PROJECT NOTES

1. BACKGROUND

Delhi being National Capital generates and attracts huge quantum of traffic not only from within Delhi but also from surrounding region. In order to cater to this regional traffic, Inner and Outer ring roads were planned in 1962, of which only inner ring road could be completed whereas outer ring road is still not a full ring. Additionally, non-Delhi destined traffic i.e. traffic to/from North Indian States (which includes Punjab, Northern Haryana, Jammu & Kashmir) to remaining Indian states (which includes Rajasthan, Southern Haryana, Gujarat, Maharashtra) has to pass through Delhi due to absence of alternate network. This leads to heavy congestion on the existing ring roads.

To address this issue & further decongest Delhi, Delhi Development Authority (DDA) as part of the Delhi Master Plan 2021 proposed Urban Extension Road (UER) - 2 as 3rd ring road of Delhi connecting all the major National Highways in the western side of Delhi including NH 1, NH 10, NH 8 and NH 2. The RoW for UER was decided as 100 m. Although substantial chunk of land was acquired in western part of Delhi between NH 1 and NH 8 including construction of road for a length of 16 Km (approx.) however, no progress was made in the section between NH 8 and NH 2. Also the section between NH 8 and NH 1 has major hindrances in terms of land acquisition including built up structures. DDA then decided to get the UER 2 section between NH 8 and NH 1 to be developed by NHAI and requested to advise on suitable alignment options at hindrance locations. Henceforth, the mandate to develop UER 2 is currently with NHAI. Later on during further discussions, two spurs were also proposed by NHAI to connect Bahadurgarh By-pass & Barwasni By-pass (near Sonipat) with UER 2. The spur form Bahadurgarh will cater to traffic originating from Rohtak, Hisar, Bahadurgarh in Haryana & destined towards Dwarka, Gurugram & Jaipur.

NHAI has further entrusted the task for preparation of Detailed Project Report (DPR) for development of UER 2 to URS Scott Wilson India Private Limited in association with AECOM India Private Limited as additional works to the contract agreement for Punjab-Package-I project of Bharatmala vide Letter No. NHAI/Planning/EC /Misc./2016/105069 dated 29/08/2017.

2. PROJECT DESCRIPTIONS

General

The study road as part of UER 2 – Package V starts from Km 26+135 of UER 2 (PKG 2) and terminates at Bahadurgarh By-pass near Village Balaur. This stretch of UER 2 (PKG V) falls in the state of Delhi & Haryana and most section of the alignment runs along the existing Mangeshpur Drain. **Figure 0-1** presents the alignment of UER-2 – Package V. UER 2 (main alignment) takes off from NH 1 (Ch. 23+800) near village Bankoli and terminates near the junction of Sector 24 in Dwarka. The present

alignment is proposed to connect NH 1 with NH 8 passing through Bawana Industrial Area, Rohini Sector 34, 35, 36, 37, Mundka Industrial Area, Najafgarh & Dwarka. The proposed alignment crosses Delhi-Karnal Railway Line, NH 10 and Delhi-Rohtak Railway Line and merges with the contract package of UER 2 taken up with Dwarka Expressway (Package 2) at Sector 24 which further connects it with Shiv Murti at NH 8. Dwarka expressway meets UER 2 at Sector 24 Junction Dwarka and connects UER 2 with State of Haryana till NH-8 at Km 40.070 near SPR Junction approx. 2 km before the Kherki Daula toll plaza.

The total length of UER 2 is 46.500 Km, out of which 38.111 Km is taken up as part of this project and a part alignment is being taken up with alignment of Dwarka expressway. The total length of Bahadurgarh Spur is 7.269 Km. The complete length of this corridor falls in the state of Delhi & Haryana.

