National Highways Authority of India

(Ministry of Road, Transport & Highways)
Government of India

4 laning from km 42.000 to km 80.00 of Dodaballapur Bypass to Hoskote section of NH-648 (Old NH-207) on Hybrid Annuity Mode under Bharatmala Pariyojna, in the state of Karnataka (Package-II)

EXECUTIVE SUMMARY

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1 INTRODUCTION

The Ministry of Road Transport and Highways (MORTH), Government of India has proposed "Bharat Mala Pariyojana" an Umbrella scheme of road development project through National Highways Authority of India (NHAI), National Highway and Industrial Development Corporation (NHIDC) and state Public Works Departments (PWD) at an estimated cost of INR 5,35,000crores. This is the second largest highways construction project in the country after NHDP, in that almost 50,000 km of roads targeted across the country. This project aim to improve connectivity particularly on economic corridors, border areas and to remote areas with an aim of rapid and safe movement of cargo to boost exports. International trade considered as a key aspect in this scheme and northeastern states have given special focus. The project cleared by the Union Cabinet on October 25, 2017.

The ambitious project expected to create nearly 100million man days of jobs during the construction and subsequently to about 22million jobs of the increased economic activity across the country. The construction will carried out through many means including debt funds, budgetary allocation, private investment, toll operator transfer etc. The total length of around 34,800km considered in phase 1 including

- Economic corridors of around 9,000km,
- Inter-corridor and feeder routes of around 6,000km,
- National Corridors Efficiency Program of about 5,000 km roads
- Border and international connectivity roads of around 2,000 km,
- Coastal and port connectivity roads of around 2,000 km,
- Expressways of around 800 km
- NHDP roads of 10,000km

In pursuance of the above program, NHAI appointed M/s Louis Berger Consulting Private Limited, New Delhi as Consultants to carry out the Consultancy Services for preparation of DPR for development of Economic Corridors, Inner corridors, feeder Routes and Costal Roads to improve the efficiency of fright movement in India - Lot 3/Andhra Pradesh, Karnataka, Goa & Kerala, / Package 1. The project consists the following stretches of roads finalized as per final Inception Report.

1. Aurad – Bidar road
2. Mydukur – Badvel road
3. Belagavi (Belgaum) – Sanquelim with a proper Connectivity to NH4A and NH 17 through existing SH
4. Chittoor – Tachoor Greenfield alignment
5. Balance Portion of Satellite Ring Road of Bangalore (West Side) including connection to Hosur town to ensure ring road connectivity for Bangalore.

Further a meeting was held in NHAI/RO/Bangalore regarding carryout the detailed project study for 6 lanes of NH 207 of Hoskote – Dabaspet section (from km 58.300 to km 138.320) with supplementary agreement to the main Bharatmala contract agreement. The supplementary agreement signed on 26/04/2018. The scope of work remain the same as that of original contract except alignment option study and its approval as it is already studied by other consultants and approved by NHAI.

The Final Feasibility Report and Technical Schedule of the project submitted to NHAI dated 04/12/2018 with 6lanes configuration and service road provision in the entire length as the road is semi urban status throughout. The project discussed in Project Appraisal & Technical Scrutiny Committee (PATSC) meeting on 22/02/2019 in NHAI It was intimate in the PATSC that per km cost of the project is towards higher side and the same may be further value engineered as far as possible. It was intimate in a meeting held with CGM and GM/NHAI (Karnataka) on 25/02/2019 to modify the project proposals to 6lane configuration with optimizing provision of service road needs considering only in the built up stretches and locations where to maintain traffic circulation. The modified details submitted dated 14/03/2018.

Further, a meeting held with CGM and GM/NHAI (Karnataka) on 10/06/2019 regarding the modification required in project proposals. It advised to consider the modification in project proposals as four lane configuration will be consider in entire project and all structures in both packages will be with 6lanes configuration including its approaches. The service road considered only in built up areas and location where to maintain traffic circulation. 45m width land width (ROW) will be consider throughout except only in structure approaches and proposed Toll Plaza locations, it will be 60m width. The Dobbaspet connectivity from existing km 138 to km 131 will be consider for 4lanes configuration with 4lanes structure proposals and its approaches. The proposed land width (ROW) will be consider as 45m. The details also confirmed by PIU/Bangalore.

2 SCOPE OF WORK

The broad scope of work are as below.

