



# DELHI WEST DISTRICT ROAD SAFETY REPORT (DRAFT)

SUBMITTED TO:



**TRANSPORT DEPARTMENT**

Government of NCT of Delhi

सत्यमेव जयते



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Government of NCT of Delhi

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Report by:



## TRANSPORT DEPARTMENT

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Philanthropies

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Road Safety



SGA sustainable  
mobility  
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# HumanQind

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Figure 34 : (Left) - Pilot School Zone West District - Raised Crossings at Asaf Ali Marg Intersections **Error! Bookmark not defined.**

Figure 35 : (Right) - Pilot School Zone West - Students walking on safe and accessible pedestrian paths, cycle track ..... **Error! Bookmark not defined.**

Figure 36 : (Left) - Pilot School Zone West - Student using Dedicated drop off zone. Learning aid, vendor spaces, green areas and waiting spaces integrated as part of pedestrian environments **Error! Bookmark not defined.**

Figure 37 : (Right) - Waiting area and street art in front of Government school **Error! Bookmark not defined.**

Figure 38 : (Left) - School students using the newly built segregated cycle track during school commute **Error! Bookmark not defined.**

Figure 39 : (Right) - Segregated Cycle Track with cycle parking separated by Multi Utility Zone with signages (as per IRC 67: 2022) and street lighting ..... **Error! Bookmark not defined.**

Figure 40 : Safe NMT Infrastructure segregated on both sides (Left); Learning Aid integrated with NMT Infrastructure for students (centre); Students walking to school from intersection (Right) **Error! Bookmark not defined.**

Figure 41 : Area between schools used as a shared space with SDG floor corner street art - safety promise and play and gym areas (Left): Students using the corner for waiting and learning about road safety principles (Right) ..... **Error! Bookmark not defined.**

Table 1 : Road crash deaths by time and day of week ..... 12

Table 2 : Who-hit-whom matrix ..... 16

Table 3 : List of high-risk locations ..... 20

## LIST OF ABBREVIATIONS

- **GNCTD** Government of National Capital Territory of Delhi
- **DM** District Magistrate
- **DMRC** Delhi Metro Rail Corporation
- **DRSC** District Road Safety Committee
- **DTC** Delhi Transport Corporation
- **DTP** Delhi Traffic Police
- **FIR** First Information Report
- **FOB** Foot Over Bridge
- **GIS** Geographic Information System
- **GT** Grand Trunk
- **HV** Heavy Vehicle
- **IACP** International Association of Chiefs of Police
- **IIT** Indian Institute of Technology
- **IPC** Indian Penal Code
- **IRC** Indian Road Congress
- **iRAD** Integrated Road Accident Database
- **ISBT** Inter State Bus Terminal
- **KM** Kilometre
- **LMV** Light Motor Vehicle
- **MACT** Motor Accident Claims Tribunal
- **MCD** Municipal Corporation of Delhi
- **MoRTH** Ministry of Road Transport and Highways
- **MPD** Master Plan for Delhi
- **MTW** Motorised Two-Wheeler
- **NCR** National Capital Region
- **NCT** National Capital Territory

- **NGO** Non-Governmental Organisation
- **NH** National Highway
- **NHAI** National Highways Authority of India
- **NIC** National Informatics Centre
- **NSP** Netaji Subhash Place
- **PCR** Police Control Room
- **QGIS** Quantum Geographic Information System
- **RSLA** Road Safety Lead Agency
- **SKV** Sarvodaya Kanya Vidyalaya
- **SOP** Standard Operating Procedure
- **TRIPC** Transportation Research and Injury Prevention Centre
- **UT** Union Territory
- **WHO** World Health Organisation

## KEY HIGHLIGHTS

- Fatal road crashes increased from 173 to 211 from 2021 to 2022.
- Pedestrians comprised 42% of the fatalities and motorcyclists comprised 49% of the fatalities in 2022.
- A large number of fatal crashes occurred between 2200 to 0600 hours.
- Two out of three fatal crashes( 62 %) are hit-and-run cases.
- A large number of fatal crashes involving pedestrians and motorcyclists were hit and run cases.
- The high-risk locations of the West District are Peeragarhi Intersection, Bhairon Enclave and SKV Mundka.

## 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 to 2021 data and identified high-risk locations for each of the eleven districts in Delhi. The report provided detailed maps, overall analysis for the National Capital Territory (NCT) of Delhi, and general recommendations for each district. The report was 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. They are instrumental in planning road safety interventions for high-risk locations in the district, implement interventions on the ground, and disburse road safety funds.

As a next logical step, to take evidence-based action in order to reduce crashes, the Transport Department are producing highly customised district specific road safety reports (DRSR) for the DRSCs. These reports include detailed findings on road crashes in the given district including a list of high-risk locations and provide specific recommendations to reduce crashes. The purpose of these DRSR is to guide DRSCs in implementing evidence-based interventions to reduce crash fatalities in high-risk locations and provide detailed infrastructure designs for specific locations which can be readily implemented on ground. The ultimate goal of this process is to inform and train the DRSC members in replicating the evidence-based action 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 the years 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 were 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 was based on the following parameters:

- Inspection of the road infrastructure and land use at the site.
- Identification of hazards and conflict points, especially pedestrians' movement, bus stop locations.
- Assessment of the type and quality of enforcement
- Observations on road user behaviour, parked vehicles, street vendors and accessibility of vulnerable road users
- Identification of types of road users and traffic mix and speed.

These data points were collated and presented for the selected high-risk sites, and were used to inform the design of the proposed interventions.

### REPORT STRUCTURE

Each district has a dedicated report. There will be a total of 11 reports - one for each district in NCT Delhi. The report is divided into three parts. The first part includes the introduction of road safety in the context of the district, and methodology that was 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

The District of West Delhi is bounded by North Delhi and Central Delhi to the east, districts of North West Delhi to the north, Jhajjar district of Haryana to the West, South West Delhi to the south. Major commercial and residential areas such as Janakpuri, Uttam Nagar and Tilak Nagar are located in West Delhi.

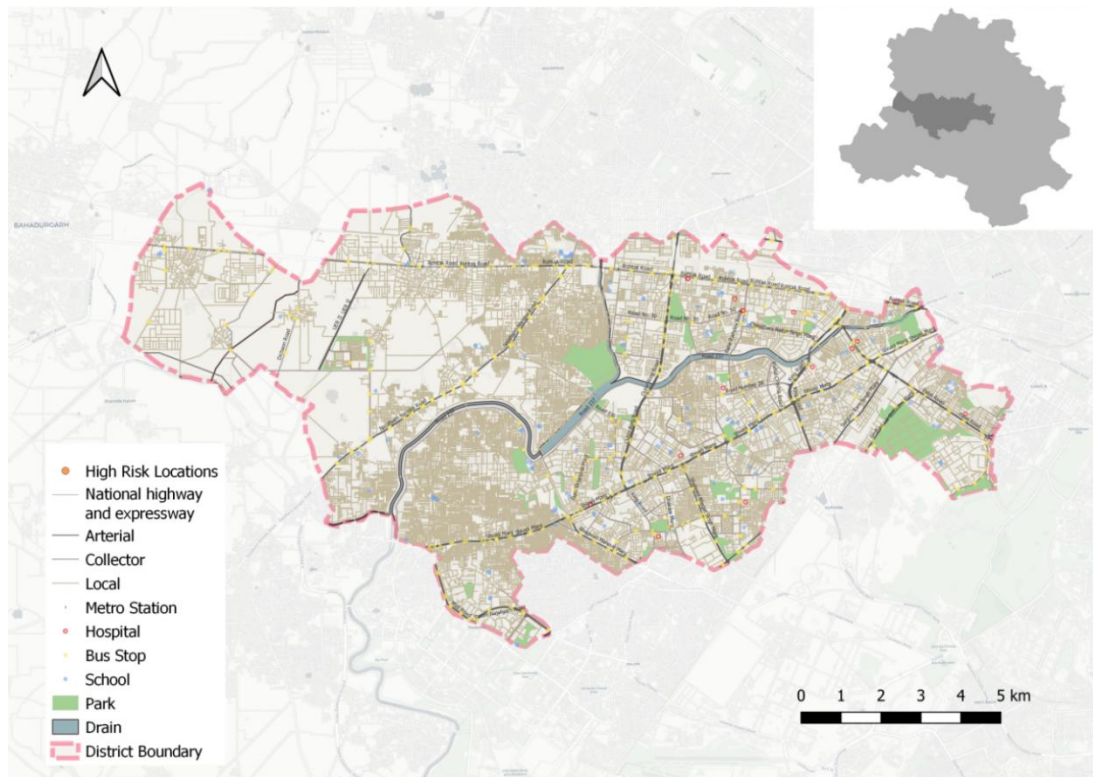


Figure 1: West district map

# A: ROAD SAFETY SITUATION AND TRENDS IN WEST DISTRICT

## A.1: ROAD CRASH DEATH TRENDS

### A.1.1 : FATAL ROAD CRASHES AND FATALITIES TREND.

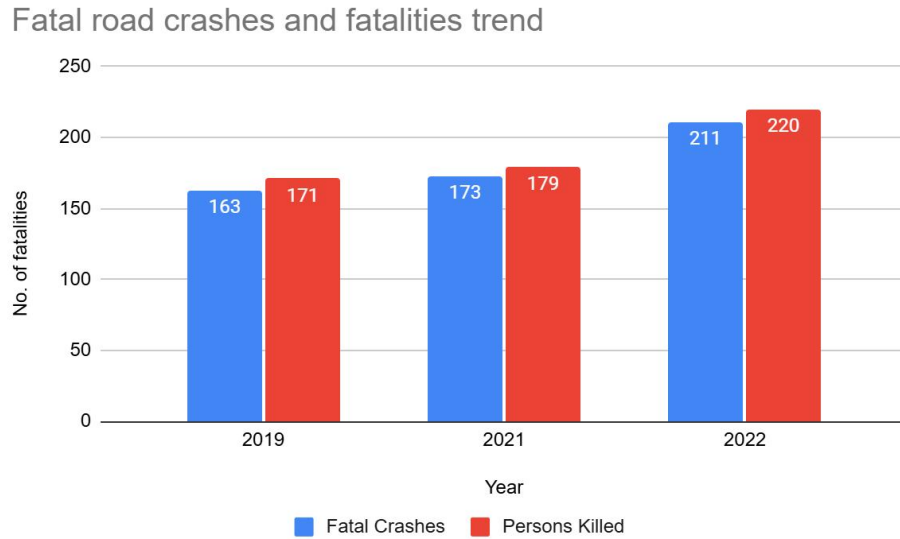


Figure 2: Fatal Road crashes and fatalities trend

There were 211 fatal road crashes in the West District of Delhi in 2022 with 220 persons killed in these crashes. There is a 22% increase in road crashes compared to the previous year 2021 which is 173. One person is killed in road crashes in the West District every one to two days.

