

EXECUTIVE SUMMARY

1.1 Background

Governments of India (GoI), Ministry of Shipping, Road Transport & Highways (MoRT&H) have decided to upgrade 6500 km of existing 4-lane National Highways (NHs) 6-lane under Phase V of National Highways Development Project (NHDP). The implementation of this project as Public Private Partnership (PPP) venture on Design, Build and Finance & Operate (DBFO) pattern has been entrusted to National Highways Authority of India (NHAI). Sections envisaged under 6-laning comprise Golden Quadrilateral (5846 km) and some other identified sections. In the first priority, a length of 3488 km has been identified. NH-2 is one of the major high density corridors in India. This highway linking Delhi and Kolkata, traverses through six states namely Delhi, Haryana, Uttar Pradesh, Bihar, Jharkhand and West Bengal and connects a number of major urban cities on its way like Delhi, Agra, Kanpur, Allahabad, Varanasi, Dhanbad, Durgapur & Howrah. The project road from Khokhraj approximately. 42kms from Allahabad towards Kanpur to Varanasi ie. Allahabad bypass to Varanasi under the proposed feasibility study is one of the identified sections of NH-2 under NHDP Phase-V.

Consultancy Services for the preparation of feasibility study of the above mentioned project road has been awarded to M/s Span Consultants Pvt. Ltd. The consultancy services are to be provided in - two stages. The name of the company has been changed to SNC Lavalin Infrastructure Pvt. Ltd.

Stage – I

- (i) Inception Report (IR)
- (ii) Strip Plans with Alternatives
- (iii) Draft Feasibility Report
- (iv) Final Feasibility Report

Stage – II

- (v) Technical Schedules
- (vi) Completion of Bidding Activities of BOT Bid
- (vii) Evaluation of BOT Bids
- (viii) Post Award Queries upto Financial Close

The present report is the 4th activity of Stage – I as Inception Report and Draft Feasibility Report Strip Plans have already been submitted to NHAI. The Final Feasibility Report was submitted vide our letter no. SCPL/C-818/RH/G/76 dated 07.06.2010. Subsequently NHAI vide their letter No. 19022/I/RO/LKO/2010/3043 dated 10.12.2010 & 11015/NHAI/sixlane/PD/ALD/4239 dated 12.11.2010 desired certain changes. Final decision was conveyed vide R.O NHAI, Lucknow letter No. 19022/1/RO/LKO/2010/15879 dated 24.12.2010 & letter dated 21.01.2011. Revised Final Feasibility Report incorporating the suggestions, was submitted vide our letter No. SCPL/C-818/RH/G/103 dated 21.02.2011. A meeting was held in the chamber of CGM on 05.07.2011 and 04.08.2011, where it has been decided that:

1. In built up areas of Handia, Barout, Bhati, Gopiganj & Mirza Murad no elevated structures are to be provided. Existing 4 lane highway with existing service roads be retained as such due to non-availability of ROW.
2. No exit, entry ramps to be provided
3. Crash barriers in median to be deleted



4. Financial Analysis to be done for whole length including bypass.
5. Drawing Volumes will be separate for Allahabad Bypass & Handia to Varanasi section.

Accordingly the Final Feasibility Report was re-revised.

Now it has been finally decided that only Handia to Varanasi section of the highway will be taken up under this project. The final Feasibility Report has, therefore, been modified accordingly.

The Executive summary pertains to Handia- Rajatalab section of NH-2. As desired by MORTH vide letter no RW/NH-37011/41/2012-PPP elevated structures have now been proposed at Handia – Barout – Bhati – Gopiganj - Mirja Murad.

1.2 Objective

The primary objective of the consultancy services is to ensure the following:

- (i) Enhanced safety of traffic, road users and the people living in close vicinity of highway.
- (ii) Enhanced operational efficiency of the highway.
- (iii) Fulfillment of the access needs of the local population.
- (iv) Minimal adverse impact on the road users and the local population during construction.
- (v) Feasible and constructible options for the project with least cost options.

1.3 Scope of Work

As per clause 4 of Terms of Reference (TOR), the scope of work includes following tasks:

- (i) To review as built drawing and various other reports of completed 4-lane project.
- (ii) To conduct supplementary survey and geotechnical investigation to validate and update the available data on completed 4-lane project.
- (iii) Environmental and Social Impact Assessment including impact on cultural properties, natural habitation, involuntary settlements etc.
- (iv) Assessment of additional Right of Way (ROW) requirement if any.
- (v) To hold Public consultation alongwith communities, located along the road, other stake holders and local administration.
- (vi) To conduct traffic studies and traffic surveys, demand forecasting, toll option studies for next thirty years.
- (vii) To carry out inventory and condition survey for road.
- (viii) To carry out inventory and condition survey for bridges.
- (ix) To provide cross drainage structures and drainage provisions.
- (x) Identification of sources of construction materials.
- (xi) To conduct fresh survey and investigation for new structures like underpasses, flyovers and their preliminary design.
- (xii) To prepare strip plans indicating various details alongwith land acquisition schedule and drawings/ estimates for cutting of trees and shifting of utilities from the concerned departments.
- (xiii) To prepare Preliminary Design Project Report, Rough Cost Estimate
- (xiv) To review the location of existing toll plazas and to suggest whether any relocation or upgradation thereof are required.