1. Traffic studies including traffic surveys and Axle load survey and collect data for analysis, accident black spot details and demand forecasting for next thirty years
2. Detailed topographic survey using mobile/ aerial LiDAR or equivalent technology
3. Pavement investigations
4. Sub-grade characteristics and strength: investigation of required sub-grade and sub-soil characteristics and strength for road and embankment design and sub soil investigation;
5. Detailed design of road, its x-sections, horizontal and vertical alignment.
6. Detailed design of structures, preparation of GAD and construction drawings and cross-drainage structures, underpasses etc.
7. Identification of the type and the design of intersections
8. Design of complete drainage system and disposal point for storm water
9. Value analysis, value engineering Safety audits on different stages of project and project costing
10. Economic and financial analyses and contract packaging.

Stages already Completion

Stage 1: Quality Assurance Plan (QAP) & Inception Report (IR) & Feasibility Report

Stage 2: Strip Plan and Clearances

Stage 3: Detailed Project Report (DPR)

Stage 4: Technical Schedules

The present report forms part of Draft Detailed Project Report

2.1 Project Description

The NH 207 starts from Hosur in Tamil Nadu state and terminates in Dabaspet in Karnataka. The entire stretch passes through Krishnagiri, Bangalore Urban and Bangalore rural districts. Important towns along the route are Hosur, Sarjapur, Hoskote, Devanahalli, Doddaballapura and Dabaspet. The total length of this NH 207 is 139.180 km. About 122.380km length passes through Karnataka state and 16.80km passes through Tamil Nadu state. The consultancy services for preparation of DPR for rehabilitation and upgradation under NHDP IV Group-A Package 1 considered. Accordingly the consultancy services were carried out by M/s Feedback Ventures, Bangalore.

The implementation works of four lanes on BOT mode was awarded to M/s Transstroy Hoskote-Dobbaspet Tollways Pvt Ltd. The cost of the project was INR 720.69crores With concession period of 30 Years (Including,910 days of construction period) Accordingly the agreement signed on 30th August 2012 with schedule completion on 4th May 2016.

The date of commencement was on 05th May 2014 with revised completion date of 31st December 2017 and however, the Concessionaire had failed to fulfil the contractual obligation and accordingly the services were terminated on 19th May 2017. Only 11.34 physical progress was achieved by the concessionaire by then

- Start of project – Near junction with NH 4 (Dabaspet) is N 13°13'40.66" & E77°14'30.20"
- End of our project - (as per scope) at Ch. 58.300 (on Hoskote bypass after the proposed interchange of Chennai Expressway) is N 13° 5'22.56" & E 77°49'19.03"

Proposed STRR on West side in Dabaspet near Ch.130.575 (Existing km 131.265) of NH 207 is N 13°14'56.91" & E 77°18'29.17

The carriageway width of this section is predominantly two lane standard (7m) with earthen shoulders on both sides. The project road stretch is passing through Plain terrain. The land use by the side of this road includes agriculture, residential and commercial use. The establishments on both sides of the road are in general are outside the available ROW. However, some built-up stretches also noticed at some location. The road runs generally on embankment at a height of about 1.0m. 45m wide ROW available in the entire reach of project road.

34no major crossing locations and 79no number of minor road junctions exist in this section of National Highway. All these junctions are at-grade level. There are no existing service roads on both sides of the state highway. One ROB and two railway level crossings exist in this stretch of the project road. A total of 114numbers of culverts (Hume Pipe 88no, Slab 25no & Box 1no) exist in this section of the road. The formation width is generally 12m on all these culverts. There are five minor bridges existing on the project stretch. The Minor Bridges are of RCC slab type super structure (length of 12.5m to 33m) and with open foundation. The formation width is generally 6.5m to 12m.

3 Socio Economic Profile

Social indicators are a set of indicators that measure the project influence area towards the policy objectives. Demographic Indicators are a scientific measure of human population dynamics. Economic indicators allow analysis of past economic performance and predictions of future performance. A list of Socio – Economic Indicators considered in the preparation of the Socio – Economic Profile are, population, male / female ratio, health, Household, literacy, poverty, employment, gross domestic product (GDP), net state domestic product (NSDP), per capita income, agriculture & irrigation , industry , and transportation

4 TRAFFIC SURVEYS, ANALYSES AND FORECAST

4.1 Traffic Surveys and Analyses

Various traffic surveys and analysis have been carried out for addressing the objectives and issues pertaining to widening and strengthening of the project road. The surveys conducted include 7- day Volume Count, Turning Movement Survey, Origin & Destination Survey, Speed & Delay Survey, etc. The study aims at obtaining the existing traffic and travel characteristics on the project road and forecasting the same for the project horizon year considering various principal streams and various scenarios. The results of this analysis will form inputs for developing capacity augmentation proposals, designing the pavement, design of intersections, decisions regarding grade separators, pedestrian facilities, and carrying out economic and financial analysis.