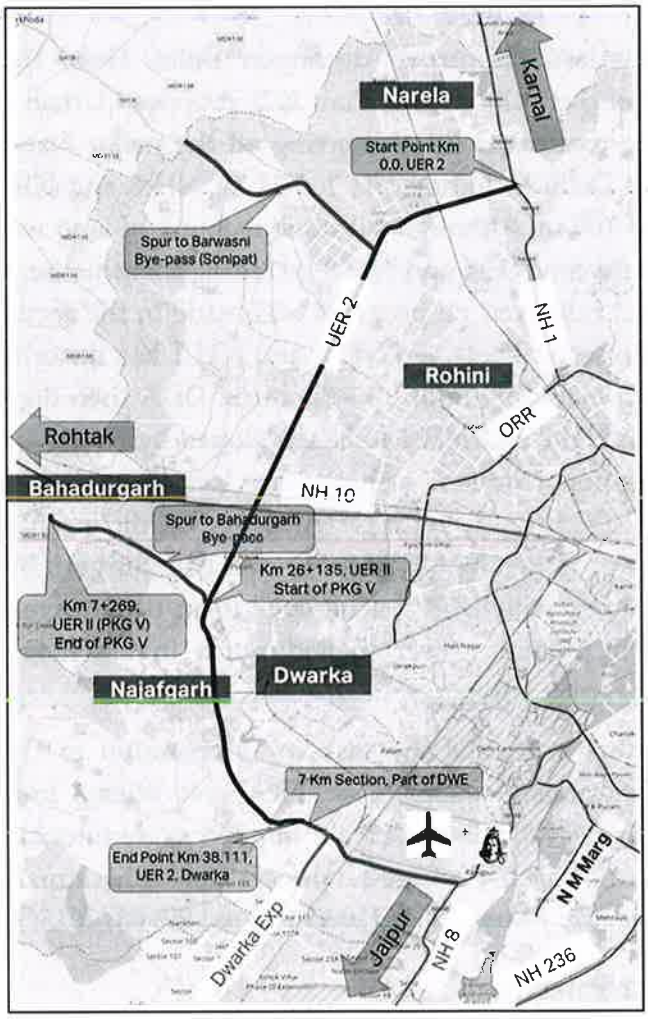

Figure 0-1: Spur to Bahadurgarh-Alignment

Contract Packaging

The total project has been further subdivided into 5 contract packages. The recommended contract packages and their respective lengths are described below:

Table 0-1: Contract Packages (UER 2 & Spurs)

S. No	Contract Package	Description	Chainage	Length (Km)
1.	Package 1	NH-1 Intersection to Karala-Kanjhawala Road	Km 0.000 to Km 15.000	15.0
2.	Package 2	From Karala Kanjhawala Road till Nangloi - Najafgarh Road	Km 15.000 to 28.450	13.45
3.	Package 3	From Nangloi - Najafgarh Road till Sector 24 Dwarka	Km 28.450 to 38.111.43	9.66
4.	Package 4	Spur to Sonipat By-pass (Bawana Industrial Area to Barwasni By-pass)	Km 0+000 to 28.300	28.3
5.	Package 5	Spur to Bahadurgarh By-pass {From Km 26+135 of UER 2 (Dichaun Kalan) to Bahadurgarh By-pass/ NH 10 near Village Balaur}	Km 0+000 to 7+500	7.500

The present report being submitted is only for Package V.

3. TRAFFIC FORECAST

Traffic Volume

UER 2 has been divided into five sections (three sections for UER 2 & 2 sections of Spurs) in such a way that traffic intensity within a particular section will be more or less uniform. The homogenous sections (HS) identified and their estimated average annual daily traffic in PCU are listed below:

Table 0-2: Annual Average Daily Traffic (PCUs)

S. No.	SECTION	2017	2020	2025	2030	2035	2040	2045	2047
I	NH-1 Intersection to NH 10 Intersection	20,455	28,010	44,358	65,927	93,147	1,25,991	1,58,642	1,74,098
II	NH 10 Intersection to Najafgarh-Dwarka Road	20,987	28,639	45,086	66,674	94,084	1,27,025	1,60,323	1,76,105
III	Najafgarh Road to Dwarka Sector 24 Junction	16,484	22,507	35,440	52,404	73,954	99,838	1,26,066	1,38,500
IV	Spur to Sonipat	7,138	9,710	15,264	22,563	31,914	43,208	54,990	60,607
V	Spur to Bahadurgarh	10,601	14,381	22,575	33,349	47,338	64,340	82,765	91,609