1.4 Main Provisions of TOR

- 1.4.1 The existing alignment and geometry shall remain unchanged unless specific approval is given by NHAI to change these features.
- 1.4.2 Six lane cross section should be accommodated within available ROW (45 m or more) with no extra land acquisition.
- 1.4.3 Facility created already during 4-laning are utilized to maximum extent.
- 1.4.4 No at grade cross movement shall be allowed on project highway. Such movement will be regulated through parallel service roads interconnected through grade separated structures. The service roads shall be provided continuous on both sides except where discontinuity is permitted, as given under Clause 2.2.2 (Minimum requirement of planning) of 'Manual of Specifications & Standards for 6-laning of National Highways through Public Private Partnership' issued by Govt. of India, Department of Road Transport & Highways, MORT&H
- 1.4.5 All entry to main highway and exit from it shall be through properly designed entry/ exit ramps.
- 1.4.6 Vehicular underpasses to be provided in such a manner that no vehicle is required to travel more than 2 kms on service road to approach an underpass for crossing over to the other side.
- 1.4.7 The pedestrian crossing facilities shall be provided through underpass or appropriate cross drainage structures such that pedestrians do not have to walk for more than 0.5 km to reach the crossing point.
- 1.4.8 Efforts shall be not to disturb the existing utilities to the extent possible.

1.5 Project Road Particulars

1.5.1 General

Total length of the project road from Handia to Varanasi is 72.644. The details of existing and proposed road are at **Table 1.1 & Table 1.2.**

Table 1.1: Details of Existing and Proposed Chainages of the project Road

S.no	Existing Chainage		Length	Design Chainage		Length
	From	To		From	To	
1	713.215	785.859	72.644	712.900	785.544	72.644

The project road passes through the Districts of Allahabad ,Sant Ravidas nagar (Badhohi),Mirzapur and Varanasi in the state of Uttar Pradesh. There are some major semi urban settlements at Handia, Bhiti, Jungiganj, Gopiganj, Aurai and Kachhua Road.

1.5.2 Alignment

Existing road has generally a good alignment having road geometrics as per NH standard. It is proposed to provide flyovers/underpasses as per site requirement to make the road partially access controlled.

1.5.3 Cross Sectional Details

(i) Right of Way (ROW)

Km 713.215 to Km 785.859 - varies from 28m to 65m

(ii) Carriageway Width

Table 1.3: Existing Carriageway Width is given below:-

S.No.	Chainage (Km)	Carriageway Width (m)	Remarks
1	713.215 to 785.859	2x8.75 (including paved shoulder)	



Median

The median width in built up area is 1.2m. In open rural areas the median width varies from 4.50m to 5.50m.

(iii) Paved Shoulder

Table 1.4: Details of Existing Paved Shoulder

Sl. No.	Chainages (Km)	Width (m)	Remarks
1	713.215 to 785.859	2x1.50m	

(v) Earthen Shoulder

The shoulder width on each carriageway is 1.00m.

1.5.4 Road Condition

On visual inspection, the pavement condition survey reveals that the rut depth is generally less than 5 mm, cracking width varies from 2 – 5 mm, pot holes/ patching are almost nil and releveling is in less than 4% area. However, shoulders are undulated in some stretches. The overall condition of the road can generally be categorised as good.

1.6 Pavement

The existing pavement is rigid & flexible as detailed below:-

Table 1.5: Existing Pavement is Rigid & Flexible

	LHS	RHS
Rigid	43.044	14.555
Flexible	29.600	58.089

1.6.1 Pavement Composition

The pavement composition for the main carriageway is as under:

Table 1.6(a): Left Side Carriageway

Rigid Pavement

Km 713.215 to Km 713.461	0.246 km
Km 743.061 to Km 785.859	42.798 km

The pavement composition from Km 713.215 to Km 713.461 is :

PQC	320mm
DLC	150mm
GSBC (drainage layer)	200mm

The pavement composition from Km 743.061 to Km 785.850 is :

PQC	330mm
DLC	150mm
GSBC (drainage layer)	200mm

Flexible Pavement

Km 713.461 to Km 743.061 = 29.600 kms

Pavement composition is as under:

BC	50mm
DBM	160mm (in 2 layers)
WMM	250mm (in 2 layers)
GSB	260mm(in 2 layers)



Table 1.6(b): Right side carriageway

Rigid Pavement

Km 713.215 to Km 713.461	0.246 km
Km 771.550 to Km 785.859	14.309 km

Pavement composition is as under:

Km 713.215 to Km 713.461 is :

PQC	320mm
DLC	150mm
GSBC (drainage layer)	200mm

Km 743.061 to Km 785.850 is :

PQC	330mm
DLC	150mm
GSBC (drainage layer)	200mm

Flexible Pavement:

Km 713.461 - Km 771.550 = 58.089 km.

Pavement composition is as under:

BC	50mm
DBM	160mm (in 2 layers)
WMM	250mm (in 2 layers)
GSB	260mm(in 2 layers)

1.7 Service Road

The service roads are existing in built-up areas.