Considering the traffic generation/diversion point, the project stretch is divided into four homogeneous section for the purpose of analysis and presentation of traffic and travel characteristics. **Table 1** depicts the details of homogeneous traffic section.

Table 1: Homogeneous Traffic Section

S No	Description	Section	Length (km)
HS 1	Dabaspet to Doddbelagavi of NH 207	km 138 to km 115.000	23
HS 2	Doddbelagavi to Doddaballapura of NH 207	km 115 to km 98.000	17
HS 3	Doddaballapura-Devanahalli of NH 207	km 98.000 to km 80.000	18
HS 4	Devanahalli- Hoskote of NH 207	km 80.000 to km 58.000	22

The average daily traffic (ADT) has been converted to average annual daily traffic (AADT) using seasonal correction factors. The AADT is the input for various analyses like traffic forecast, capacity augmentation, pavement design, economic and financial analysis etc. **Table 2** below gives the ADT plying on the project road.

Table 2: Summary of ADT & AADT at count locations

S No	Homogenous section	Location (km)	ADT		AADT	
			No	PCU	No	PCU
1	HS 1	131.000	7,729	11,328	8,346	11,747
2	HS 2	116.000	7,704	10,941	8,304	11,323
3	HS 3	92.100	12,349	15,641	13,142	15,508
4	HS 4	64.000	11,027	12,971	11,684	13,061

4.2 Traffic Forecast

Traffic demand plays the most important factor in deciding the type of infrastructure facility to be provided. This in turn determines likely costs to develop and benefits arising out of the improvement. The highway project require significant investment and thus prediction of traffic demand becomes an important task and need to be carried out accurately. For the design of pavement, plan for future maintenance program as well as capacity augmentation and for economic & financial evaluation, it is necessary to have realistic estimation of the size of traffic to the concession period.

Traffic forecasting is made by determining the past trend of traffic flow and by the use of economic models developed to co-relate past vehicle registration data with economic indices such as per capital income (PCI), net state domestic product (NSDP) and gross domestic product (GDP). By using the elasticity values obtained from the economic models and the likely rate of growth of indicators, the mode wise growth rates are obtained. Applying these growth rates, future traffic volume is estimated. The traffic forecast are given in the **Table 3** below.

Table 3: Projected sectional AADT in PCU

Sections	2018	2020	2025	2030	2035	2040	2045
HS1	11,774	13,756	39,677	54,139	71,265	91,282	116,961
HS2	11,347	13,300	39,130	53,538	40,608	90,555	116,139
HS3	15,572	18,292	45,741	62,811	83,110	106,807	137,089
HS4	13,084	15,325	42,116	57,642	76,101	97,626	125,062

4.3 Capacity analysis

Table 4: Section wise Capacity requirement

Description	Section 1	Section 2	Section 3	Section 4
Year LOS B of 4 Lane Capacity Reached	2026	2026	2023	2025
Year LOS C of 4 Lane Capacity Reached	2032	2032	2030	2031

From the above, it is relevant to mention that section 1 & 2 are accomplish level of service (LOS) B in the end of year between 2023- 2026 and achieve level of service (LOS) C in the year 2030 - 2032. However, considering the current project cost and other economic consideration NHAI intent to consider the project with 4lanes configuration and with six lanes structures and approaches

5 SURVEY AND INVESTIGATIONS

5.1 Topographic Survey

The broad outlines of the scope of services are:

i) Fixing of control frame work comprising of the following activities:

   a) Establishment of Main Control by DGPS

   b) Establishment of Subsidiary Control Points by Total Station.

c) Establishment of Height Control by Digital Level

ii) Detailed Topographical Survey using LiDAR based survey.

iii) Additional survey as required for geometric improvements like designing of junctions, ROB, bridge site, hydrological requirements and bypass/realignment.

The detailed topographical survey for the road corridor is completed. However additional surveys required are yet to be complete in realignment portion.