## A.1.2 : ROAD CRASH FATALITIES BY ROAD USER TYPES

Road crash fatalities by road user types

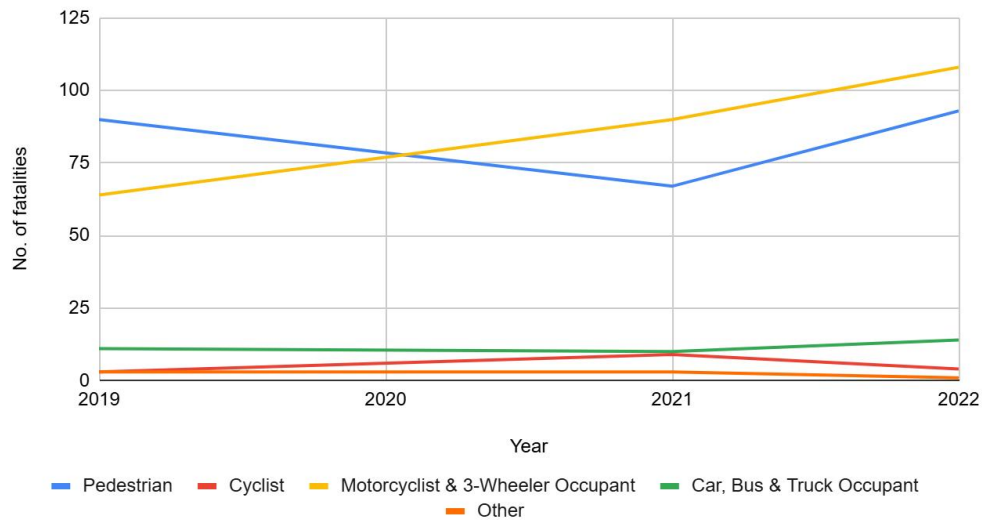


Figure 3: Road crash fatalities by road user types

Motorcyclists, auto rickshaw occupants and pedestrians formed a majority of persons killed in road crashes in the West District across all three years. Between the highlighted categories, the pedestrians' fatalities surpassed the motorcyclist and autorickshaw occupants' fatalities in 2021 and 2022.

A.1.3 : ROAD CRASH DEATHS BY MONTH

Road crash deaths (month-wise trends)

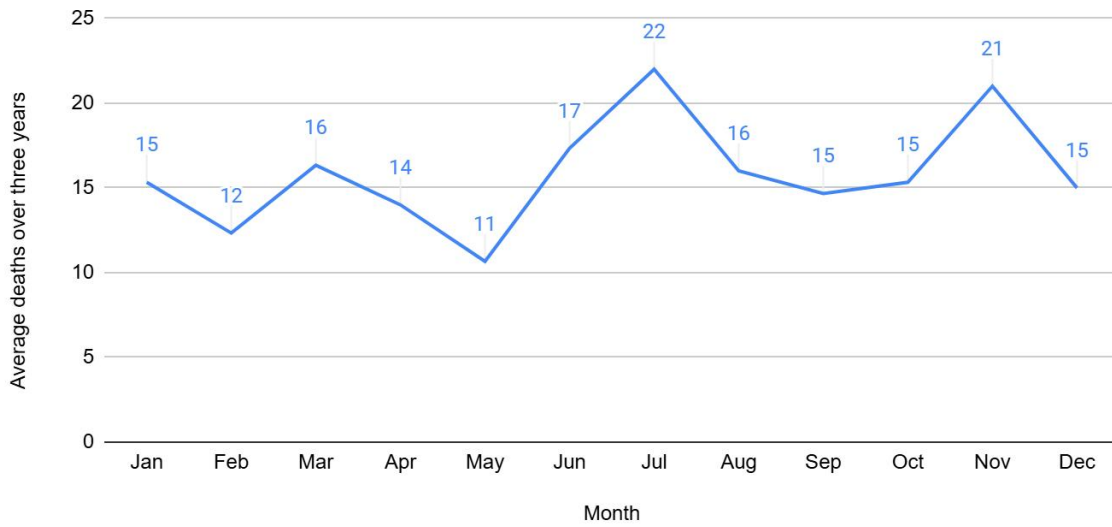


Figure 4: Average Road crash deaths by months

July witnessed the highest number of persons killed followed by November and June, there is no discernible pattern of fatalities by month.

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

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
02:00-06:00	8	8	6	11	14	5	14	66
06:00-10:00	10	12	11	8	11	10	6	68
10:00-14:00	7	6	9	4	11	8	7	52
14:00-18:00	8	9	12	11	11	7	16	74
18:00-22:00	14	16	13	20	15	16	9	103
22:00-02:00	31	23	22	19	23	37	32	187
<b>Total</b>	<b>78</b>	<b>74</b>	<b>73</b>	<b>73</b>	<b>85</b>	<b>83</b>	<b>84</b>	<b>550</b>

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

Thirty four percent of the total road crash deaths occurred at night 10:00 pm to 2:00 pm. Forty five percent of the total deaths occurred either on Friday, Saturday or on Sunday.

## A.2 : ROAD CRASH DEATHS BY AGE AND GENDER

### A.2.1 : ROAD CRASH DEATHS BY GENDER

Road crash deaths by gender

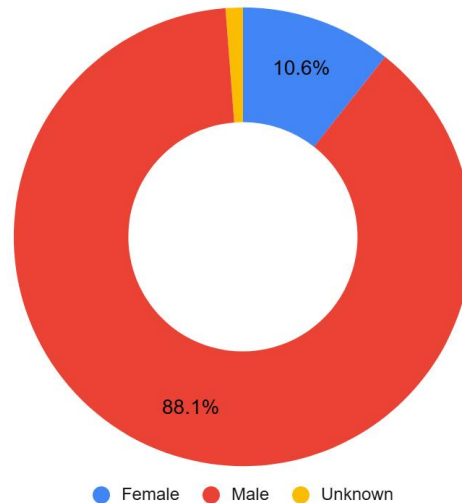


Figure 5: Road cash deaths by gender

### A.2.2 : ROAD CRASH DEATHS BY AGE-GROUPS AND GENDER

Road crash deaths by age and gender

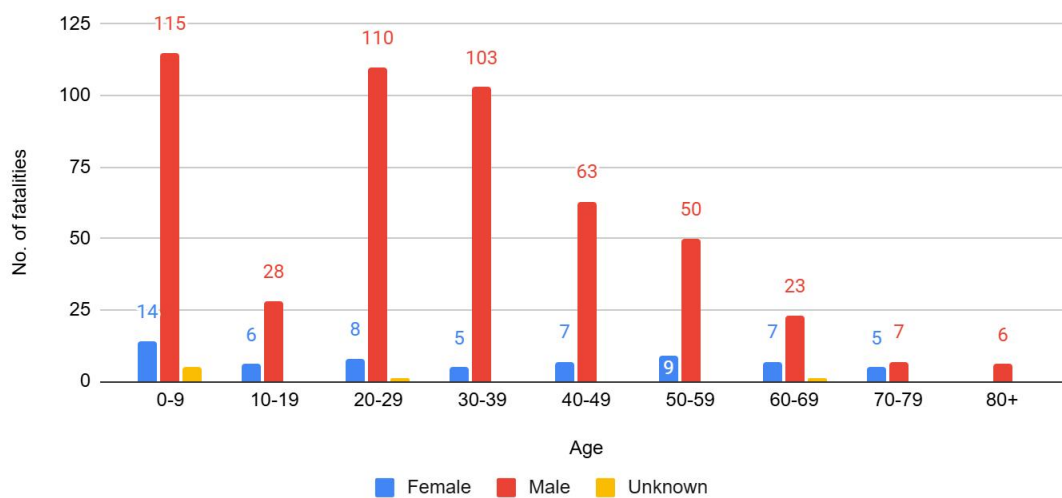


Figure 6: Road crash deaths by age groups and gender

Looking at the absolute numbers, the males had a higher number of fatalities 88% compared to females. Among the males, the fatalities were observed to be highest in the age group of 0-9 years, followed by 20-29 years.

### A.3: ROAD CRASH DEATHS BY ROAD USER TYPE

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

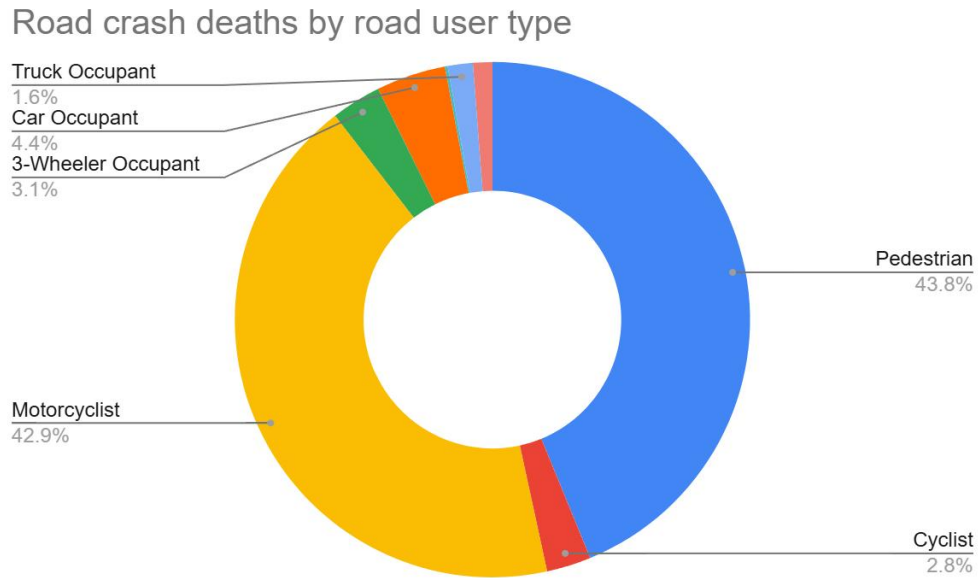


Figure 7: Road crash deaths by road user type (2019, 2021, 2022)

\*Other includes cycle rickshaws, converted rickshaws and hand carts

Ninety-three percent of fatalities were among vulnerable road users (i.e., pedestrians, motorcyclists, cyclists, and auto rickshaw occupants). Among this, forty three percent of road crash deaths in the West district were among motorcyclists, followed by pedestrians (44%).