1.8 Existing Cross Drainage and other Structures

1.8.1 Cross drainage Structures

1.8.1.1 Bridges

There are 3 Box type minor bridges in this section (as tabulated below :) These are proposed to be widened to six lane section on outer side of both carriageways as per section of the main highway on approaches. New bridges will be provided for service roads.

Table 1.7: Bridges on Handia to Varanasi section

Sl. No.	Structure-ID	Chainage (Km)	Span Arrangement	Carriage way width	Type of Structure	Type of Foundation	Remarks	Condition
1	723/1	722+350	3x3.5	10.1+9.4 (4m-median)	3 cell- (3.33*3) RCC Box	RCC raft	300mm RCC wing wall-both ends-old c/w repaired	Good
2	731/1	730+726	3x8.5	9.37+9.37 (5m-median)	3 cell- (8.5*3) RCC Box	RCC raft	300mm RCC wing wall - both ends- old c/w repaired recently	Good



Sl. No.	Structure-ID	Chainage (Km)	Span Arrangement	Carriage way width	Type of Structure	Type of Foundation	Remarks	Condition
3	768/1	767+477	3x3.0	9.5+9.75 (5m-median)	3 cell- (3*2) RCC Box	RCC raft	300 mm RCC wing wall - both ends- Left side constructed-old c/w repaired in recently	Good

1.8.1.2 Culverts

Culverts are as given below:-

- Hume Pipe Culverts : 14
- Box Culverts : 30
- Slab Culvert: : 01
- Pipe Syphon : 33

1.9 Deficiencies and Issues

Keeping in view the guidelines laid down in Manual for 6-laning/ TOR, following deficiencies have been identified:

- Insufficient highway capacity available to carry anticipated traffic.
- At grade junctions at some major/ minor intersections.
- Inadequate existing pavement to cater for anticipated traffic.
- Lack of existing truck laybys.
- Lack of existing road side safety features.

1.10 Investigations and Surveys

In order to design various components of highway; following investigations and surveys have been carried out:-

- Traffic surveys
- Topographic surveys including GPS
- Road and Bridge Inventory Surveys.
- Pavement Investigation (pavement condition, roughness, and BBD)
- Material Surveys & Investigations
- Social and Environmental Surveys.

1.11 Improvement Proposals

It has been decided to take up the 6-laning work of Project road. The existing alignment has been retained. The project road has been designed as partially Access Controlled Highway.

Following is the summary of the recommended improvements and facilities to be provided on the existing road.



1.11.1 Improvements

Proposed improvements include the following:

- Widening of existing 4-lane carriageway to 6-lane except narrow stretches in Handia, Barout, Bhati, Gopiganj, Mirza Murad where Six lane elevated structures (without Footpath have been provided)
- Paved/ Earthen shoulders on either side
- Service roads on either side except in stretches having no habitation or where there are no crossroads.
- Grade separated structures at intersections (as per site requirement)
- Widening of existing bridges/ construction of bridges on service roads
- Utility corridor on either side
- Construction of Vehicular Underpasses & pedestrian Underpasses

1.11.2. Facilities/ Safety Features

Staggered Toll plaza at km 746.760 (LHS) and km 747.065 (RHS)

Truck Laybys

- Bus bays/ Q shelters
- Road side furniture
- Highway lighting in built up area & at flyovers/interchanges etc.
- Highway Traffic Management System (HTMS)
- Traffic Medical Aid and Rescue Aid Post
- Rest Areas

1.11.3 Design Parameters

Following design parameters have been adopted as per IRC:SP:87-2013.

1.11.3.1 Alignment

Table 1.8: Alignment

Sl. No.	Parameter	Value
1	Design Speed	100 kmph
2	Minimum Radius (Horz alignment)	360 m
3	Gradient	Not steeper than ruling grade of 3.33%
4	Sight Distance (Stopping)	180 m
5	Super elevation	5% maximum
6	Camber	2.5%
7	Side Slope	2 (H): 1(V)

1.11.3.1 Cross Sectional Details

Table 1.9: Cross Sectional Details

1	Carriageway Width	2 x 10.50
2	Median Side paved strip	0 . 50 m on both carriageways
3	Median	6.00 m/ 2.5 m (Raised) (Including Curb Shyness)
4	Paved Shoulder	1.5 m (Rural Area) 2.0 m (Urban Area)
5	Earthen Shoulder	Varying (minimum 1m)
6	Service Road	Varying from 5.5 to 7.0m
7	Utility Corridor	Varying from 1.0 to 2.0m



1.11.4. Traffic

1.11.4.1 Traffic Volume Count Survey (AADT)

Table 1.10: Traffic on Handia - Varanasi section (Year 2014).

