



DELHI NORTHWEST



TRANSPORT DEPARTMENT

Government of NCT of Delhi



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Government of NCT of Delhi

सत्यमेव जयते

Report by:



Data support by:



Supported by:



HumanQind

ACKNOWLEDGMENTS

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Data encoding, analysis and report writing was done collectively by the Transportation Research and Injury Prevention Centre ((TRIP Centre) at IIT Delhi, Vital Strategies and the BIGRS embedded staff with inputs from BIGRS partners.

The report covers detailed proposals and budget estimates for 3 high risk locations and 1 school zone for the district. In collaboration with TRIP centre, proposals with budget estimations for selected high-risk locations have been prepared by SG Architects under the leadership of Dr. Sandeep Gandhi. Under the leadership of Ruchi Varma, HumanQind Design Foundation (HumanQind) is the lead partner of TRIP Centre, IIT Delhi to pilot the Safe School Zone Initiative with school road safety clubs in each district. HumanQind has prepared the detailed proposal and budget estimates for the school zone location.

The report was edited and compiled by Ishan Gogoi (Vital Strategies) and co-authored by Rahul Goel (TRIP Centre, IIT Delhi), Shivanshu Singh (SG Architects), Ruchi Varma and Aastha Khatri (HumanQind) under the leadership of Prof. Geetam Tiwari (TRIP Centre, IIT Delhi).

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TABLE OF CONTENTS

ACKNOWLEDGMENTS	3
LIST OF FIGURES AND TABLES	6
INTRODUCTION	7
METHODOLOGY	8
ABOUT THE DISTRICT	9
A ROAD SAFETY SITUATION AND TRENDS:	10
A.1 : Road crash death trends	10
A.1.1 : Fatal Road crashes	10
A.1.2 : Road Crash Deaths by Road user type	11
A.1.3 : Road crash deaths by months	12
A.1.4 : Road crash deaths by time and day of week	13
A.2 : Road crash deaths by Age and Gender	14
A.2.1 : Road crash deaths by gender	14
A.2.2 : Road crash deaths by age and gender	14
A.3 : Road crash deaths by road user types.	15
A.3.1 : Total Road crash deaths by road user types (2019,2021,2022)	15
A.3.2 : Who-hit-who matrix	16
A.4 : Hit-and-runs in fatal road crashes	17
A.4.1 : Percentage of hit-and-run and non-hit-and-run cases	17
A.4.2 : Hit-and-run road user types	17
A.5 : Road crash heatmaps	18
A.5.1 : Heatmap of all road crash deaths	18
A.5.2 : Heatmap of all pedestrian deaths in fatal road crashes	18
A.5.3 : Heatmap of all motorcycle (rider + pillion) related deaths	19
A.6 : High-Risk Locations	20
A.6.1 : List of high-risk locations	20
A.6.2 : Map of all high-risk locations	20
A.6.3 : High risk corridors	21
B. Data to Action	22
B.1 : Netaji Subhash Place	22
B.1.1 : General Description Of the site	22
B.1.2 : Existing Land Use	22
B.1.3 : Existing Scenario	22
B.1.4 : Conflict points	23

B.1.5 : Issues identified	24
B.1.6 : Proposed design	26
B.1.7 : Summary budget estimates	28
B.2 : Punjabi Bagh Junction	33
B.2.1 : General description of the site	33
B.2.2 : Existing land use	33
B.2.3 : Existing scenario around the site	33
B.2.4 : Conflict points	34
B.2.5 : Issues identified	35
B.2.6 : Proposed design	37
B.2.7 : Summary design estimates	38
B.3 : Madhuban Chowk	43
B.3.1 : General description of the site	43
B.3.2 : Existing pedestrian circulation	44
B.3.3 : Conflict points	45
B.3.4 : Issues identified	46
B.3.5 : Proposed design	47
B.4 : Powerhouse Pitampura	52
B.4.1 : General description of the site	52
B.4.2 : Existing scenario on site	53
B.4.3 : Existing Design	57
B.4.4 : Proposed design	58
B.5 : Jaspal kaur public school, Shalimar Bagh	62
B.5.1 : General Description of the site	62
B.5.2 : Existing Scenario	63
B.5.3 : Issues Identified	65
B.5.4 : Activity Map	66
B.5.5 : Proposed design	68
B.5.6 : Summary budget estimates	70

LIST OF FIGURES AND TABLES

Figure 1: Fatal Road crashes and road crash deaths	10
Figure 2: Road crash deaths by road user type	11
Figure 3: Average Road crash deaths over months	12
Figure 4: Road crash deaths over months	12
Figure 5: Road crash deaths by gender	14
Figure 6: Road crash deaths by age and gender	14
Figure 7: Road crash deaths by road user type	15
Figure 8: Percentage of hit-and-run and non-hit-and-run cases	17
Figure 9: Victim Road user types in hit-and-run cases	17
Figure 10: Heatmap of all road crash deaths	18
Figure 11: Heatmap of all pedestrian deaths in fatal road crashes	18
Figure 12: Heatmap of all motorcycle (rider pillion) related deaths	19
Figure 13: Map of all high-risk locations	20
Figure 14: High risk corridors (2019, 2021, 2022)	21
Figure 15: Deaths per km on the high risk corridors (2019, 2021, 2022)	21
Figure 24: Home to school travel modal distribution: Jaspal Kaur Public School	63
Figure 25: School to home travel modal distribution: Jaspal Kaur Public School	63
Table 1: Road crash deaths by time and day of week	13
Table 2: Who-hit-whom matrix	16
Table 3: List of high risk corridors	20

INTRODUCTION

There has been an increase of road crash fatalities in Delhi since the easing of pandemic mobility restrictions. Vulnerable road users such as pedestrians, two-wheeler occupants and three-wheeler occupants are most at risk of severe injuries and - in worst case scenarios - death in a road crash. This risk which hinders the basic right of mobility for the road users warrants that effective and evidence-based road safety interventions and programs must be implemented regularly and systematically to mitigate the effects of road crashes.

In the year 2023, the Transport Department released the ‘Data to Action’ report which analysed 2019-2021 data and identified high-risk locations for each of the districts in Delhi. The report provided detailed maps, general analysis, and recommendations for each district. This has been presented to the District Road Safety Committees (DRSCs) to guide them in implementing road safety interventions and address the most urgent road safety risk factors in their jurisdictions. The DRSCs take the lead in drafting the district road safety plan, are instrumental in planning road safety interventions for district high-risk locations, implement interventions on the ground, and disburses the road safety fund.

To continue analysing road crash data and addressing the risks in crash-prone locations, the Transport Department are producing these highly customised district specific road safety reports (DRSR) for the District Road Safety Committees. These reports include detailed findings on crashes in specific districts and recommendations to reduce the crashes. The purpose of these DRSR is to guide DRSCs in implementing evidence-based interventions to reduce crash fatalities in high-risk locations. The report aims to provide detailed infrastructure designs which can be readily implemented on ground. Finally, it seeks to inform and train the DRSCs on how they can replicate the investigation and analyses used in the report on their own in the future.

METHODOLOGY

DATA SOURCE

The District Road Safety Report (DRSRs) focused on road crash fatalities' data in the National Capital Territory (NCT) of Delhi from 2019, 2021 and 2022. The data source for this report is police crash data records from the Motor Accident Claims Tribunal (MACT) cells of the districts. In addition, this data is supplemented by the FIR lists from the Delhi Traffic Police. The dataset was compiled, digitised, and cleaned at the Transport Department.

DATA ANALYSIS

The digitised datasets were compiled and analysed using MS Access to produce descriptive statistics and mapped using Quantum Geographic Information Systems (QGIS) platform, to identify high-risk locations including high-risk corridors in each district. Similar process will be followed for producing district road safety reports for the remaining districts.

ON-SITE INVESTIGATION OF HIGH-RISK LOCATIONS AND CORRIDORS

An in-depth and on-site investigation was conducted for the identified high-risk locations. At the site, both qualitative and quantitative data were collected which informed the design of the interventions. The data collection process includes the following activities:

- Inspection of the road infrastructure and land use
- Identification of hazards and conflict points
- Assessment of the type and quality of enforcement
- Observations on road user behaviour and accessibility of vulnerable road users
- Identification of types of road users and traffic mix, etc.

These data points were collated and presented for the chosen high-risk sites and informed the design of the interventions.

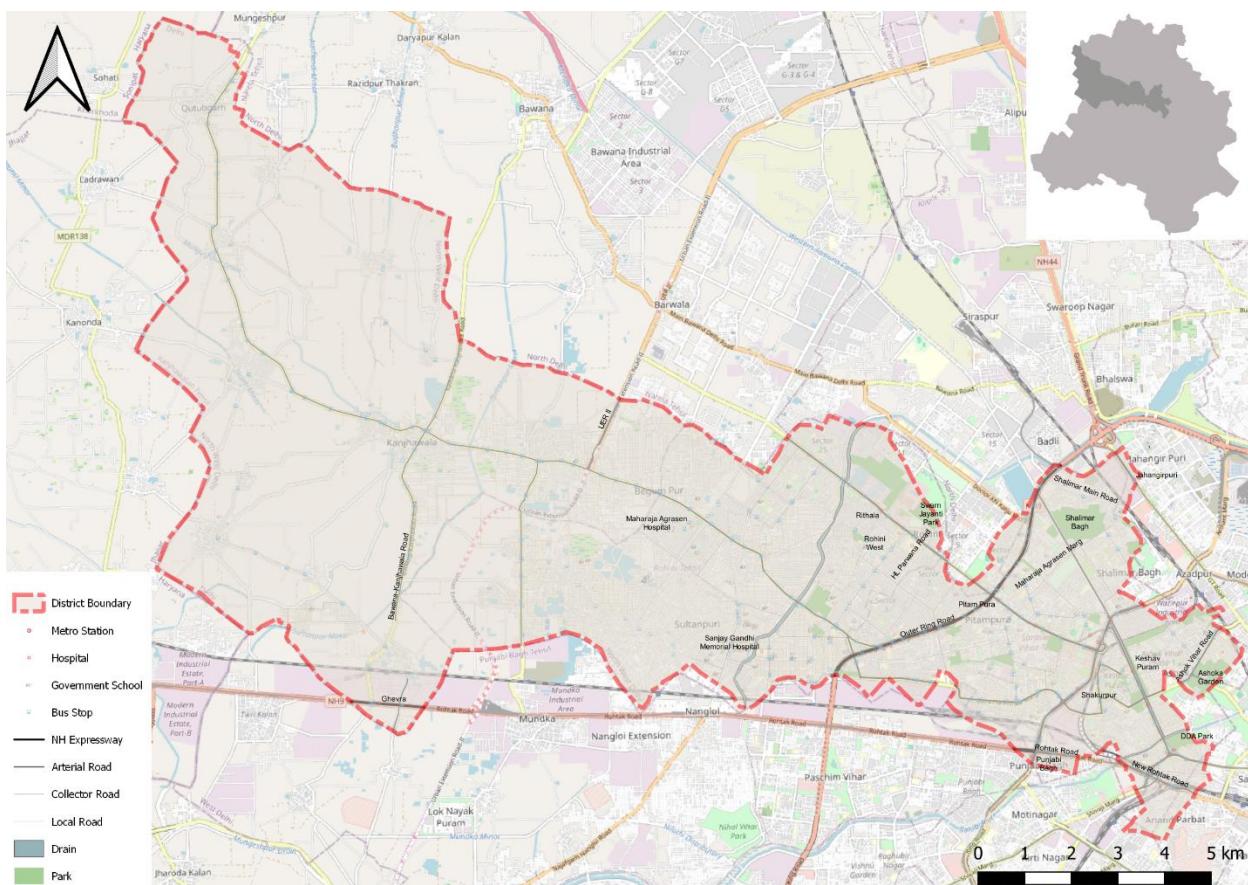
REPORT STRUCTURE

Each district will have their own customised report. There will be a total of 11 reports - one for each district in Delhi. The report is divided into three parts. The first part is the introduction of road safety in the context of the district, and methodology followed to produce the report. The second part covers the discussion on the road safety situation in the given district. Finally, the last part of the report provides detailed investigation and recommendations for the selected high-risk sites in the district.

ABOUT THE DISTRICT

North West Delhi is bounded by the

- 1) Yamuna River on the North East,
 - 2) Districts of North Delhi to the East and Northeast,
 - 3) West Delhi to the South,
 - 4) Jhajjar district of Haryana state to the west,
 - 5) Sonipat district of Haryana to the northwest and north and,
 - 6) Baghpat district and Ghaziabad district of Uttar Pradesh state to the northeast across the Yamuna.



AREA (IN SQM/ SQ KM): 442.84 sq km (170.98 sq mi); **ELEVATION:** 213 m (699 ft)

MAJOR ROADS: Outer Ring Road, Mahatma Gandhi Marg.

A ROAD SAFETY SITUATION AND TRENDS:

A.1: ROAD CRASH DEATH TRENDS

A.1.1 : FATAL ROAD CRASHES

There were 150 fatal road crashes in North West district of Delhi in 2022 with 152 persons killed in these crashes. This is a 12% increase compared to the previous year, 2021 (129, and 134 respectively). One person is killed in road crashes in the North West district every three-to-four day.

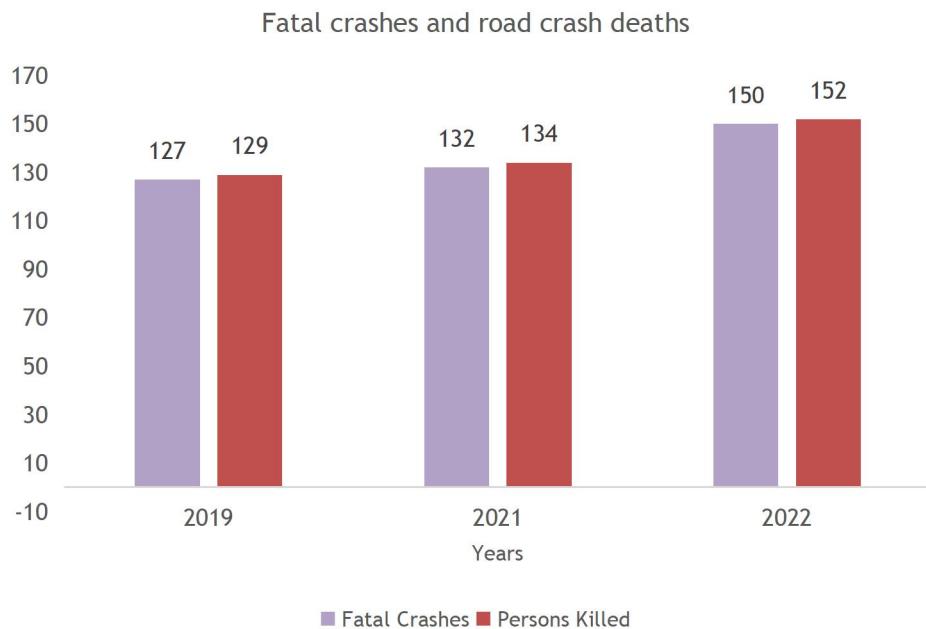


Figure 1: Fatal Road crashes and road crash deaths

A.1.2 : ROAD CRASH DEATHS BY ROAD USER TYPE

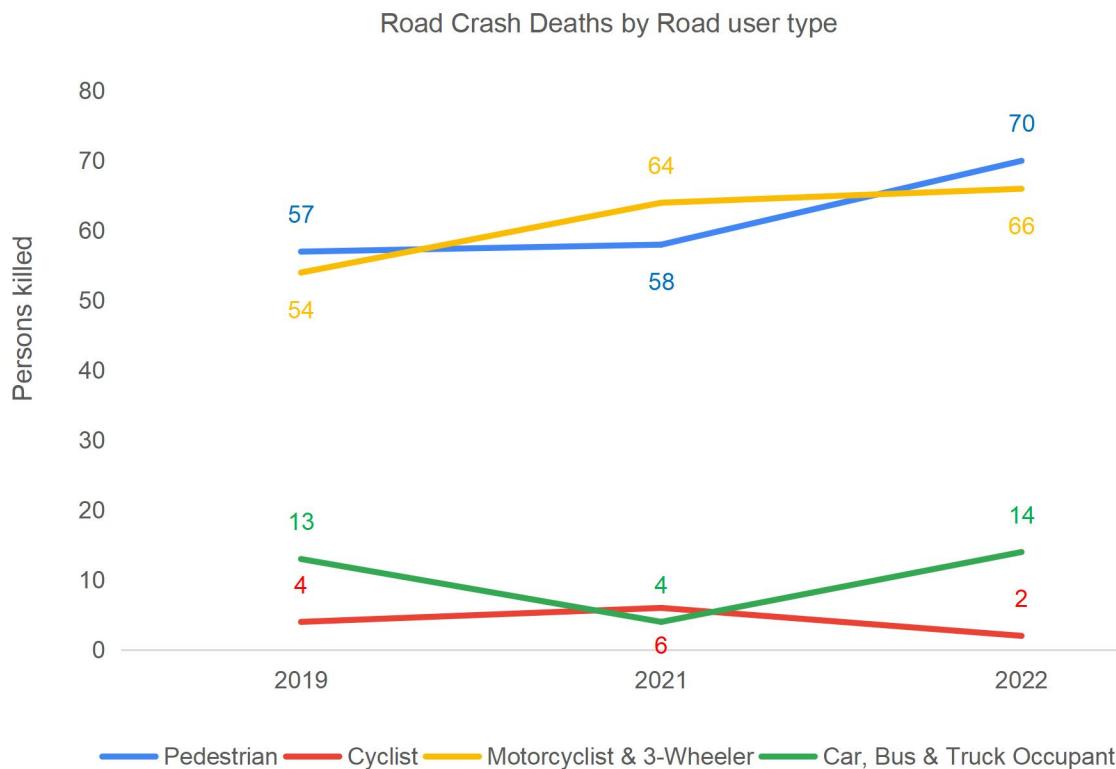


Figure 2: Road crash deaths by road user type

*Note: 3- Wheelers include Auto rickshaw and E-rickshaw

Motorcyclists, auto rickshaw occupants and pedestrians formed a majority of persons killed in road crashes in the North West district across all three years. Between the highlighted three categories, the pedestrian fatalities surpassed motorcyclist & auto rickshaw occupants' fatalities in 2019 and 2022.

A.1.3 : ROAD CRASH DEATHS BY MONTHS

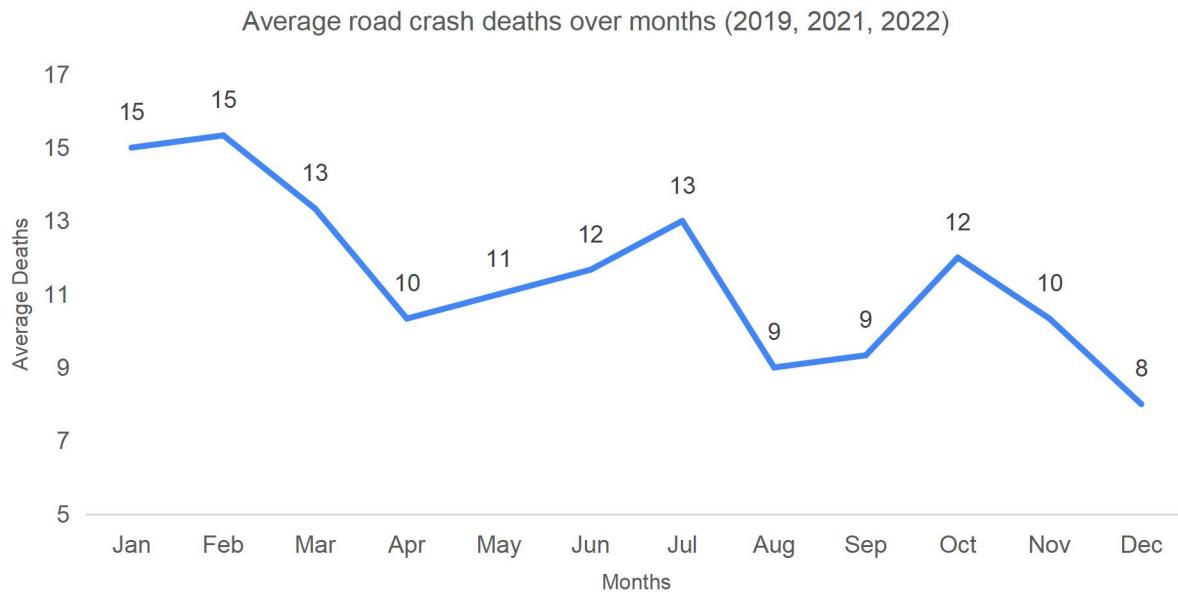


Figure 3: Average Road crash deaths over months

January and February witnessed the highest number of persons killed followed by March and July however, there is no discernible pattern of fatalities by month.

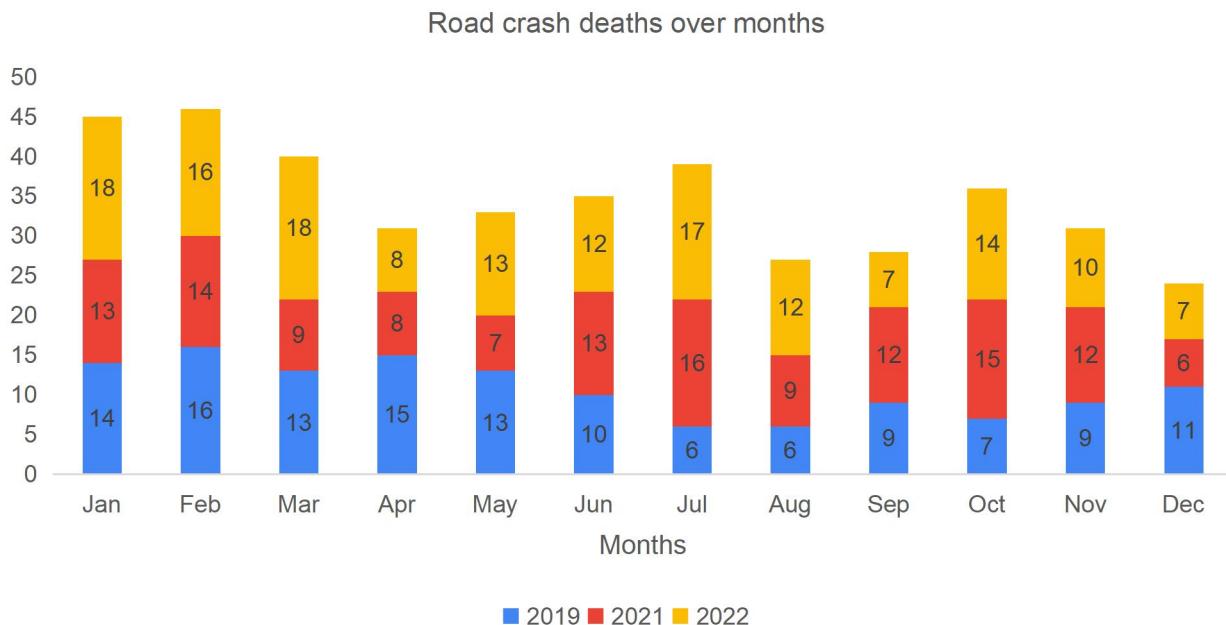


Figure 4: Road crash deaths over months

A.1.4 : ROAD CRASH DEATHS BY TIME AND DAY OF WEEK

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
02:00-06:00	5	5	1	8	8	11	6	44
06:00-10:00	10	12	8	6	7	9	8	60
10:00-14:00	6	6	10	10	5	7	8	52
14:00-18:00	8	11	7	7	8	15	8	64
18:00-22:00	14	8	11	14	14	9	7	77
22:00-02:00	14	12	17	30	11	16	18	118
Total	57	54	54	75	53	67	55	415

Table 1: Road crash deaths by time and day of week

Twenty-eight percent of the total road crash deaths occurred at night between 10:00 pm to 2:00 am. Similarly, 34% of the total deaths occurred either on Thursdays or on Saturdays.