The current package of which this report is being submitted falls under Homogenous section V. The project corridor under this study is expected to serve **average annual daily traffic of more than 60,000 in next 25 years design period.**

4. ALIGNMENGT DESIGN:

The report details out the alignment design considerations for entire project however; the section below describes the alignment design of Package 5 only

Section 4: Between UER 2 (Km 26+135, NH 344-M) till Bahadurgarh By-pass

The proposed alignment of Spur to Bahadurgarh By-pass takes-off from Km 26+135 of UER 2/ NH 344-M. The spur makes a T-junction with UER 2. A grade separated interchange has been proposed at this location. The interchange will comprise of two right turning flyovers, one from Bahadurgarh Spur towards Dwarka (at Level +2) and one from NH-1 towards Bahadurgarh (Level +1). Part of road-works of this interchange has been taken up with UER 2 –Package 2. **Figure 0-2** presents the typical arrangement of road at this location.

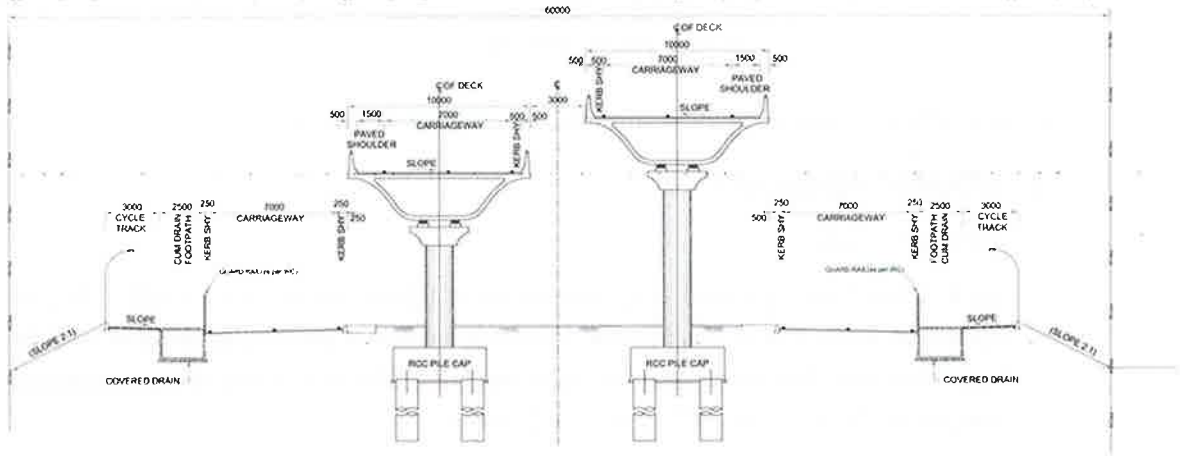

Figure 0-2: Typical Arrangement of Spur to Bahadurgarh at Take-off Location (Km 26+135)

After crossing the interchange arrangement, the alignment follows the standard alignment of 42 m as proposed for the Spur till Km 4+500. The same is presented in **Figure 0-3**.