5.2 Details of Right of Way

The proposed right of way for the project road considered as 60m in the throughout corridor earlier. However, it was scale down to 45/60m considering the cost of acquisition as per NHAI letter dated 06/07/2019

5.3 Soil, Material and Pavement Investigation

Field & Laboratory Investigation on Existing Subgrade Soil (Main Carriageway)

Field Tests

In field investigation for existing subgrade, test pits of size 0.60m x 0.60m were excavated up to the subgrade level at the interface of the earthen shoulder and the carriageway. The general observations noted during the field investigation at each test pit are reported below.

- Details of the pavement composition
- Visual identification of subgrade soil
- Field dry density of the sub-grade with Core cutter method
- Field moisture content by oven dry method
- DCP test on sub-grade extending up to about 80 cm depth

FDD & FMC

Field dry density and field moisture content have been measured at the excavated pits. FDD and FMC values vary from 1.71 to 1.99 g/cc^3 and 5 % to 10% respectively.

Dynamic Cone Penetration (DCP) Test

DCP test was carried out as recommended by TRRL (U.K.) vide Road Note No. 31.

Laboratory Tests on Existing Subgrade (Main Carriageway)

Following laboratory tests carried out on the disturbed soil samples of test pits.

- Particle size analysis
- Liquid Limit and Plasticity Index
- Modified Proctor Compaction test

CBR test in 4 days (96 hours) soaked conditions at three energy levels corresponding to 10, 35 & 65 blows of heavy compaction rammer. The CBR at 97% of MDD for the collected samples varies from 4.8% to 9.10%.

Existing Pavement Composition

The existing pavement crust consists of bituminous layer (BC, DBM), granular layers (WMM, GSB) and subgrade soil. The pavement composition observed for carriageway. Total thickness

of flexible section of the pavement of the main carriageway varies from 300mm to 720mm. The thickness of the bituminous surfacing varies from 80mm to 130mm.

5.4 Survey and Investigation of Borrow Materials for Construction

Borrow Area Soil

Extensive survey was conducted to locate the potential source of borrow area soil required for the construction of embankment and subgrade. four locations of borrow areas are identified along the project road at distance of 0.1km to 2.50km Generally soil samples were collected from 1.5m to 2.0 m depth of the pit dug at the center of the borrow area. Based on the availability of suitable borrow area soil, subgrade CBR of 7% for design of new construction has been considered

Evaluation of Borrow Soil and OGL

- 2 out of 5 borrow areas having CBR more than 6.8% are suitable for both subgrade and embankment. The rest 3 areas are suitable for embankment construction
- 1 out of 3 borrow areas having CBR more than 6.5% are suitable for both subgrade and embankment. The rest 2 areas are suitable for embankment construction

Stone Metal

Three stone quarries were identified as the potential source of coarse aggregates required for road construction in the vicinity along the project road. It can be concluded that material from all the quarries fulfils the requirement of MORTH specifications.

Sand

One source identified as potential source for sand from Hemavati River near km 103.200 with average lead of 300km. Also two crusher sand sources identified at km 58.000 & km 138.200 with lead of 25km and 11km respectively.

Water

Water samples were collected from available sources (hand pump and river) located within the project influence area and tests were conducted to evaluate its suitability for use in construction work. The test results water samples reveal that the water is safe for all construction purposes.

Fly ash

Fly ash is proposed to be used as per Government of India notification. Raichur and Bellary Thermal Power Plants are accordingly identified.

6 DESIGN STANDARDS AND SPECIFICATIONS

Manual of specification and standards for four lanes of highway through public private partnership (IRC: SP: 84-2014) adopted

Design proposals

Four lanes with paved shoulder configuration and 6 lanes structures including approaches in the entire package

7 PAVEMENT DESIGN

Pavement performance ensured to support the projected traffic loading throughout the design period. Its cost represents a major proportion of the total construction cost. The project road has four homogeneous sections based on the traffic, CBR and existing Pavement composition. During

the Feasibility study three different types of pavement options considered (Flexible type/Cement Treated Base and Granular Sub-base/ Rigid Pavement) considering merits and demerits and its life cycle costs Flexible pavement option is recommended. The composition of the paved shoulder will be same as that of main carriageway

Table 5: Design Traffic (MSA)