A.2: ROAD CRASH DEATHS BY AGE AND GENDER

A.2.1 : ROAD CRASH DEATHS BY GENDER

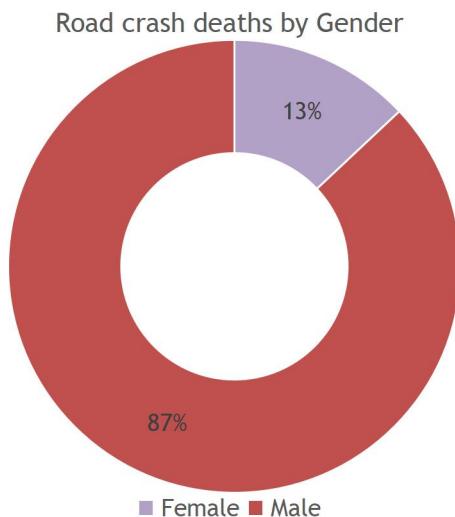


Figure 5: Road crash deaths by gender

A.2.2 : ROAD CRASH DEATHS BY AGE AND GENDER

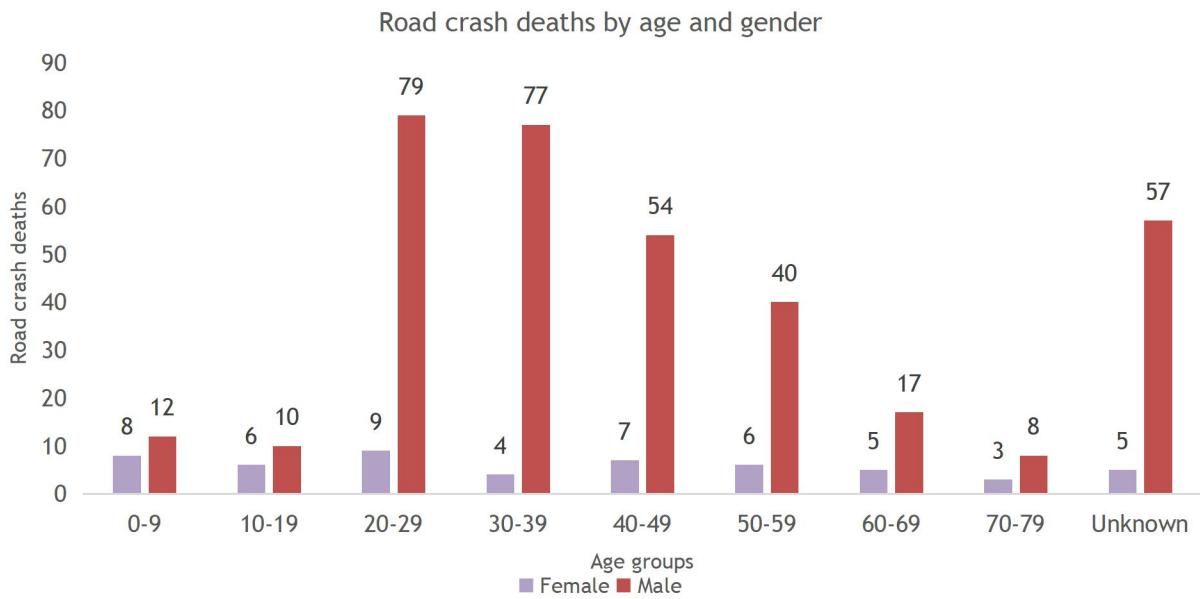


Figure 6: Road crash deaths by age and gender

Males had a higher number of fatalities (87%) compared to females. Among males, the fatalities were observed to be highest in the age group 30 to 40 years (37%), followed by those in the age group 15 to 29 years (30%).

A.3: ROAD CRASH DEATHS BY ROAD USER TYPES.

A.3.1 : TOTAL ROAD CRASH DEATHS BY ROAD USER TYPES (2019,2021,2022)

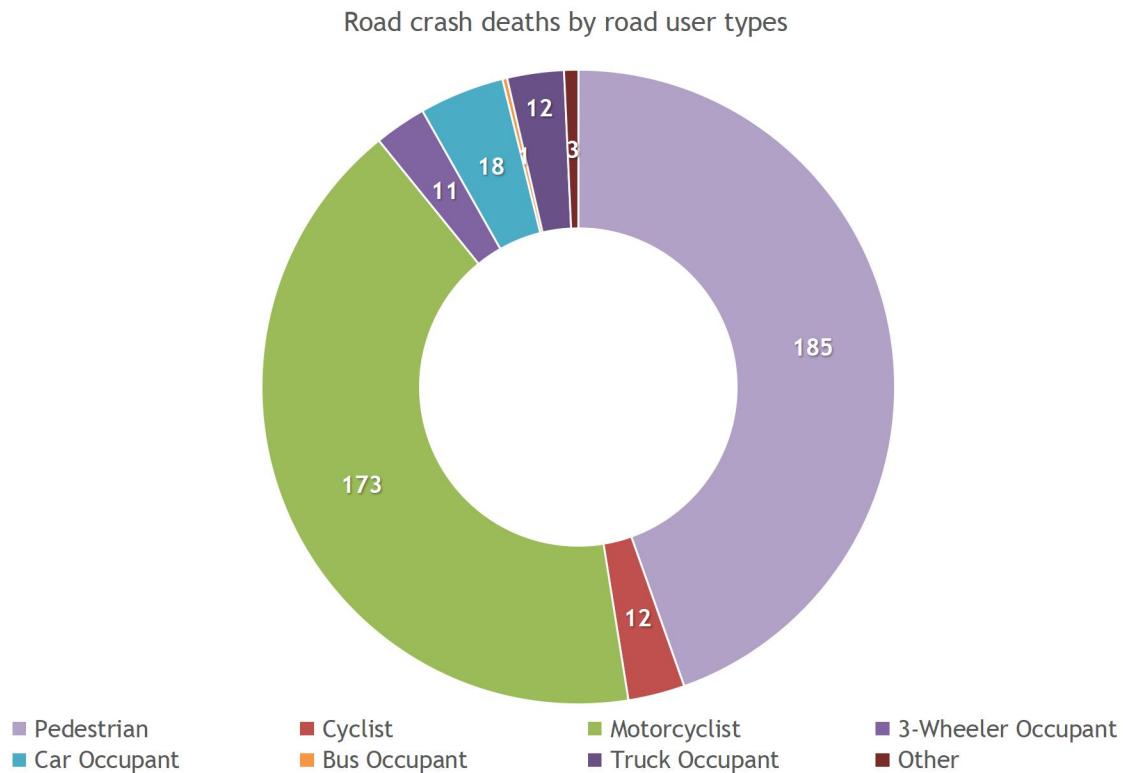


Figure 7: Road crash deaths by road user type

Note: Others include bus, cycle rickshaw and unknown vehicle occupants

Ninety percent of fatalities were among vulnerable road users (i.e., pedestrians, motorcyclists, cyclists, and auto rickshaw occupants). Out of this, forty four percent of road crash deaths in the North West district were among pedestrians, followed by motorcyclists (41%).

A.3.2 : WHO-HIT-WHO MATRIX

Victim Road User	Impacting Vehicle								
	Motorcycle	3-Wheeler	Car	Bus	Truck/ Tractor	Single Vehicle Crash	Other	Unknown	Total
Pedestrian	18	4	22	4	29	0	5	103	185
Cyclist	0	0	4	0	4	0	0	4	12
Motorcyclist	7	2	32	12	38	16	1	65	173
3-Wheeler Occupant	1	0	3	1	4	1	1	0	11
Car Occupant	1	0	5	1	5	4	0	2	18
Bus Occupant	0	0	0	0	0	0	1	0	1
Truck Occupant	0	0	2	1	5	2	1	1	12
Other	0	0	3	0	0	0	0	0	3
Total	27	6	71	19	85	23	9	175	415

Table 2: Who-hit-whom matrix

Among crashes where the impacting vehicle was known, pedestrians were found to be the most vulnerable category of road users. They were often hit by trucks or tractors followed by cars and motorcycles. Similarly, motorcyclists (the second most affected vulnerable road users) were often killed by trucks and cars. Hit-and-run crashes dominate both the categories of cases where the impacting vehicle was not known for 175 crashes.

A.4: HIT-AND-RUNS IN FATAL ROAD CRASHES

A.4.1 : PERCENTAGE OF HIT-AND-RUN AND NON-HIT-AND-RUN CASES

Percentage of Hit-and-Run and Non Hit-and-Run cases

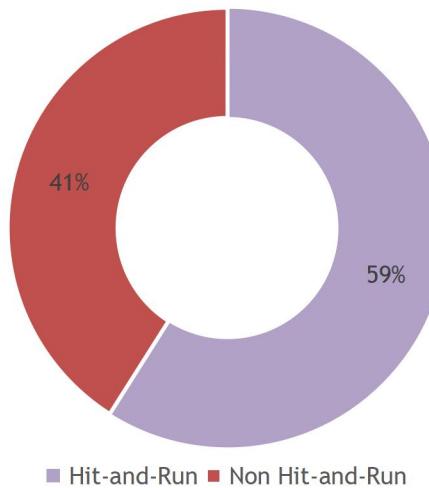


Figure 8: Percentage of hit-and-run and non-hit-and-run cases

Overall, three out of five crashes are hit-and-run cases. The high rate of hit-and-run cases is indicative of non-reporting of accused vehicles as well as non-reporting of crashes by the public.

A.4.2 : HIT-AND-RUN ROAD USER TYPES

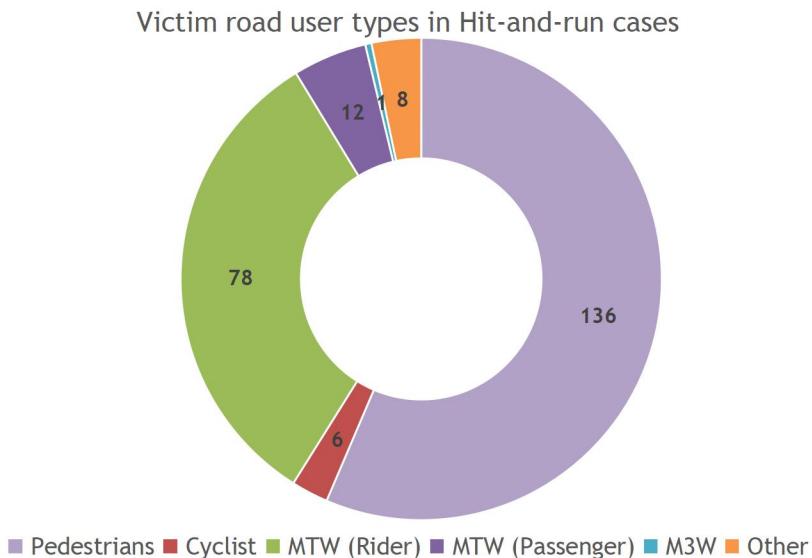


Figure 9: Victim Road user types in hit-and-run cases

A.5: ROAD CRASH HEATMAPS

A.5.1 : HEATMAP OF ALL ROAD CRASH DEATHS

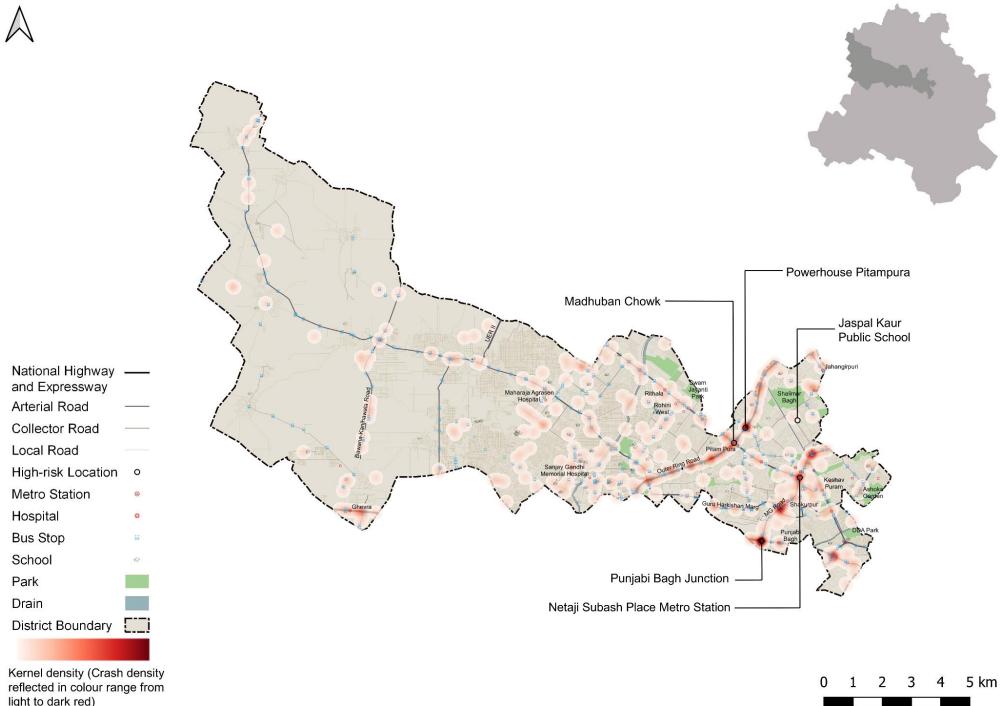


Figure 10: Heatmap of all road crash deaths

A.5.2 : HEATMAP OF ALL PEDESTRIAN DEATHS IN FATAL ROAD CRASHES

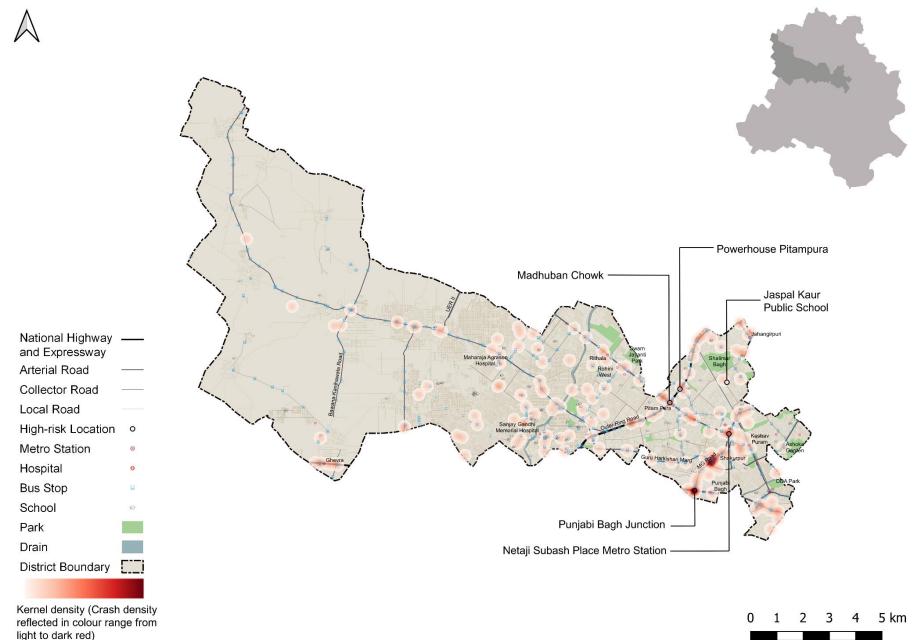


Figure 11: Heatmap of all pedestrian deaths in fatal road crashes

A.5.3 : HEATMAP OF ALL MOTORCYCLE (RIDER + PILLION) RELATED DEATHS

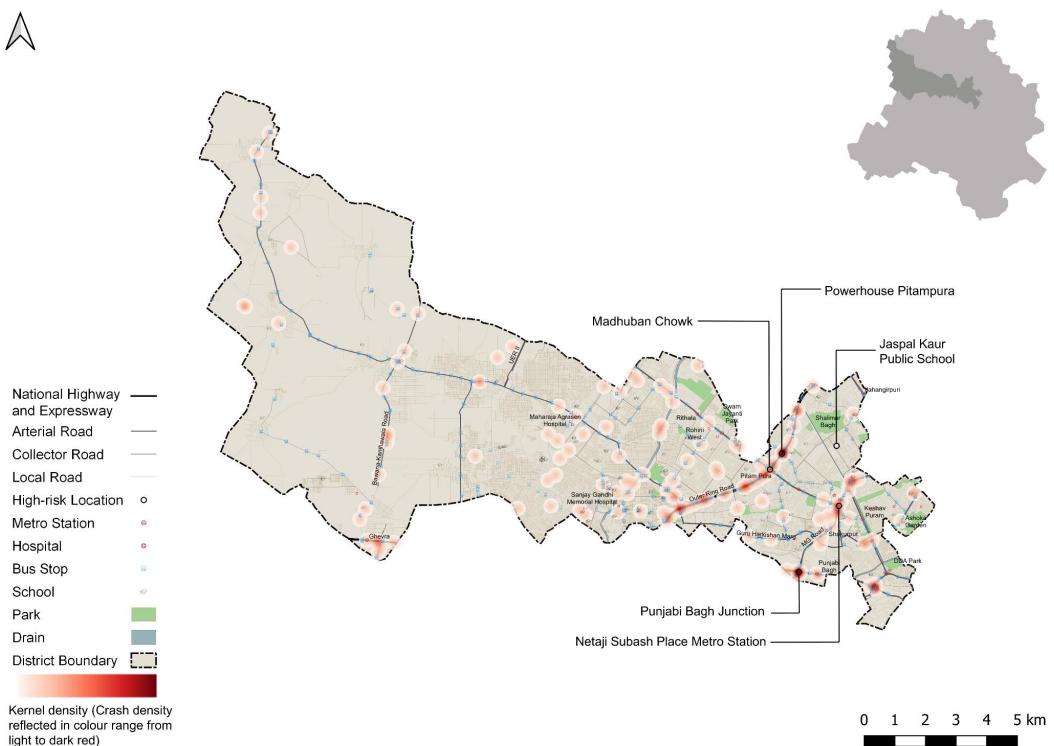


Figure 12: Heatmap of all motorcycle (rider + pillion) related deaths

A.6 : HIGH-RISK LOCATIONS

A.6.1 : LIST OF HIGH-RISK LOCATIONS

The following is a list of high-risk locations in the North West district which include the number of fatal crashes, hit-and-run crashes, and deaths. Punjabi Bagh Metro Station has the highest in all the three metrics out of all the identified locations. This is followed by Netaji Subhash Place Metro Station.

