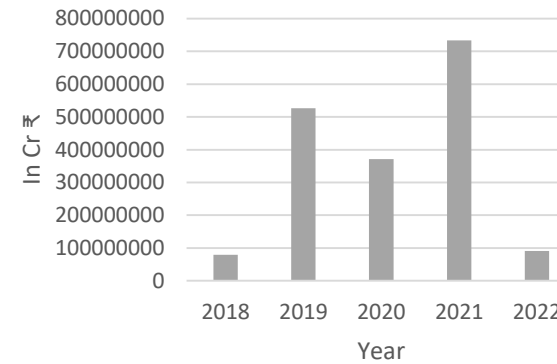
3,878
Proposed Parking Supply
(2-Wheeler and 4-Wheeler)

About the charges

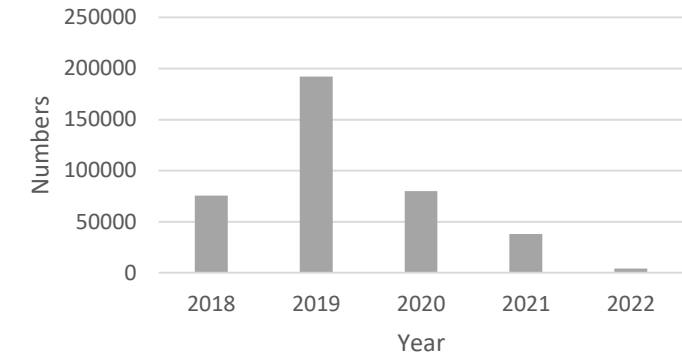
Vehicle type	Clamping (₹)		Towing Charge (₹)		No parking fine (₹)
	2018	2022	2018	2022	2018 & 2022
2-Wheeler	200	250	250	300	500
Data Collection	300	300	500	600	500



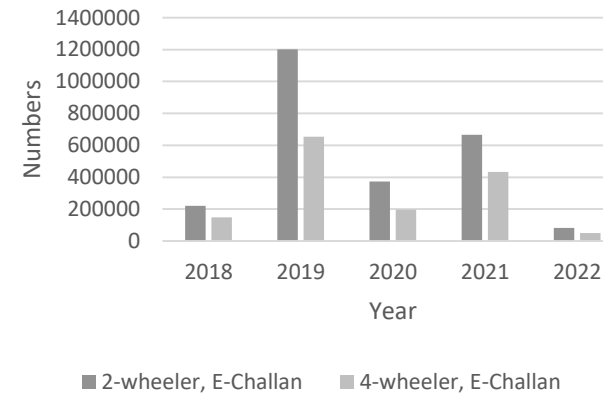
Total fines collected



Vehicles towed



E-Challan generated



- Reduction in number of vehicles towed indicates the ease in enforcement.
- Number of challans issued post 2019 has decreased indicating laxity in enforcement which has led to an increase in the on-street parking.

Note:

- 2022 data collected is till the month of March.
- 2020 pandemic impact

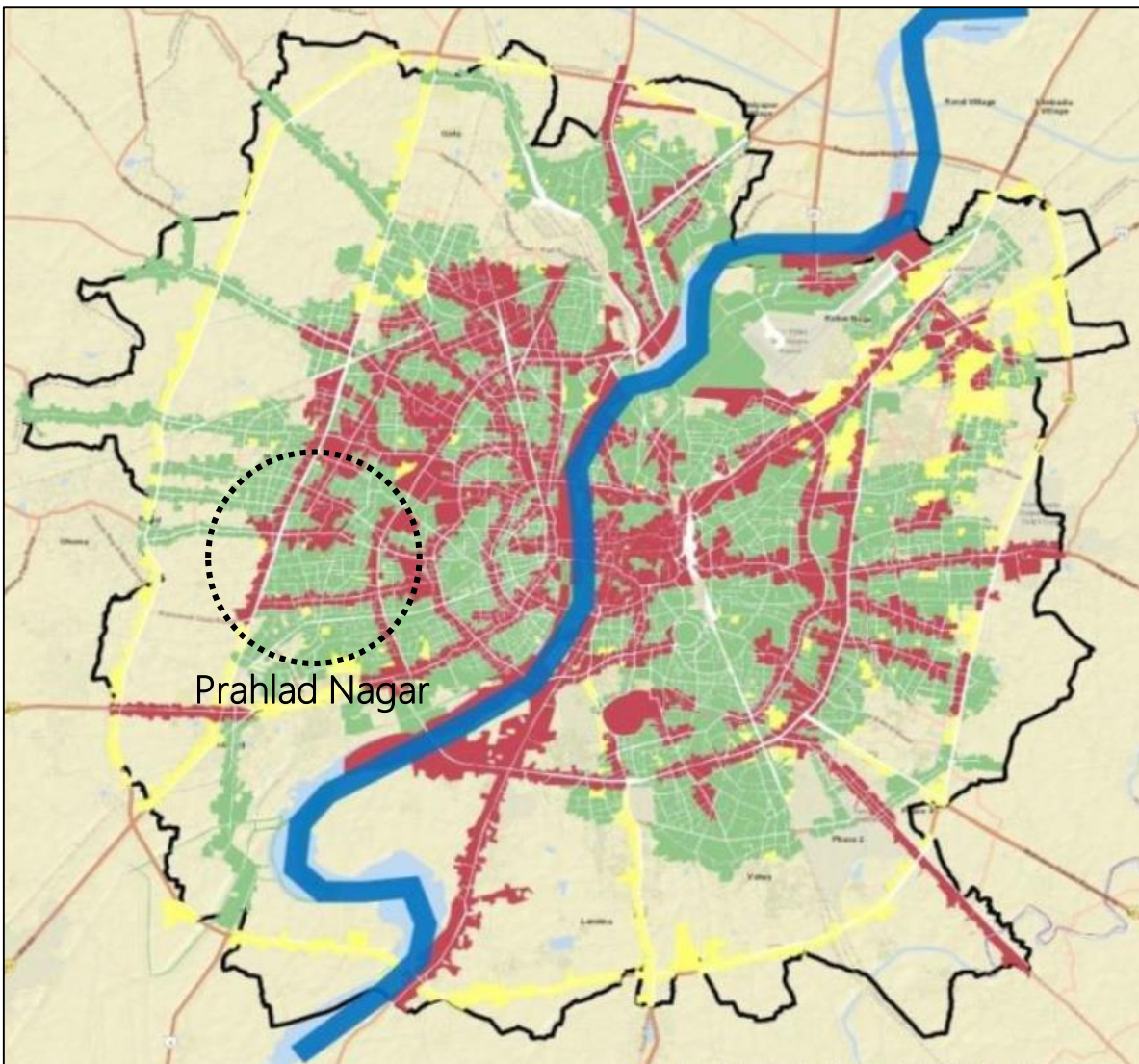


Image Source : *Parking policy of Ahmedabad*

Key Learnings from the drive:

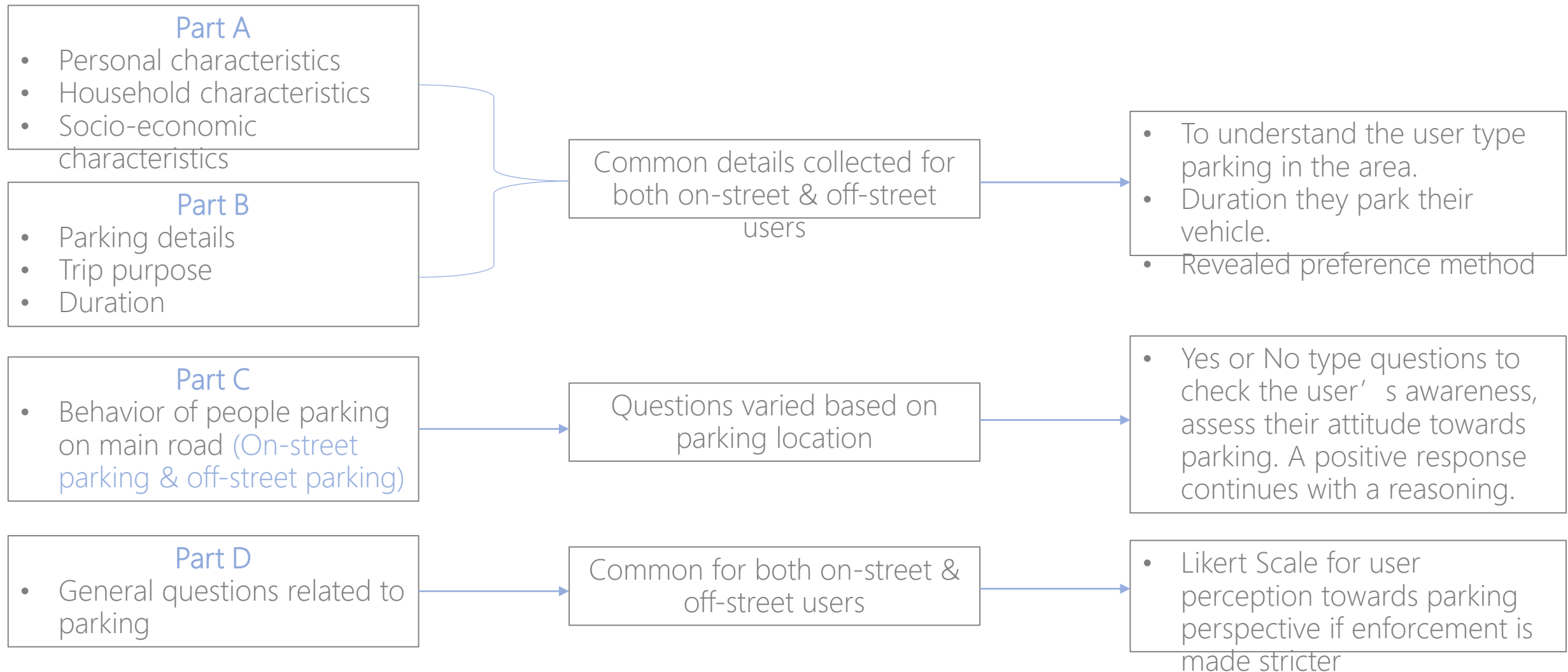
1. Not envisioned for extended period therefore encroachments have come up again and people have again started to park on the footpaths and roads.
2. It brought immediate results and if continued it is possible to obtain long time results as there was a change in behavior of people observed. With strict enforcement.
3. The drive in a way made people cautious about they park on the roads.