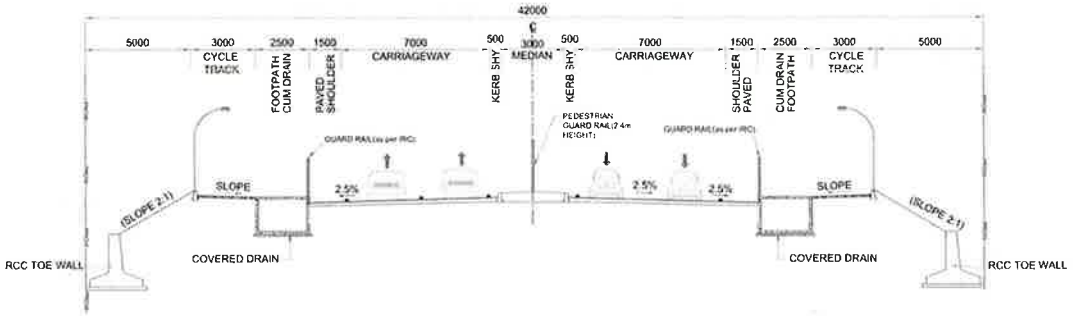

Figure 0-3: Typical Arrangement of Spur to Bahadurgarh (At-grade Section)

After Km 4+500 3 continuous structures have been proposed wherein, VUP has been proposed at Chainage Km 4+906, elevated structure has been proposed at Chainage 5+341 over connector drain to Mangeshpur Drain & road along the drain. Thereafter another elevated structure has been proposed at Chainage Km 5+642 for

Bahadurgarh-Najafgarh Cross Road. In addition to these, slip road has been provided along this section for providing accessibility to the nearby settlements/villages. **Figure 0-4** presents the arrangement of the same.

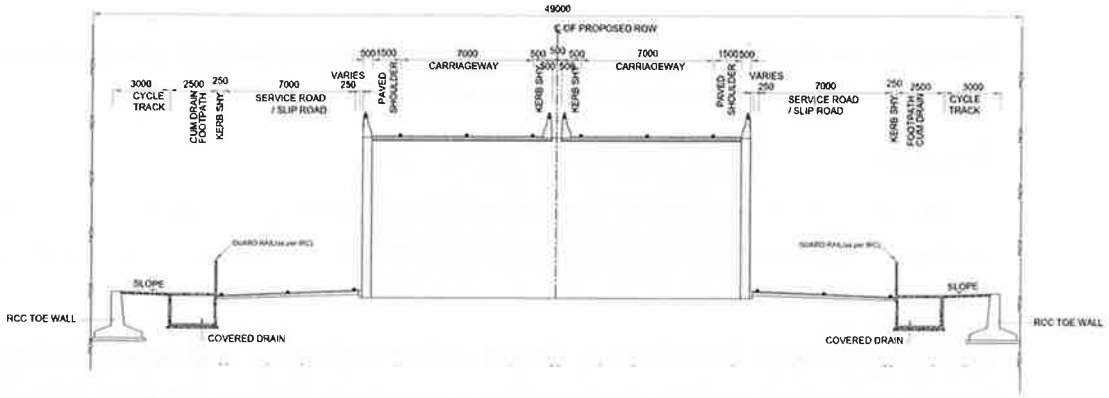

Figure 0-4: Typical Arrangement of Spur to Bahadurgarh from Jharoda Kalan- Tikri Kalan cross road till Bahadurgarh-Najafgarh Cross Road.

After crossing Najafgarh-Bahadurgarh cross road, the alignment continues to be at-grade till the interchange with NH-10 (Bahadurgarh By-pass). The proposed spur forms T-junction with NH-10 at Km 7+269 (Chainage of Spur alignment). One right turning elevated structure & one left turning elevated structure has been proposed at this interchange. The interchange shall comprise of a left turning elevated structure from Spur to Bahadurgarh towards Rohtak (NH-10) and right turning elevated structure from Rohtak (NH-10) towards Spur to Bahadurgarh. **Figure 0-5** presents the typical arrangement of the same. In addition to these two elevated structures, a left in has been proposed from NH-10 towards Spur (towards Dwarka), the same shall provide access to traffic accessing the spur from Bahadurgarh.