A.3.2 : TIMEWISE ROAD CRASH DEATHS BY ROAD USER TYPE

Timewise road crash deaths by road user type

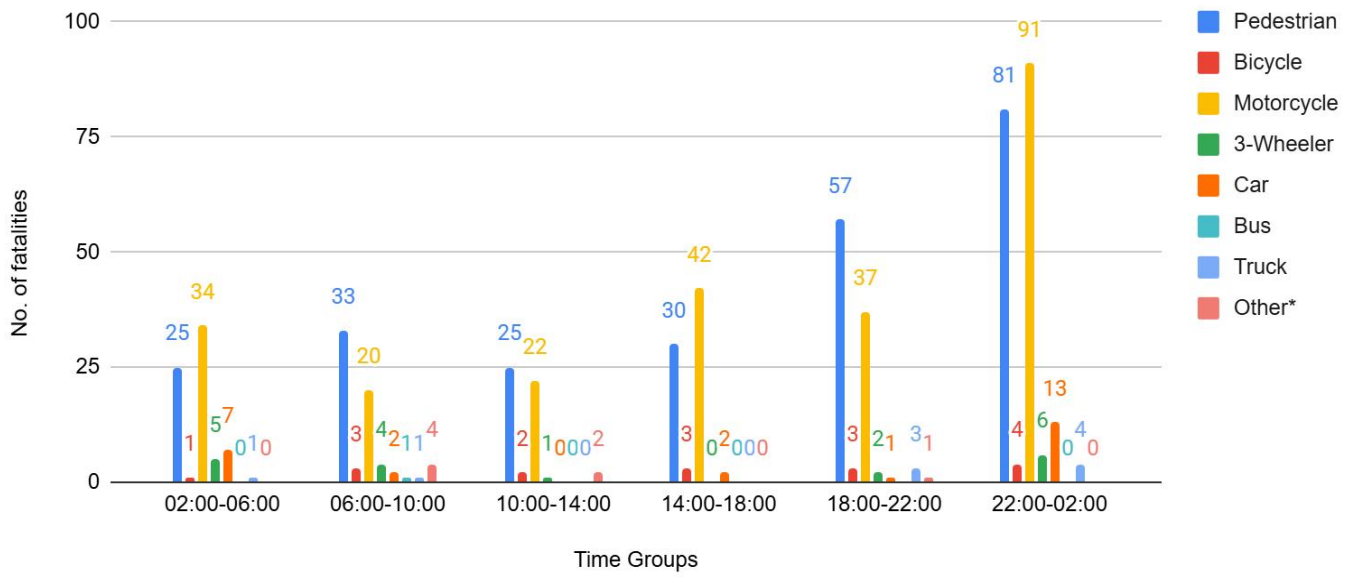


Figure 8: Timewise Road crash deaths by road user types

\*Other includes cycle rickshaws, converted rickshaws and hand carts

### A.3.3 : WHO-HIT-WHOM MATRIX

Victim Road User	Impacting Vehicle								
	Motorcycle	3-Wheeler	Car	Bus	Truck/Tractor	Single Vehicle Crash	Other	Unknown	Total
<b>Pedestrian</b>	21	2	31	14	30	0	2	151	<b>251</b>
<b>Cyclist</b>	2	0	3	2	7	0	0	2	<b>16</b>
<b>Motorcyclist</b>	2	5	35	20	61	17	7	99	<b>246</b>
<b>3-Wheeler Occupant</b>	0	0	6	0	5	2	1	4	<b>18</b>
<b>Car Occupant</b>	1	0	1	0	7	10	0	6	<b>25</b>
<b>Truck Occupant</b>	0	0	0	0	6	1	1	1	<b>9</b>
<b>Other</b>	0	1	3	1	0	1	0	2	<b>8</b>
<b>Total</b>	<b>26</b>	<b>8</b>	<b>79</b>	<b>37</b>	<b>116</b>	<b>31</b>	<b>11</b>	<b>265</b>	<b>573</b>

Table 2: Who-hit-whom matrix

Note: Other includes cycle rickshaws, converted rickshaws and hand carts

Among all fatal road crashes where the impacting vehicle was known, pedestrians and motorcyclists were found to be the most vulnerable category of road users. They were often hit by trucks and tractors. Hit-and-run crashes dominate both the categories of cases where the impacting vehicle was not known for 151 cases in case of pedestrians and 99 in case of motorcyclists.

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

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

#### Hit-and-Run and Non Hit-and-Run

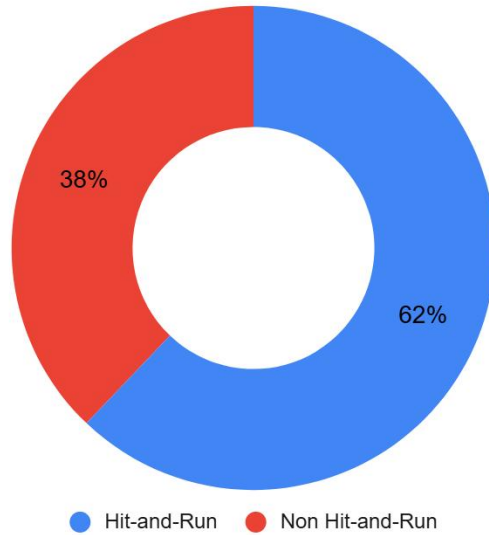


Figure 9: Percentage of hit-and-run and non-hit-and-run cases

Overall, two out of three 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

#### Hit-and-Run fatalities by road user type

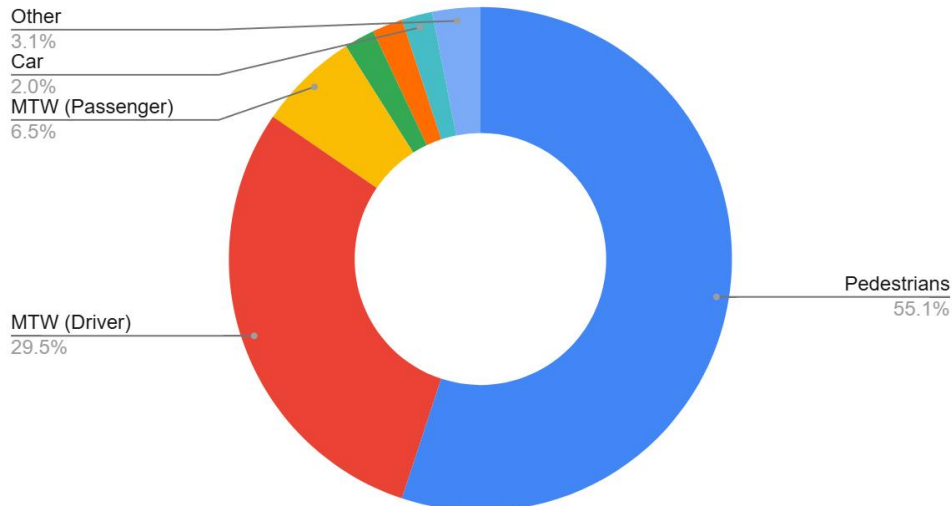


Figure 10: Hit-and-run Road user types

## A.5: ROAD CRASH HEATMAPS

### A.5.1 : HEATMAP OF ALL ROAD CRASH DEATHS

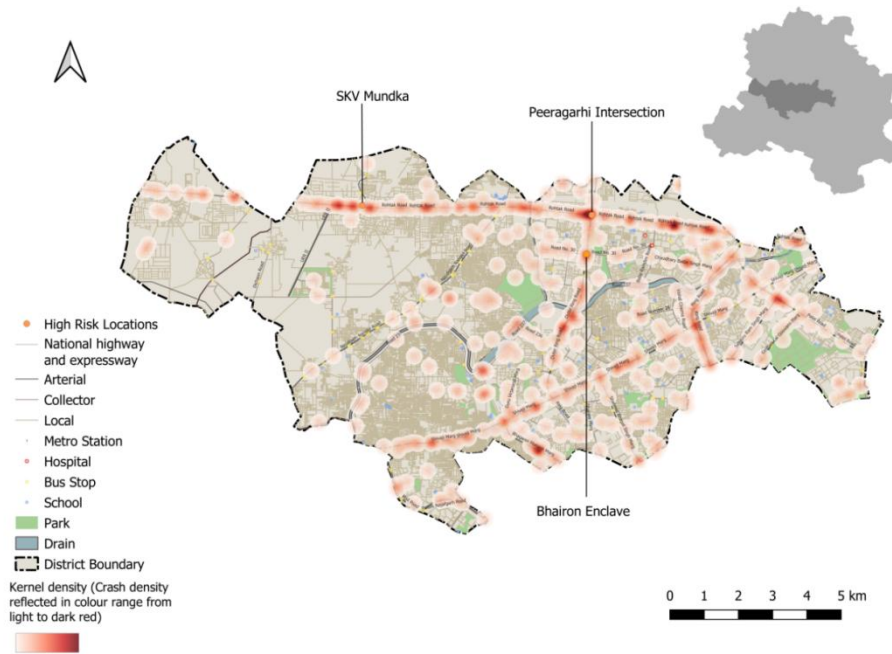


Figure 11: Heatmap of all road crash deaths in West district

### A.5.2 : HEATMAP OF ALL PEDESTRIAN DEATHS

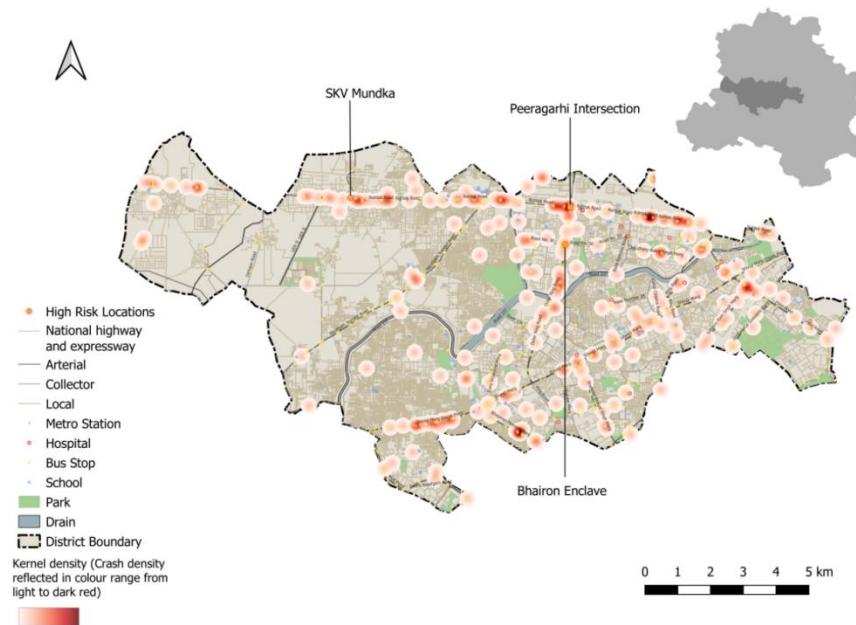


Figure 12: Heatmap of all pedestrian deaths due to road crashes in West District

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

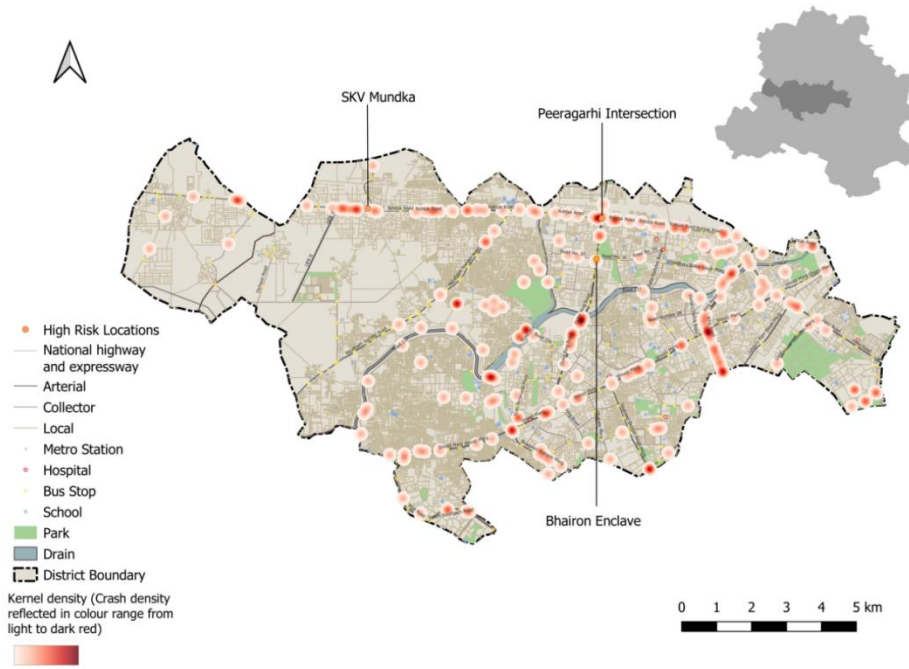


Figure 13: Heatmap of all motorcycle related deaths due to road crashes in West District