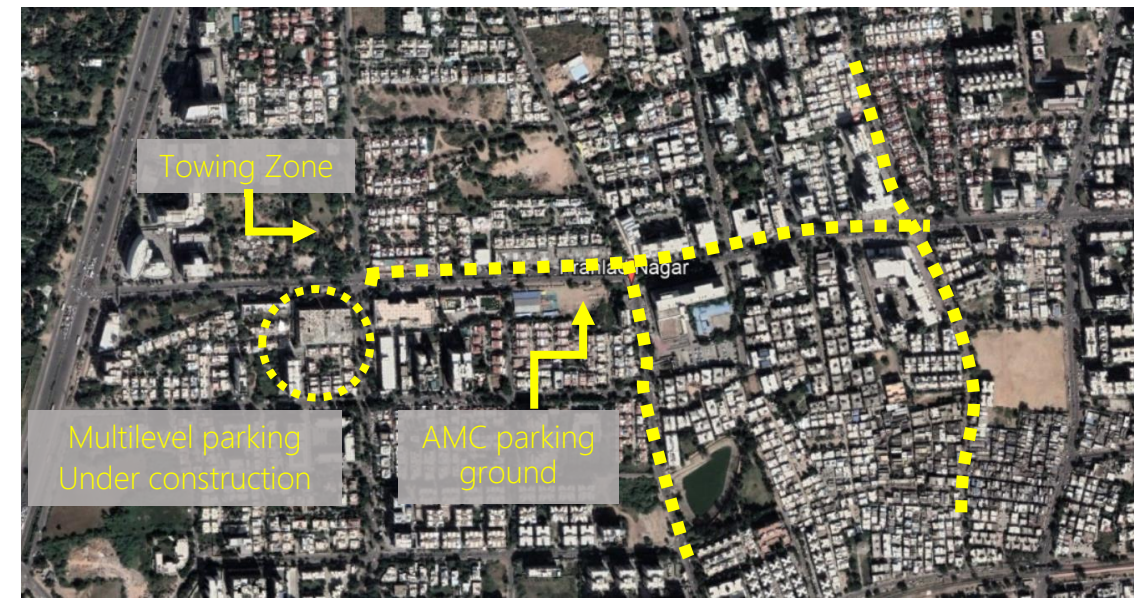
“Thus, the need to understand user's behavior and finding reasons why they continue to park in the designated no-parking zone”

Delineating the stretch for study:

For the preparation of parking plan for the city traffic and parking surveys were conducted based on which parking zones were identified.