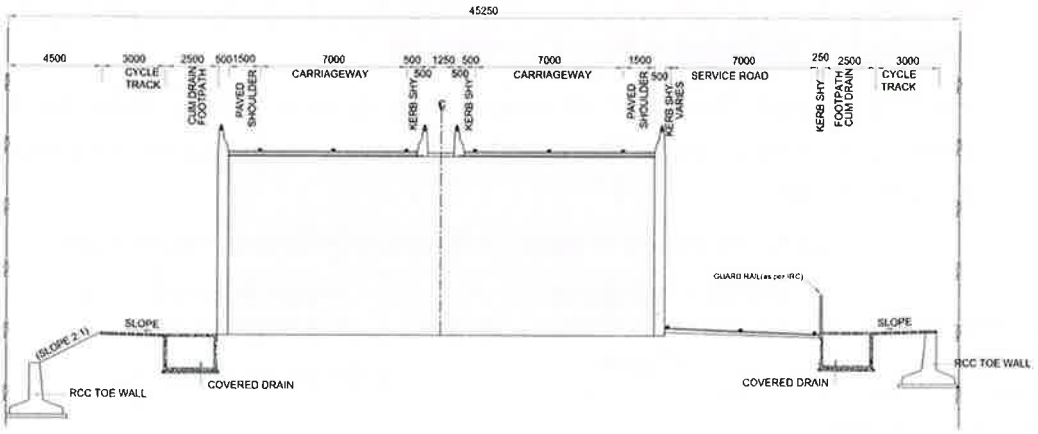

Figure 0-5: Typical Arrangement of Spur to Bahadurgarh at NH-10 Interchange.

The proposed TCS have also been attached in Volume 4-Drawings.

5. PROJECT DEVELOPMENT DESCRIPTION

Proposed Pavement

Main Carriageway, Slip Road, Service road and all ramps of flyovers shall be flexible pavement.

Stone Matrix Asphalt 50mm thick laid in single layer shall be provided as wearing course on all grade separated structures and bridges.

Design Life

For the design of pavement, the design life is defined in terms of the cumulative number of standard axles that can be carried before strengthening of the pavement is necessary.

Flexible pavement for new pavement or for widening and strengthening of the existing pavement shall be designed for a minimum design period of 20 years. Stage construction shall not be permitted. All rigid pavements should be designed for a minimum design period of 30 years. The minimum thickness of rigid pavement shall be 300 mm of Pavement Quality Concrete (PQC) and 150 mm of de-bonded Dry Lean Concrete (DLC)

Main carriageway, Interchange ramps shall be designed for minimum design traffic of 100 MSA.

For new flexible pavement of all the above roads, following minimum thickness of the bituminous layers shall be maintained:

- BC – 50 mm
- DBM – 115 mm

For service roads, slip roads, flexible pavement shall be designed for minimum 20 MSA.

Proposal for Widening of Main Carriageway

For Bahadurgarh Spur and all ramps merging to or exiting from the Expressway under this scope of work, the paved carriageway including shyness shall be as per the table below:

Table 0-3: Details of Main Carriageway for Spur to Bahadurgarh

S. No.	Chainage of UER-II		Design Chainage of UER-II / Individual Link / Ramp		Length (m)	Width of Paved Carriageway (m)		Remarks
	From	To	From	To		Left C/w	Right C/w	
Main Carriageway (MCR0)								
1	0+960	7+269	0+960	7+269	6309	9.0	9.0	7.0 wide Carriageway, 1.5 m wide paved shoulder on left hand side, 0.5 m wide kerb shy distance on right hand side (in both directions)

Note:

1. *Reconstruction of main carriageway (as per the requirement set forth in Schedule D and the Manual) along the location of overlap with existing carriageway shall be included in the scope of work.*
2. *The design & integration of Spur to Bahadurgarh By-pass (UER 2-Package 5) with UER – Package 2 & NH – 10 (Bahadurgarh By-Pass) and necessary co-ordination with various agencies including DDA, DJB, Delhi Police, TCPO Haryana, PWD Haryana etc. shall be included in the "scope of works".*

Intersections

A total of 6 major intersections are proposed to be improved as a part of upgradation project. The junction improvement plan for junctions is listed in Table given below:

Table 0-4: Major Junction Improvement Proposal

S. No.	Location	Salient Features	Minimum Length of viaduct to be provided	Road to be carried under/ above the structure	Remarks
1	0+643	Intersection of Spur to Bahadurgarh with Jharoda Kalan-Hiran Kudna Cross Road	As per Clause 2.9	Main Carriageway	Main Carriageway Elevated, cross road at-grade
2	3+921	Intersection of Spur to Bahadurgarh with Cross Road	As per Clause 2.9	Main Carriageway	Main Carriageway Elevated, cross road at-grade
3	4+906	Intersection of Spur to Bahadurgarh with Mundka-Jharoda Kalan Cross Road	As per Clause 2.9	Main Carriageway	Main Carriageway Elevated, cross road at-grade
4	5+341	Intersection of Spur to Bahadurgarh with Mundka Industrial Area Cross Road	As per Clause 2.9	Main Carriageway	Main Carriageway Elevated, cross road at-grade
5	5+642	Intersection of Spur to Bahadurgarh with Najafgarh-Bahadurgarh Road	As per Clause 2.9	Main Carriageway	Main Carriageway Elevated, cross road at-grade
6	7+269	Intersection of Bahadurgarh Spur with Bahadurgarh By-Pass (NH-10)	As per Clause 2.9	Main Carriageway	Left Turning Flyover from Bahadurgarh Spur (UER 2-PKG V) towards Rohtak – **MC06**, Right Turning Flyover from Rohtak towards Bahadurgarh Spur (UER 2-PKG V) – **MC05**, rest all movements remain at-grade

Proposal of Flyovers, Bridges, Culverts and other Structures

a) Bridges

There are no existing major or minor bridges on the project road under Package-V. However, 2 minor bridges & 2 new culverts (balancing culverts) are to be constructed on the project corridor. Detail of the same given in Table 0-5 & Table 0-6.

Table 0-5: Proposed Minor Bridges

Sl. No	Chainage (km)	Type of Structure	Span Arrangement (m)	Width (m)	Remarks
1	2+595	RCC Box	1 x 8.5 m	34.0	
2	5+392	RCC Box	20+30 m	7.5 m, 2 nos.	Service Road Bridge

Table 0-6: Proposed Culverts

Sl. No	Chainage (km)	Type of Culvert	Span /Opening with span length (m)
1	1+600	Box	2*2
2	6+200	Box	2*2

b) Proposal for Elevated Structure/Flyover/Underpass

Table 0-7: Proposal for Elevated Structure, Flyover, Underpasses

S. No.	Design Chainage	Length (m)	Proposed Structure	Width (m)	Vertical Clearance (m)	Remarks
1	0+232 to 0+498	266	Elevated Flyover	10.0	As per design Profile	Main Carriage way Elevated (7.0 m wide carriageway, 1.5 m wide paved shoulders on left hand side, 0.5 m wide kerb shy distance on right hand side and 0.5 m wide crash barrier on both sides) – **MC05**
	0+498 to 0+585	87			5.5 m	
	0+585 to 0+794	209			As per design Profile	
2	0+232 to 0+502	270	Elevated Flyover	10.0	As per design Profile	Main Carriage way Elevated (7.0 m wide carriageway, 1.5 m wide paved shoulders on left hand side, 0.5 m wide kerb shy distance on right hand side and 0.5 m wide crash barrier on both sides) - **MC06**
	0+502 to 0+570	68			5.5 m	
	0+570 to 0+780	210			As per design Profile	
3	0+636 to 0+651	15 (Skewed)	Underpass Box (VUP)	12	5.5	VUP for cross road (7 m wide carriageway, 1.5 m wide paved shoulder in both directions and 1 m wide footpath cum covered drain in both directions)
4	3+917 to 3+925	8 (Skewed)	Underpass Box (SVUP)	7.0	4.0	VUP for cross road (5.0 m wide carriageway and 1.0 m wide footpath cum covered drain in both directions)
5	4+900 to 4+912	12	Underpass Box (VUP)	12	5.5	VUP for cross road (7 m wide carriageway, 1.5 m wide paved shoulder in both directions and 1 m wide footpath cum covered drain in both directions)
6	5+326 to 5+413	87 (skewed)	Flyover	20.5	5.5	Flyover (7 m wide carriageway in both directions, 1.5 m wide paved shoulder in both directions, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on Right hand side & left hand side in both directions and 0.5 m wide central median)
7	5+606 to 5+676	70	Flyover	20.5	5.5	Flyover (7 m wide carriageway in both directions, 1.5 m wide