High Risk Location	Total fatal crashes	Total hit and run fatal crashes	Total persons killed
Punjabi Bagh metro station	16	9	16
Netaji Subhash Place Metro Station	10	7	10
Madhuban Chowk	10	7	10
Powerhouse Pitampura	8	4	8

Table 3: List of high risk corridors

A.6.2 : MAP OF ALL HIGH-RISK LOCATIONS

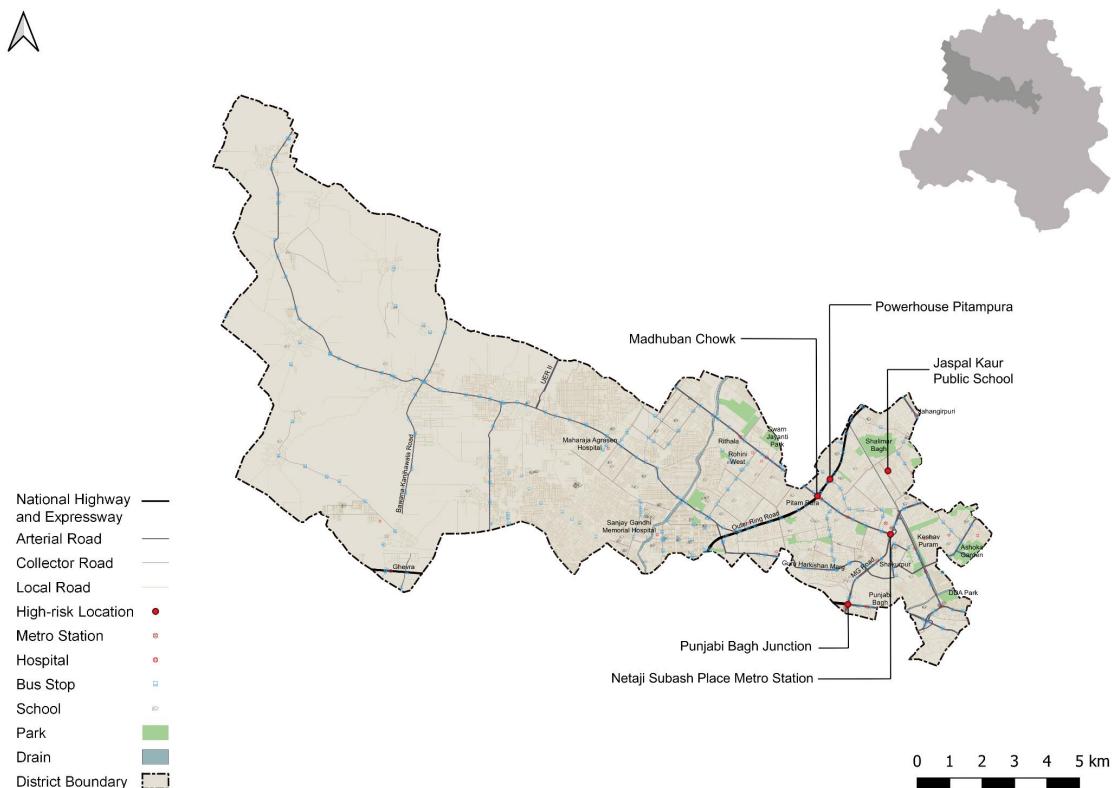


Figure 13: Map of all high-risk locations

A.6.3 : HIGH RISK CORRIDORS

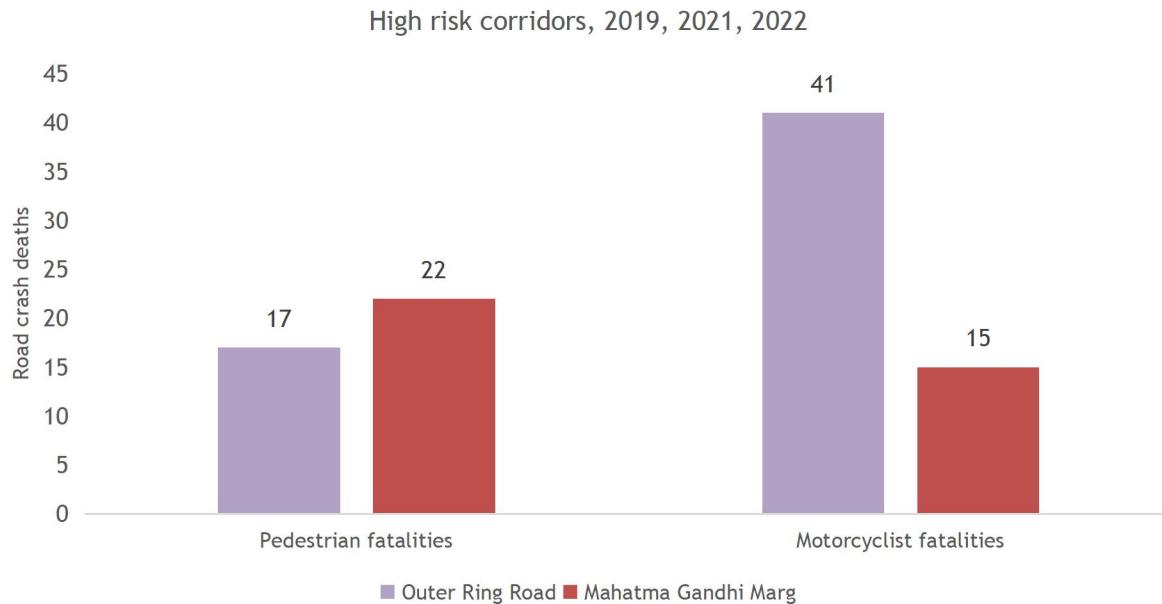


Figure 14: High risk corridors (2019, 2021, 2022)

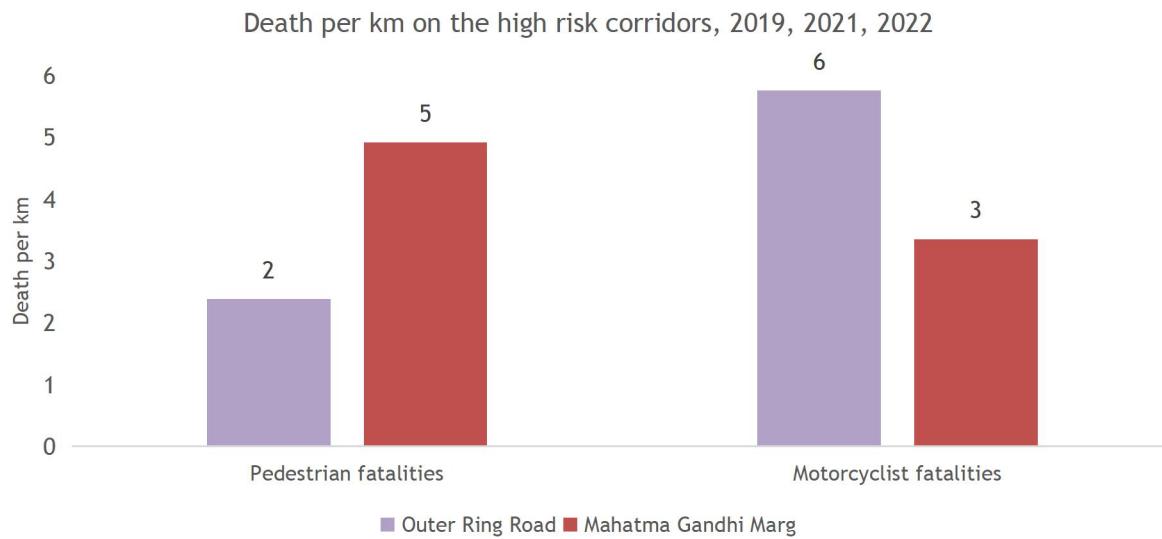


Figure 15: Deaths per km on the high risk corridors (2019, 2021, 2022)

Passing through the North West district, the Outer Ring Road is a seven km stretch and the Mahatma Gandhi Marg is a 4.5 km stretch. There are a total of 41 motorcyclist deaths and 17 pedestrian deaths on the Outer Ring Road. Similarly, there are 15 motorcyclist deaths and 22 pedestrian deaths in Mahatma Gandhi Marg. The above graph shows the deaths per km among motorcyclists and pedestrians. We can see that the motorcyclists are more vulnerable at Outer Ring Road when compared to Mahatma Gandhi Marg and pedestrians are more vulnerable at Mahatma Gandhi Marg when compared to the Outer Ring Road.

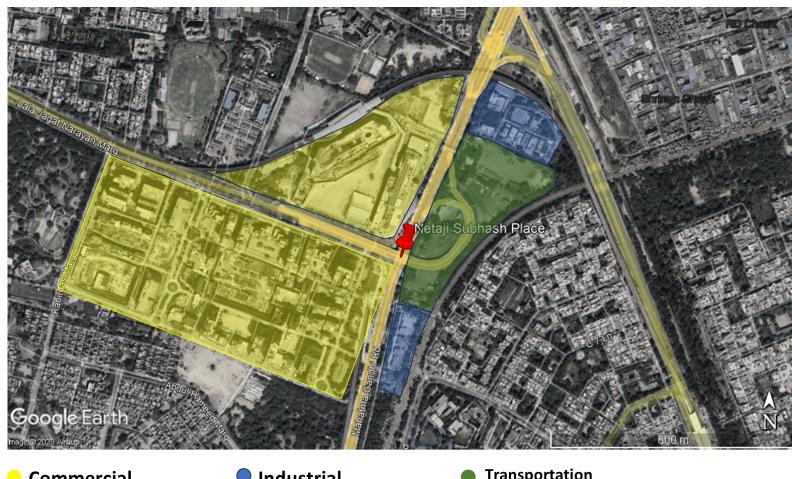
B. DATA TO ACTION

B.1: NETAJI SUBHASH PLACE

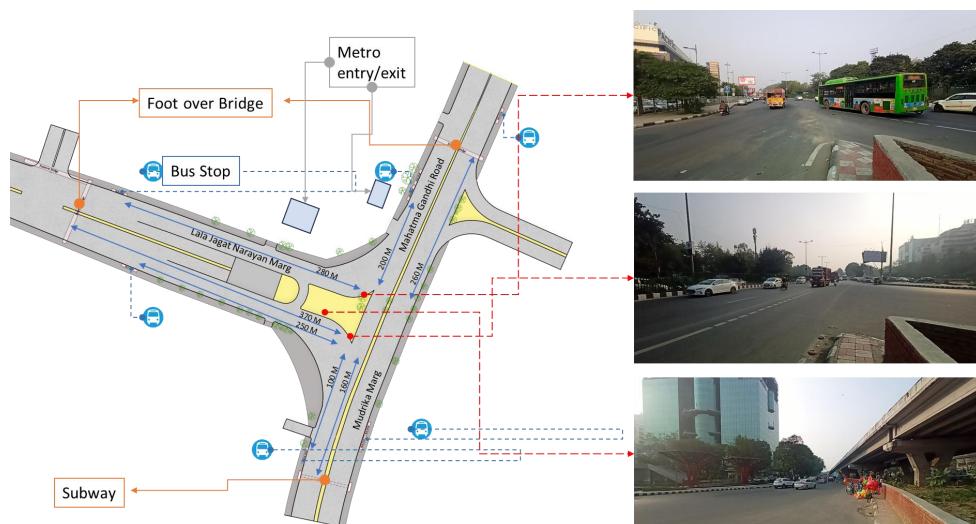
B.1.1 : GENERAL DESCRIPTION OF THE SITE

Netaji Subhash Place (Latitude: $28^{\circ} 41'34.72''N$, Longitude: $77^{\circ} 9'14.45''E$) is an unsignalized three-arm intersection with an interchange across a DTC bus terminal where Mahatma Gandhi Road and Lala Jagat Narayan Marg intersect. It is a major point for passengers between Pitampura and Azadpur. This area is served by the red line, and the nearest metro station is the Netaji Subhash Place metro station. The pink line also intersects the Netaji Subhash Place intersection with Shakarpur and Shalimar Bagh nearby. The nearby land uses are commercial, industrial and transportation (the DTC bus terminal).

B.1.2 : EXISTING LAND USE



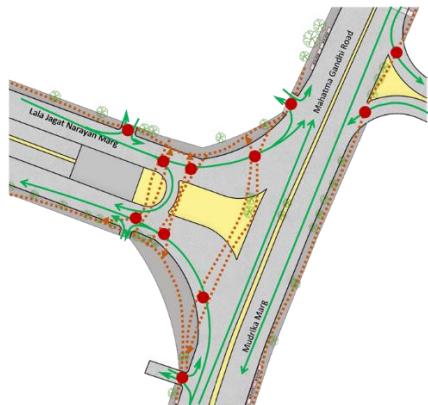
B.1.3 : EXISTING SCENARIO



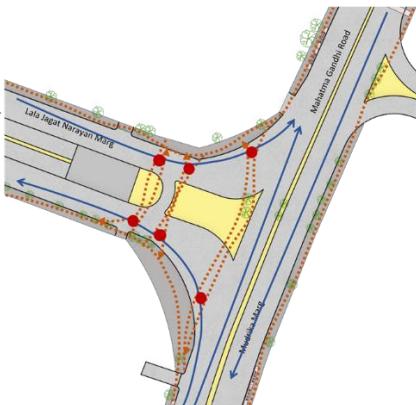
Note: The drawing presented above is a conceptual drawing and is not to scale.

B.1.4 : CONFLICT POINTS

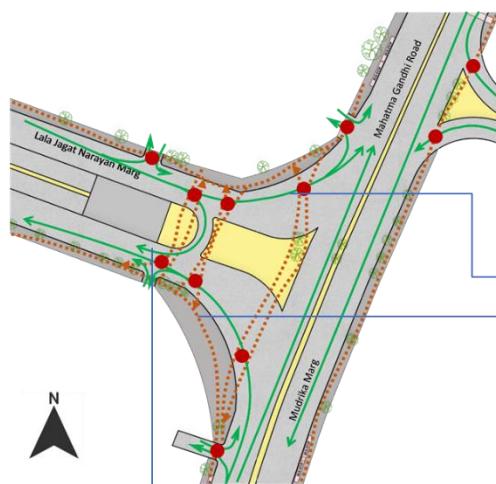
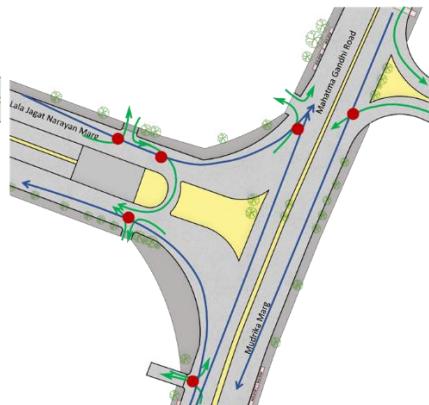
Cars/2W vs Pedestrians;



Buses vs Pedestrian;



Cars/2W vs Buses



Conflict Points

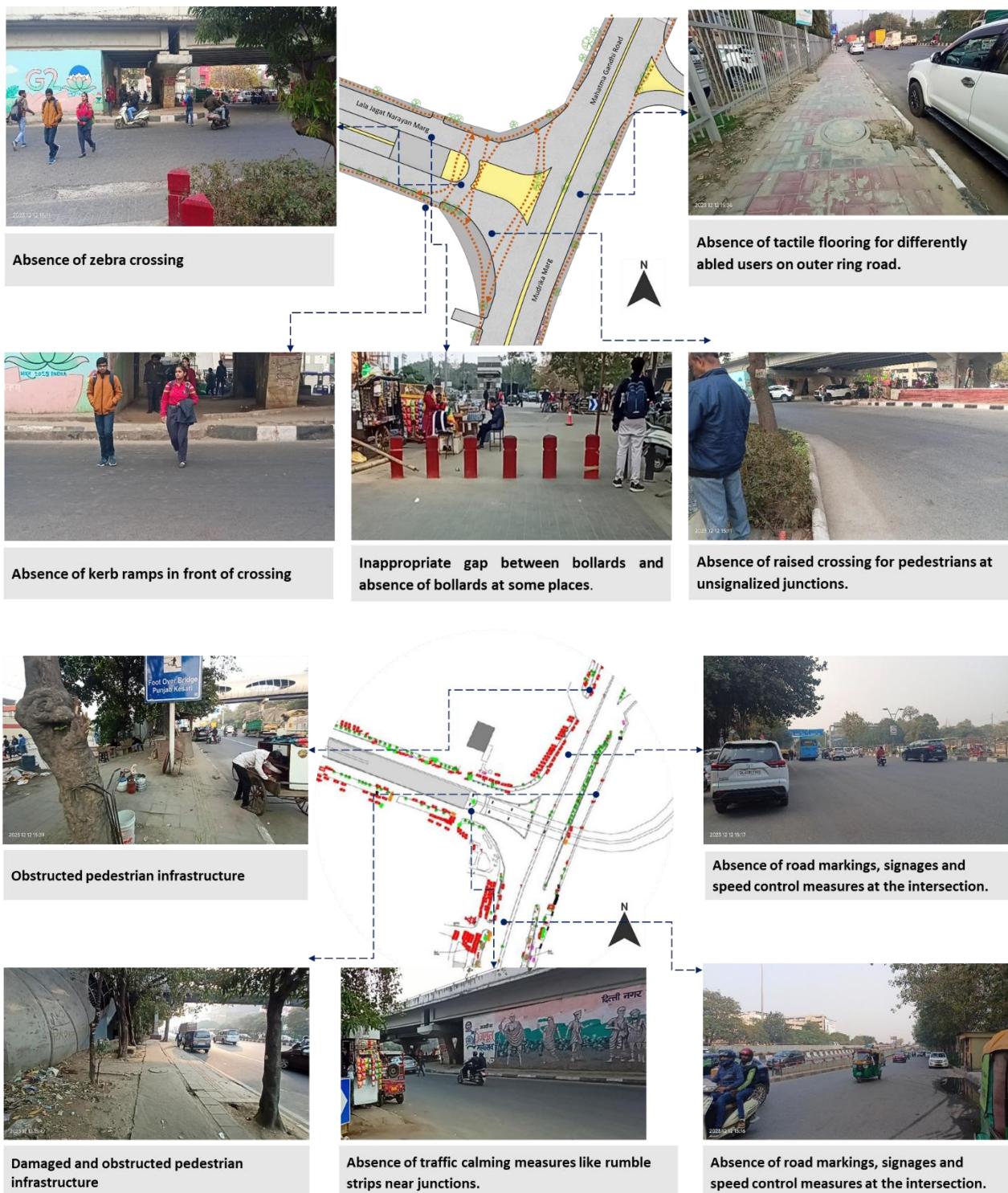


Conflict Points



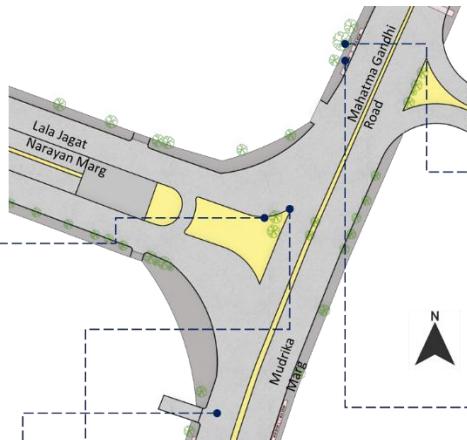
Conflict Points

B.1.5 : ISSUES IDENTIFIED





Absence of delineators and reflectors on the median and carriageway edges.



Visual hindrance by excessive growth of trees, hiding the signages and obstructing the driver's vision.



Absence of segregated cycle tracks on arterial roads.

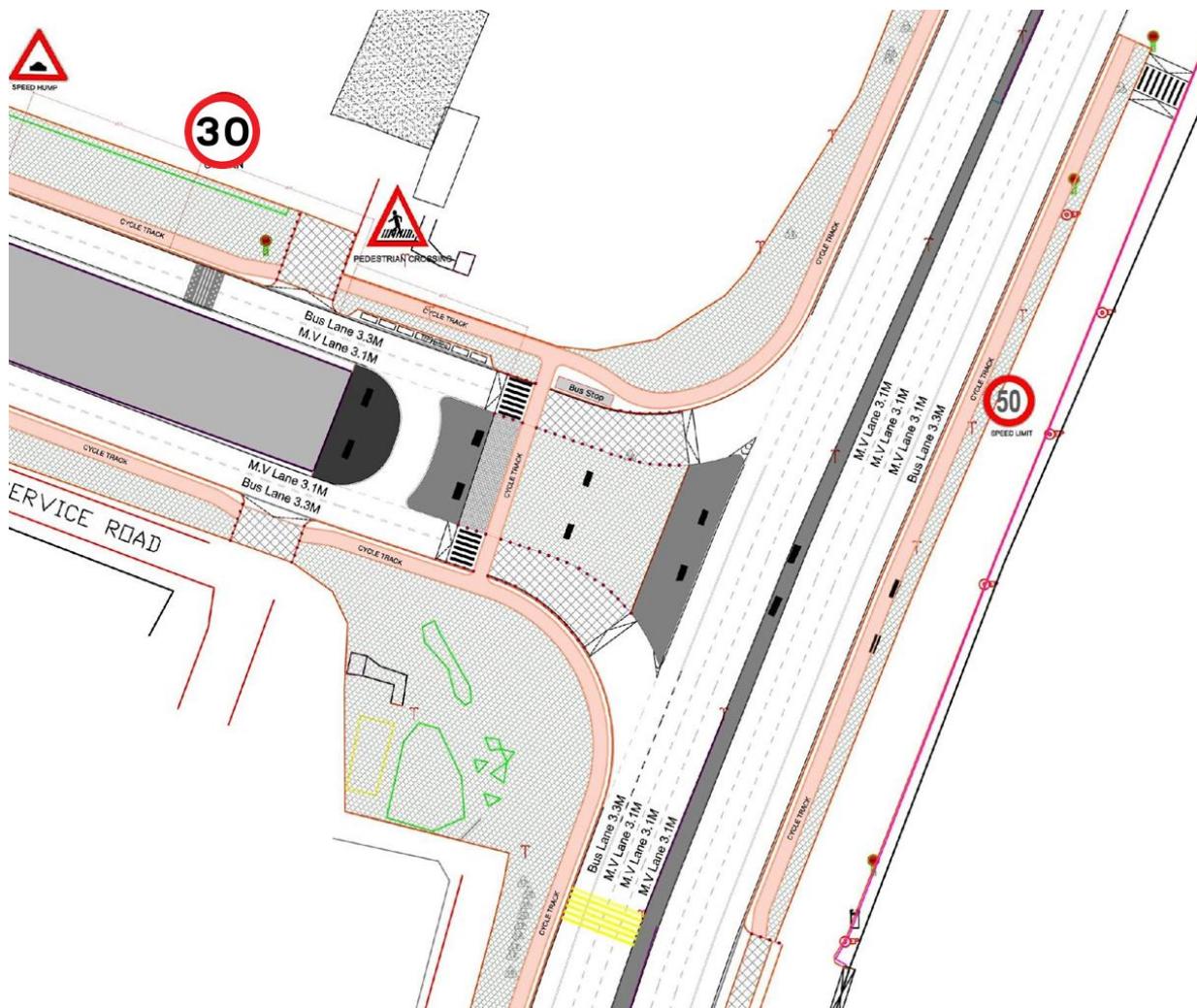


Absence of chevron marking.



Absence of bus stop marking at bus stop.

B.1.6 : PROPOSED DESIGN



1. Provision of kerb ramps for the accessibility of differently abled users (as per IRC:103-2022).
2. Bollards should be provided in front of at-grade zebra crossing (as per IRC code:103-2022).
3. Provision of zebra crossing (as per IRC:35-2015, Pg. 107).
4. Provision of tactile pavers for differently abled on footpath (as per IRC 103-2022, Pg. 18).
5. Provision of raised crossing to slow down traffic and for the safety of pedestrians at crossing. As per IRC: 99-2018, Pg. 25 raised crossing with a height of 150mm and slope of 1:10 is recommended.
6. User- friendly footpaths must be provided, at a height of 150mm from road and a minimum clear width of 1.8m - and/or in conformation with the guidelines given in IRC:103-2022, Pg. 8).
7. Typical road markings for road intersections should be provided (as per IRC:35-2015 Annexure: A, Pg. 101).
8. Signages (as per IRC: 67-2022).
9. Provision of rumble strip (as per IRC code 99-2018, Pg. 10).
10. Delineators and reflectors must be provided on the median and carriageway edges for avoiding accidents and for alerting users at night (as per IRC:79-2019, Pg. 03).

11. Provision of dedicated cycle track to separate the motor traffic and the cyclists (as per IRC: 11-2015 Table No.4, Pg.-7).
12. Any kind of vegetation must be removed at junctions for a length of 120 m on either side of the opening to afford complete visibility to drivers (as per IRC: SP: 88-2019, Pg. 44).
13. Provision of chevron marking at intersection (as per IRC: 35-2015 Pg. 30) and hazard markers or flexible object markers at bull noses (as per IRC: 79-2018 Pg. 11 & 12).
14. Provision of bus stop marking (as per page no. 79 IRC:35-2015).