## A.6 : HIGH RISK LOCATIONS

### A.6.1 : LIST OF HIGH-RISK LOCATIONS

The following is a list of high-risk locations in the West district which includes the number of fatal crashes, hit-and-run crashes, and deaths occurred during these crashes in years 2019, 2021 and 2022.

High Risk Location	Total fatal crashes	Total hit and run fatal crashes	Total persons killed
Peeragarhi Intersection	24	10	27
Bhairon Enclave	6	4	6
SKV Mundka	12	9	16

Table 3: List of high-risk locations

### A.6.2 : MAP OF ALL HIGH-RISK LOCATIONS

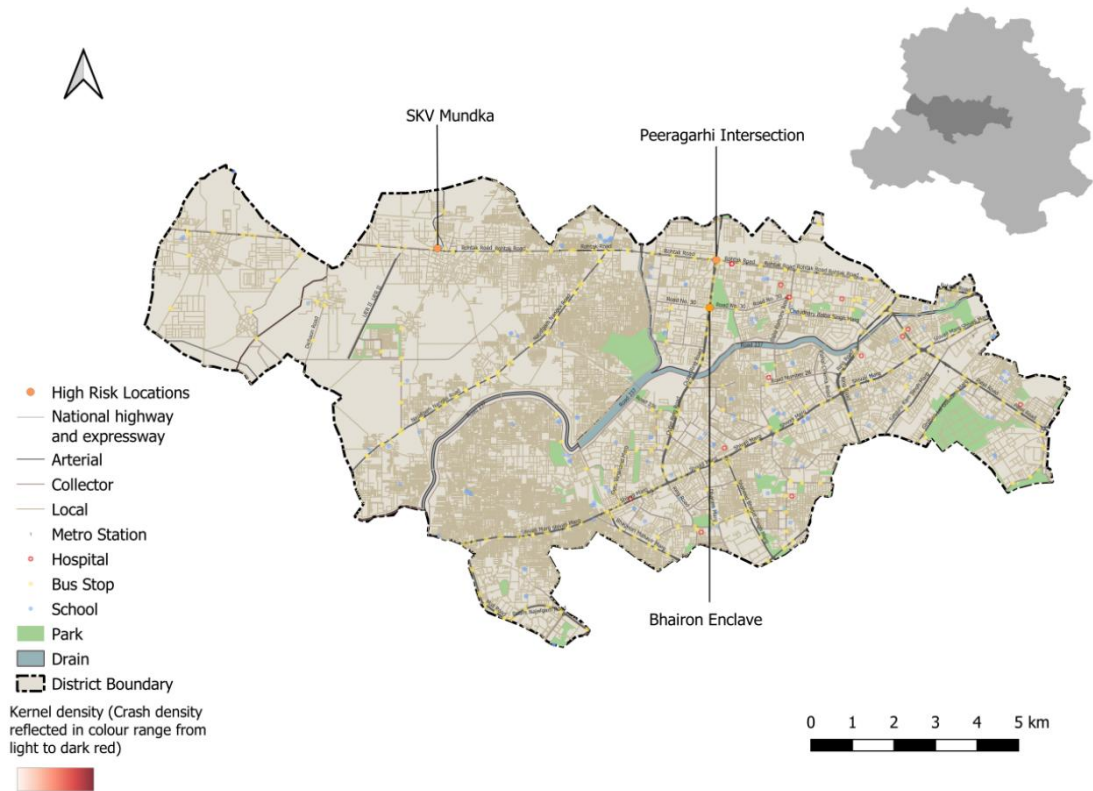


Figure 14: Map of all high-risk locations intervened in West District

### A.6.3 : HIGH RISK CORRIDORS

#### Pedestrian and motorcyclist fatalities in High Risk Corridors

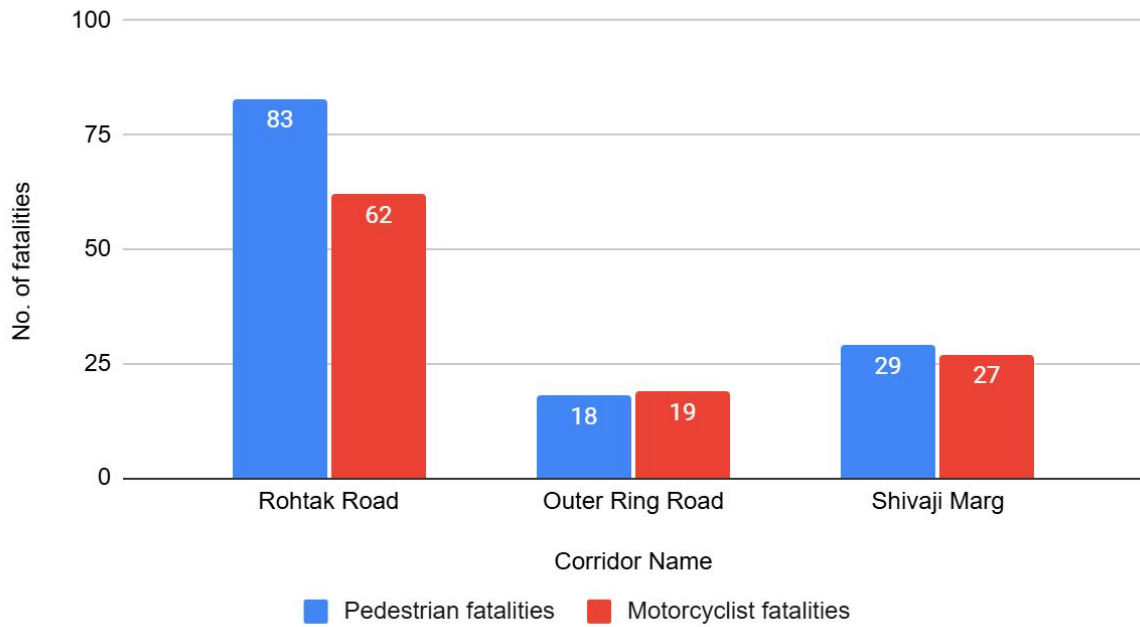


Figure 15: Vulnerable Road users on corridors

#### Death per km in High Risk Corridors

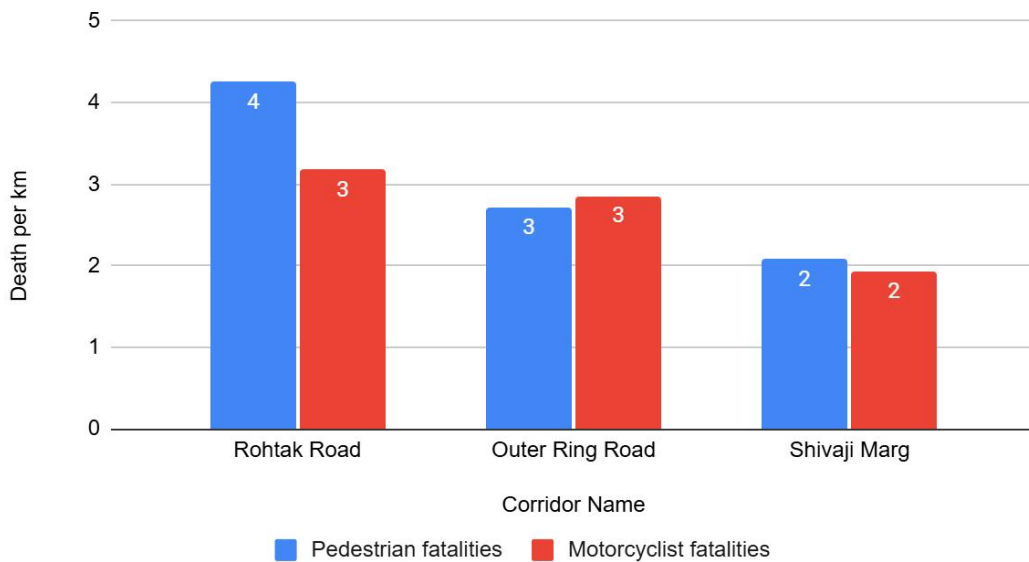


Figure 16: Vulnerable Road users' death per km

# B : DATA TO ACTION

## B.1 : PEERAGARHI CHOWK

### B.1.1 : GENERAL DESCRIPTION OF THE SITE

Peeragarhi Chowk (Latitude: 28° 40' 46.38"N, Longitude: 77° 5' 40.69"E). It is a four-arm junction which is signalised. The intersecting road names are Rohtak-Delhi Road (Arterial Road) and Outer Ring Road (Arterial Road).