Preparation of Questionnaire

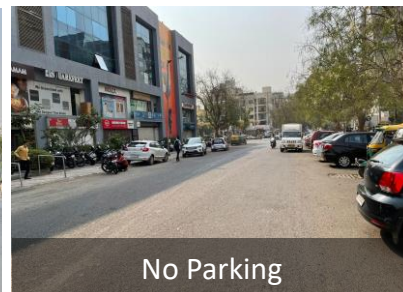
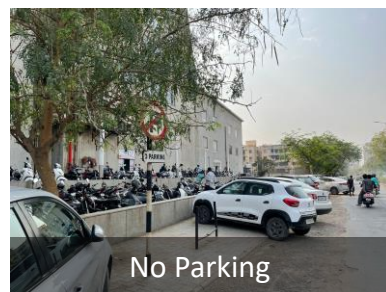
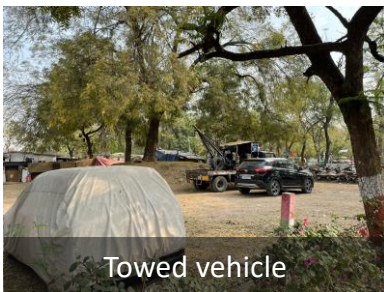




Prahlad Nagar – West zone of Ahmedabad

Sample Size = 291

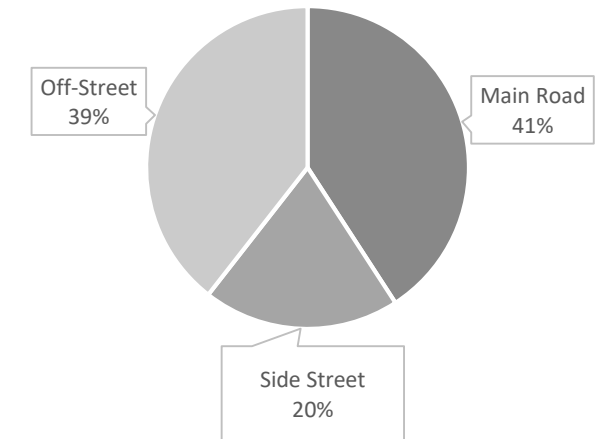
Existing scenario



Inventory at the corridor delineated

1. Stretch divided into on-street (main street and side street parking) and off-street parking.
2. Survey done for 7 days at different time of the day from different parking location.
3. The survey was done for 2-wheeler & 4-wheeler user only
4. Some data like towing details were collected from traffic police and newer parking supply details were collected from Ahmedabad Municipal Corporation.