B.1.7 : SUMMARY BUDGET ESTIMATES

S.No	Component	Details	Notes	Rate (per sq.m.)	Cost (INR)	Cost (INR, crores)
A	CIVIL WORK					
A.1	Footpath (Primary, Secondary including other Flooring area)	2m to 3m wide segregated footpath with tactile pavers	Providing and laying of footpath 2m to 3m wide, including earthwork and base layer - PCC, GSB and finishing material.	2594	1,40,44,129	1.404
A.2	Raised Crossing	Raised crossing with 80mm thick pavers and DQ stone surface	Providing and laying Raised crossing with 80 mm thk pavers blocks, and DQ stone including Earth work and Base layers- PCC (M15), RCC (M30 Design mix) & GSB etc.	4290	52,03,783	0.520
A.3	Cycle Infrastructure	2.5m wide segregated cycle track	Providing and laying cycle track (2.5mt wide segregated) including Earth work and Base layers- PCC (M15), RCC (M40 Design mix) & GSB etc. also thermoplastic paint for marking and cycle symbol and spring post etc	3551	91,25,057	0.913
A.4	CC Items (Kerbs, Pipe, etc)	Kerb stones, Bollards, Kerb Channels etc.	Providing and fixing Kerbs, Bollards, and Kerb Channel etc. in CC.		23,43,315	0.234
A.5	Signages	Mandatory, Cautionary and Informatorily Sign Boards of different sizes	Providing and fixing Signage Mandatory, Cautionary and informatorily sign board inculding all the fixing and labours etc.		59,485	0.006
A.6	Marking	Thermoplastic Paint Marking (Edge lines, Centre Line, Lane Marking, Hazard Marking, Chevron, Zebra Crossing,	Providing and applying road marking strips (retro- reflective) of specified shade/ colour using hot thermoplastic material for road marking .	748	5,39,912	0.054

S.No	Component	Details	Notes	Rate (per sq.m.)	Cost (INR)	Cost (INR, crores)
		Bar Marking, etc)				
A.7	Special Zones	Provision of Sitting Bollards, CC Benches, GRC Jali, Pergola, Dustbin etc.	Miscellaneous items- Provision of Sitting Bollards, CC Benches, GRC Jali, Pergola, Dustbin etc. complete items- including foundation and fixing etc.		1,22,175	0.012
A.8	Brick Work		Brick work with common burnt clay F.P.S. (non-modular) bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:4 (1 cement: 4 coarse sand)	7370.65/CUM	2,94,826	0.029
A.9	Steel Reinforcement for RCC work		Steel reinforcement (in per kg) for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete up to plinth level. Thermo-Mechanically Treated bars of grade Fe-500D or more	107.85/kg	43,140	0.004
A.10	Pavement Surface Dressing	Pavement of Bitumen layer on existing road surface	Surface dressing on old surface with hot bitumen of grade VG - 10	175.10 / sq.m	4,00,104	0.040
A.11	Safety Management Equipment (as per design requirement)	Provision of Delineator Post, Spring Post, Cat eye/studs etc.	Miscellaneous items for Safety Management Equipment (as per design requirement) - Provision of Delineator Post, Spring Post, Cat eye/studs etc.- including foundation and fixing etc.		1,20,886	0.012

S.No	Component	Details	Notes	Rate (per sq.m.)	Cost (INR)	Cost (INR, crores)
A.12	Bus Shelter	10.5mX2.5m Bus Shelter (Stainless Steel Structure)			18,00,000	0.180
	SUB TOTAL CIVIL WORK (A)				3,40,96,810	3.410
B	Drainage, Irrigation & Plumbing	(Drainage items based on design proposal)	Drainage, Irrigation & Plumbing work @ 20% of the cost of Civil work	20%	68,19,362	0.682
C	Electrical Work	(Light poles, junction box, other electrical works proposed based on design proposal)	Electrical work @25% of the cost of Civil work	25%	85,24,202	0.852
D	Horticulture Work	(Landscape items based on design proposal)	Horticulture work @ 15% of the cost of Civil work	15%	51,14,521	0.511
E	Dismantling / Demolition	--	Dismantling work @ 15% of the cost of Civil work	15%	51,14,521	0.511
F	Work Zone Safety & Management	--	Work zone Management @ 5% of the cost of Civil work	5%	17,04,840	0.170
PART 1	SUB TOTAL PART 1 (A+B+C+D+E+F)				6,13,74,258	6.137

S.No	Component	Details	Notes	Rate (per sq.m.)	Cost (INR)	Cost (INR, crores)
G	Design Services & Support	--	Design Consultancy (Preparation of Drawings, BOQ support, Work Zone plan, Site Supervision, Community Engagement & Liaison, Change Management @ 2% - 8% of the cost of Civil work.	2%	12,27,485	0.123
H	Survey Cost	--	Survey Cost (Total Station Survey, underground services, tree demarcation, girths, level differences, steps etc @ (80,000 per junction - 250m on each arm)	80000	80,000	0.008
PART 2	SUB TOTAL PART 2 (PART 1 + G +H)				6,26,81,743	6.268
J	Contingencies '2.5%	--	Contingencies (@2.5%)		15,67,044	0.157
I	GST ('@18%)	--	GST @18%		1,15,64,782	1.156
FINAL	GRAND TOTAL (PART 2 + J + I)				7,58,13,568	7.581

Notes:

- This is a preliminary estimate. Final costing to be evaluated & approved by road owning agency
- DSR 2023 has been followed for all rates. Market Rate and Costing from part PWD projects has been included for certain items
- Cost of Drainage, Irrigation, Plumbing has been calculated at 20% of the civil work cost
- Cost of Electrical Work can be calculated at 20% - 25 % of the civil work cost
- Cost of Horticulture has been calculated at 15% of the civil work cost
- Cost of Dismantling has been calculated at 15% of the civil work cost

- Cost of Work Zone Management has been calculated at 5% of the civil work cost
- Cost for Design Support can range from 2% - 8%, can vary from site to site. This should include Technical Assistance on drawings, 3D supports, Site Supervision, Change management
- Bus Shelter has been calculated at 18 L per shelter; can be changed as per design specific cost
- In case of new items specific to design, please add relevant rows in detail budget estimation and include the same in the budget summary under relevant head.

B.2 : PUNJABI BAGH JUNCTION

B.2.1 : GENERAL DESCRIPTION OF THE SITE

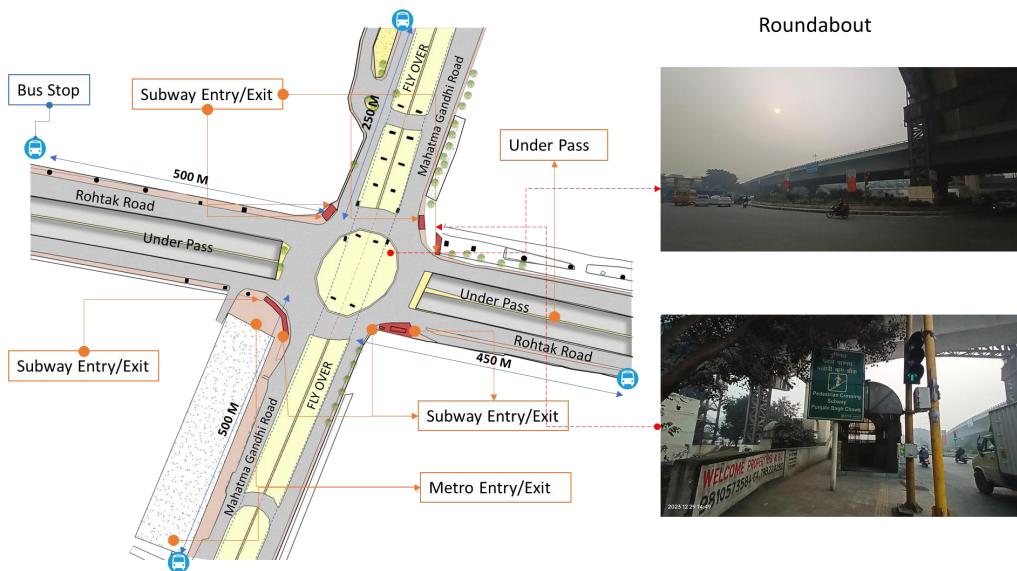
Punjabi Bagh junction (Latitude: $28^{\circ} 40' 25.67''\text{N}$, Longitude: $77^{\circ} 8' 24.37''\text{E}$) is a grade-separated, signalised 4 arm junction/roundabout where the Mahatma Gandhi Road and Rohtak Road intersect. It is a major interchange for the passengers coming to Delhi from Rohtak side. The nearest metro station is Punjabi Bagh West on the pink line. The green line crosses the intersection with Shivaji Park and Punjabi Bagh metro stations nearby.

B.2.2 : EXISTING LAND USE



● Commercial ● Transportation ● Residential

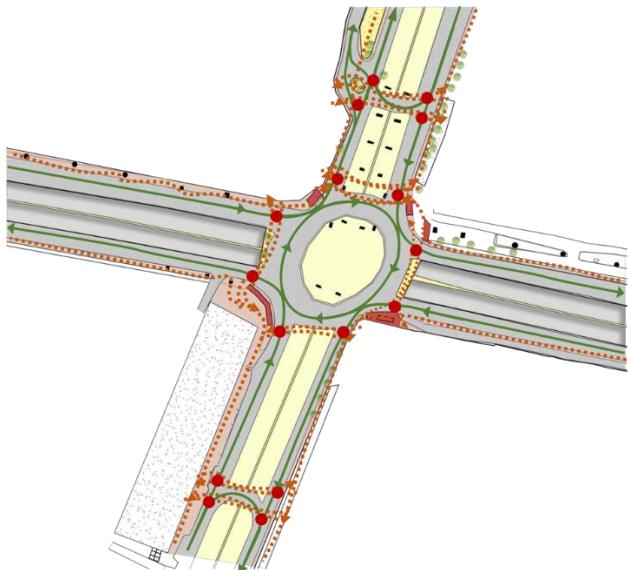
B.2.3 : EXISTING SCENARIO AROUND THE SITE



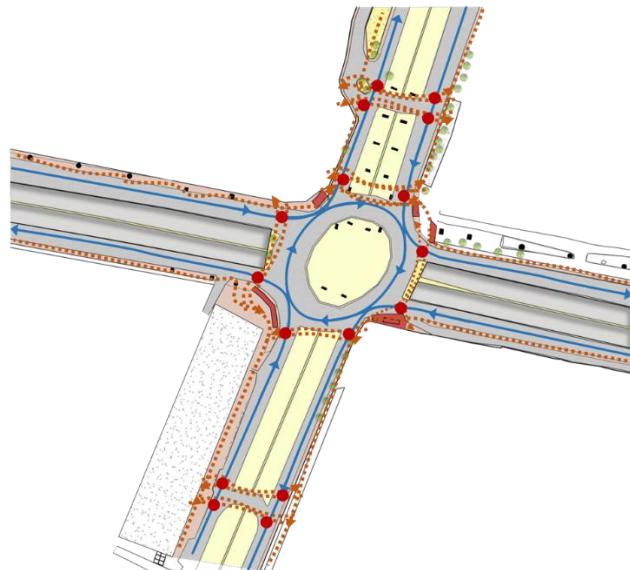
Note: The drawing presented above is a conceptual drawing and is not to scale.

B.2.4 : CONFLICT POINTS

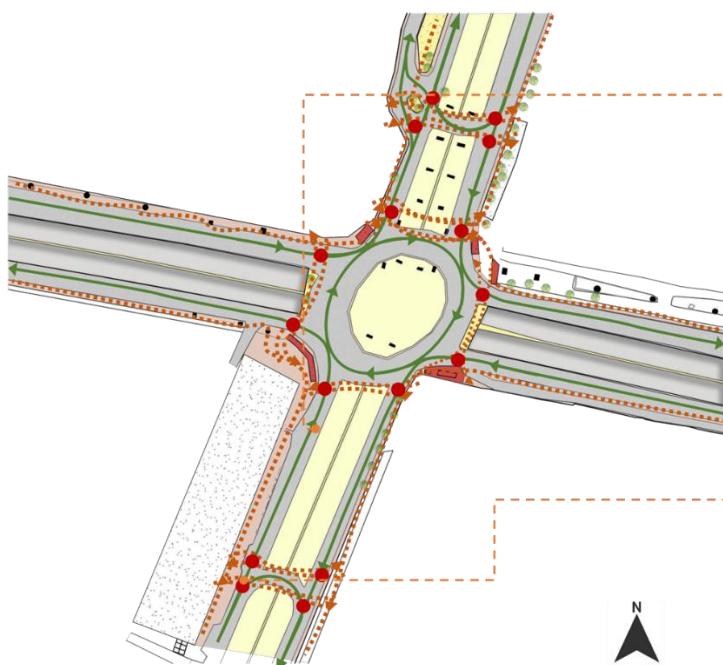
Car/ 2wheeler vs Pedestrian



Bus vs Pedestrian



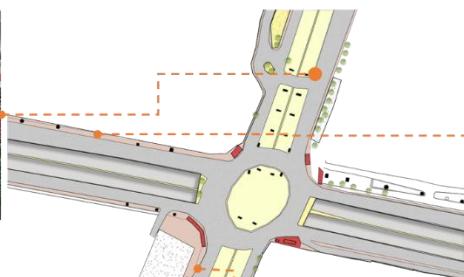
- Conflict points emerging due to absence of pedestrian crossing and refuge island.
- The geometry of junction is also one of the main reasons for conflict points.



B.2.5 : ISSUES IDENTIFIED



Absence of zebra crossing



Absence of tactile flooring for differently abled users on outer ring road



Absence of kerb ramps in front of crossing



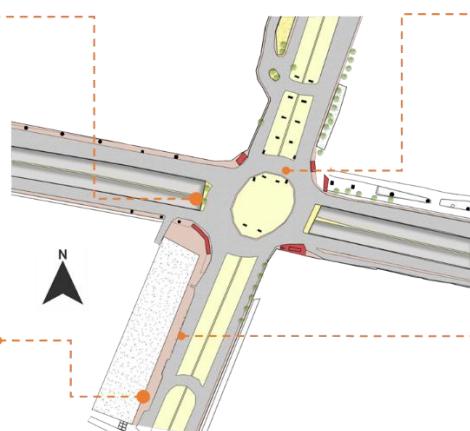
Inappropriate gap between bollards and absence of bollards at some places



Damaged footpath



Damaged pedestrian infrastructure



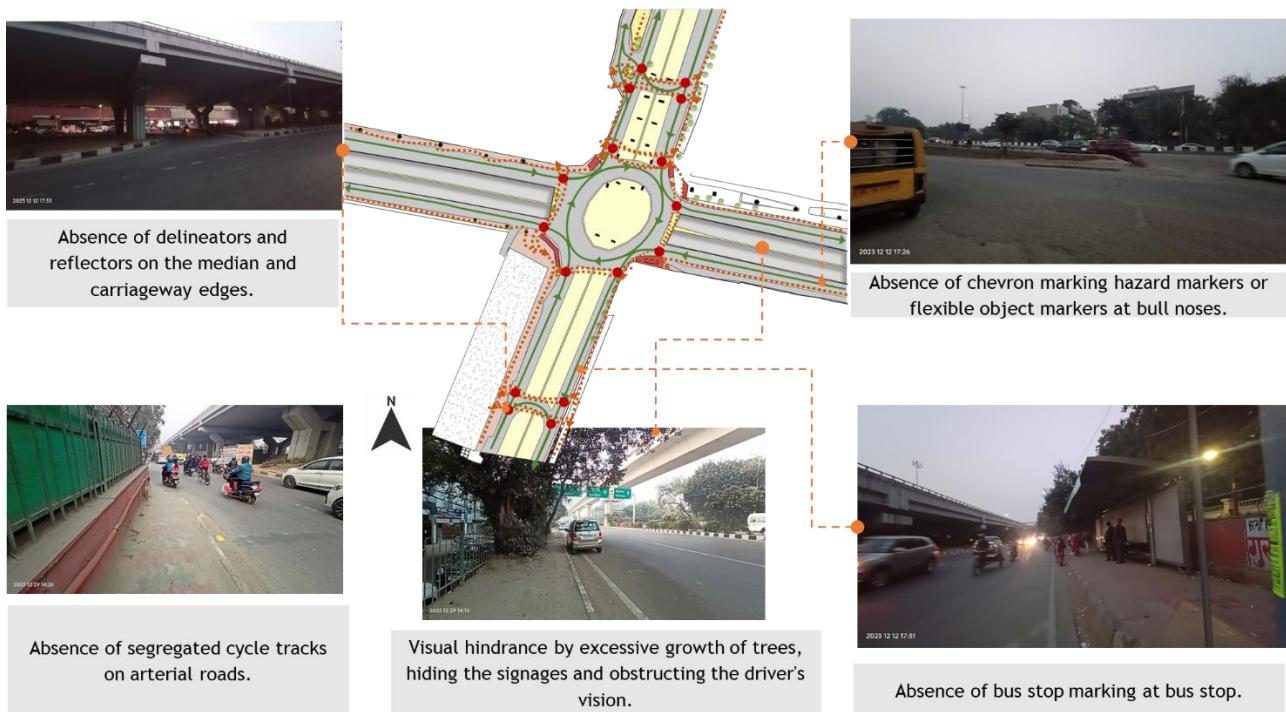
Absence of road markings, signages and speed control measures at the intersection.



Obstructed pedestrian infrastructure

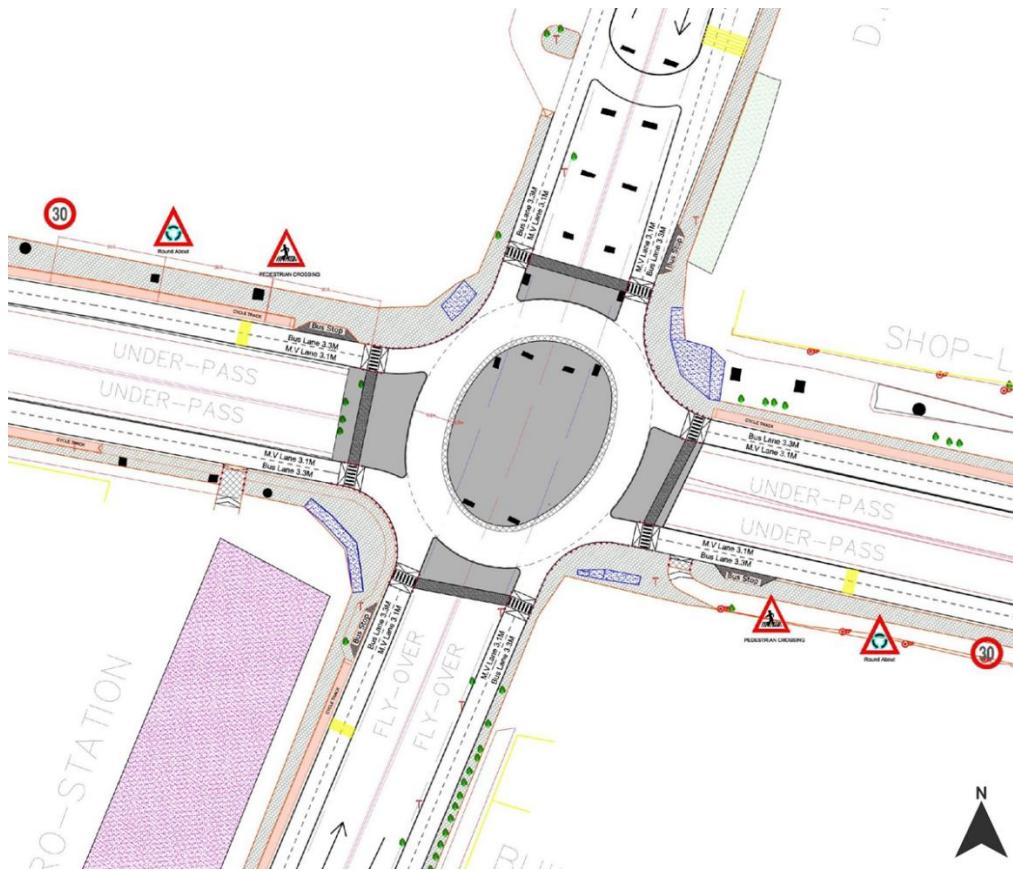


Absence of traffic calming measures like rumble strips near junctions (to control the speed of vehicles).



1. Absence of at-grade pedestrian infrastructure at the junction, making the pedestrians extremely vulnerable among the high-speed traffic movement.
2. There are no bus stops near the junction; they're about 400 to 500 meters away on each road leading from the junction.
3. Damaged and obstructed pedestrian infrastructure on each arm, most of the pedestrian is obstructed with columns.
4. Absence of tactile flooring for differently abled users.
5. Absence of traffic calming near junctions (to control the speed of vehicles).
6. Absence of road markings, signages and speed control measures at the intersection.
7. Absence of delineators and reflectors on the median and carriageway edges.
8. Absence of chevron marking and hazard markers or flexible markers at bull noses.
9. Absence of segregated cycle tracks on arterial roads.
10. Visual hindrance by excessive growth of trees, hiding the signages and obstructing the driver's vision.