Figure 17: Peeragarhi Chowk satellite image

### B.1.2 : EXISTING LAND USE

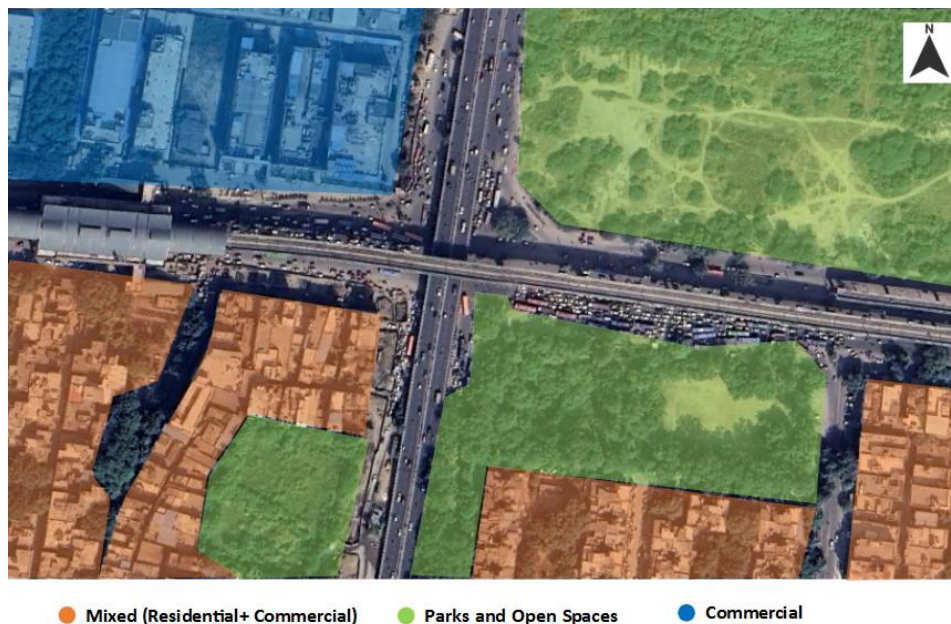


Figure 18: Existing land use around Peeragarhi Chowk

B.1.3 : EXISTING SCENARIO



Figure 19: Existing scenario of Peeragarhi Chowk

B.1.4 : ISSUES IDENTIFIED



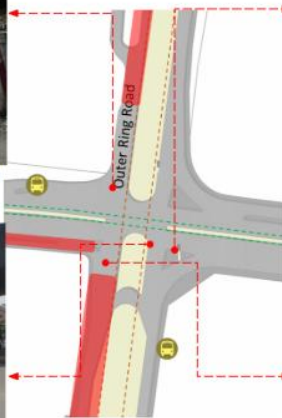
Damaged and obstructed pedestrian infrastructure on each arm with construction work.



Absence of pedestrian path due to DMRC construction work



Absence of delineators, chevron and hazard markings



Absence of signages and speed control measures at the intersection.



Figure 20: Issues identified at Peeragarhi Chowk

#### Issues Identified:

1. Absence of at-grade pedestrian infrastructure at the junction, making the pedestrians extremely vulnerable among the highspeed traffic movement.
2. Absence of pedestrian path due to DMRC construction work, should provide as per IRC 55.
3. Damaged and obstructed pedestrian infrastructure on each arm, most of the footpath is damaged and obstructed with construction work.
4. Absence of formal bus stops at junction due to construction by DMRC. DMRC should provide the temporary bus stops as per IRC 55.
5. Damaged & uneven road infrastructure.
6. Absence of traffic calming near junctions (to control the speed of vehicles).
7. Absence of road markings, signages and speed control measures at the intersection.
8. Absence of delineators and reflectors on the median and carriageway edges.
9. Absence of chevron marking and hazard markers or flexible markers at bull noses.
10. Absence of segregated cycle tracks on arterial roads.

## B.1.5 : PROPOSED DESIGN

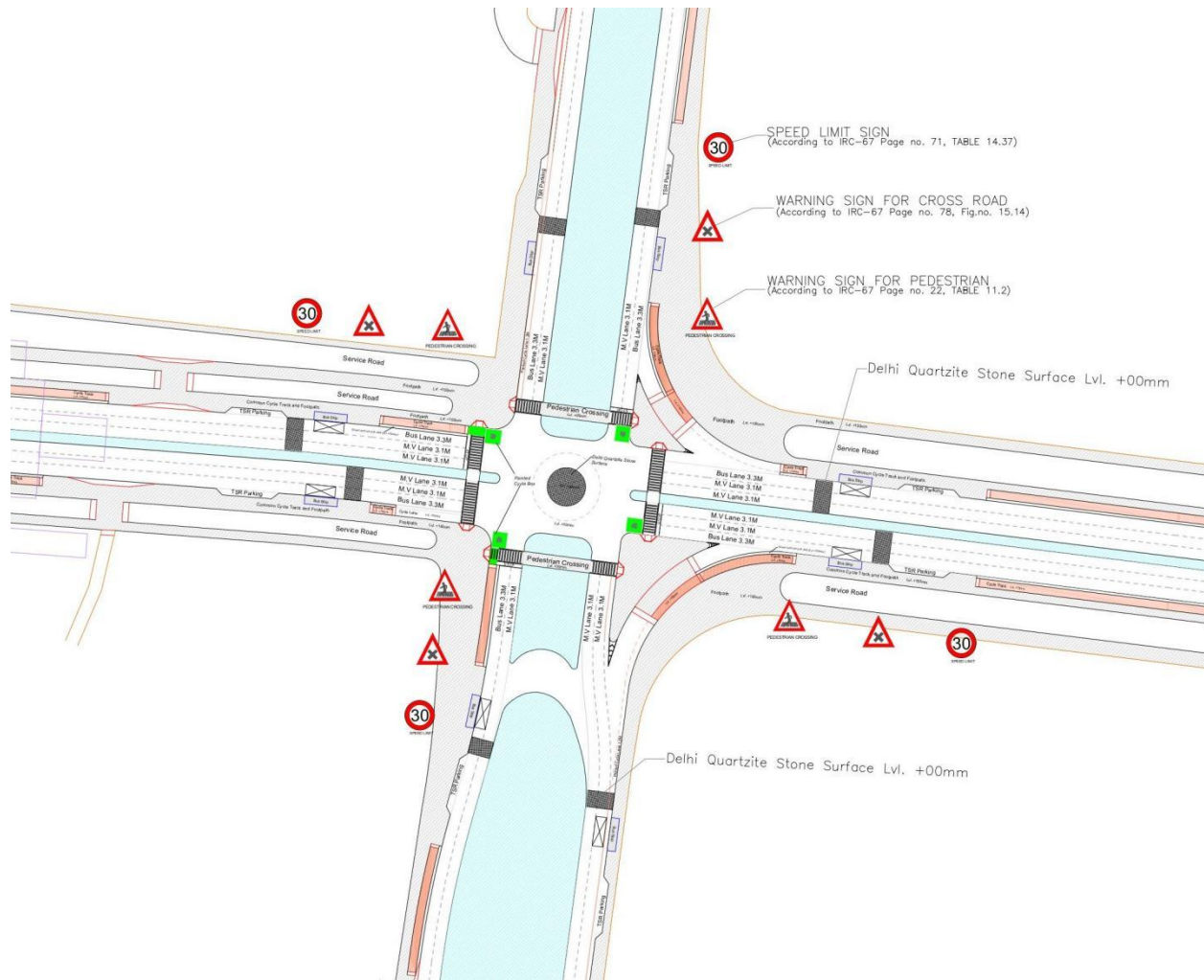


Figure 21: Proposed design for Peeragarhi Chowk

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 (as per IRC:103-2022)
3. Proposed new bus stop near the junction to reduce the pedestrian crossing movement
4. Dedicated 2.5m wide cycle track to separate the motor traffic and the cyclists (as per IRC: 11-2022)
5. Installation of signages - Speed Limit, stop sign, pedestrian crossing and other necessary Signages on all approaching roads
6. Redesigned the geometry of junction and proposed a roundabout with cobbled stone texture on surface to prevent speeding at junction
7. Corrected turning radius, road width and proposed raised crossing on free left turn
8. Provision of Delhi Quartzite stone surface to slow down the approaching traffic
9. Demarcation of Road Markings (properly painted as per IRC 35)
10. Provision of tactile pavers and kerb ramps for the accessibility of differently abled users (as per IRC:103-2022)

**B.1.6: SUMMARY BUDGET ESTIMATES**

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
<b>A</b>	<b>CIVIL WORK</b>					
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.	2682	21,457,718	2.146
A.2	Raised Crossing	Raised crssing with 80mm thick pavers and DQ stone surface	Providing and laying Raised crosseing with 80 mm thk pavers blocks, and DQ stone including Earth work and Base layers- PCC (M15), RCC (M30 Design mix) & GSB etc.	4124	2,185,957	0.219
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	3790	6,821,513	0.682

A.4	CC Items (Kerbs, Pipe, etc)	Kerb stones, Bollards, Kerb Channels etc.	Providing and fixing Kerbs, Bollards , and Kerb Channel etc. in CC.		2,354,097	0.235
A.5	Signages	Mandatory, Cautionary and Informatory Sign Boards of different sizes	Providing and fixing Signage Mandatory, Cautionary and informatory sign board inculding 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, Zebra Crossing, Bar Marking, etc)	Providing and applying road marking strips (retro-reflective) of specified shade/ colour using hot thermoplastic material for road marking .	748	643,108	0.064
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.		329,529	0.033
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	294,826	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 upto 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	3,326,900	0.333
A.11	Safety Management Equipment (as per design requirement)	Provision of Delieator Post, Spring Post, Cat eye/studs etc.	Miscellaneous items for Safety Management Equipment ( as per design requirement) -Provision of Delieator Post, Spring Post, Cat eye/studs etc. - including foundation and fixing etc.		139,221	0.014
A.12	Bus Shelter	10.5mX2.5m Bus Shelter (Stainless Steel Strcuture)			10,800,000	1.080
	<b>SUB TOTAL CIVIL WORK (A)</b>				<b>48,492,739</b>	<b>4.849</b>
<b>B</b>	<b>Drainage, Irrigation &amp; Plumbing</b>	(Drainage items based on design proposal)	<b>Drainage, Irrigation &amp; Plumbing work @ 20% of the cost of Civil work</b>	<b>20%</b>	<b>9,698,548</b>	<b>0.970</b>

<b>C</b>	Electrical Work	(Light poles, junction box, other electrical works proposed based on design proposal)	Electrical work @25% of the cost of Civil work	25%	12,123,185	1.212
<b>D</b>	Horticulture Work	(Landscape items based on design proposal)	Horticulture work @ 15% of the cost of Civil work	15%	7,273,911	0.727
<b>E</b>	Dismantling / Demolition	--	Dismantling work @ 15% of the cost of Civil work	15%	7,273,911	0.727
<b>F</b>	Work Zone Safety & Management	--	Work zone Management @ 5% of the cost of Civil work	5%	2,424,637	0.242
<b>PART 1</b>	<b>SUB TOTAL PART 1 (A+B+C+D+E+F)</b>				<b>87,286,930</b>	<b>8.729</b>
<b>G</b>	Design Services & Support	--	Design Consultancy (Preparation of Drawings, BOQ support, Work Zone plan, Site Supervision, Community Engagement & Liason, Change Management @ 2% - 8% of the cost of Civil work.	2%	1,745,739	0.175

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
<b>PART 2</b>	<b>SUB TOTAL PART 2 ( PART 1 + G +H)</b>				<b>89,112,669</b>	<b>8.911</b>
J	Contingencies '2.5%	--	Contingencies (@2.5% )		<b>2,227,817</b>	<b>0.223</b>
I	GST('@18%)	--	GST @18%		<b>16,441,287</b>	<b>1.644</b>
<b>FINAL</b>	<b>GRAND TOTAL (PART 2 + J + I)</b>				<b>107,781,773</b>	<b>10.778</b>