S. No.	Design Chainage	Length (m)	Proposed Structure	Width (m)	Vertical Clearance (m)	Remarks
						paved shoulder in both directions, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on Right hand side & left hand side in both directions and 0.5 m wide central median)

Note:

a) Vertical clearance of 5.5m, wherever applicable as per the above table, shall be maintained between the at-grade service road, Service road and all the structural components of the elevated/ underground main carriageway / Link/ slip road/ Service Road.

b) In all underpasses for the service road, links and ramps, the width of underpass including the merging locations shall cater to adequate set back distance to ensure stopping sight distance corresponding to the design speed.

c) Width of elevated structure mentioned is the outer width including crash barrier.

d) Width of underpass/VUP is clear width excluding the wall thickness. The width is typical and shall cater to adequate set back distance to ensure stopping sight distance corresponding to the design speed.

e) Any Changes in GAD, span arrangement or any other features due to comments/observations or approval of other agencies such as Irrigation & Flood Control Dept.-Govt. of Delhi, Indian Railways, PWD-Govt. of Haryana etc. shall not be considered as "change in scope of works"

c) Details of Grade Seperated Strcutres

The summarised details of proposed grade separated structures are given below in table:

Table 0-8: Details of all Grade Separated Structures

S. No.	Design Chainage	Length (m)	Proposed Structure	Remarks
1	0+232 to 0+794	562	Elevated Flyover	Main Carriageway Elevated from NH-10 (from Rohtak) to Bahadurgarh Spur (Towards UER 2) - **MC05**
2	0+232 to 0+780	548	Elevated Flyover	Main Carriageway Elevated from Bahadurgarh Spur (From UER 2) towards NH-10 (Towards Rohtak) - **MC06**
3	0+636 to 0+651	15 (Skewed)	VUP	Dichaon Kalan- Hiran Kudna Cross Road
4	3+917 to 3+925	8 (Skewed)	SVUP	Cross Road
5	4+900 to 4+912	12	VUP	Mundka-Jharoda Kalan Cross Road
6	5+326 to 5+413	87 (skewed)	Flyover	Tikri Kalan-Mundka Industrial Area Cross Road & Drain
7	5+606 to 5+676	70	Flyover	Najafgarh-Bahadurgarh Road

d) Pedestrian Facilities

2.5 m wide footpath and 3.0 m wide cycle track is proposed on both sides of the entire project stretch.