B.2.6 : PROPOSED DESIGN



- 1) The junction is redesigned for the speed of 30 km/hr to ensure the safety
- 2) Proposed at-grade pedestrian infrastructure to increase the accessibility and safety for pedestrians.
- 3) Provision of raised crossing and extended Median Refuge islands on all four sides to slow down traffic for safety of pedestrians (as per IRC: 99-2018)
- 4) Dedicated 2.5m wide cycle track to separate the motor traffic and the cyclists (as per IRC: 11-2015)
- 5) Proposed new bus stops near the junction (30m to 40m) on each approaching road to reduce the pedestrian crossing movement
- 6) Redesigned the geometry of roundabout and corrected the turning radius and road width to reduce the conflict area at intersection
- 7) Road Markings (as per IRC 35).
- 8) Installation of signages - Speed Limit, stop sign, pedestrian crossing and other necessary Signages.
- 9) Provision of rumble strip to slow down the through traffic (as per IRC code 99-2018, Pg. 10)

B.2.7 : SUMMARY DESIGN ESTIMATES

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
A	CIVIL WORK					
A.1	Footpath (Primary, Secondary including other Flooring area)	2m to 3m wide segregated footpath with tactile pavers	Providing and laying of footpath 2m to 3m wide, including earthwork and base layer - PCC, GSB and finishing material.	2559	1,75,50,428	1.755
A.2	Raised Crossing	Raised crossing with 80mm thick pavers and DQ stone surface	Providing and laying Raised crossing with 80 mm thk pavers blocks, and DQ stone including Earth work and Base layers- PCC (M15), RCC (M30 Design mix) & GSB etc.	3999	7,39,786	0.074
A.3	Cycle Infrastructure	2.5m wide segregated cycle track	Providing and laying cycle track (2.5mt wide segregated) including Earth work and Base layers- PCC (M15), RCC (M40 Design mix) & GSB etc. also thermoplastic paint for marking and cycle symbol and spring post etc	3621	45,54,781	0.455
A.4	CC Items (Kerbs, Pipe, etc)	Kerb stones, Bollards, Kerb Channels etc.	Providing and fixing Kerbs, Bollards, and Kerb Channel etc. in CC.		22,94,219	0.229
A.5	Signages	Mandatory, Cautionary and Informatory Sign Boards of different sizes	Providing and fixing Signage Mandatory, Cautionary and informative sign board including all the fixing and labours etc.		96,731	0.010
A.6	Marking	Thermoplastic Paint Marking (Edge lines, Centre Line, Lane Marking, Hazard Marking, Chevron,	Providing and applying road marking strips (retro- reflective) of specified shade/ colour using hot thermoplastic material for road	748	5,83,284	0.058

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
		Zebra Crossing, Bar Marking, etc)	marking.			
A.7	Special Zones	Provision of Sitting Bollards, CC Benches, GRC Jali, Pergola, Dustbin etc.	Miscellaneous items- Provision of Sitting Bollards, CC Benches, GRC Jali, Pergola, Dustbin etc. complete items- including foundation and fixing etc.		1,43,470	0.014
A.8	Brick Work		Brick work with common burnt clay F.P.S. (non-modular) bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:4 (1 cement : 4 coarse sand)	7370.65/CUM	5,89,652	0.059
A.9	Steel Reinforcement for RCC work		Steel reinforcement (in per kg) for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.Thermo-Mechanically Treated bars of grade Fe-500D or more	107.85/kg	86,280	0.009
A.10	Pavement Surface Dressing	Pavement of Bitumen layer on existing road surface	Surface dressing on old surface with hot bitumen of grade VG - 10	175.10 / sq.m	19,56,567	0.196
A.11	Safety Management Equipment (as per design requirement)	Provision of Delineator Post, Spring Post, Cat eye/studs etc.	Miscellaneous items for Safety Management Equipment (as per design requirement) - Provision of Delineator Post, Spring Post, Cat eye/studs etc.- including foundation and fixing etc.		2,12,100	0.021

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
A.12	Bus Shelter	10.5mX2.5m Bus Shelter (Stainless Steel Structure)			72,00,000	0.720
	SUB TOTAL CIVIL WORK (A)				3,60,07,297	3.601
B	Drainage, Irrigation & Plumbing	(Drainage items based on design proposal)	Drainage, Irrigation & Plumbing work @ 20% of the cost of Civil work	20%	72,01,459	0.720
C	Electrical Work	(Light poles, junction box, other electrical works proposed based on design proposal)	Electrical work @25% of the cost of Civil work	25%	90,01,824	0.900
D	Horticulture Work	(Landscape items based on design proposal)	Horticulture work @ 15% of the cost of Civil work	15%	54,01,095	0.540
E	Dismantling / Demolition	--	Dismantling work @ 15% of the cost of Civil work	15%	54,01,095	0.540
F	Work Zone Safety & Management	--	Work zone Management @ 5% of the cost of Civil work	5%	18,00,365	0.180
PART 1	SUB TOTAL PART 1 (A+B+C+D+E+F)				6,48,13,135	6.481

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
G	Design Services & Support	--	Design Consultancy (Preparation of Drawings, BOQ support, Work Zone plan, Site Supervision, Community Engagement & Liaison, Change Management @ 2% - 8% of the cost of Civil work.	2%	12,96,263	0.130
H	Survey Cost	--	Survey Cost (Total Station Survey, underground services, tree demarcation, girths, level differences, steps etc @ (80,000 per junction - 250m on each arm)	80000	80,000	0.008
PART 2	SUB TOTAL PART 2 (PART 1 + G +H)				6,61,89,398	6.619
J	Contingencies '2.5%	--	Contingencies (@2.5%)		16,54,735	0.165
I	GST('@18%)	--	GST @18%		1,22,11,944	1.221
FINAL	GRAND TOTAL (PART 2 + J + I)				8,00,56,077	8.006

Notes:

- This is a preliminary estimate. Final costing to be evaluated & approved by road owning agency.
- DSR 2023 has been followed for all rates. Market Rate and Costing from part PWD projects has been included for certain items.
- Cost of Drainage, Irrigation, Plumbing has been calculated at 20% of the civil work cost.

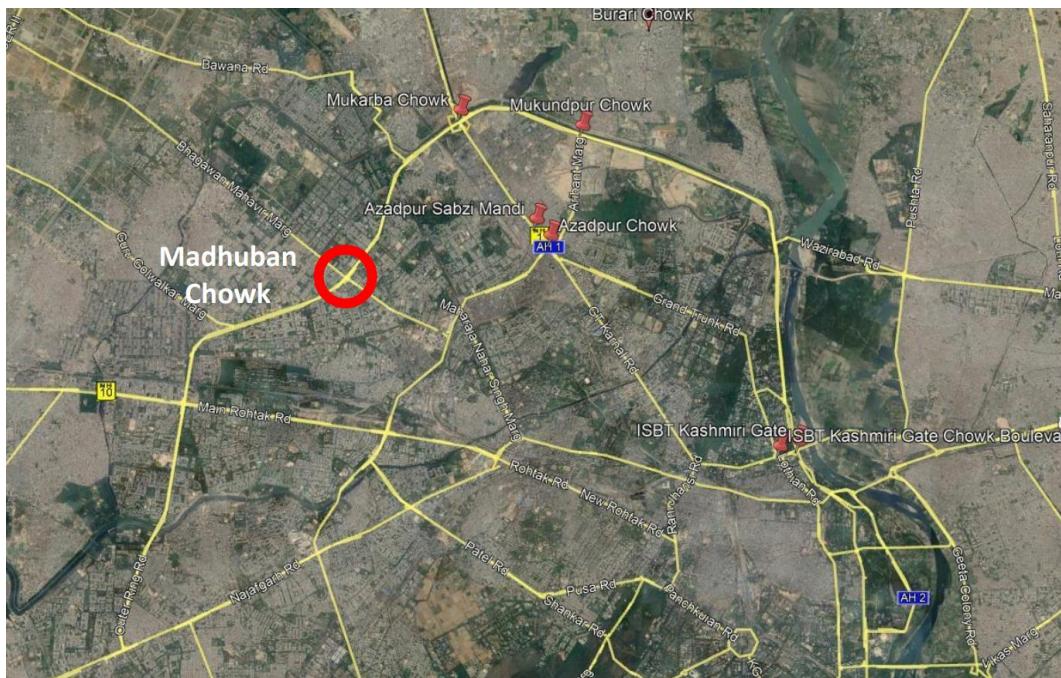
- Cost of Electrical Work can be calculated at 20% - 25 % of the civil work cost.
- Cost of Horticulture has been calculated at 15% of the civil work cost.
- Cost of Dismantling has been calculated at 15% of the civil work cost.
- Cost of Work Zone Management has been calculated at 5% of the civil work cost.
- Cost for Design Support can range from 2% - 8%, can vary from site to site. This should include Technical Assistance on drawings, 3D supports, Site Supervision, Change management.
- Bus Shelter has been calculated at 18 L per shelter; can be changed as per design specific cost.
- In case of new items specific to design, please add relevant rows in detail budget estimation and include the same in the budget summary under relevant head.

B.3 : MADHUBAN CHOWK

B.3.1 : GENERAL DESCRIPTION OF THE SITE

A major interchange point, Madhuban Chowk is where the Outer Ring Road, Bhagwan Mahaveer Marg and Lala Jagat Narayan Marg intersect. It is a major interchange point for passengers between the Delhi Metro and other modes of public transportation on the Outer Ring Road.

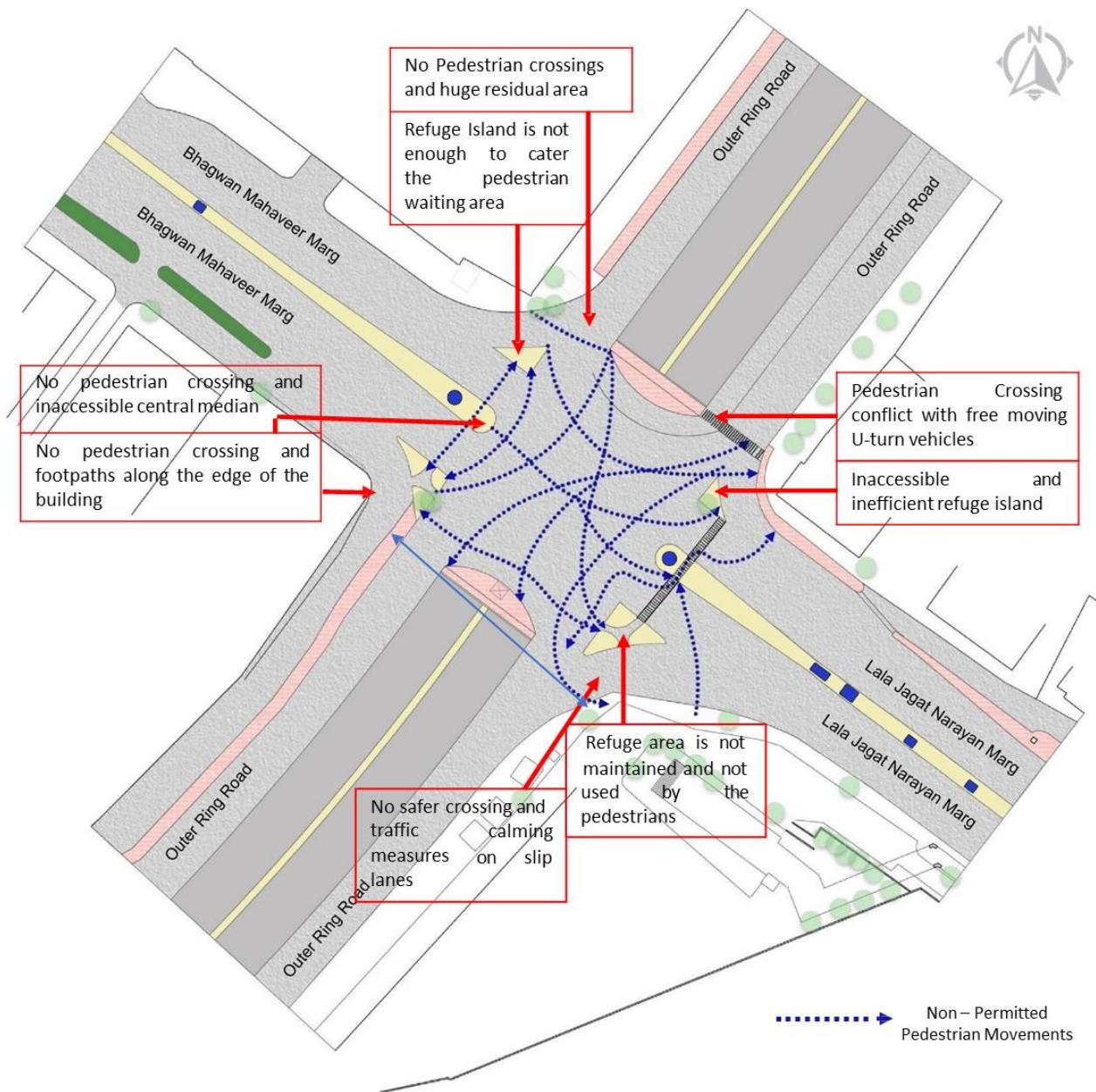
Madhuban Chowk: The area is served by the Red Metro line, and the nearest metro station is Pitampura, and nearby land uses include residential, commercial, and institutional. With Pitampura as the nearest metro station, it attracts high pedestrian footfall. The wide junction also encourages speed making it a risky spot. The road at the junction is wide enough to encourage increase in Vehicular speeds, resulting in unsafe movement for all road users. As per Delhi Traffic Police Accident Report, it was named as one of the blackspots in 2019.



3400 sqm four - armed intersection witnesses' traffic throughout the day.

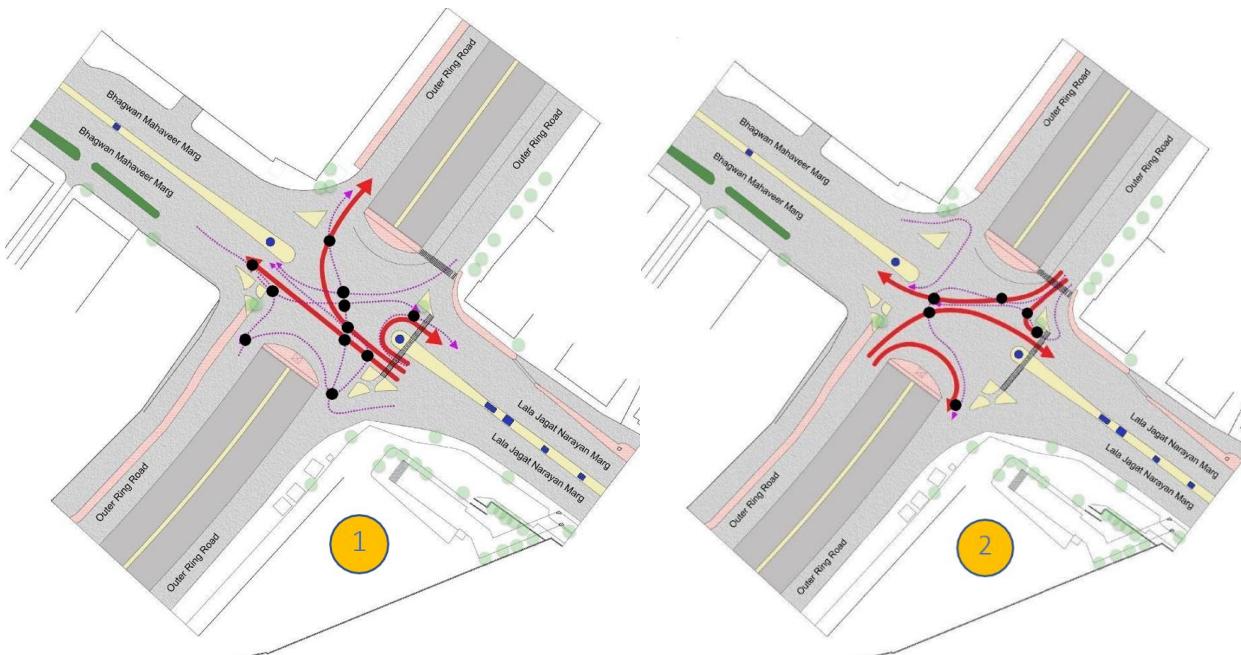
- There are no restricted right turns or U-turns here.
- All the arms have two and three defined lanes while the traffic forms multiple ques during the signal.
- There is no provision for non - motorized transport infrastructure.
- There are numerous non permitted vehicular movements around the refuge islands, as well as conflicting signal phasing which leads to an unsafe environment for vulnerable road users.

B.3.2 : EXISTING PEDESTRIAN CIRCULATION



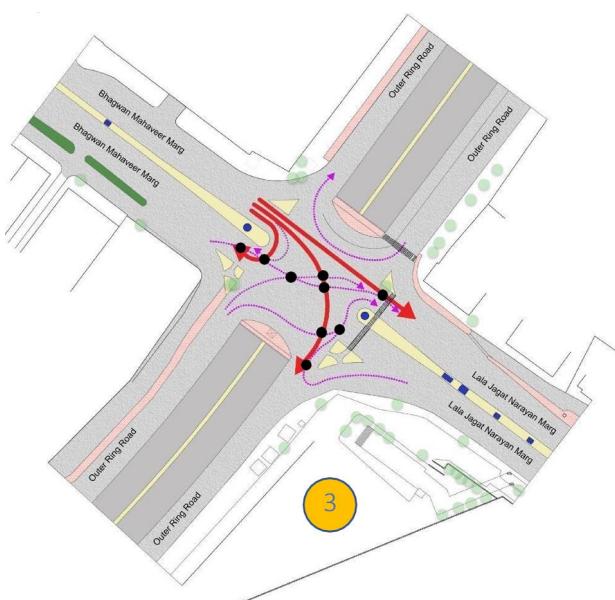
- The junction lacks refuge islands and pedestrian crossings, putting lives at risk. People also tend to cross haphazardly owing to lack of pedestrian infrastructure.
- The wide slip lanes for free left turns lack traffic calming measures.
- Long distance to cross due to underpass without any refuge islands makes pedestrian extremely vulnerable among the high-speed traffic movements.

B.3.3 : CONFLICT POINTS



1.Traffic from Southwest is taking non permitted movement leads to availability of space near the refuge islands. Also, multiple two wheelers take U- turn on the North - East edge from an unseparated space increases the risk of near miss.

2.During the second phase of the signal, right turn movements are allowed from two directions increasing the risk of collisions. This increases the risk of crashes.



3. Movement from South - East edge of the intersection but there are multiple non permitted movements overriding the refuge islands from South - West corner.

Signalized Traffic Movements
 Non - Permitted Movements
 Conflict Points

B.3.4 : ISSUES IDENTIFIED



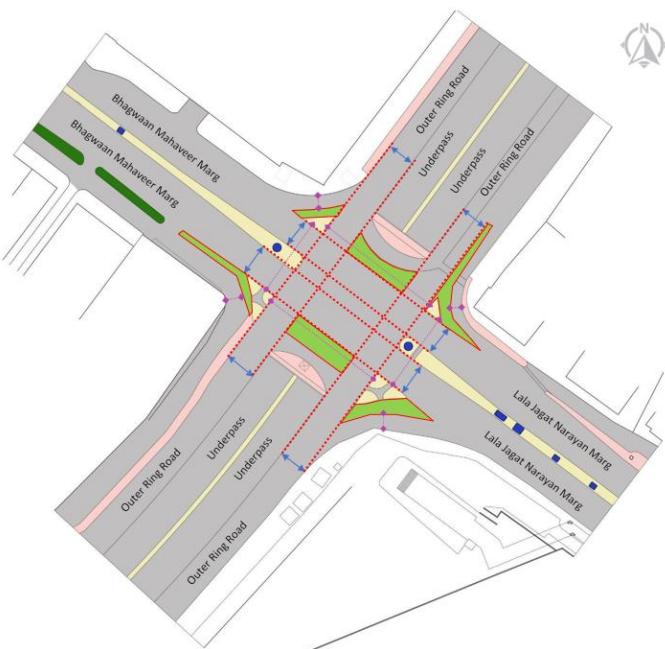
- Due to existing road alignment and underpass infrastructure, two residual spaces are created on North- East and South-West edge of the intersection. As a result, these residual spaces are misused by vehicles to take U- turns.
- Due to unavailability of the pedestrian crossings, pedestrians also prefer to use these spaces as waiting areas, exposing them to high-speed turning vehicles.
- These residual spaces also encourage non permitted movements further adding to the risk factors.



B.3.5 : PROPOSED DESIGN

CONCEPTUAL DESIGN

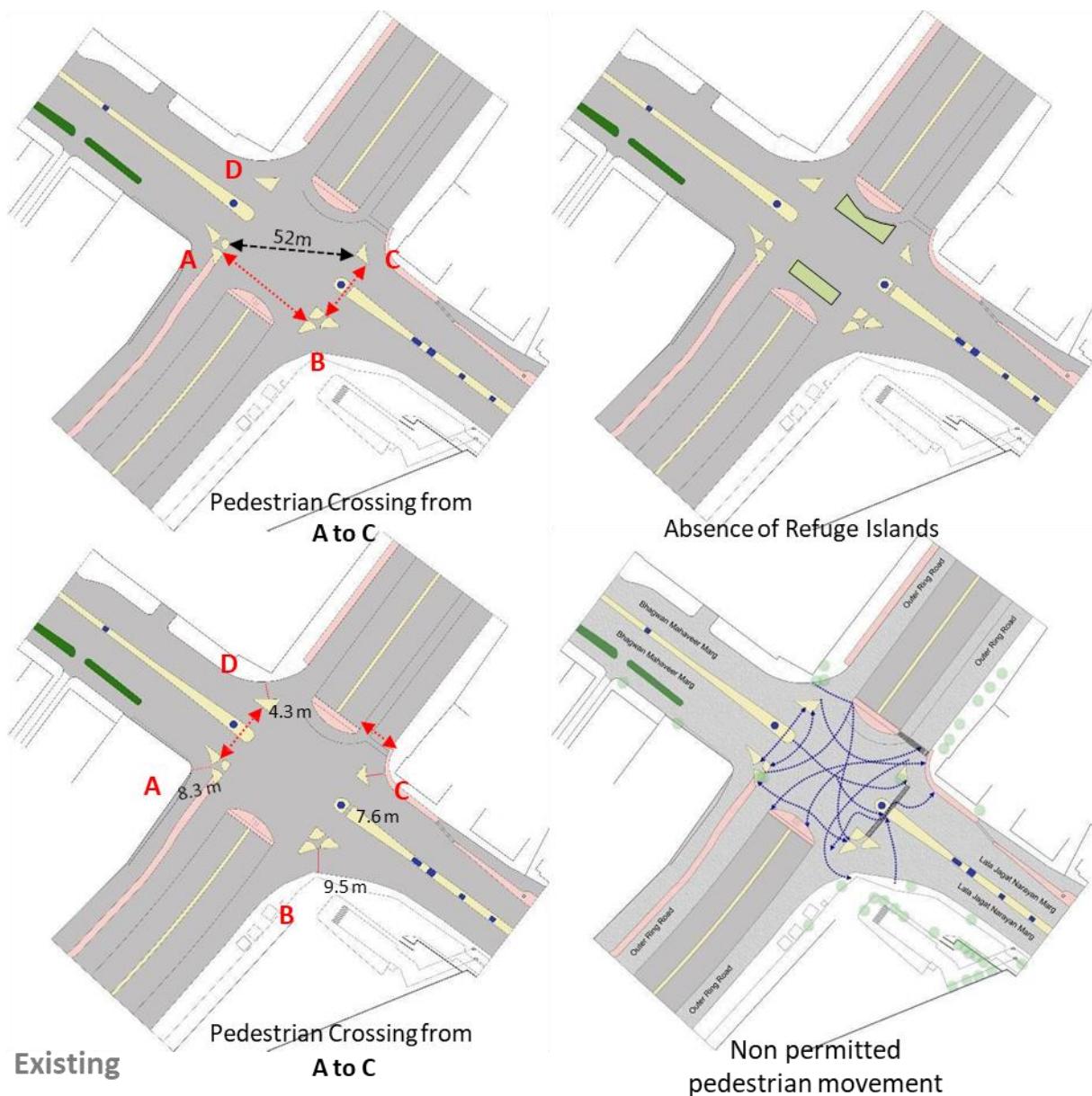
- 1** Balancing downstream and upstream on all four arms by defining minimum available space on roads for the carriageway.
- 2** Aligning all the roads and orient them to the opposite side for a smooth and efficient traffic flow.
- 3** Absorb the residual spaces to expand the existing refuge islands and create new ones for pedestrians to safely wait before crossing.
- 4** Identifying the shortest, continuous and safest pedestrian paths by compacting the conflicting area of the intersection. Providing tabletops on all four corners for safer access.