Sample distribution



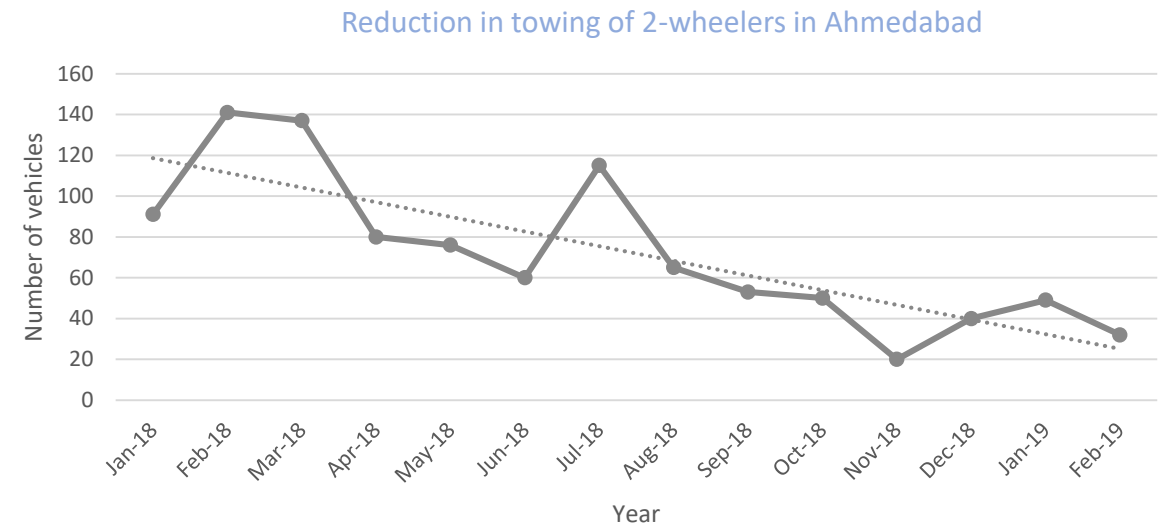


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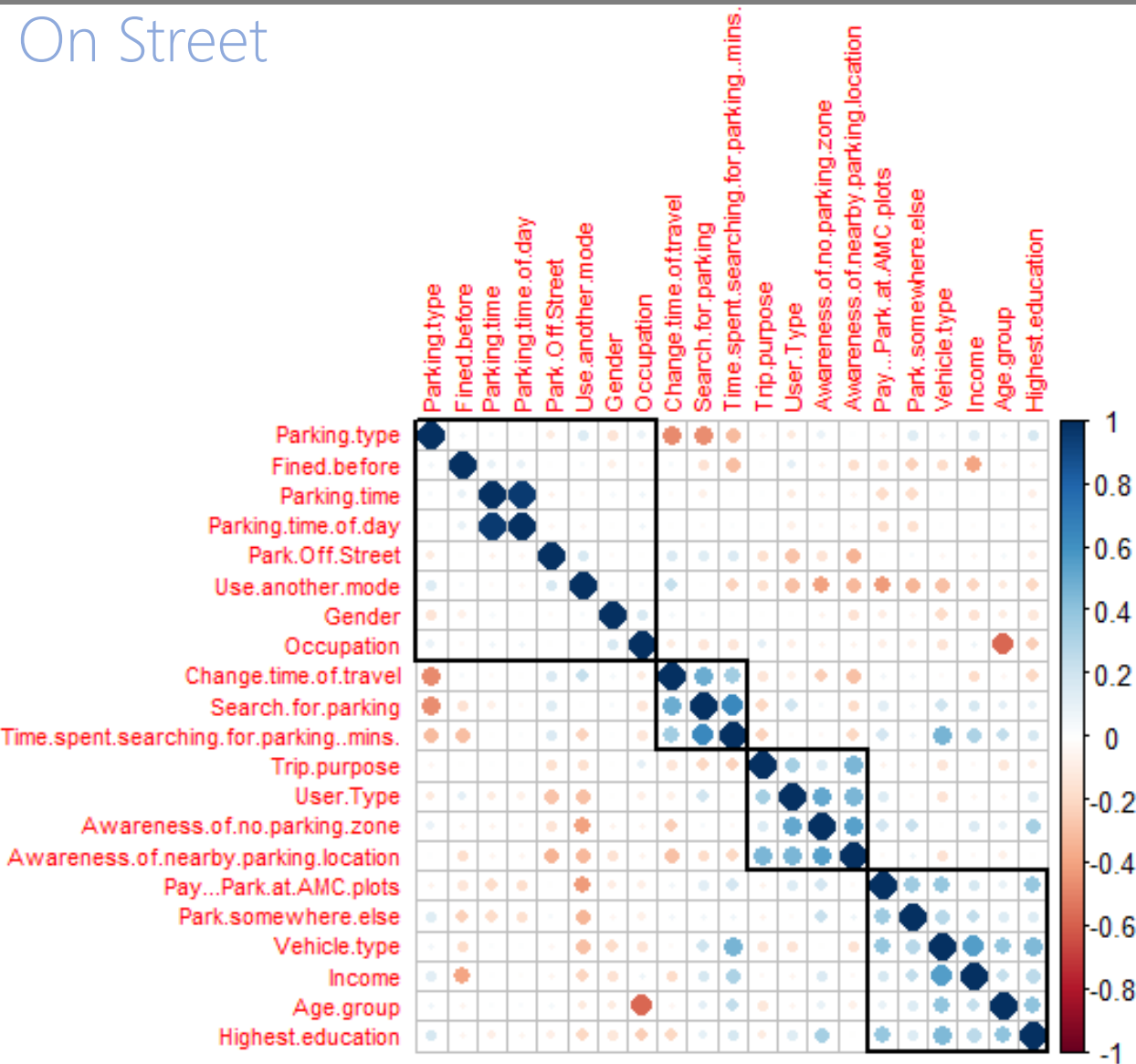
Basic Observation

1. Approximately 1000 vehicles are parked in the delineated area of which nearly 766 are bikes and 234 are cars.
2. Free parking (AMC parking ground) is available on the delineated stretch, which is under utilized.
3. New multi-level parking is being constructed by AMC.
4. Main street parking is less during the morning hours when compared to the afternoon or evening.
5. On side street parking is maximum during the evenings mainly due the commercial activities happening on the road and side street.
6. There is an existing towing zone, but towing is done only for 2-wheelers, 4-wheelers are usually clamped.