e) Reinforced Earth Wall

Table 0-9: Proposal for RE Wall

S. No.	Chainage	Length(m)	Side	Average Height from Ground Level (m)	Remarks
1	1+100 to 1+246	146	RHS	4 (Varying from 1 to 8)	Main Carriage way Elevated (7.0 m wide carriageway, 1.5 m wide paved shoulders on left hand side, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on left hand side & right hand side{crash barrier to be provided after cycle track on left hand side}) – **MC02**
	1+261 to 1+570	309	RHS	4 (Varying from 1 to 8)	
2	1+077 to 1+228	172	LHS	4 (Varying from 1 to 8)	Main Carriage way Elevated (7.0 m wide carriageway, 1.5 m wide paved shoulders on left hand side, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on left hand side & right hand side {crash barrier to be provided after cycle track on left hand side}) – **MC01**
	1+243 to 1+552	309	LHS	4 (Varying from 1 to 8)	
3	0+560 to 0+712	152	RHS	4 (Varying from 1 to 8)	Main Carriage way Elevated (7.0 m wide carriageway, 0.25 m wide kerb shy distance on both sides, 0.5 m wide crash barrier on left hand side & right hand side{crash barrier to be provided after cycle track on left hand side}) – **MC03**
4	3+650 to 3+917	267	Both	4 (Varying from 1 to 8)	Main Carriage way Elevated (7.0 m wide carriageway, 0.50 m wide kerb shy distance on right hand side, 1.5 m wide paved shoulder on left hand side, 2.5 m wide Footpath cum drain on left hand side, 3.0 m wide Cycle track on left hand side & right hand side and 0.5 m wide crash barrier on left hand side in both directions and 0.5 m wide Central median)
	3+925 to 4+180	255			
5	4+540 to 4+900	360	Both	4 (Varying from 1 to 8)	Main Carriage way Elevated (7 m wide carriageway in both directions, 1.5 m wide paved shoulder in both directions, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on Right hand side & left hand side in both directions and 0.5 m wide central median)
6	4+912 to 5+326	414	Both	4 (Varying from 1 to 8)	Main Carriage way Elevated (7 m wide carriageway in both directions, 1.5 m wide paved shoulder in both directions, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on Right hand side & left hand side in both directions and 0.5 m wide central median)
7	5+413 to 5+605	192	Both	4 (Varying from 1 to 8)	Main Carriage way Elevated (7 m wide carriageway in both directions, 1.5 m wide paved shoulder in both directions, 0.5 m

S. No.	Chainage	Length(m)	Side	Average Height from Ground Level (m)	Remarks
					wide kerb shy distance on right hand side, 0.5 m wide crash barrier on Right hand side & left hand side in both directions and 0.5 m wide central median)
8	5+676 to 6+060	384	Both	4 (Varying from 1 to 8)	Main Carriage way Elevated (7 m wide carriageway in both directions, 1.5 m wide paved shoulder in both directions, 0.5 m wide kerb shy distance on right hand side, 0.5 m wide crash barrier on Right hand side & left hand side in both directions and 0.5 m wide central median)
9	0+048 to 0+232	184	Both	4 (Varying from 1 to 8)	Right Turning Elevated Link from NH-10 (From Rohtak) towards Bahadurgarh Spur (Main Carriageway 7.0 m, 0.5 m wide kerb shy distance on right hand side, 1.5 m wide paved shoulders on left hand side & 0.5 m wide crash barrier on both sides) - **MC05**
	0+794 to 0+945	151			
10	0+048 to 0+232	184	Both	4 (Varying from 1 to 8)	Left Turning Elevated Link from Bahadurgarh Spur towards NH-10 (Towards Rohtak) {Main Carriageway 7.0 m, 0.5 m wide kerb shy distance on right hand side, 1.5 m wide paved shoulders on left hand side & 0.5 m wide crash barrier on both sides} - **MC06**
	0+780 to 0+925	145			

f) Drains

The location of RCC Cover drains are given in ***Table 0-10.***

Table 0-10: Construction of New RCC Drain

S No.	Stretch	Length (m)	Type	Width (m)	Side	Remarks
Main Carriageway						
1	0+000 to 0+320	320	Rectangular RCC covered drain	2.5 m	Both	Covered Drain
2	0+960 to 3+650	2690	Rectangular RCC covered drain	2.5 m	Both	Covered Drain
3	4+180 to 7+269	3089	Rectangular RCC covered drain	2.5 m	Both	Covered Drain

Note:

1. *Detail design of outfall arrangement of all the drains is in scope of concessionaire*
2. *Along all underpasses/VUPs, 1.5m wide RCC covered drain shall be constructed on left hand side.*
3. *Integration of drain arrangement of Spur to Bahadurgarh (UER 2-Package 5), UER 2 (Package 2) & NH-10 shall be included in the scope of work of the contractor. Necessary co-ordination with various agencies viz. Delhi Jal Board, DDA, Delhi Police, PWD Haryana, TCPO Haryana etc. shall also be included in the scope of work of contractor.*