Vehicle Type		Near Handia	Near Lal Nagar	Near Raja Talab
		Km 718.000	Km 746.500	Km 782.500
		AADT	AADT	AADT
Two Wheeler		6030	6030	6779
Auto Rickshaw		1307	1307	1309
Car/Jeep/Van		1616	1616	3021
Jeep/ Tempo (>8 Seater)		1871	1871	2866
BUS	Mini Bus	298	210	461
	Standard	374	306	411
LCV	4 Tyre	755	549	1176
	6 Tyre	784	597	1091
2 Axle Truck		883	525	1055
3 Axle Truck		2708	1973	3376
MAV		1627	1832	2738
Tractor with Trailor		66	116	83
Tractor without Trailor		51	18	43
Cycle		3010	2589	3874
Cycle Rickshaw		15	23	57
Animal/ Hand Drawn		4	6	3
Toll Exempted	Car/Jeep/Van	111	94	106
	Bus	4	3	22
	LCV	9	19	32
	Truck	8	15	46
Total Vehicles		22964	19699	28549
Total PCUs		33813	28928	45087

1.11.4.2 Growth Rate

Table 1.11 : Projected Traffic Growth Rates by Vehicle type (%)

Vehicle Type	upto 2014	upto 2019	beyond 2019
Motor Cycles	5%	5%	5%
Cars	5%	5%	5%
3W	5%	5%	5%
Bus	5%	5%	5%
Goods Vehicles	5%	5%	5%

1.11.4.4 Capacity

Keeping in view the DSV at LOS'B' the requirement of widening of existing 4 lane facility has been assessed and the same is brought out in the following:-

Table: 1.12: Lane Requirement

Section (Km)	Present Configuration	Requirement for 8 lane based 6 lane capacity with service roads.
714 to 740	4 lane with paved shoulder	2040
740 to 754	4 lane with paved shoulder	2044



Section (Km)	Present Configuration	Requirement for 8 lane based 6 lane capacity with service roads.
754 to End of Project	4 lane with paved shoulder	2035
For Total Project (As per Average Traffic)	4 lane with paved shoulder	2039

1.11.5 Widening proposal for Road

Widening of the existing 4-lane road to 6-lane has been proposed generally. In built up areas where ROW is deficient, 6 lane elevated structures have been provided

Service Roads / Slip Roads

Service Roads of km 78.534 length and Slip Roads of km 65.440 length have been proposed.

1.12 Pavement Design (Six Laning)

Pavement design aims at determining the total thickness of the pavement structure as well as the thickness of the individual layers. The design of flexible pavement depends on sub-grade characteristics, traffic load, and environmental condition. Different currently accepted methods for pavement design are available and the approach of consultants has been to work out the requirements by various methods, compare the results and optimized the proposal considering the economics of design and construction. The sub-base and base course have been designed for 20 years traffic projections after implementation of the project and the bituminous courses have been considered for 10 years traffic projections.

1.12.1 Flexible Pavement

The flexible pavement design methodology generally based on the guidelines of IRC:37:2001 (Design of flexible pavement) and overlay has been worked out basically as per guidelines of IRC:81-1997.

(a) Design thickness (6-lane divided carriageway widening)

(i) Main Carriageway :- Open Rural areas

Table 1.13(a) : Recommended Pavement Composition for Widening in sections where service roads do not exist.

Sl. No.	Carriageway	Chainage	Base & Sub base Course Thickness (mm)		Wearing & Binding Course (mm)		Total Thickness (mm)
			GSB	WMM	DBM	BC	
1	Left side carriageway	Km 712.900 to 734.585& 734.645to Km 742.744	350	250	120 (70+50)	50	770
2	Right side carriageway	Km 713.146 to 734.585, 734.645 to 750.911, 751.093 to Km 764.553&764.655 to 771.242	350	250	120 (70+50)	50	770

Table 1.13(b): Recommended Pavement Composition for section where existing service road is to be made a part of main c/w & paved shoulders:

Sl.No.	Side	Chainage	Base & Sub base Course Thickness (mm)		Wearing & Binding Course (mm)		Total Thickness (mm)
			GSB	WMM	DBM	BC	
1	Both Side	Km 734.585 to Km 734.645	-	230 to350	120 (70+50)	50	400 to 520



Sl.No.	Side	Chainage	Base & Sub base Course Thickness (mm)		Wearing & Binding Course (mm)		Total Thickness (mm)
			GSB	WMM	DBM	BC	
2	RHS	Km 750.911 to 751.093	-	230 to 350	120 (70+50)	50	400 to 520
3	RHS	Km 764.553 to 764.655	-	230 to 350	120 (70+50)	50	400 to 520

b) Overlay Design

Overlay design has been done as per IRC guidelines provided in IRC:81-1997. Considering the fact that the 4-laning work has been completed in 2008 it has been decided that an overlay of 50mm BC be proposed.

BC - 50 mm

1.12.2. Rigid Pavement

Rigid pavement has been proposed for widening in sections where the rigid pavement has been provided in the existing carriageways at the location given below:-

Since the rigid pavement has been constructed recently and its life is 30 years no overlay is proposed. The pavement composition provided in the existing carriageways has been proposed in the proposed widening. The details are as under:-

Table 1.14: Pavement Composition

Sl.No	Chainage	C/W side	GSB(mm)	DLC(mm)	PQC(mm)	Total thickness(mm)
1	742.744 to 785.544	Left	200	150	330	680
2	771.242 to 785.544	Right	200	150	330	680

1.12.3. Pavement for Service Road

(i) New Service Road

The pavement for service roads has been designed for minimum 10msa and a CBR of 7%. The crust composition proposed is as follows:

Minimum thickness of pavement layers (compacted Thickness)

- Wearing Course - BC - 40 mm
- Bituminous Layer - DBM - 60 mm
- Base Course - WMM - 250 mm
- Sub-base Course - GSB - 230 mm

Total Crust Thickness proposed for the service road is 580 mm as above.