**Notes:**

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

7. Cost of Work Zone Management has been calculated at 5% of the civil work cost
8. 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.
9. Bus Shelter has been calculated at 18 L per shelter; can be changed as per design specific cost.
10. 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 : BHAIRON ENCLAVE

### B.2.1 : GENERAL DESCRIPTION OF THE SITE

Bhairon Enclave (Latitude: 28° 40'9.37"N, Longitude: 77° 5'34.57"E). It is a four-arm signalised junction. This intersection is intersecting Outer Ring Road (Arterial Road) and Captain Kumud Kumar Road (Sub-Arterial Road)



Figure 22: Bhairon Enclave satellite image

### B.2.2 : EXISTING LAND USE

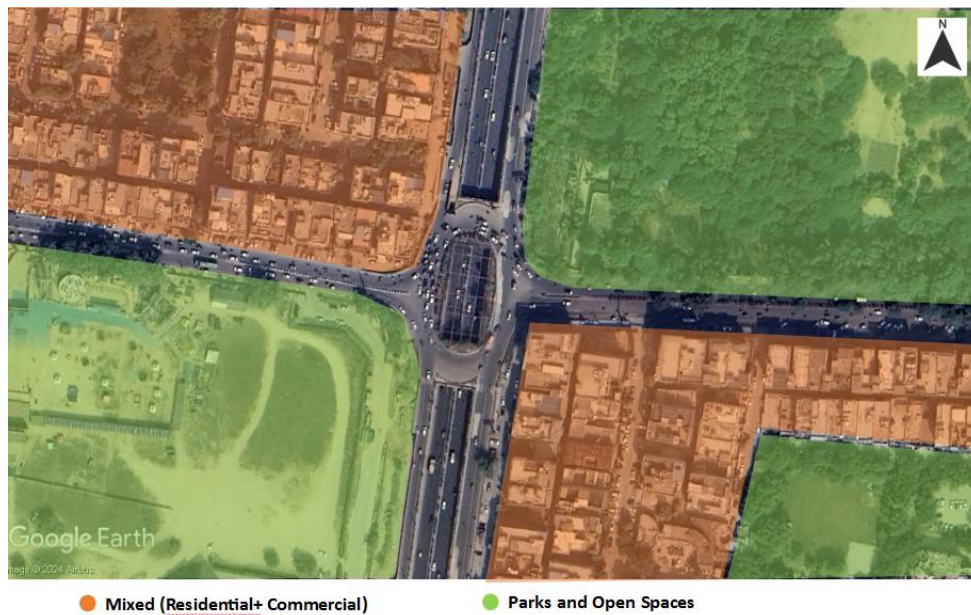


Figure 23: Existing land use near Bhairon Enclave Intersection

B.2.3 : EXISTING SCENARIO



Figure 24: Existing scenario at Bhairon Enclave



Figure 25: Existing vehicular and pedestrian movement at Bhairon Enclave

### B.2.4 : ISSUES IDENTIFIED



Absence of at-grade pedestrian infrastructure at the junction.



Damaged and obstructed pedestrian infrastructure on each arm



Absence of road markings



Absence of signages and speed control measures at the intersection.

1. Absence of at-grade pedestrian infrastructure at the junction, making the pedestrians extremely vulnerable among the highspeed traffic movement
2. Damaged and obstructed pedestrian infrastructure
3. Damaged & uneven road infrastructure
4. Absence of tactile flooring for differently abled users.
5. Absence of road markings, signages and speed control measures at the intersection.
6. Absence of delineators and reflectors on the median and carriageway edges.
7. Absence of chevron marking and hazard markers

## B.2.5 : PROPOSED DESIGN

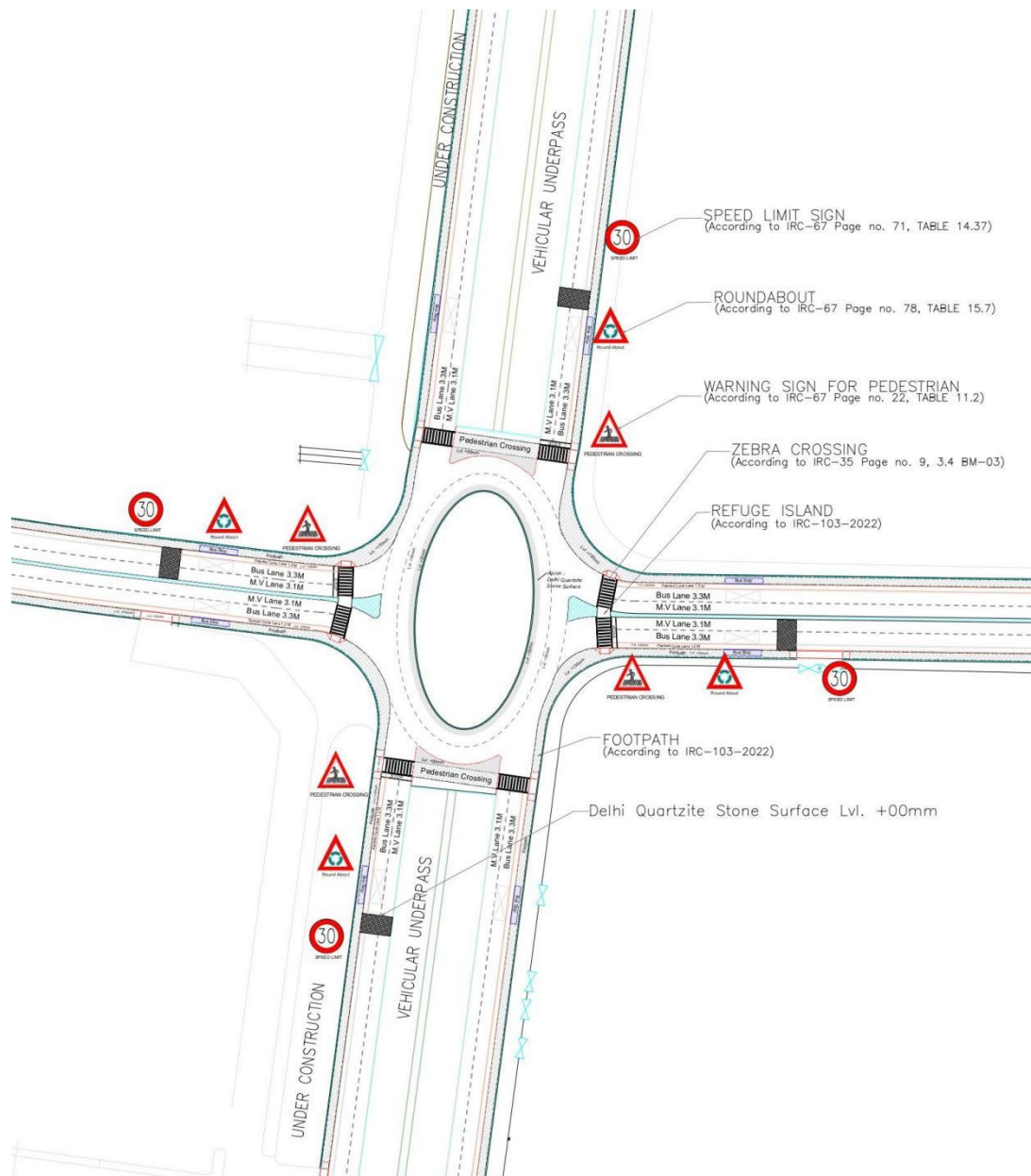


Figure 26: Proposed design for Bhairon Enclave

1. The junction is redesigned for the speed of 30 km/hr to ensure the safety
2. Proposed at-grade pedestrian infrastructure connecting with bridge over underpass to increase the accessibility and safety for pedestrians
3. Proposed new bus stop near the junction to reduce the pedestrian crossing movement
4. Installation of signages - Speed Limit, stop sign, pedestrian crossing and other necessary Signages on all approaching roads
5. Provision of Delhi Quartzite stone surface to slow down the approaching traffic
6. Demarcation of Road Markings (properly painted as per IRC 35)
7. Provision of tactile pavers and kerb ramps for the accessibility of differently abled users (as per IRC:103-2022)

**B.2.6 : SUMMARY BUDGET ESTIMATES**

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
<b>A</b>	<b>CIVIL WORK</b>					
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.	2939	8,464,711	0.846
A.2	Raised Crossing	Raised crssing 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.	-	-	0.000
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	777	1,165,700	0.117
A.4	CC Items (Kerbs, Pipe, etc)	Kerb stones, Bollards, Kerb Channels etc.	Providing and fixing Kerbs, Bollards , and Kerb Channel etc. in CC.		969,554	0.097
A.5	Signages	Mandatory, Cautionory and Informatory Sign Boards of different sizes	Providing and fixing Signage Mandatory, Cautionory and informatory sign board including all		72,548	0.007

S.No	Component	Details	Notes	Rate (per sq. m)	Cost (INR)	Cost (INR, crores)
			the fixing and labours etc.			
A.6	Marking	Thermoplastic Paint Marking (Edge lines, Centre Line, Lane Marking, Hazard Marking, Chevron, Zebra Crossing, Bar Marking, etc)	Providing and applying road marking strips (retro- reflective) of specified shade/ colour using hot thermoplastic material for road marking .	748	409,794	0.041
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.		143,470	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/CU M	147,413	0.015
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	43,140	0.004

S.No	Component	Details	Notes	Rate (per sq. m)	Cost (INR)	Cost (INR, crores)
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	2,521,440	0.252
A.11	Safety Management Equipment (as per design requirement)	Provision of Delieator Post, Spring Post, Cat eye/studs etc.	Miscellaneous items for Safety Management Equipment ( as per design requirement) -Provision of Delieator Post, Spring Post, Cat eye/studs etc.- including foundation and fixing etc.		72,323	0.007
A.12	Bus Shelter	10.5mX2.5m Bus Sheltor (Stainless Steel Strcuture)			10,800,000	1.080
	<b>SUB TOTAL CIVIL WORK (A)</b>				<b>24,810,093</b>	<b>2.481</b>
<b>B</b>	Drainage, Irrigation & Plumbing	(Drainage items based on design proposal)	Drainage, Irrigation & Plumbing work @ 20% of the cost of Civil work	20%	<b>4,962,019</b>	<b>0.496</b>
<b>C</b>	Electrical Work	(Light poles, junction box, other electrical works proposed based on design proposal)	Electrical work @25% of the cost of Civil work	25%	<b>6,202,523</b>	<b>0.620</b>
<b>D</b>	Horticulture Work	(Landscape items based on design proposal)	Horticulture work @ 15% of the cost of Civil work	15%	<b>3,721,514</b>	<b>0.372</b>