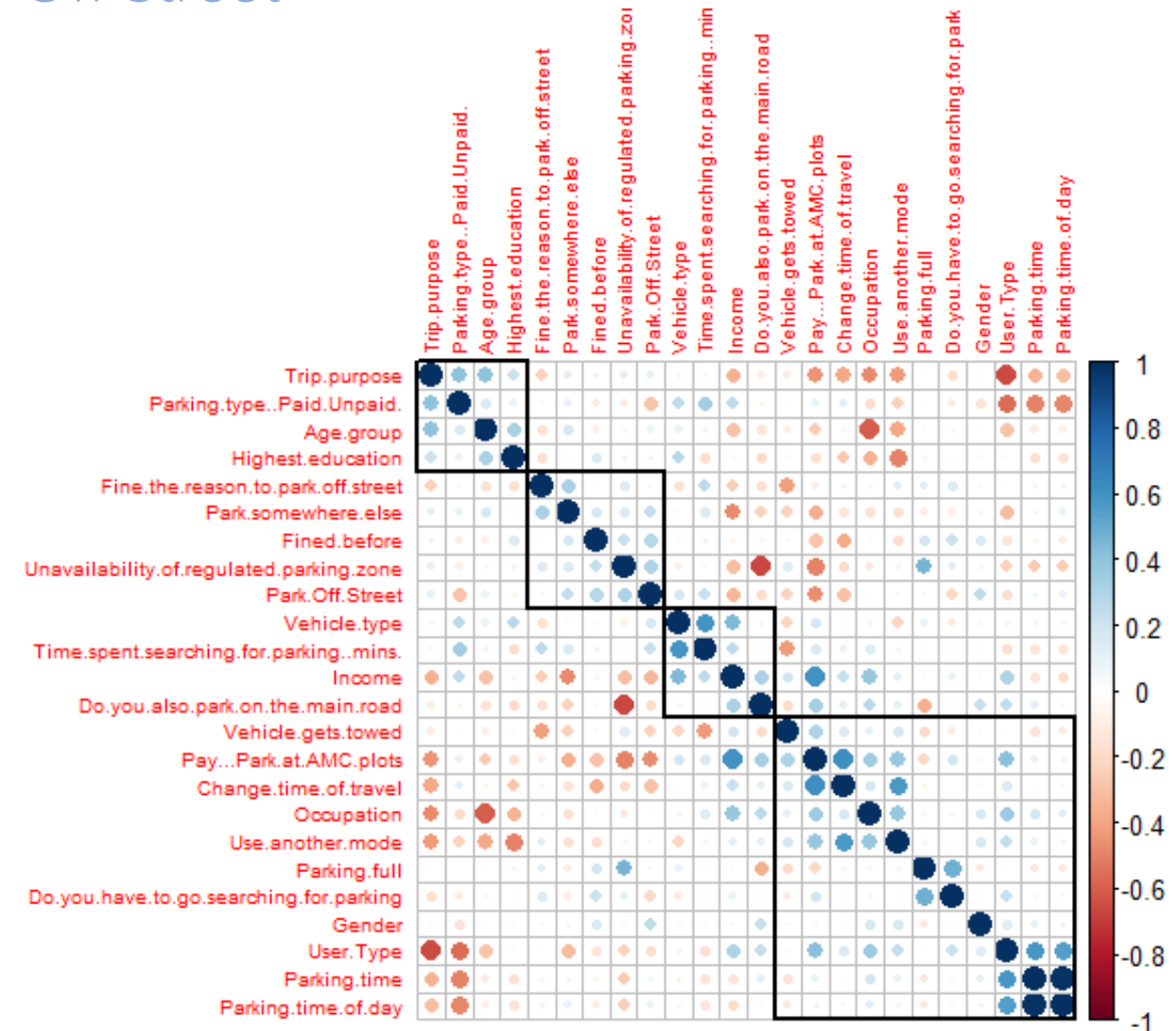


Source : Ahmedabad Traffic Police

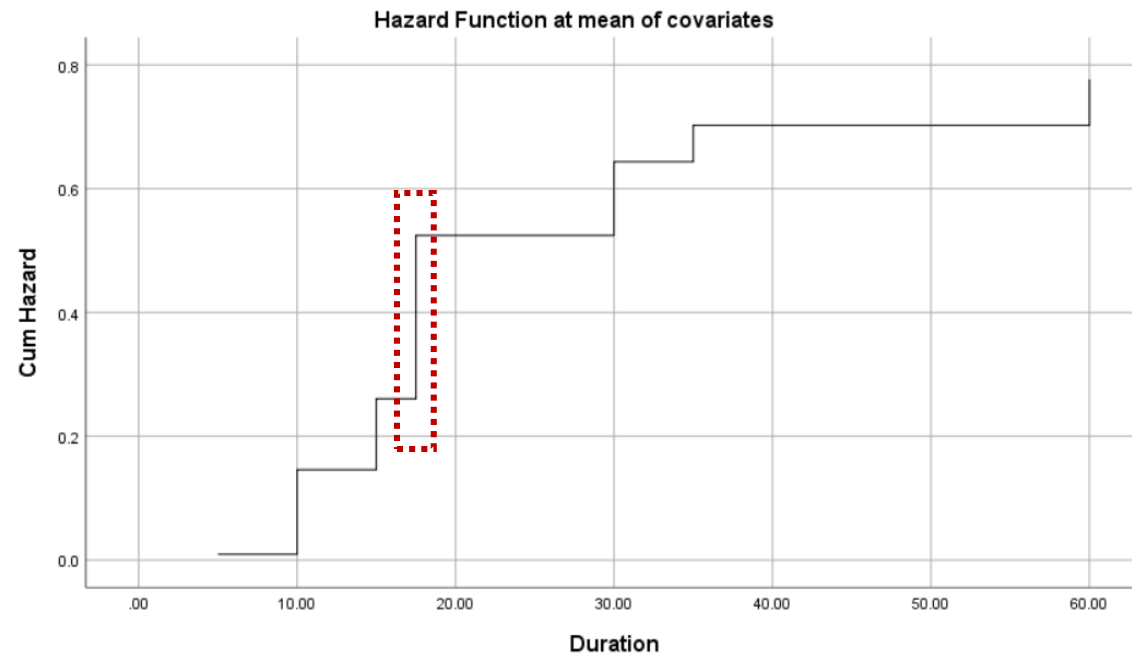
On Street



Off Street



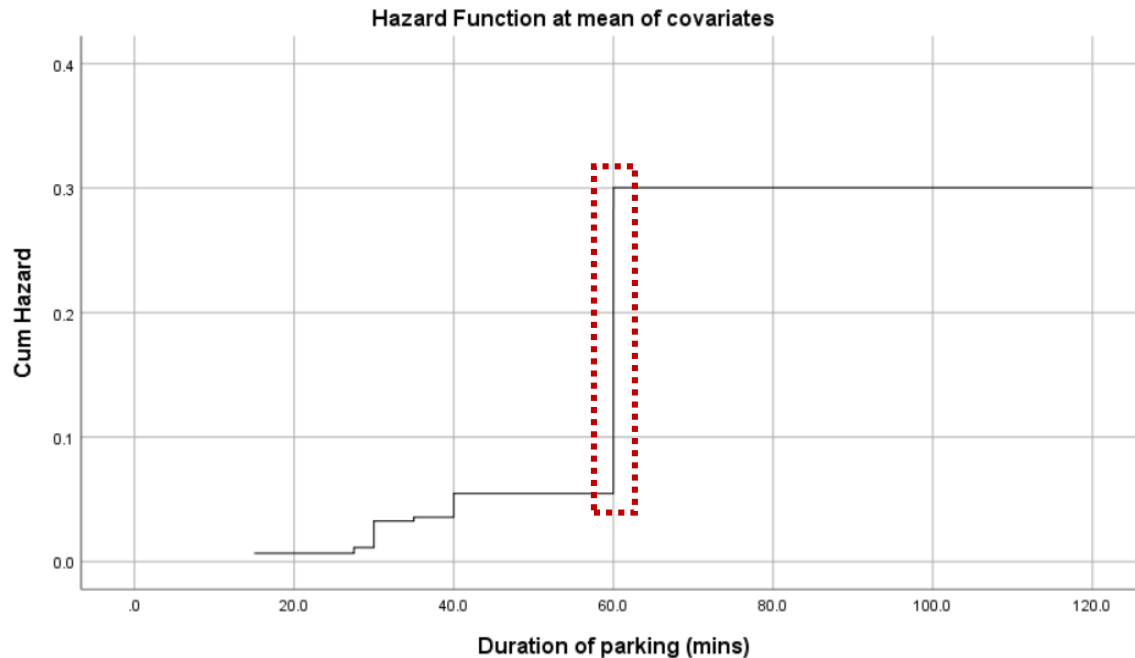
On Street



Variable	Regression coefficient (b)	Standard error SE(b)	P-value	e ^b Hazard ratio Exp(b)	95% CI for hazard ratio	
					Lower	Upper
User type Daily = 1 Other = 0	.654	.326	.045	1.924	1.015	3.647
User type Weekly = 1 Other = 0	.675	.363	.063	1.964	.965	3.998
Fined Yes = 1 No = 0	.486	.266	.067	1.626	.966	2.738
Parking location Main road = 1 Other = 0	.899	.323	.005	2.458	1.304	4.633

- The y-axis is the cumulative hazard and x-axis is the duration in (mins)
- The line highlighted indicates that for on street parking the duration is highest between 10 – 15 mins.
- Higher the hazard rate chances of survival is less (survival rate is nothing but probability of an individual surviving in the parking area beyond a point of time.
- E.g. people who have experienced fine they associate themselves with shorter duration of parking compared to people who have not experienced fine.

Off Street



Variable	Regression coefficient (b)	Standard error SE(b)	P-value	e ^b Hazard ratio Exp(b)	95% CI for hazard ratio	
					Lower	Upper
Pay & Park Strongly disagree = 1 Other = 0	1.400	.630	.026	4.054	1.178	13.94
Change travel time Strongly disagree = 1 Other = 0	-1.670	.532	.002	.188	.066	.534
Park somewhere else Neutral = 1 Other = 0	.584	.257	.023	1.794	1.084	2.967