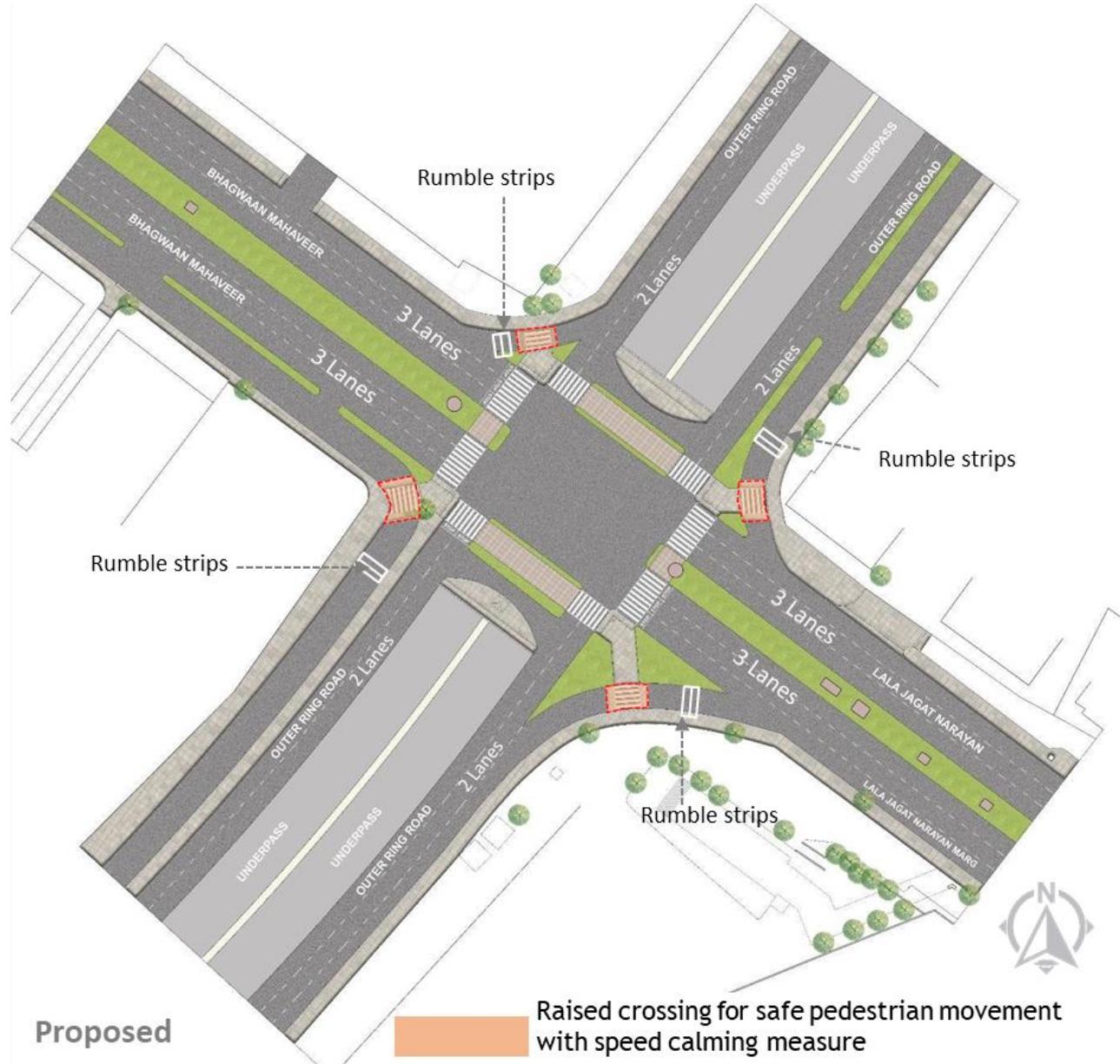
COMPACT INTERSECTION: 50% REDUCTION IN CONFLICT AREA



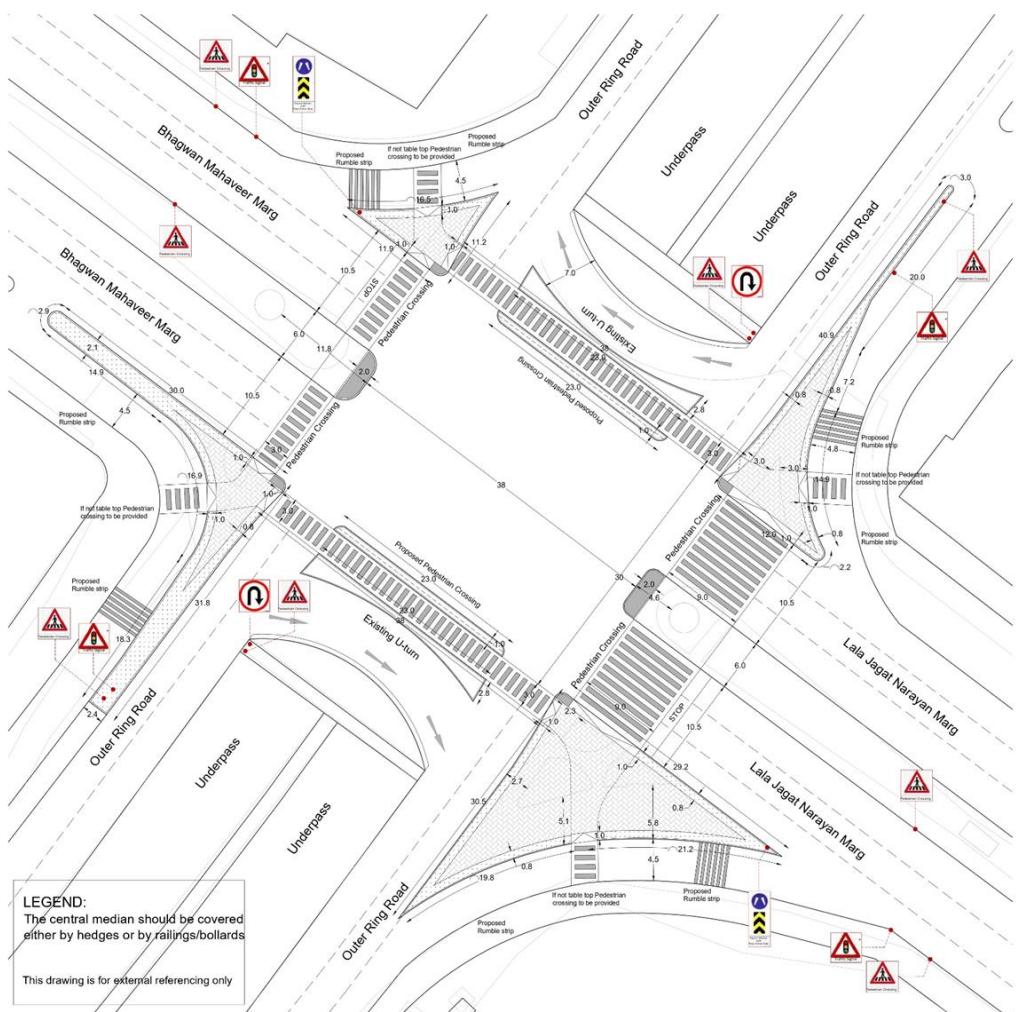
SAFE AND ACCESSIBLE PEDESTRIAN MOVEMENT: CONTINUOUS AND ACCESSIBLE PEDESTRIAN CROSSINGS WITH REFUGE ISLANDS AFTER EVERY TWO - THREE LANES



TRAFFIC CALMING MEASURES: RAISED CROSSING FOR SAFE PEDESTRIAN MOVEMENT WITH TRAFFIC CALMING MEASURE



FINAL DESIGN



In summary,

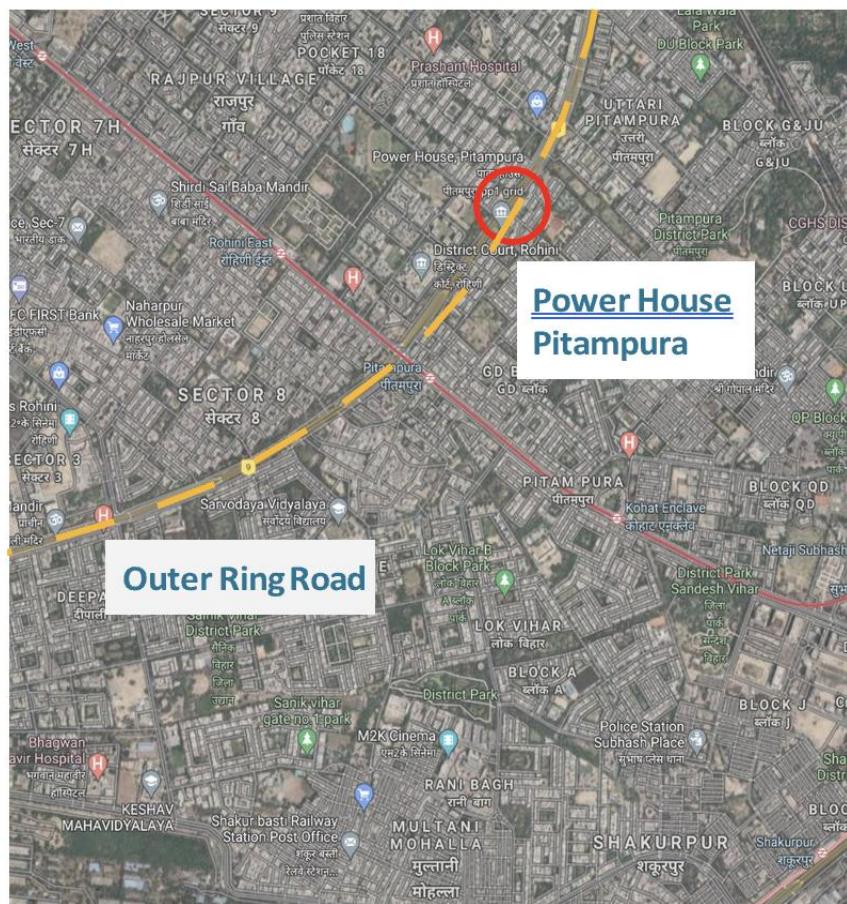
- Intersection space needs to be compacted by balancing downstream and upstream on all four arms and aligning all the roads for a smooth and efficient traffic flow, well integrated with the U-turns present on the Ring Road.
- There is a need to create permanent corner refuge islands and central medians as demonstrated during the temporary installation to create safe and secure waiting spaces for crossing the intersection.
- Permanent pedestrian crossing & road markings need to be aligned with the post geometrical correction to provide a shortest, continuous pedestrian infrastructure.
- Additionally, to support the execution of the proposed design traffic signals should be placed at appropriate locations as per the suggested geometrical correction, to improve the efficiency of the traffic movement.

- To make it inclusive and safer for all road users some key elements such as lighting, Signages, table tops at the slip lanes, rumble strips, and horticulture need to be incorporated at the time of implementation.

B.4: POWERHOUSE PITAMPURA

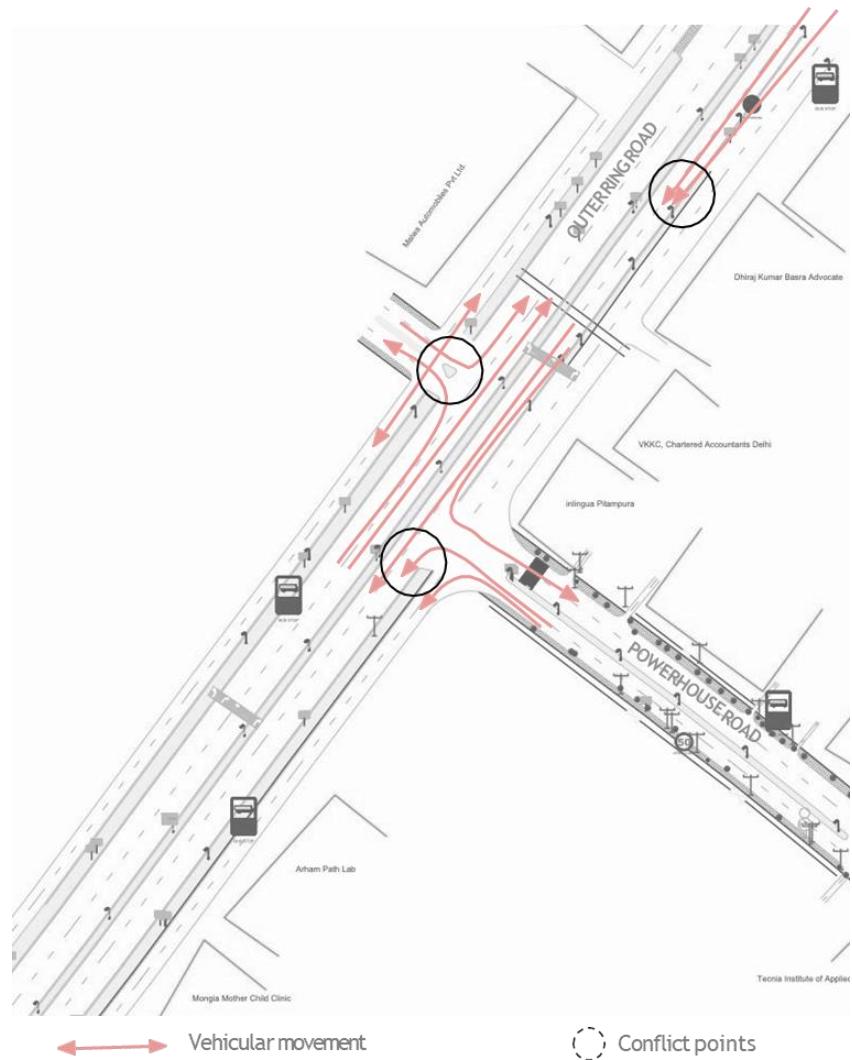
B.4.1 : GENERAL DESCRIPTION OF THE SITE

Power House Pitampura is located in North West Delhi, on the Outer Ring Road which is a continuous high-speed road that encircles Delhi. The area has dense commercial and residential use, so high volumes of pedestrians and vulnerable road users frequent this location. Vehicular traffic has been given top priority in the way the Outer Ring Road has been designed making it less safe for pedestrians and cyclists. Currently, the corridor also has Delhi Metro construction work underway.

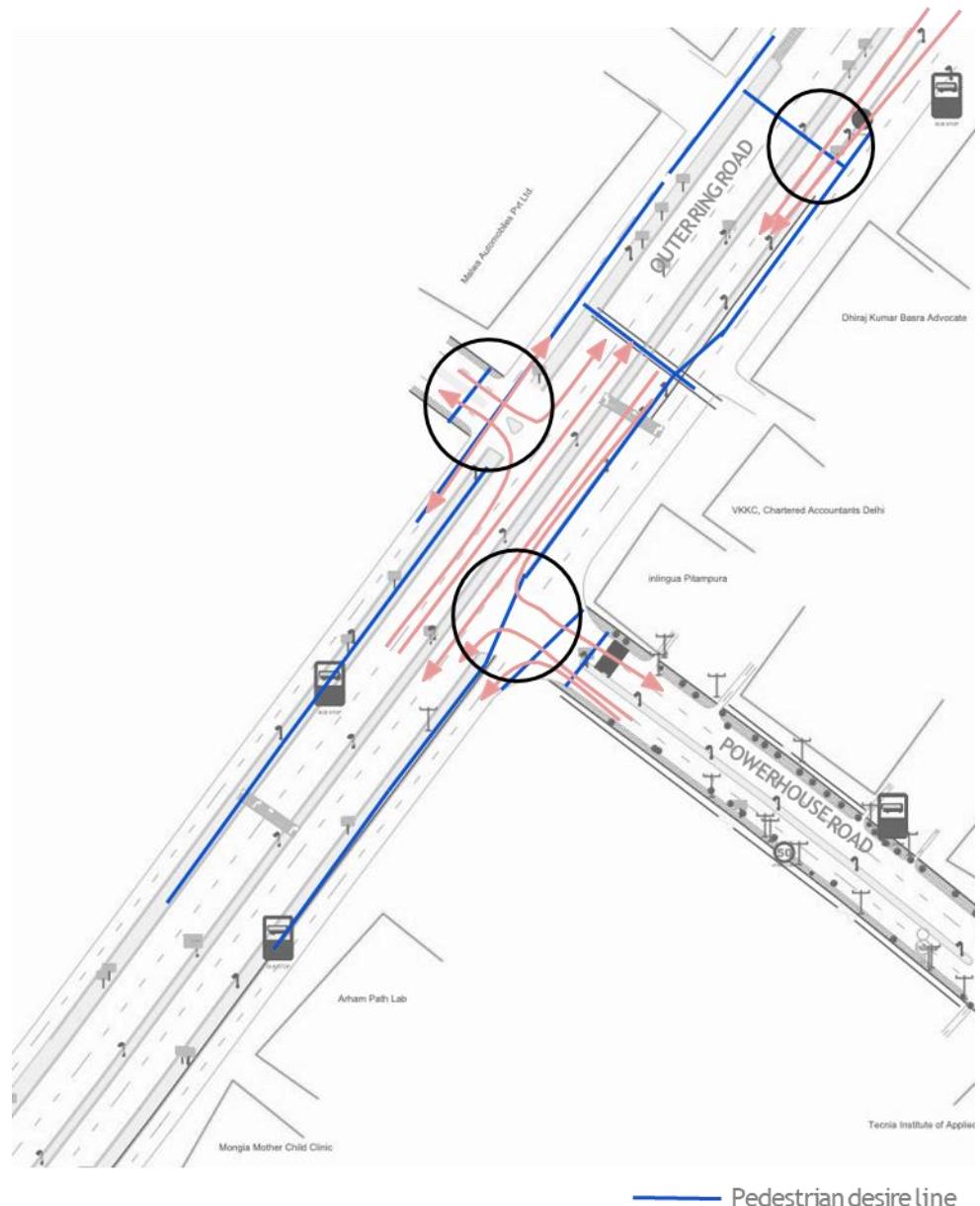


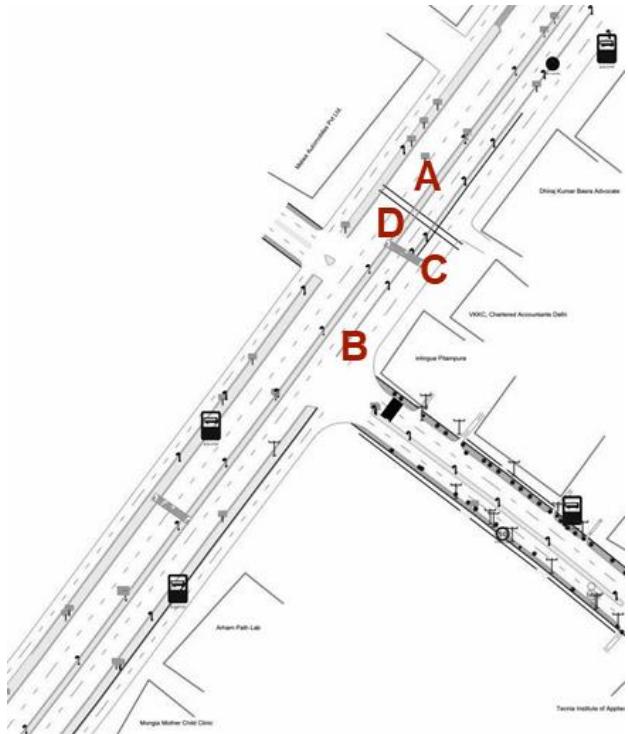
B.4.2 : EXISTING SCENARIO ON SITE

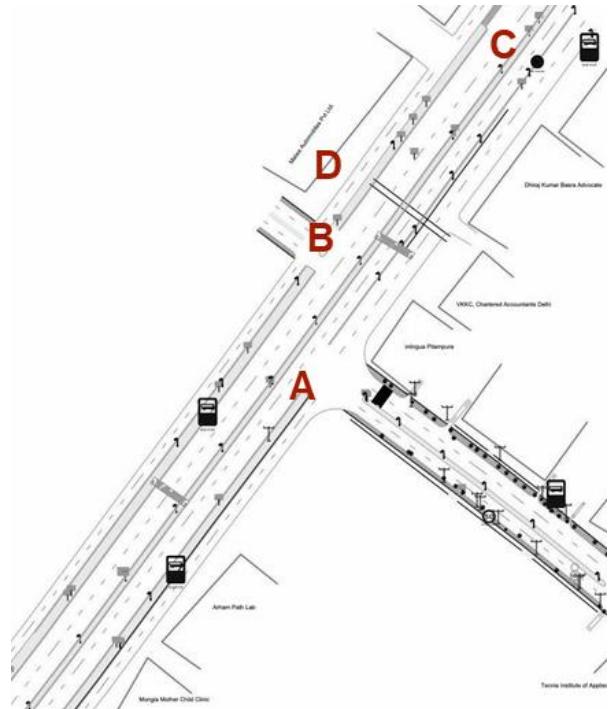
- Wide, 6 lane corridors with high-speed traffic and no signals.
- Large corner radii and unregulated turns leading to vehicles turning at high speeds.
- Service lanes used for vehicle parking.
- Blind turn due to metro barricade.
- Conflicting traffic where the flyover and the underpass meet the road.