S.No	Component	Details	Notes	Rate (per sq. m)	Cost (INR)	Cost (INR, crores)
E	Dismantling / Demolition	--	Dismantling work @ 15% of the cost of Civil work	15%	3,721,514	0.372
F	Work Zone Safety & Management	--	Work zone Management @ 5% of the cost of Civil work	5%	1,240,505	0.124
<b>PART 1</b>	<b>SUB TOTAL PART 1 (A+B+C+D+E+F)</b>				<b>44,658,167</b>	<b>4.466</b>
G	Design Services & Support	--	Design Consultancy (Preparation of Drawings, BOQ support, Work Zone plan, Site Supervision, Community Engagement & Liason, Change Management @ 2% - 8% of the cost of Civil work.	2%	893,163	0.089
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
<b>PART 2</b>	<b>SUB TOTAL PART 2 ( PART 1 + G +H)</b>				<b>45,631,330</b>	<b>4.563</b>
J	Contingencies 2.5%	--	Contingencies (@2.5% )		1,140,783	0.114

S.No	Component	Details	Notes	Rate (per sq. m)	Cost (INR)	Cost (INR, crores)
I	GST(@18%)	--	GST @18%		8,418,980	0.842
<b>FINAL</b>	<b>GRAND TOTAL (PART 2 + J + I)</b>				<b>55,191,094</b>	<b>5.519</b>

**Notes:**

1. This is a preliminary estimate. Final costing to be evaluated & approved by the road owning agency.
2. DSR 2023 has been followed for all rates. Market Rate and Costing from part PWD projects has been included for certain items.
3. Cost of Drainage, Irrigation, Plumbing has been calculated at 20% of the civil work cost.
4. Cost of Electrical Work can be calculated at 20% - 25 % of the civil work cost.
5. Cost of Horticulture has been calculated at 15% of the civil work cost.
6. Cost of Dismantling has been calculated at 15% of the civil work cost.
7. Cost of Work Zone Management has been calculated at 5% of the civil work cost
8. Cost for Design Support can range from 2% - 8%, and can vary from site to site . This should include Technical Assistance on drawings, 3D supports, Site Supervision, Change management.
9. Bus Shelter has been calculated at 18 L per shelter; can be changed as per design specific cost.
10. 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 : SAFE SCHOOL ZONE: GSKV MUNDKA

#### B.3.1 : GENERAL DESCRIPTION OF THE SITE

Government Sarvodaya Kanya Vidyalaya (GSKV) is a government girls shift school, located on the Metro Road (15-16m ROW), adjoining the Delhi Rohtak Road and Lieutenant Vikrant Lakra Marg intersection in Mundka, Delhi. Being a shift school, the school campus is used by the Government Boys Senior Secondary School in the evening. On the opposite side of the school, there is a Delhi Metro Rail Corporation (DMRC) Yard, covered with a high boundary wall of about 11feet (approx). The land use in this block is institutional; however it is surrounded by residential, commercial and industrial infrastructure. The street also has an MCD school.

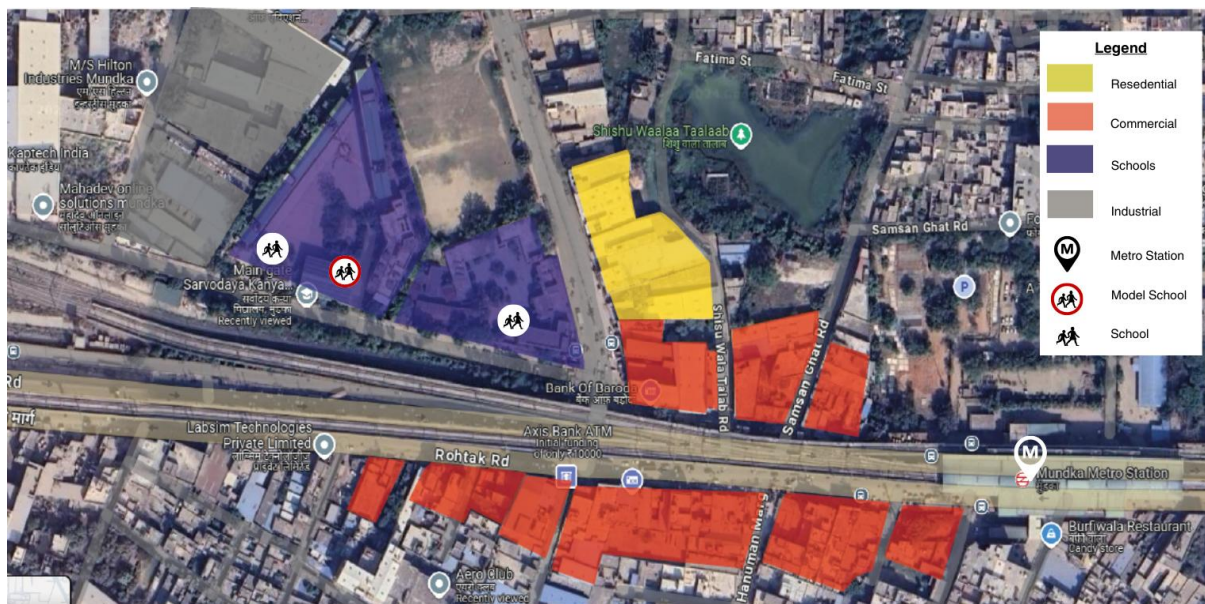


Figure 27: Land Use Map of GSKV Mundka (AY 22-23)

GSKV Mundka has a total enrollment of 4000+ students (as per the academic year 2022-2023), from class I to XII (age 6 to 18). The school premise has a total of two gates that open on the Metro road. Both are used by students during the entry and exit hour. Walking and public transport are observed to be the largest modes of transport used by students and the school community to commute to/from school.

### B.3.2 : ISSUES IDENTIFIED

**Observations on Road Infrastructure:** The school is located on a local street. Due to the traditional vehicle-centric planning approach, the road infrastructure does not promote pedestrian infrastructure and creates an unsafe environment for the vulnerable road users. High conflict between the students particularly during the entry/exit hours and motorised vehicles increases the risk of injuries, this creates an unsafe environment for students and school community. In District West, some of the critical issues observed also include heavy water logging with risk of electrocution during the monsoon seasons; instances of the e-rickshaws carrying students overturning are also reported. With that there is a lack of student friendly and safety infrastructure like traffic calming, accessible and continuous footpath, safe space to cycle, signages and marking. Integration of parking spaces, and pick-up and drop off zones are also needed. Better planning of utilities like lighting and drainage with green and vendor areas can promote a better environment in the school surroundings.



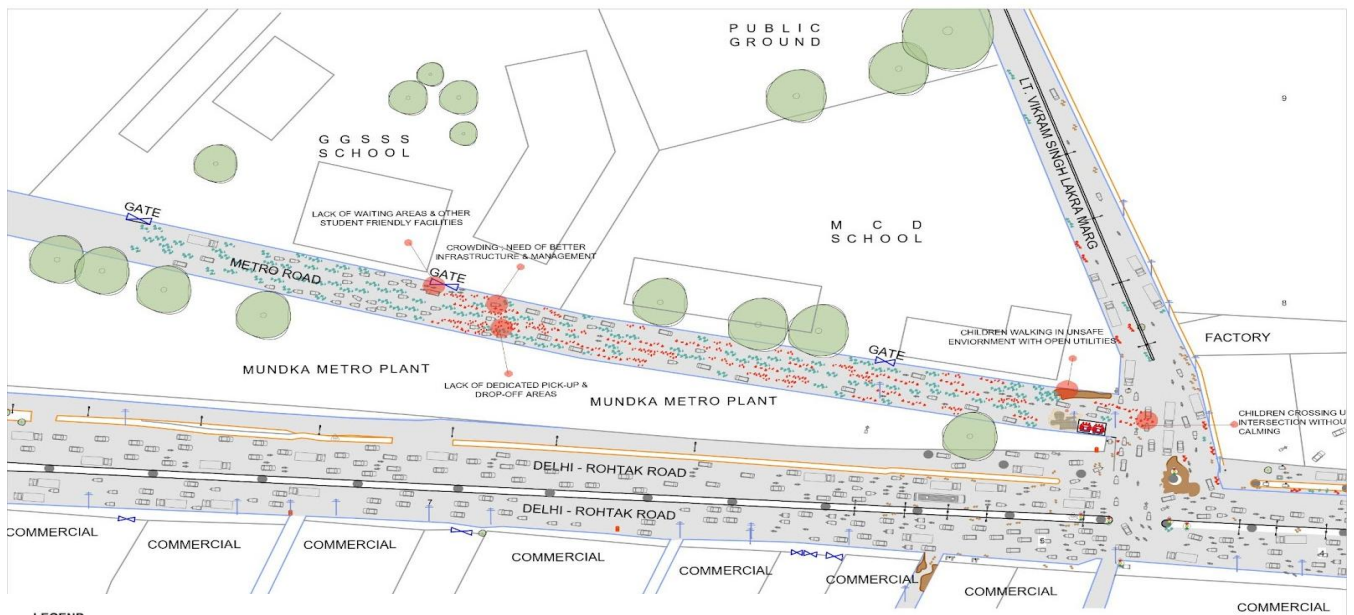
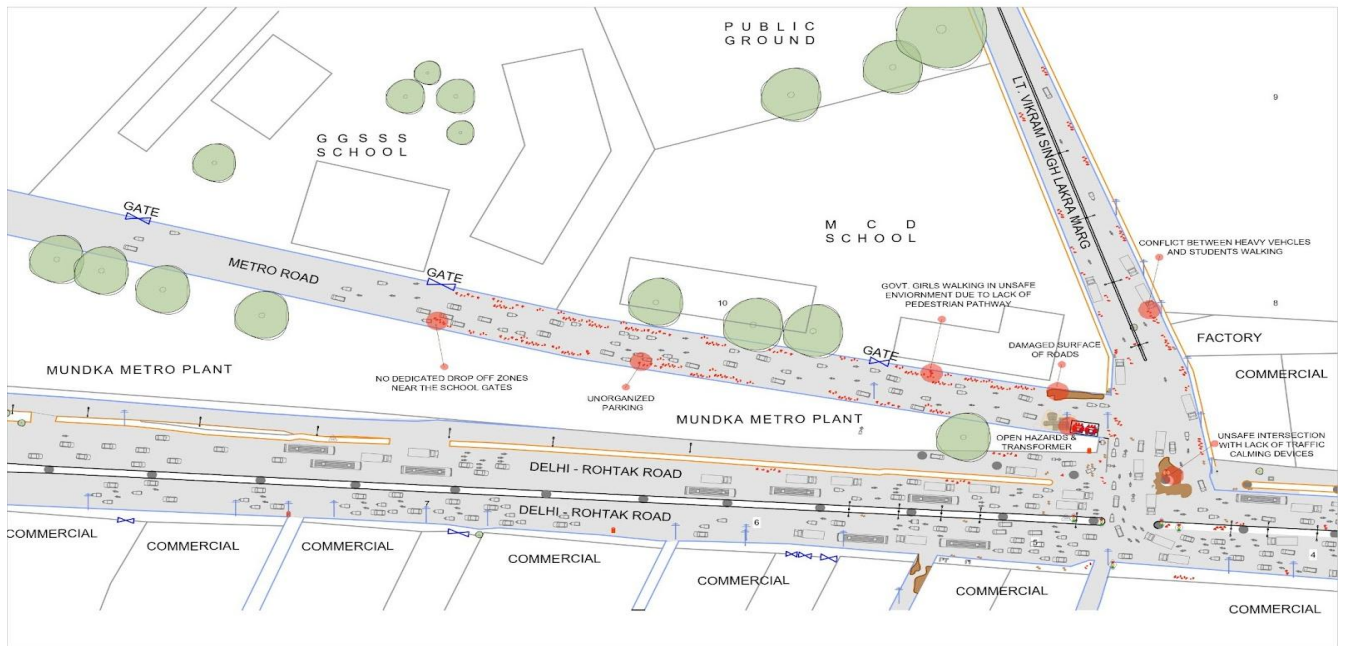
Figure 29: Site Photographs : Government Sarvodaya Kanya Vidyalaya- Students walking between heavy vehicles and crossing in conflict with high speed traffic (Left) ; Girls walking on the water logged roads during monsoons (Right)