Pay & Park Agree = 1 Other = 0	2.725	.844	.001	15.253	2.918	79.741
User type Daily = 1 Other = 0	-4.142	.737	.000	.016	.004	.067

- +ve co-efficient indicates the shorter duration of parking whereas a negative co-efficient indicates longer duration of parking.
- The line highlighted indicates that for off street parking the duration is highest for 60 mins and is beyond 120 mins
- E.g., People parking off-street do not prefer to change their travel time with a negative co-efficient of higher duration of parking and not prefer to pay and park due to which prefer parking off-street.

The study shows that on-street parking

- Short term parkers parking on main road are:
 - i. Regular parkers parking for shorter duration.
 - ii. Purpose is mainly due to recreational or market purpose.
 - iii. Have not experienced fine and neither are aware.
 - iv. Most of them are salaried and middle, higher income group.
 - v. The vehicle type mostly being parked is 2 – wheeler and 4-wheeler.
- Long term parkers parking on main road are:
 - i. Non-regular parkers parking for longer duration.
 - ii. Purpose is due to recreational purpose.
 - iii. Have experienced fine and are aware.
 - iv. Most of them are higher income group.
 - v. The vehicle type mostly being parked is 4 – wheeler.
- In both cases if enforcement is made stricter their next preferred location would be immediately available parking or off the street and are not in favour of pay and park due to time and cost viability.

The study shows for off-street parking

- Short term parkers parking off-street are:
 - i. Regular parkers parking for shorter duration.
 - ii. Purpose of parking is recreational.
 - iii. Have experienced fine and are aware about the charges.
 - iv. Most of them are salaried and middle income group.
 - v. The vehicle type mostly being parked is 4 - wheeler.
- Long term parkers parking off-street are:
 - i. Non-regular parkers parking for longer duration.
 - ii. Purpose of parking is due to work.
 - iii. Have not experienced fine but are aware about it.
 - iv. Most of them are salaried and middle income group.
 - v. The vehicle type mostly being parked is 2 – wheeler and 4 - wheeler.
 - vi. If enforcement is made stricter this group of people will not change their travel time as their purpose of travel is work
- In both cases if they do not find parking they will park in the neighbourhood or parking zone (paid or unpaid) as they are aware of towing and fines and would want to avoid them.

- i. Need to create awareness amongst people with regards to parking charges and fine is important as it has impact on the parking decision being made.
- ii. Factors like socio-economic characteristics, trip purpose, and past experience influences the decision of parking and also has an impact on its duration.
- iii. Strict parking enforcement play an important role in the decision-making process of the user and if there is laxity in enforcement people will tend to change their behavior towards parking.

THANK YOU