1.12 Cross Drainage Structures

In the project road section there are 3 minor bridges. There are 88 culverts comprising of Slab/Box/HP/Syphon culverts. All the cross drainage structures have been constructed as per 4-lane standards. Upgrading of the road section to a 6 lane dual carriageway involves widening of the existing structures from 4-lane configuration to 6-lane. The section from Handia to Varanasi has been four laned recently, new bridges & culverts have been constructed for the new carriageway. The existing culverts have been repaired satisfactorily so the condition of existing culverts is good. The existing cross drainage structures are by and large sufficient to cater for the anticipated discharge as has been revealed during local enquiries and functioning of the existing cross drainage structures. However, it is proposed to replace the pipe culvert at Km 724.275 and by a box culvert of size 2mx2m. Two new box culverts are proposed at Km 717.146 and Km 764.485.



1.13.1 Broadly the widening Scheme for culverts will be as under:-

1.13.1.1 Widening of Culverts and Ducts

All the culverts and ducts will be widened on outer side of both carriageways in full formation width. Additional culverts of same span/type as that in the main carriageway will be constructed for service roads.

1.14 Widening of Structures

Minor Bridges

There are only 3 Box type minor bridges in this section (as tabulated below:) These are proposed to be widened to six lane section on outer side of both carriageways as per section of the main highway on approaches. New bridges will be provided for service roads.

Table 1.15: Bridges

S. No.	Design Chainage (Km)	Side	Overall Width (m)	Carriageway Width (m)	Span Arrangement (m)	Type of Structure		Remark
						Super-structure	Sub-structure	
1	722+035	Both	2x14.2	12.5 (including Paved Shoulder & kerb Shyness)	3.5x3	RCC		
2	730+411	Both	2x13.4 (SQ)	12.5 (including Paved Shoulder & kerb Shyness)	8.5x3	RCC		Skew 45°
3	767+162	Both	2x13.4	12.5 (including Paved Shoulder & kerb Shyness)	3x3	RCC		

1.15 New Grade Separated Structures (Flyovers/ Underpasses)

Keeping in view the provision of TOR, no median opening will be allowed on the project road as it creates traffic hazard and also reduces the efficiency of high speed corridor. Therefore, all the existing median openings functioning so far for taking U-turn and at the locations of at grade intersections have to be closed. Considering the importance of cross roads, these have been replaced by providing vehicular underpass at minor intersections and by flyover at major intersections.

Pedestrian/ cattle underpasses have also been proposed.

Flyovers are proposed at identified locations where traffic flow (both main and cross) exceeds the minimum requirement of Peak Hour traffic at base year or so and also at locations where localized movement of traffic influences the traffic flow pattern thereby warranting a full fledged flyover.

1.15.1 Six lane elevated structures

In the following built up section it is proposed to provide six lane elevated structures:-



Table 1.16: Six lane elevated structures

S. No.	Type of Structure	Design Chainage (Km)		Total Length including Approach es (m)	Span Arrangement	C/W Width (m)	Overall Width (m)
		From	To				
1	Precast R.C.C Segment	712900	716280	3380	21X36+27X25+27X36	2X11	23.55
2	Precast R.C.C Segment	721630	724330	2700	17X36+14X 25+22X36	2X11	23.55
3	Precast R.C.C Segment	725220	727570	2350	24X36+25X25	2X11	23.55
4	Precast R.C.C Segment	739830	742850	3020	28X25+1X40+6X 25+6X36+1X40+27X36	2X11	23.55
5	Precast R.C.C Segment	775630	777865	2235	20X36+23X25	2X11	23.55

1.15.2 Flyovers

Table 1.17: Flyovers

S.No.	Design Chainage (km)	Name of Village/Town	Structural Configuration	Viaduct length (m)	RE Wall Length (m)	Clear Span(m)	Overall Width (m)	Remarks	
1	754+441	Aurai	New 2x3 lane structure	35	2x423 +2x457	1x35	2x13.4	SH-5	At-grade crossing under the Flyover as per Clause 3.2, Fig 3.3 of the manual
2	769+967	Kachhwa	New 2x3 lane structure	35	2x370 +2x450	1x35	2x13.4	SH-98&SH-74	At-grade crossing under the Flyover as per Clause 3.2, Fig 3.3 of the manual
3	784+297	Rajatalab	New 2x3 lane structure	120	2x432 +2x403	4x30	2x13.4	MDR	At-grade crossing under the Flyover as per Clause 3.2, Fig 3.3 of the manual



1.15.3 Underpasses (Vehicular)

The proposal for providing Vehicular Underpasses is given below in Table 1.18

Table 1.18 : Details of Proposed Vehicular Underpasses

S. No.	Design Chainage (km)	Clear Span (m)	Vertical clearance (m)	Name of Village/ Town	Overall Width (m)	Remarks
1	729+655	1x12.0	5.5	Unj	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
2	731+497	1x12.0	5.5	Wahida mod	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
3	734+175	1x12.0	5.5	Jangiganj	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
4	738+275	1x12.0	5.5	Chakpurouna	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
5	744+820	1x12.0	5.5	Rajnagar	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
6	750+499	1x12.0	5.5	Madosingh	2x12.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
7	759+728	1x12.0	5.5	Kothra	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
8	762+746	1x12.0	5.5	Katka	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
9	765+050	1x12.0	5.5	Balusarai	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
10	773+057	1x12.0	5.5	Rupapur	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual
11	780+278	1x12.0	5.5	khajuri	2x13.4	At-grade crossing under the underpass as per Clause 3.2, Fig 3.2 of the manual