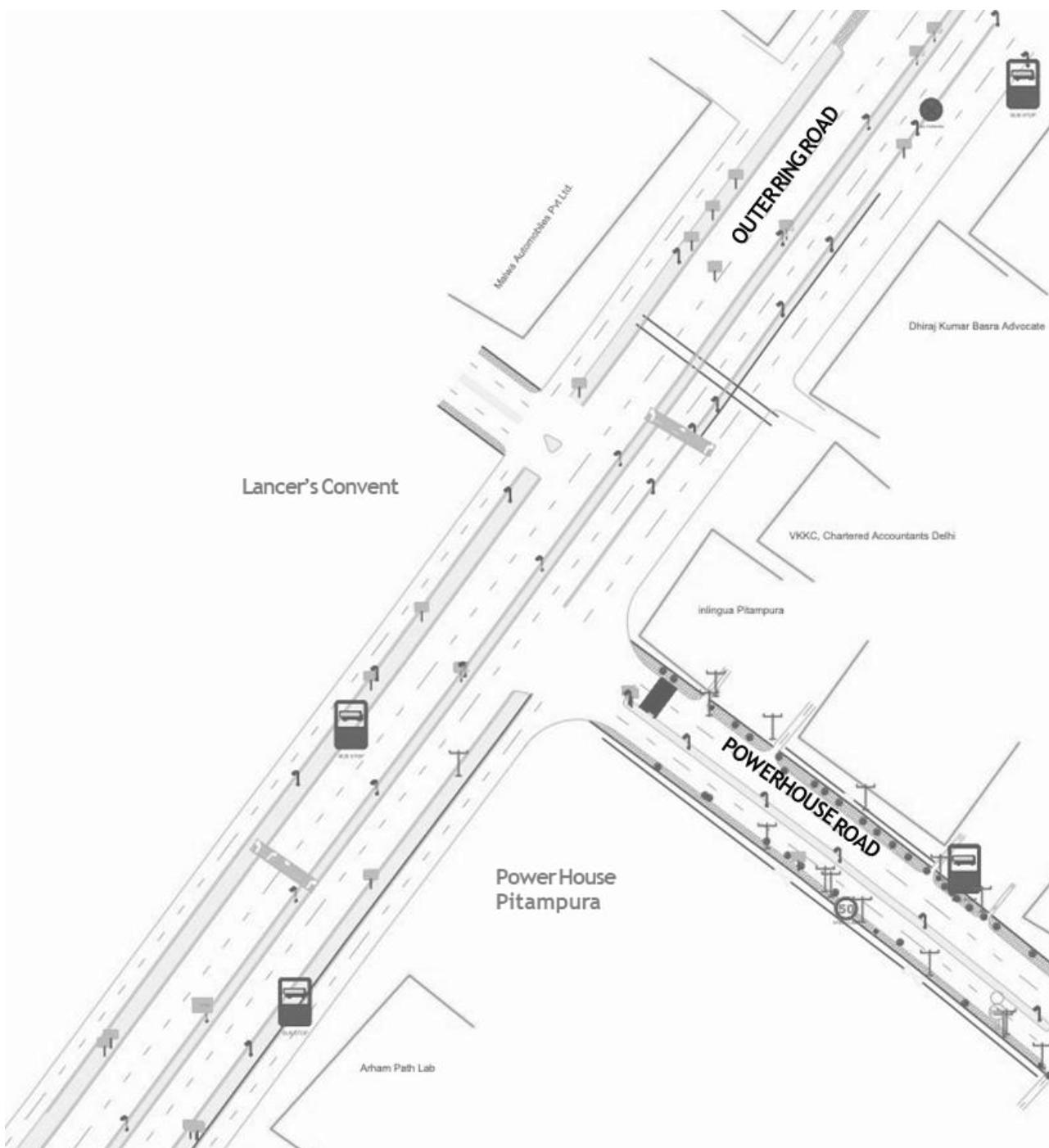
- Lack of pedestrian infrastructure such as signals and continuous footpaths.
- No at-grade pedestrian crossing for over a km, resulting in unsafe pedestrian movement across the unsafe corridor.
- Encroachment of service lanes and footpaths with parking.
- No designated bus, taxi, and auto loading zones causing boarding/deboarding in the middle of the street.
- School kids and commercial activity causing pedestrian desire lines.



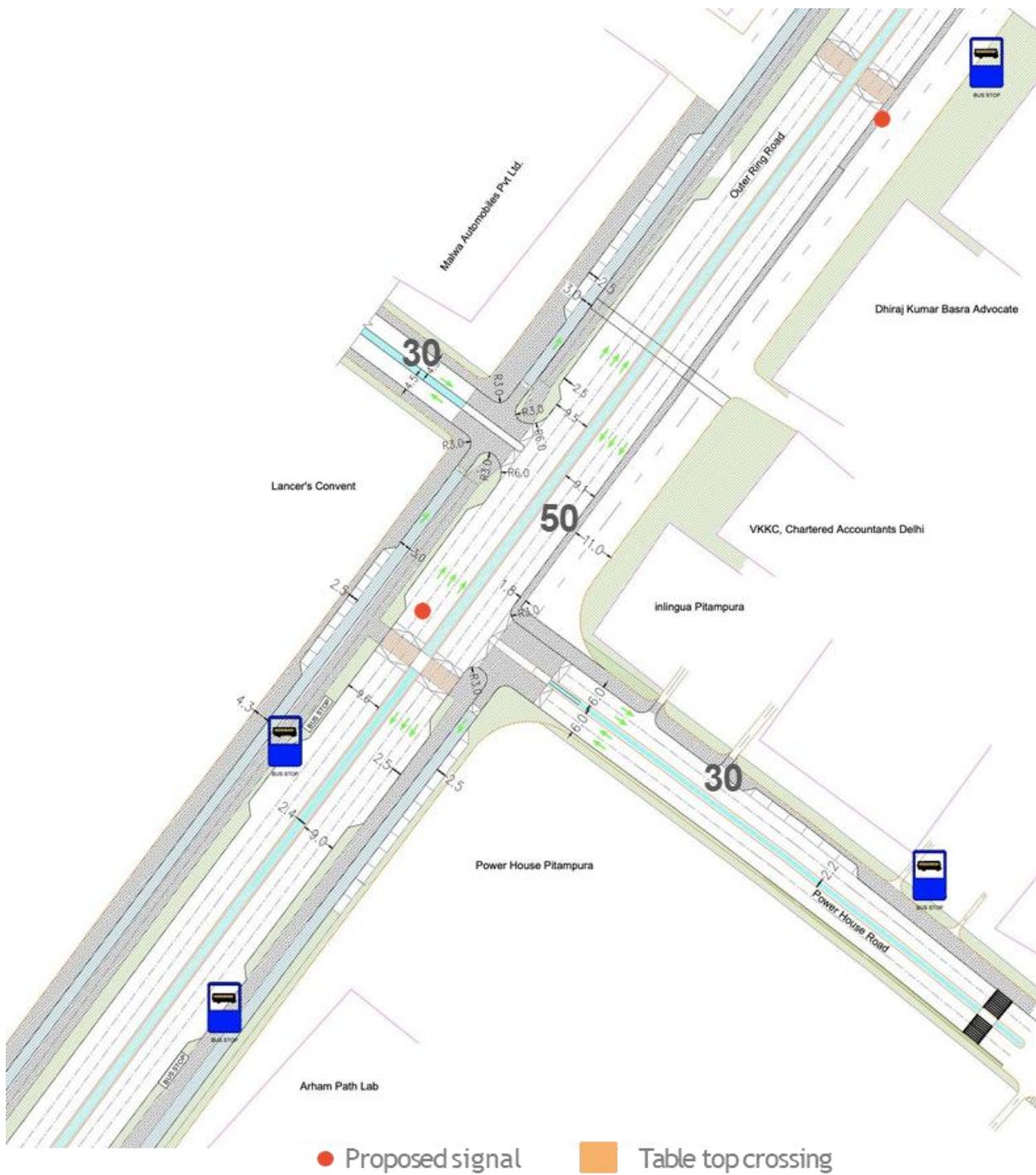


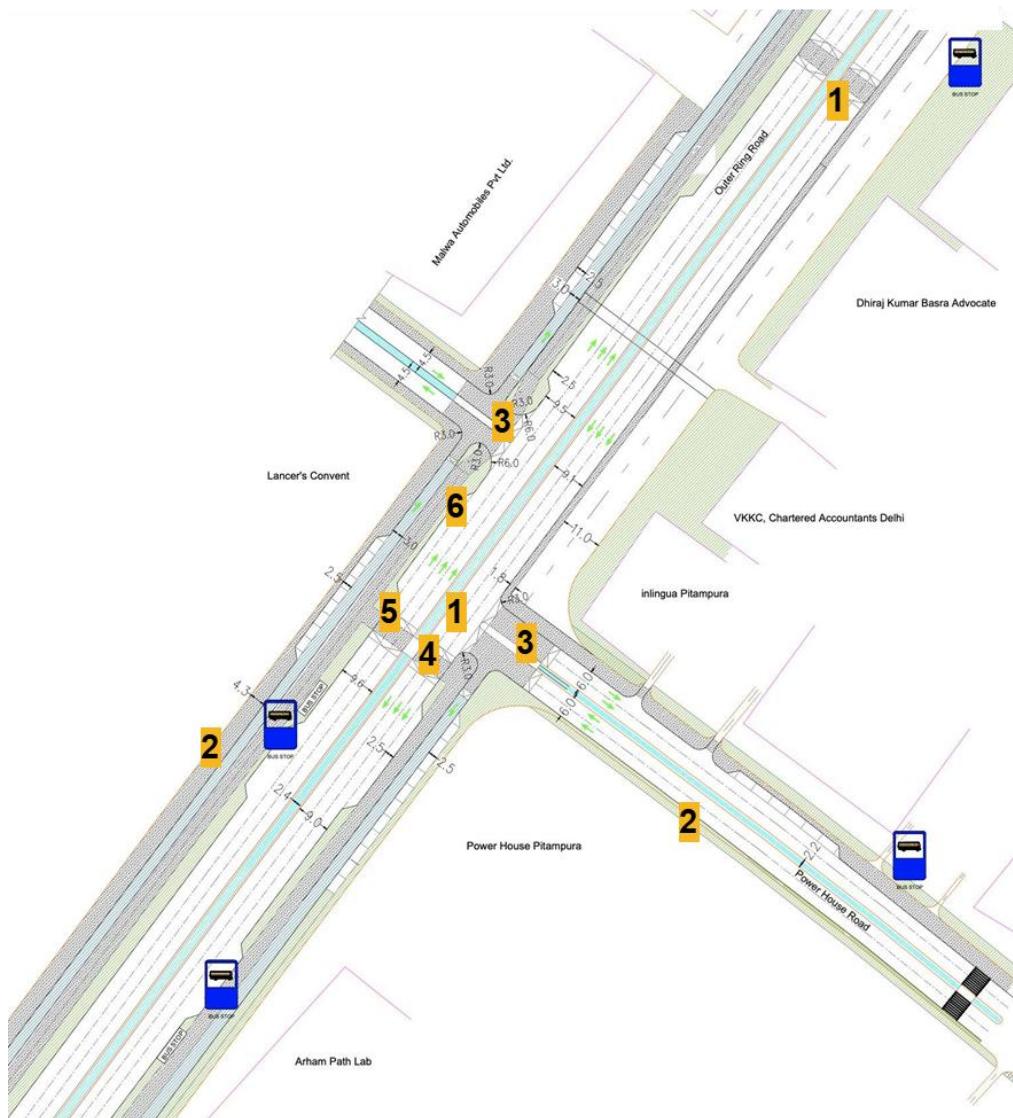


B.4.3 : EXISTING DESIGN



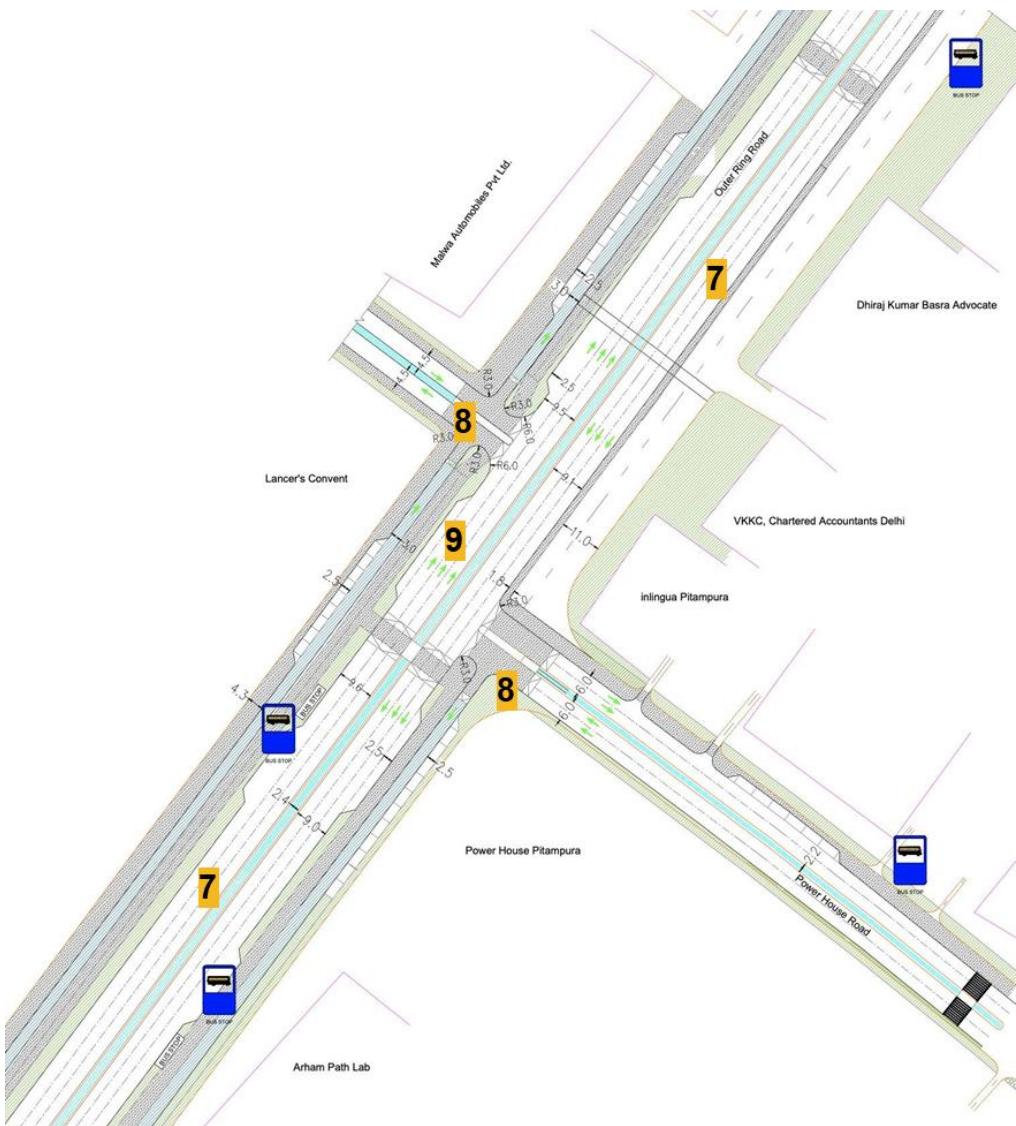
B.4.4 : PROPOSED DESIGN



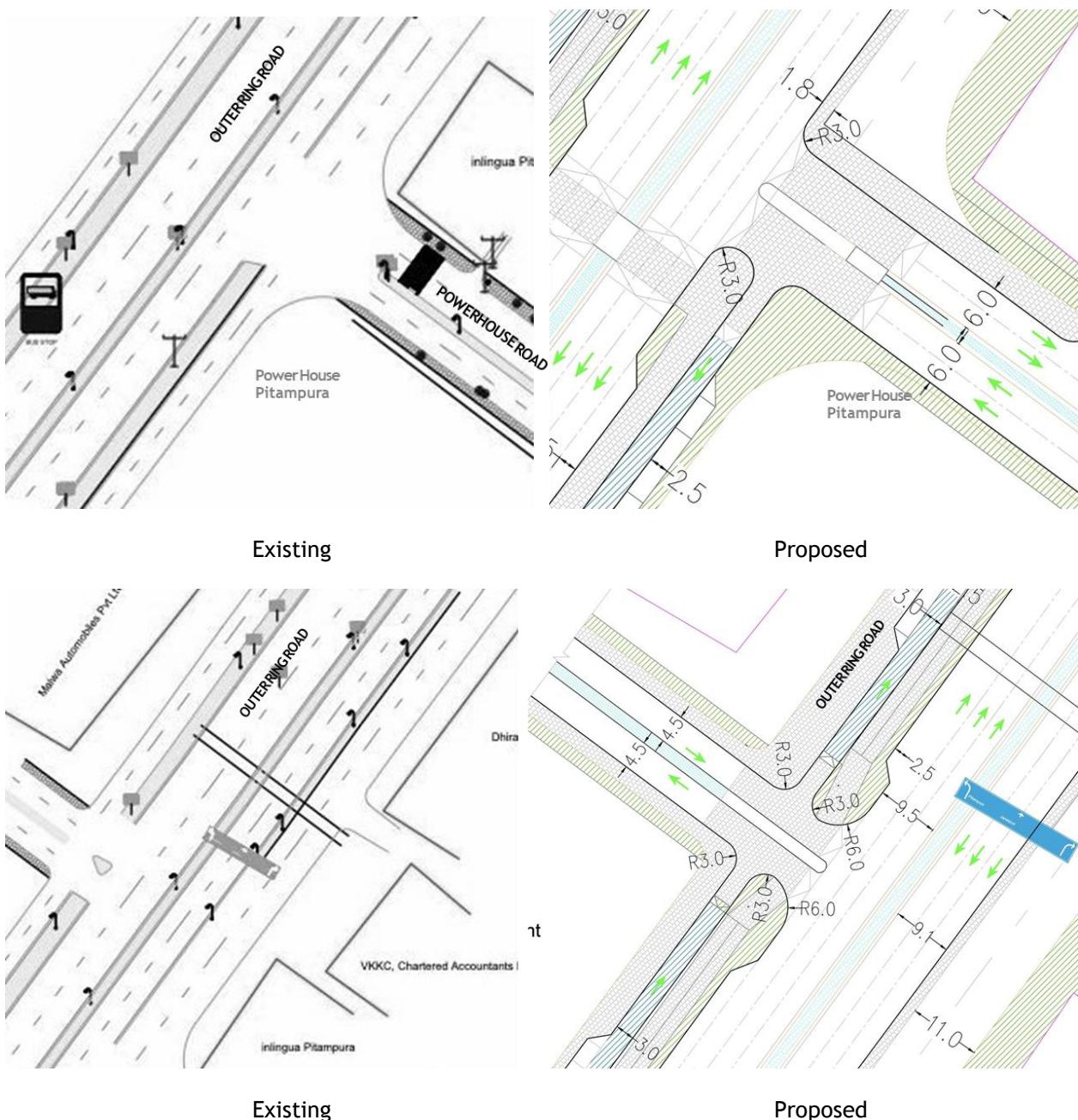


1. At grade pedestrian crossings at maximum 200 metres intervals with table top facilities.
2. Continuous clear path for walking with minimum width of 1.80 - 2.40 metres.
3. Table top crossing at T-junctions.
4. Introduction of safe and accessible refuge islands along all corridors to reduce speeds and provide pedestrians with a safe space.
5. Introduction of bulb outs to reduce crossing distances.
6. Dedicated bike lanes along all main corridors.

Note: Proposed interventions and dimensions are in line with the UTTIPEC guidelines and IRC Codes.

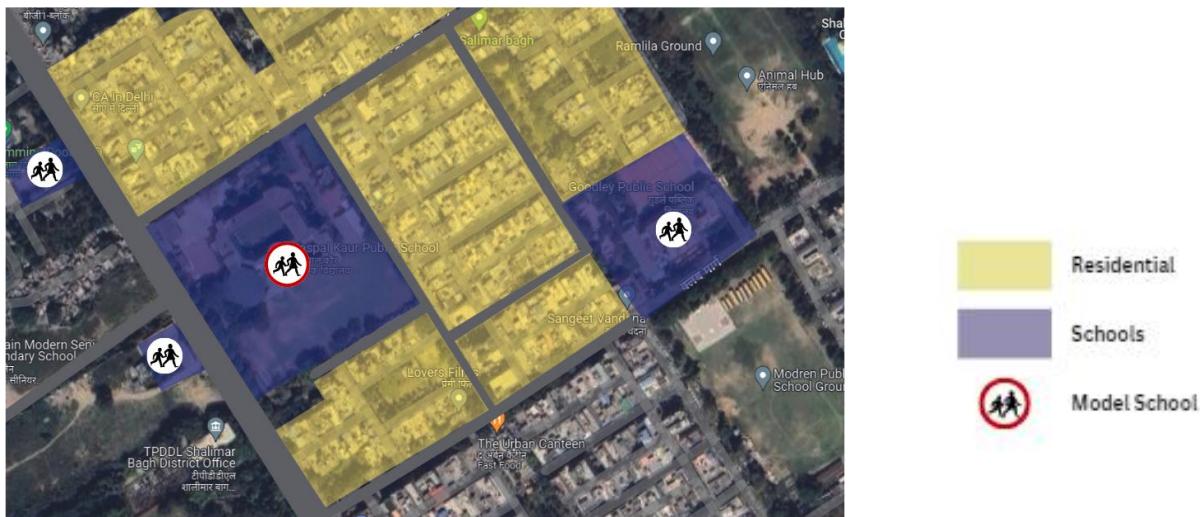


7. Even and equal travel lane widths with lane narrowing.
 8. Tightening turning radii at all locations to reduce tuning speeds.
 9. Dedicated and accessible parking spaces for vehicles, autos, two wheelers, buses.



B.5: JASPAL KAUR PUBLIC SCHOOL, SHALIMAR BAGH

B.5.1 : GENERAL DESCRIPTION OF THE SITE



District	Co-ed	School Shift	Shared Campus	Cluster of Schools	Total No. of Students:	ROW
North West	Yes	Morning	No	Yes	2404	14m - 24m

Length of Intervention (all arms, in meters): 625

Land Use Map around Jaspal Kaur Public School and School Zone Data (AY 22-23)

Situated at the Gyan Shakti Mandir Marg and Som Bazar Road, the Jaspal Kaur Public School (JKPS) is the pilot safe school site in the North West district. With a cluster of 4 schools, the site was identified as a potential crash location as per the Action to Data report 2022-23. The school is surrounded in the vicinity of Shalimar Bagh and Godaipur, making the land use predominantly residential in nature with small shops and other schools. The school has a total of four gates. Gate no. 1, 2, and 3 opens at the Som bazar road and gate no. 4 opens at the Gyan shakti mandir marg. Currently, only gate no.1 and gate no.4 are used during the entry and exit hours. JKPS is a co-ed school with a total enrolment of 2404 students from class Nursery to XII (age 5 to age 17). With a wing distribution of 48.8% in junior, 22.3% in secondary and 29% in senior secondary, the school thus has children from age 5 to 17 travelling to and from school. The larger modes of transport observed in the school surroundings are walk, iPT, buses, cars, and vans.