**Type and quality of enforcement:** Due to the lack of dedicated pick-up and drop off zones during the entry/exit hours, issues of unorganized parking are observed. This leads to uncontrolled and chaotic traffic circumstances near the school gates and on the approaching ends of Metro road. As the school is located in the vicinity major intersection with no pedestrian infrastructure and safe crossing, with a high influx of heavy vehicles that makes the school environment unsafe. There is a requirement for traffic management personnel and teams to ensure safe and comfortable movement for all commuters. Since this school premises is used in shifts, the exit hours of the morning girls school overlaps with the entry hours of the evening boys school, leading to difficulties for students to navigate their way through the crowd.

**Road users behaviour and mobility patterns:** To understand the patterns of movements and conflicts in the school zone, activity mapping was conducted in morning hours (home to school traffic) and exit timing during afternoon (school to home).

An activity map documents all kinds of street users including vendors, vehicular movements & parking in a particular road environment specific to a certain time duration.

B. 3. 3 : ACTIVITY MAP



**LEGEND**


Figure 30: Activity mapping at GSKV Mundka (Home to School - Up, and School to Home - Down)

**Key Findings:**

<b>Morning : Home to School</b>	<b>Afternoon : School to Home</b>
<ul style="list-style-type: none"><li>● With the influx of heavy vehicles, the risk of crash and injuries among the girls walking to school increases.</li><li>● Due to the lack of traffic calming, girls have to travel with high speed moving traffic in the morning hours.</li><li>● Lack of dedicated parking areas near the school gates results in chaos and inconvenience to students and school community and other commuters.</li><li>● Need of drop-off zones for better management and smooth movement of people and traffic during the entry hours.</li><li>● Better planning of utilities is required as many open hazards are observed on the Metro Road.</li><li>● Due to lack of pedestrian and cycle infrastructure, girls have to travel with moving vehicles</li></ul>	<ul style="list-style-type: none"><li>● During the exit hours of the school crowding due to unorganised parking and lack of drop off-pick up zones is observed near the school gates.</li><li>● The exit hours of morning girls school overlap with entry hours of the boys school causing inconvenience to commuters due to the lack of planned infrastructure and management.</li><li>● Girls students have to walk in chaotic and unsafe environments with lack of traffic calming and other student friendly facilities.</li><li>● Lack of dedicated waiting areas for parents and other caregivers is observed in the school surroundings.</li><li>● Better planning of utilities is required as many open hazards are observed on the Metro Road.</li></ul>

### B.3.4 : PROPOSED DESIGN

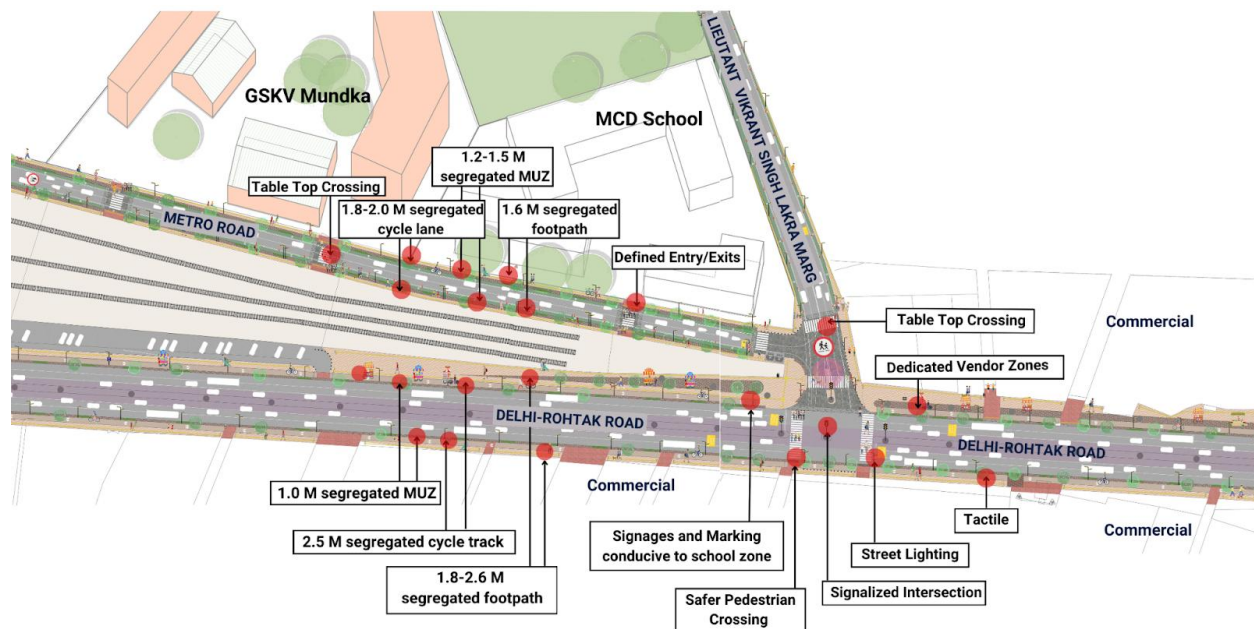


Figure 31: Proposed School Zone Plan for GSKV Mundka

#### DESIGN INTERVENTIONS:

The proposal prepared by road safety clubs (Refer Safer Delhi through Road Safety Clubs) is called ‘A Beautiful School Dream’ aligning to pedestrian first approach, traffic safety principles, UN Sustainable Development Goals and Ladder of Children Participation. A Beautiful School Dream is an area plan connecting 3 schools and the neighbourhood under 1.3 km 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 and safe mobility. Continuous footpaths with designated boarding areas and drop off zones have been proposed covering Delhi-Rohtak road till Mundka Metro Station, Metro Road and Lieutenant Vikrant Lakra Marg.

The Right of Way (ROW) and intersection design has been designed as per the street typology.

- 1.6-2.6 m accessible and segregated footpaths on both sides covering Metro Road, Delhi-Rohtak Road and Lt. Vikram Lakra Singh Marg
- 1.8-2.0 m segregated cycle lane on Metro Road, and 2.5m cycle track on Delhi-Rohtak Road. (as per IRC 11: 2015)
- 1.2-1.5 m of Multi-Utility Zone for Services such as lighting and drainage.
- Defined entry/exits in front of school gates.
- Designated boarding areas and drop off zones.
- Safer and Signalized Intersection with traffic calmings.
- Integrated Tactile and differently-abled features like ramps for wheelchairs.
- Integrated waiting spaces with street furniture & dedicated vendor areas.
- Integrated street artworks
- School Zone safety specific signage and marking
- Continuous carriageway 2 lanes on Metro Road



Figure 32: Render of the proposed Metro Road in front of GSKV Mundka

**Estimated budget** - Approx INR 12.5 Cr. for ~1.3 km length

Source: Estimated budget for 250m length of DAV Vasant Kunj Pedestrianisation (PWD II), Pilot School Zone, District South, Public Works Department, Delhi

**B.3.5 : SUMMARY BUDGET ESTIMATES**

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
A	<b>CIVIL WORK</b>					
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.	2850	22496373	2.250
A.2	Raised Crossing	Signalised Intersections and traffic calming at entry/exits	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.	5047	3255054	0.326
A.3	Cycle Infrastructure	2.5m segregated cycle tracks on 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	4505	11416053	1.142
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.		2504744	0.250

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
A.5	Signages	Provision of signages as per IRC 67 for school zone & 20km/h	Providing and fixing Signage Mandatory, Cautionary and informative sign board including all the fixing and labours etc.		345637	0.035
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 .	806	1897456	0.190
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, Pargola, Dustbin etc. complete items- including foundation and fixing etc.		2941949	0.294
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	740750	0.074
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	1027811	0.103
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	443879	0.044
A.11	Safety Management	Provision of Delieator Post, Spring Post, Cat eye/studs	Miscellaneous items for Safety Management Equipment ( as per design requirement) -Provision of		7000	0.001

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
	Equipment (as per design requirement)	etc.	Delicator Post, Spring Post, Cat eye/studs etc.- including foundation and fixing etc.			
A.12	Bus Shelter	Provision of new bus shelter.			7200000	
	<b>SUB TOTAL CIVIL WORK (A)</b>				<b>54276706</b>	<b>5.428</b>
<b>B</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%	<b>10855341</b>	<b>1.086</b>
<b>C</b>	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%	<b>13569177</b>	<b>1.357</b>
<b>D</b>	Horticulture Work	To increase green cover and shade, landscape plan to promote ground cover and trees for seasonal variation and color. Irrigation plan to be finalised with PWD.	Horticulture work @ 15% of the cost of Civil work	15%	<b>8141506</b>	<b>0.814</b>
<b>E</b>	Dismantling / Demolition	--	Dismantling work @ 15% of the cost of Civil work	15%	<b>8141506</b>	<b>0.814</b>

S.No	Component	Details	Notes	Rate (per sq.m)	Cost (INR)	Cost (INR, crores)
F	Work Zone Safety & Management	--	Work zone Management @ 5% of the cost of Civil work	5%	2713835	0.271
<b>PART 1</b>	<b>SUB TOTAL PART 1 (A+B+C+D+E+F)</b>				<b>97698071</b>	<b>9.770</b>
G	Design Services & Support	--	Design Consultancy (Preparation of Drawings, BOQ support, Work Zone plan, Site Supervision, Community Engagement & Liason, Change Management @ 2% - 8% of the cost of Civil work.	5%	4884904	0.488
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	80000	0.008
<b>PART 2</b>	<b>SUB TOTAL PART 2 ( PART 1 + G +H)</b>				<b>102662975</b>	<b>10.266</b>
J	Contingencies 2.5%	--	Contingencies (@2.5% )		2566574	0.257
I	GST(@18%)	--	GST @18%		18941319	1.894
<b>FINAL</b>	<b>GRAND TOTAL(INR) (PART 2 + J + I)</b>				<b>124170868</b>	<b>12.417</b>

**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 the 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%, and 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.