1.15.4 Pedestrian Underpasses

Table 1.19 : Details of Proposed Pedestrian Underpasses

S. No.	Design Chainage (km)	No. of Spans	Clear Width (m)	Vertical clearance (m)	Overall Width (m)	Name of Village/Town	Remarks
1	717+749	1	7.0	3.5	2x12.4	Handia	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
2	719+474	1	7.0	3.5	2x13.4	Handia	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
3	721+225	1	7.0	3.5	2x13.4	Baraut	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
4	728+845	1	7.0	3.5	2x13.4	Unjh Thana	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
5	736+420	1	7.0	3.5	2x13.4	Jangiganj	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
6	749+425	1	7.0	3.5	2x13.4	Madosingh	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
7	752+643	1	7.0	3.5	2x13.4	Ghosia	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
8	756+070	1	7.0	3.5	2x13.4	Kothra	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
9	757+770	1	7.0	3.5	2x13.4	Kothra	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
10	761+720	1	7.0	3.5	2x13.4	Katka	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
11	767+903	1	7.0	3.5	2x13.4	Bhira	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual
12	779+445	1	7.0	3.5	2x13.4	Sadhanpriya	At-grade crossing under the underpass as per Clause 3.2, Fig 3.1 of the manual



1.15.4.1. Foot Over Bridges

Table 1.20: Foot Over Bridges proposed at the following locations

S. No.	Design Chainage (km)	No. of Spans	Clear Width of Walkway (m)	Vertical clearance (m)	Overall Walkway Length (m)	Name of Village/Town	Remarks
1	771+765	1	3.0	5.5	60	Bhraiha	6-lane divided Carriageway
2	781+937	1	3.0	5.5	60	Rakhkuna	6-lane divided Carriageway

1.15.5 Exit and Entry Locations

We proposed exit/ entry locations as given below.

S. No.	Entry and Exit	
	Left	Right
1	718085	718085
2	724330	724330
3	730045	730045
4	738665	738665
5	750880	750880
6	760110	760110
7	770435	770435
8	784760	784760

1.15.6 Rest Areas

No new rest areas are proposed

1.15.7. Truck Lay byes

The provision of truck lay bays is governed by the site requirement and as per MoRT&H guidelines vide circular RW/34032/5/88-DOII dated 22/08/1988. Tentative locations of Truck lay byes on either side of the road is given in **Table 1.22** below.

Table 1.22: Proposed Truck Lay byes

S. No.	Chainage (Km)	Side	Length(m)
1	727+900	Right	100
2	728+200	Left	100
3	766+600	Right	100
4	767+330	Left	100

1.15.8. Bus Bays/ Bus Shelter

For the safety of commuters traveling by Transport buses, bus bays are proposed tentatively at following locations. These shall be provided as per relevant IRC guidelines.

Table 1.23 : Proposed Bus Bays Location

S. No.	Chainage (Km)	Side	Remarks
1	713+200	LHS	Busbay with Bus shelter
2	713+200	RHS	Busbay with Bus shelter
3	716+120	LHS	Bus shelter
4	716+120	RHS	Bus shelter
5	721+880	LHS	Busbay with Bus shelter
6	721+880	RHS	Busbay with Bus shelter
7	724+460	LHS	Busbay with Bus shelter
8	724+460	RHS	Busbay with Bus shelter



S. No.	Chainage (Km)	Side	Remarks
9	728+605	LHS	Busbay with Bus shelter
10	728+655	RHS	Busbay with Bus shelter
11	732+480	LHS	Busbay with Bus shelter
12	732+497	RHS	Busbay with Bus shelter
13	733+815	RHS	Busbay with Bus shelter
14	733+900	LHS	Busbay with Bus shelter
15	736+100	LHS	Busbay with Bus shelter
16	736+100	RHS	Busbay with Bus shelter
17	739+395	LHS	Bus shelter
18	739+420	RHS	Bus shelter
19	742+700	RHS	Bus shelter
20	743+100	LHS	Bus shelter
21	749+575	LHS	Bus shelter
22	750+225	RHS	Busbay with Bus shelter
23	753+885	LHS	Bus shelter
24	753+885	RHS	Bus shelter
25	760+030	LHS	Bus shelter
26	760+030	RHS	Bus shelter
27	764+770	LHS	Bus shelter
28	764+770	RHS	Bus shelter
29	766+420	LHS	Bus shelter
30	768+420	RHS	Bus shelter
31	770+550	LHS	Bus shelter
32	770+700	RHS	Bus shelter
33	775+900	RHS	Bus shelter
34	775+900	LHS	Bus shelter
35	784+880	LHS	Bus shelter
36	785+020	RHS	Bus shelter

1.15.9 Road Drainage

The rain water shall be discharged at cross drainage structures already existing along the project highway. Wherever the distance of the natural cross drainage structures is more and it may not be feasible to dispose of the water from drain above HFL of the natural cross drainage, ground water recharge units will be provided.