B.5.2 : EXISTING SCENARIO

As per a travel survey conducted in Dec 22, response from 196 students (8% of total school population) was mapped to understand travel patterns and socio-emotional data relevant to school journeys.

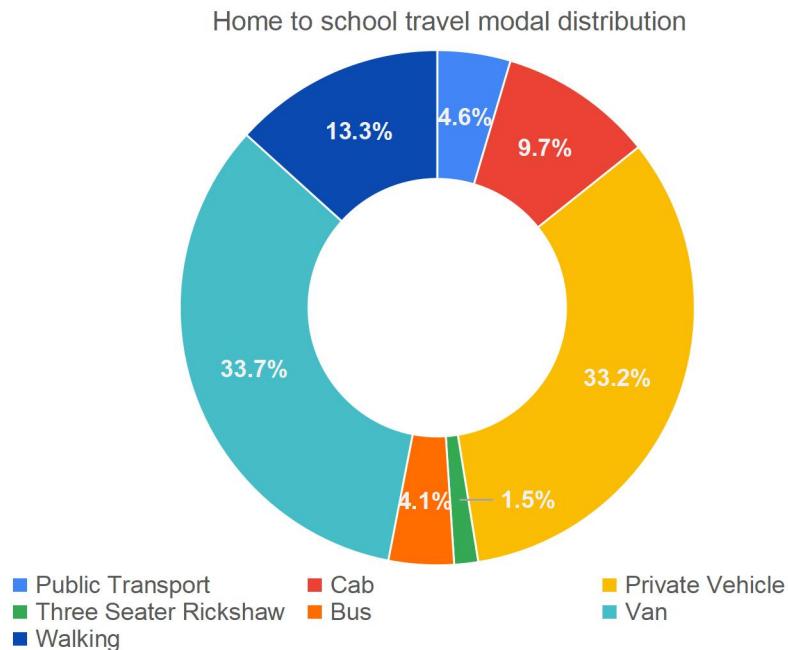


Figure 24: Home to school travel modal distribution: Jaspal Kaur Public School

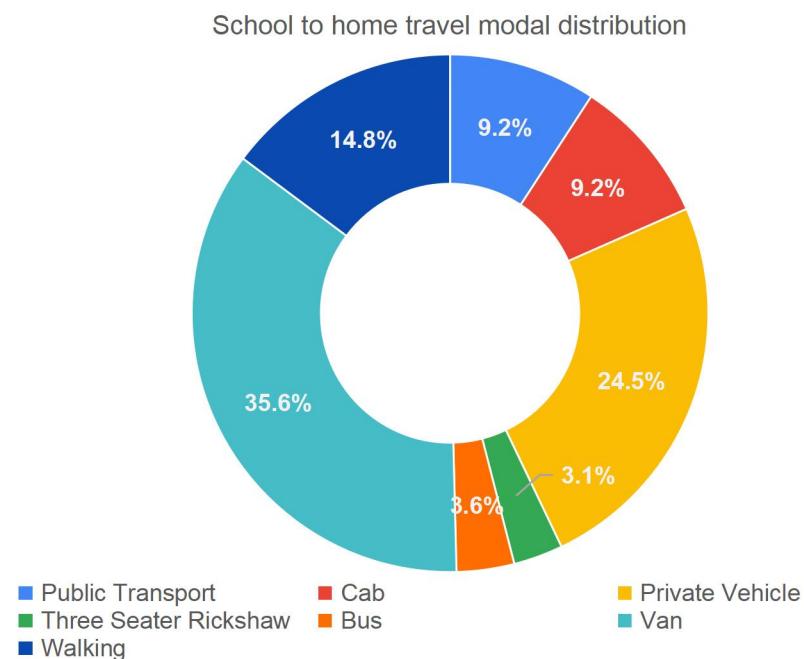


Figure 25: School to home travel modal distribution: Jaspal Kaur Public School

Source: HumanQind School Travel Survey 2022-2023

- Private vehicles and school van are the most common modes of travel both in the morning and the afternoon.
- Although the number of private vehicles decreased slightly in the afternoon.
- Around 14% of the students walked to and back from school.
- And 9.5% of them used cabs. Public transport use is very low in the morning < 5% although it increases to 9% in the afternoon. Very few of the students who responded travel by school buses
- 24% of the students live within 1 km of the school.
- More than half the students live more than 2km away from the school.
- 90% of the students stay within 8km of the school.
- As noted above very few students walk to school and none of them cycle. There might be a scope to improve an active mode of travel.
- Since students come from larger distances, we need to ensure a safe travel to and from the school by making all routes and roads they access as safer. Safe street designs must be implemented on the major routes which they take.
- Half of the students feel unsafe during their trip to school.
- Gender wise distribution of this is also very similar with the male students reporting marginally less fear compared to girls.
- Students felt the safest in private vehicles.
- Students travelling in vans and autorickshaws felt the most unsafe in the morning.
- In the afternoon no student responded to the fear while using vans and only half of them responded as feeling unsafe for autorickshaws.
- Many students felt unsafe while walking 50% in the morning and 38% in the afternoon.
- Students travelling in public transport also reported some fear although much less in the afternoon trip.
- Many of these numbers maybe misleading due to low data collection and might change with an extensive data collection.

Infrastructure Interventions and its Impact on Social and Emotional Learning

When asked what infrastructural changes both in the school surroundings and their travel routes will have a positive impact on them. 73% of students preferred no crowding outside the school 67% suggested a footpath for walking will be beneficial to them. There are also a significant number of students who opted for comfortable waiting spaces, vehicle-free streets and organised entry and exit outside the schools (63%, 61% and 60% respectively). Infrastructure not only provides a change in the environment but also serves a psychological purpose of providing safety and comfort which affects the sense of belonging and emotions around a public space. (Source: HumanQind School Travel Survey 22-23)

Infrastructure Interventions and Academic Performance

The students were also surveyed about what are the factors they believe with enhance their learning and academic performance. 75% of students reported lesser noise outside the classroom and school. Noise is a major factor in learning and concentration and can have an impact on the attention process. 56% of students also reported the availability of school transport, public transport near the school (51%) and lesser travel time (52%). Long and cumbersome commutes to school can hamper the readiness for learning and the exhaustion of learning. (Source: HumanQind School Travel Survey 22-23)

B.5.3 : ISSUES IDENTIFIED

Observations on Road Infrastructure: Due to the traditional vehicle centric planning approach, the road infrastructure does not adhere to safety principles as per IRCs. This leads to an unsafe environment for the vulnerable road users. There have been observations about high speeding and wrong side driving because of the lack of any traffic calming devices, signages and marking conducive to school zones. With that, there is lack of provision in the pedestrian and cyclist infrastructure though a good number of students commute to school and back home by walk and cycle. Some additional infrastructure issues with high demand value includes, lack of dedicated parking zones, waiting areas, dedicated drop off and pick off areas and vendor/hawker's zone within the school zone and better planning of utilities.



Site Photographs: Jaspal Kaur Public School

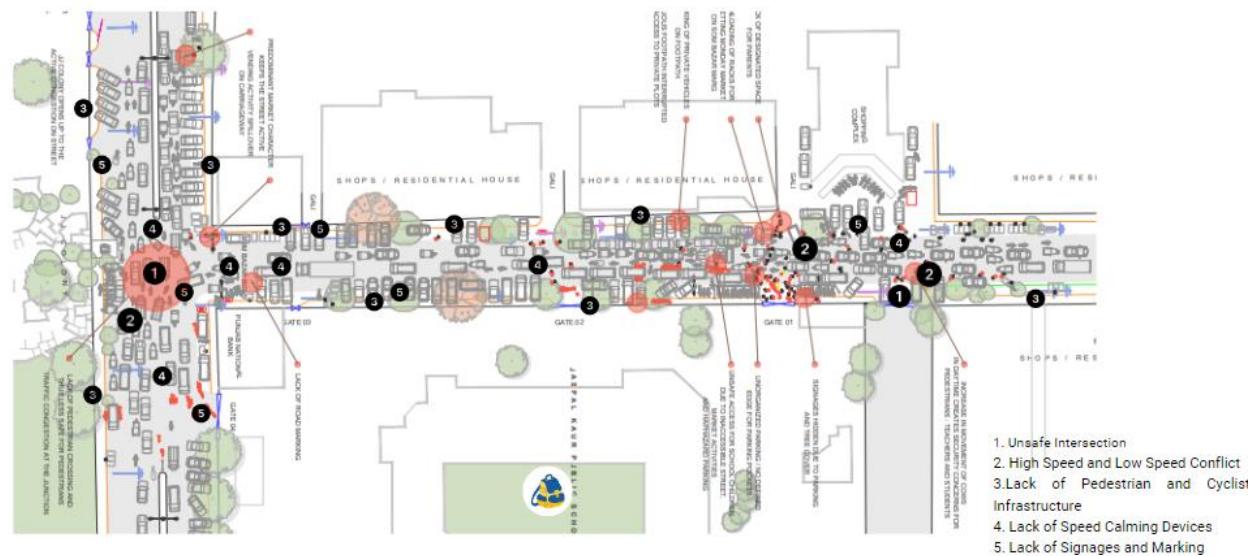
Type and Quality of Enforcement

Lack of traffic personnel in the school vicinity leads to an uncontrolled environment and circumstances. Over speeding and wrong side driving is observed to be a common phenomenon. Especially during the active school hours, this results in conflict with vulnerable road users.

Road Users Behaviour and mobility patterns

To understand the regular patterns of movements and conflicts in the school vicinity, HumanQind conducted activity mapping during the active school hours for Jaspal Kaur Public school. Observations were made twice in a day. First, for the morning hours i.e., to derive Home to school patterns of students. Second, in the afternoon hours i.e., to derive school to home patterns of students

B.5.4 : ACTIVITY MAP



Activity Mapping

Key Findings:

Morning: Home to School	Afternoon: School to Home
<ul style="list-style-type: none">• There is overcrowding of vans and e-rickshaws near main gate 01. Students find it difficult to navigate their way to the school gate.• Private vehicles are parked on footpaths making it inaccessible to the students and parents who walk to school. Pedestrians and children as young as 5 walk on the carriageway with high-speed traffic.• Parents and caregivers are observed standing due to lack of waiting spaces near the school gate. Parents with two wheelers also park their bikes very close to the school gate for the same reason.• There is a clear conflict between the high and low speed vulnerable users on the street near the school.	<ul style="list-style-type: none">• In the afternoon hours of school, the conflict points relatively increase with the increase in general traffic on the road.• The vans and e-rickshaw due to no pick-up points are scattered on the carriageway. Students find it difficult to navigate through them and some students have also mentioned that they tend to get late and miss their vans because of overcrowding and congestion at the school gate.• Due to encroachment and parking on footpaths, the students walking often spill over at the carriage way, and thus it becomes difficult for them to navigate through high speed and wrong side driving traffic.

B.5.5 : PROPOSED DESIGN

Design Interventions

The proposal prepared by road safety clubs (Refer Safer Delhi through Road Safety Clubs) is called ‘Happy School Zone’ aligning to pedestrian first approach, traffic safety principles, UN Sustainable Development Goals and Ladder of Children Participation. Happy School Zone is an area plan connecting 3 schools and the neighbourhood to 625m of school zone development. The entire plan is in adherence to Indian Road Congress Guidelines. To reduce speeds and conflicts, the school zone has been designed as per 20km/h or lower speed, promoting walkability, safe mobility. Continuous footpaths with designated boarding areas and drop off zones have been proposed. All streets are collector streets and cycle lanes with bollards have been planned. The area in front of gates, including the intersection of Gyan Bharti Marg and Som Bazar Road have been made safer with Table top crossings, change of surface texture and prominent markings to highlight school zones for all road users.

- 2.5m segregated footpaths on both sides
- 0.75m of Multi-Utility Zone for Services such as lighting and drainage.
- Designated boarding areas and drop off zones near school gates
- Waiting spaces and Street furniture integrated
- 1.5m painted cycle lanes on both sides (segregated by spring post)
- School specific signage and marking
- Minor intersections converted to table top crossings with change of surface texture.
- Wide Pedestrian Crossings to accommodate three school traffic.
- Continuous carriageway (2 lanes each direction on Gyan Shakti Marg) and (one lane each direction on Som Bazar Road)

The plan proposes certain restrictions such as the Monday market on Som Bazar Road to initiate installation post school exit hours to avoid conflict. Staggering the two activities can help resolve conflicts and streamline movement. Active measures need to be taken up to curb wrong side driving.

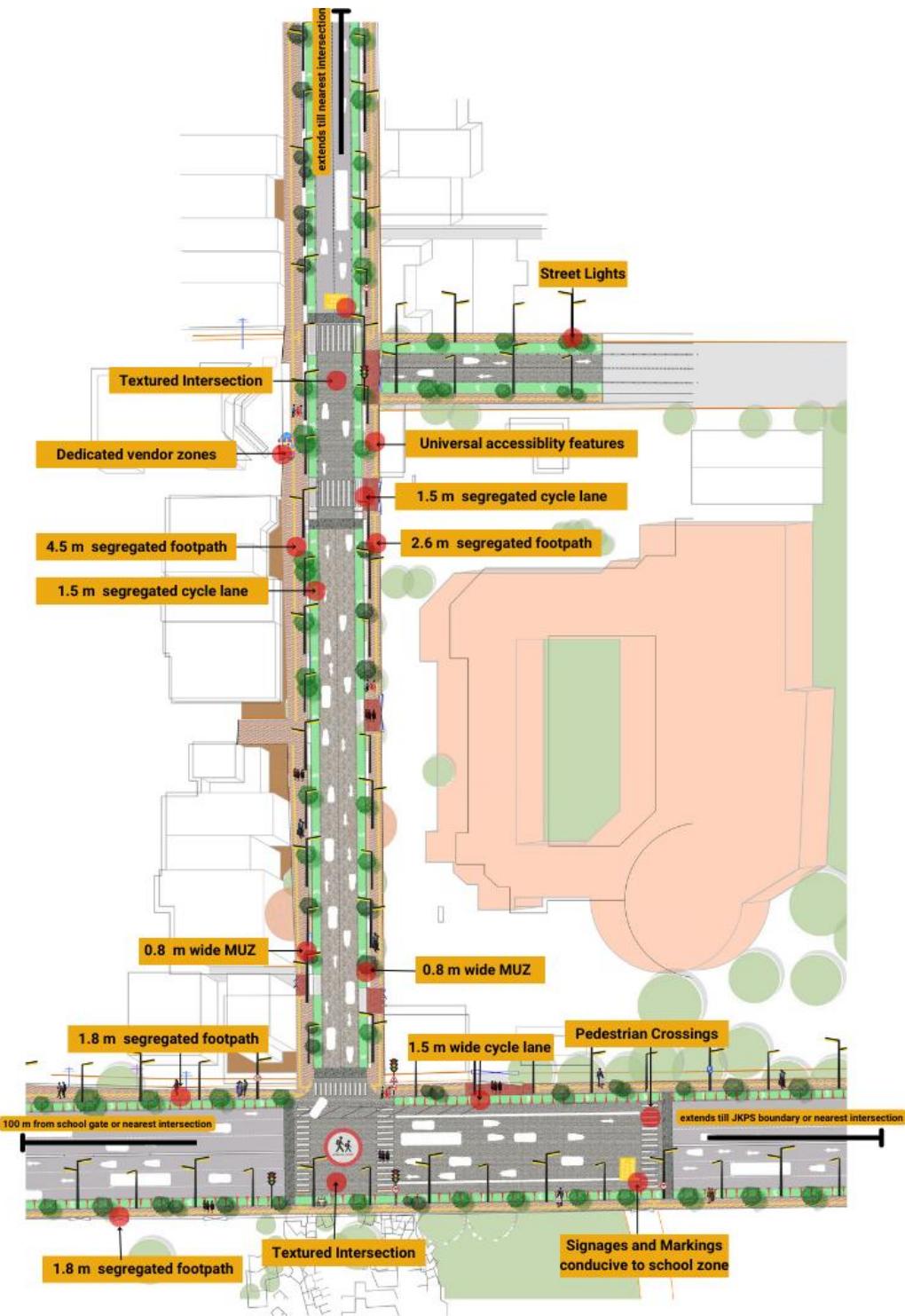


Figure 9- Proposed Design for School Zone Jaspal Kaur Public School, Shalimar Bagh

B.5.6 : SUMMARY BUDGET ESTIMATES

Total Length: 625m

Estimated Total Cost: INR 4.752 Crores

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
A	CIVIL WORK					
A.1	Footpath (Primary, Secondary including other Flooring area)	2.5m segregated footpath with tactile pavers in both directions	Providing and laying of footpath 2m to 3m wide, including earthwork and base layer - PCC, GSB and finishing material.	2929	9322396	0.932
A.2	Raised Crossing	Traffic calming in front of school gate 1, intersection of som bazar road and	Providing and laying Raised crossing with 80 mm thick pavers blocks, and DQ stone including Earth work and Base layers- PCC (M15), RCC (M30 Design mix) & GSB etc.	3635	7400277	0.740
A.3	Cycle Infrastructure	1.5m cycle lane both sides	Providing and laying cycle track (2.5mt wide segregated) including Earth work and Base layers- PCC (M15), RCC (M40 Design mix) & GSB etc. also thermoplastic paint for marking and cycle symbol and spring post etc	0	1676556	0.168
A.4	CC Items (Kerbs, Pipe, etc)	Provision of bollards, kerbs - mountable, kerb channels, etc	Providing and fixing Kerbs, Bollards, and Kerb Channel etc. in CC.		511773	0.051
A.5	Signages	Provision of signages as per IRC 67 for school zone & 20km/h	Providing and fixing Signage Mandatory, Cautionary and informatorily sign board		697166	0.070

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
			including all the fixing and labours etc.			
A.6	Marking	Provision of signages as per IRC 35 for school zone & 20km/h	Providing and applying road marking strips (retro- reflective) of specified shade/ colour using hot thermoplastic material for road marking.	1368	466635	0.047
A.7	Special Zones	Provision of seating areas, vendor spaces and play integrated with design proposal	Miscellaneous items- Provision of Sitting Bollards, CC Benches, GRC Jali, Pergola, Dustbin etc. complete items- including foundation and fixing etc.		112865	0.011
A.8	Brick Work	--	Brick work with common burnt clay F.P.S. (non-modular) bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:4 (1 cement: 4 coarse sand)	7370.65/ CUM	191489	0.019
A.9	Steel Reinforcement for RCC work	--	Steel reinforcement (in per kg) for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete up to plinth level. Thermo-Mechanically Treated bars of grade Fe-500D or more	107.85/k g	407673	0.041
A.10	Pavement Surface Dressing	Pavement of Bitumen layer on existing road surface	Surface dressing on old surface with hot bitumen of grade VG - 10	175.10 / sq.m	0	0.000
A.11	Safety Management Equipment (as per design requirement)	Provision of Delineator Post, Spring Post, Cat eye/studs etc.	Miscellaneous items for Safety Management Equipment (as per design requirement) -Provision of Delineator Post, Spring Post, Cat eye/studs etc.-		0	0.000

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
			including foundation and fixing etc.			
A.12	Bus Shelter	--	Provision of new bus shelter.		0	
	SUB TOTAL CIVIL WORK (A)				2078683 0	2.079
B	Drainage, Irrigation & Plumbing	Details promote catch pit along the footpath linked to existing manholes. Bell mouths are not recommended. Details to be finalised with PWD	Drainage, Irrigation & Plumbing work @ 20% of the cost of Civil work	20%	4157366	0.416
C	Electrical Work	5m and 10m light poles have been located alongside footpath / MUZ. Details to be finalised with PWD.	Electrical work @25% of the cost of Civil work	25%	5196707	0.520
D	Horticulture Work	To increase green cover and shade, landscape plan to promote ground cover and trees for seasonal variation and colour. Irrigation plan to be finalised with PWD.	Horticulture work @ 15% of the cost of Civil work	15%	3118024	0.312
E	Dismantling / Demolition	--	Dismantling work @ 15% of the cost of Civil work	15%	3118024	0.312
F	Work Zone Safety & Management	--	Work zone Management @ 5% of the cost of Civil work	5%	1039341	0.104
PART 1	SUB TOTAL PART 1 (A+B+C+D+E+F)				3741629 4	3.742

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
G	Design Services & Support	--	Design Consultancy (Preparation of Drawings, BOQ support, Work Zone plan, Site Supervision, Community Engagement & Liaison, Change Management @ 2% - 8% of the cost of Civil work.	5%	1870815	0.187
H	Survey Cost	--	Survey Cost (Total Station Survey, underground services, tree demarcation, girths, level differences, steps etc @ (80,000 per junction - 250m on each arm)	0	0	0.000
PART 2	SUB TOTAL PART 2 (PART 1 + G +H)				3928710 8	3.929
J	Contingencies '2.5%	--	Contingencies (@2.5%)		982178	0.098
I	GST(@18%)	--	GST @18%		7248471	0.725
FINAL	GRAND TOTAL (PART 2 + J + I)				4751775 7	4.752

Notes:

1. DSR 2023 has been followed for all rates. Market Rate and Costing from part PWD projects has been included for certain items. This is a preliminary estimate. Final costing to be evaluated & approved by road owning agency.
2. Cost of Drainage, Irrigation, Plumbing has been calculated at 20% of the civil work cost
3. Cost of Electrical Work can be calculated at 20% - 25 % of the civil work cost

4. Cost of Horticulture has been calculated at 15% of the civil work cost
5. Cost of Dismantling has been calculated at 15% of the civil work cost
6. Cost of Work Zone Management has been calculated at 5% of the civil work cost
7. Cost for Design Support can range from 2% - 8%, can vary from site to site. This should include Technical Assistance on drawings, 3D supports, Site Supervision, Change management
8. Bus Shelter has been calculated at 18 L per shelter; can be changed as per design specific cost
9. In case of new items specific to design, please add relevant rows in detail budget estimation and include the same in the budget summary under relevant head.

Link to the appendix report: <https://trippc.iitd.ac.in/publication/report>