1.15.10 Road side Furniture

Road side furniture shall be provided in accordance with Section 11 of the Manual of Specification and Standards.

1.15.11 Toll Plaza

There is a Staggered Toll Plaza at km 746.760 (LHS) and 747.065 (RHS).

1.15.12 Landscaping and Tree Plantation

Landscaping and tree plantation shall be provided in accordance with Section 12 of the Manual of specification and Standards

1.15.13. Advanced Traffic Management System (ATMS)

This system working round the clock shall be established for informing the road users of the road, traffic and weather conditions on the project Highway, for making interventions as required for smooth, safe and efficient traffic operation and for providing rescue and relief to the users in distress. If required it can be provided in accordance with specification Manual



1.15.14 Highways Lighting

Street lighting shall be provided in accordance with para 13.3 of Section 13 of the Manual of Specification and Standards

Illumination: - The average level of illumination on the stretch of the mainline(including major intersection/ Junction, toll plazas wayside amenities-service areas, Truck Lay-bys) grade separators and under passes shall be 20 lux with suitable high mast poles approved by IE NHA.

The layout of the lighting system together with type of luminaries for different location shall be determined in consultation with Independent Engineer NHA.

1.16 Utility Relocation Plan

The survey for the collection of data on all existing utilities within the land to be acquired has been done. Efforts have been made not to disturb the existing utilities to the extent possible. The detailed lists of utilities are given in Chapter 5.

1.17 Environment, Resettlement, and Land Acquisition

The Environmental Impact Assessment (EIA) Notification 2006, Ministry of Environment and Forests, Government of India, came into effect from 14th September 2006. The EIA Notification, 2006 specifies the various development projects requiring prior clearance from Ministry of Environment and Forests (MoEF). In the present case, the proposed project involves widening and upgradation of section of NH2 within the available ROW and there is no land acquisition. Hence, as per EIA notification 2006, the proposed project does not fall under any category requiring Environmental Clearance.

The entire alignment passes through the plain terrain. The road section lies between Latitude 25°21' N & 25°16' N and Longitude 82°10' E & 82°50' E. The project area lies between 70 m to 90 m above mean sea level. The project road falls under ZONE III of seismic zone of India which is classified as Moderate Damage Risk Zone. Land use pattern along the project road is mainly agricultural, followed by built up areas, and some barren land exist on both sides of the project road.

The project area experiences all four seasons. The summer season is from March to June with the maximum temperatures ranging between 40 °C to 46 °C. Monsoon begins in early July and lasts till September. Spring season begins from early October and lasts till November end. During this period monsoon retreats and temperature starts falling. The winter season is from December to February. Temperature in the December continuously decreases till January. The temperature during the month of January drops to as low as 4.5 °C. The project area witnesses severe fog during the month of January. Mean annual rainfall of the project area is 1026.6 mm.

To study the baseline environmental scenario within the project corridor the ambient air quality, surface/ground water quality and noise levels were measured at various locations. The both side of the project road from Km 713.146 to Km 785.859 is notified under protected forest within ROW. About 16732 roadside trees along the project road are likely to be affected.

The proposed widening and upgradation project of NH-2 will have impacts on the environment in two distinct phases. During the construction phase which may be regarded as temporary or short term, the other during the operation stage which will have long term effects. Appropriate mitigation measures have been proposed in the project. The environmental monitoring plan covering various performance indicators, frequency and institutional arrangements for the project in the construction and operation stages has been prepared and presented.

The focus group discussions were held based on structured questionnaire. The main points of discussion were concentrated on environmental awareness, afforestation, health, safety, shifting of structures, etc.



Environmental Management Plan has also been prepared for the project which consists of EMP Implementation Framework, supervision monitoring and reporting requirements. A summary matrix of environmental monitoring during construction and operation phase giving institutional responsibilities is given in detail in EIA Report. A budgetary cost estimated for environmental management activities is Rs. 5.60 Crores.

1.18 Social Impact Assessment (SIA) & Rehabilitation Action Plan (RAP)

The Resettlement Action Plan (RAP) is based on Social Impact Assessment of the people and the properties affected due to the proposed project. In view of the human dimensions involved, the possible social impacts have been integrated into the improved alternative engineering designs to minimize the task of resettlement. This task has been achieved by adopting technically viable solutions.

The RAP for this project has been prepared based on the provisions of National Resettlement and Rehabilitation Policy (NRRP) 2007. Its emphasis is to avoid adverse impacts as far as possible as also to suggest steps which need to be taken to minimize the negative impact.

1.18.1 Approach and Methodology

The SIA has been carried out with a view to comply with appropriate national laws and guidelines and the National Resettlement and Rehabilitation Policy, 2007. The study collected the baseline information of each affected structure, household details and affected person. In order to determine qualitative aspects of the sub-project, the study conducted public consultations to invite people's suggestions and recommendations on the project and reduce conflicts. The Participatory methodology was adopted during the study as to collect information on community resources as well as field investigation through door to door survey of the affected persons and captured existing baseline socio-economic information of the same in structured socio-economic survey questionnaire. To comprehend APs' concerns, apprehensions, perceptions on the project and issues and conflicts associated with involuntary resettlement, livelihood and other related issues, the study conducted the FGDs and stakeholder consultations across project influence areas

1.18.2 Socio-Economic Profile of the Project Area

The socio-economic and demographic features of the project impacted districts are Allahabad, Sant Ravidas Nagar, Mirzapur and Varanasi. In order to understand the demographic and socio-economic background, a micro level analysis has been made for the project influence area comprising population characteristics, workforce, workers participation in major economic activities and other socio-economic features.

1.18.3 Policy Framework & Entitlement Matrix

The project specific entitlement framework has been prepared in accordance with the National Resettlement and Rehabilitation Policy (NRRP), 2007. The framework describes the principle and approach to minimize and mitigate the negative impacts caused by the project.

1.18.4 Magnitude of Impact on Properties and People

It has emerged from the social survey that out of total 1303 structures that are likely to be affected, 1199 belong to the category of private ownership followed by religious category (54), Government properties (49) and community properties (1). As far as construction of affected structures is concerned a majority of structures likely to be affected are Wooden type (515), pucca (392), followed by semi-pucca (237) and kutcha (159).

1.18.5 Impact on Project Affected Persons

A total of 1238 households owning private properties will be affected leading to impact on 8967 PAPs excluding land owners (males 51.20% and females 48.80%). Results of social stratification of PAPs has revealed that a majority of households which are likely to be affected belong to GEN category (50.32%), followed by OBC (38.05%), ST (6.30) and SC (5.33%).



1.18.6 Land acquisition

Generally the available ROW is sufficient to accommodate the proposed alignment. Hence no land acquisition will be required for the proposed project road.

1.18.7 Stakeholder Consultations

Extensive community consultations and Consultation with other stakeholders were carried out along the project corridor with the objective of minimizing probable adverse impacts of the project through alternate design solutions and to achieve speedy implementation of the project through bringing awareness among the PAPs on the benefits of the project. As many as 36 consultations were conducted along the project route, promoting public understanding of the processes and mechanisms through which developmental problems and needs are investigated and resolved. The major key stakeholders who participated in consultations at Screening and Feasibility stages include all Project Affected Families/Persons (PAF/PS); elected representatives, representatives of market association, Community leaders of PAPs, representatives of CBOs; local government official and representatives of local NGOs etc.

1.18.8 Resettlement & Rehabilitation Cost Estimates

The R&R cost estimates works out to **Rs 12.34 Crores**. It involves the cost of built up properties, such as residential structures, commercial structures, residential-cum-commercial, religious, and Community/ULB and land cost. In addition, the budget also includes the cost of R&R assistance; administrative expenses, NGOs and Monitoring and Evaluation (M&E).

1.19 Estimation of Quantities and Project Cost

The estimate shall be based on detailed design of different components of the project. The rates shall be analyzed following labour/machine and material co-efficients suggested in the MORT&H Data Book and market/ PWD Schedule of Rates as prevailing/applicable in Project catchment area. The unit rate analyses shall duly take into consideration, the various inputs and their basic rates, suggested locations of plants, lead involved in carriage of natural materials from borrow area, quarries etc. The quantities and costs shall be prepared separately for each package.

The project cost estimates as prepared shall be compared with rates of similar on going works in the project catchments area/in the country under World Bank and ADB financial assistance to assess their validity for the Project.

1.20 Cost Estimates

The cost has been assessed as per estimated inputs for individual items. The details of the cost as worked out are as under:

Table 1.24: Abstract of Cost (Handia-Varansi 72.644 Km)

Item No.	Description	Total Amount (Rs.)	Total Amount (Crores)
1	Site Clearance and Dismantling	46,405,823	4.64
2	Earth Work	515,035,934	51.50
3	Granular Sub-Base and Base Courses	2,368,443,401	236.84
4(A)	Bituminous Courses (Flexible Pavement)	2,977,551,024	297.76
4(B)	Rigid Pavement	471,321,121	47.13
5	Cross-Drainage Works (Culverts)	200,213,952	20.02
6	Bridges	9,087,956,373	908.80
7	Drainage and Protection Works	3,156,710,951	315.67
8	Junctions	255,400	0.03
9	Traffic Signs, marking and Road Appurtenances	246,996,640	24.70
10	Miscellaneous	312,822,851	31.28
11	Maintenance	6,774,485	0.68
	Civil cost of the project	19,390,487,956	1939.05



Item No.	Description	Total Amount (Rs.)	Total Amount (Crores)
	Civil Cost per km (Rs. Crores)		26.69
	Contingencies @ 3 %	581,714,639	58.17
	Supervision charges @ 6%	1,163,429,277	116.34
	Agency Charges @1%	193,904,880	19.39
	Sub total	21,329,536,752	2132.95
13	Environment Mitigation Measures	56,000,000	5.60
14	Cost of Acquisition of structures and Rehabilitation and resettlement	123,400,000	12.34
15	Shifting of Utilities	44,900,000	4.49
	Total	21,553,836,752	2155.38
	Cost per km (Rs. Crores)		29.67

* Based on survey conducted in Year 2014-2015