Homogeneous Section	Cumulative Standard Axle (CSA) in msa					Design Traffic (20 year)
	10th Year	15th Year	20th Year	25th Year	30th Year	
H1 - Dabaspet to Doddbelagavi, NH- 207	50.09	88.92	139.32	204.76	290.00	140
H2 - Doddbelagavi to Doddaballapura, NH-207	48.39	86.11	135.20	199.07	282.42	140
H3 - Doddaballapura-Devanahalli, NH-207	52.20	92.77	145.54	214.16	303.66	150
H4 – Devanahalli - Hoskote, NH-207	45.32	80.32	125.69	184.52	261.05	130

Table 6: Pavement Composition – Granular Base and Granular Sub-base

Traffic	HS-1	HS-2	HS-3	HS-4
	140 msa	140 msa	150 msa	130 msa
Bituminous Concrete (BC) - PMB-40 (IRC:SP:53)	50	50	50	50
Dense Bituminous Macadam (DBM) – VG 40	155	155	155	150
Wet Mix Macadam (WMM)	250	250	250	250
Granular Sub-base (GSB) - Gradation III & IV for drainage layer and I, II, V & VI for filter/separation layer of MORTH Specification	250	250	250	250
Subgrade (Effective CBR >= 7%)	500	500	500	500

8 Bridges and Structures

The proposals envisage the following structures. There is no major bridge in this project road section. The details of minor bridges, proposed ROB, Vehicular Underpasses (VUP), LVUP, Viaduct, cross drainage structures proposed as below. This will be further studied as per design and the proposals will be further modified as per site requirements

Major Bridges: Nil

Minor Bridges: 13 on Main carriageway and 7no on service roads

Culverts:

- Reconstruction of Existing Culverts: 14no
- Construction of New Culverts: 36no

- In order to ensure uninterrupted free flow traffic following ROBs, VUPs, Viaduct are proposed the details of locations are as follow.

Table 7: Proposed ROB Tentative Span Arrangement

S. No.	Existing Chainage (km)	Design Chainage (From km to km)	No. of Tracks	Proposed Structure Type			Proposed Span arrangement No of span x span length* (m)	Total width of the structure (m)
				Type of Super-structure	Type of Sub-structure	Founda-tion		
1	Devana halli Bypass	From km 54.010 to km 54.100	1	Concrete Deck Slab & PSC I Girder	RCC Pier	Pile foundati-on	3x30	2 x 14.5 m

Table 8: Proposed VUP's Location

S. No.	Existing Chainage (km)	Design Chainage (km)	Span Arrangement (m)	Remarks
1.	95.150	44.200	1x30	MDR
2.	91.415	47.940	1x30	For Traffic Circulation
3.	Devanahalli Bypass	50.625	1x30	NH-207
4.	Devanahalli Bypass	56.855	2x30	SH 96
5.	80.780	60.785	1x30	NH-207
6.	74.785	66.645	1x30	MDR
7.	Hoskote Bypass	67.385	1x30	NH-207
8.	Hoskote Bypass	70.875	1x30	NH-207
9.	Hoskote Bypass	78.475	2x30	SH 82

Table 9: Proposed LVUP's Location

S. No.	Existing Chainage (km)	Design Chainage (km)	Total Width (m)	Span Arrangement (m)	Remarks
1.	Devanahalli Bypass	52.545	2x14.5	1x12	Village Road

S. No.	Existing Chainage (km)	Design Chainage (km)	Total Width (m)	Span Arrangement (m)	Remarks
2.	78.580	62.900	2x14.5	1x12	Village Road
3.	Hoskote Bypass	68.715	2x14.5	1x12	Village Road
4.	Hoskote Bypass	73.100	2x14.5	1X12	Village Road
5.	Hoskote Bypass	74.630	2x14.5	1X12	Village Road
6.	Hoskote Bypass	79.445	2x14.5	1X12	Village Road

Table 10: Proposed SVUP's Location

S. No.	Existing Chainage (km)	Design Chainage (km)	Total Width (m)	Span Arrangement (m)	Remarks
1	Devanahalli Bypass	56.600	2x14.5	1x7	For Traffic Circulation

Table 11: Grade Separated Structures / Interchanges

S. No.	Existing Chainage (km)	Design Chainage (km)	Total Width (m)	Span Arrangement	Remarks
1	Devanahalli Bypass	55.265	**2x14.5**	**20m + 45m + 20m**	NH-7 Crossing
1A	NH-7	0.750	**2x16.5**	**24m**	on NH-7
1B	NH-7	1.100	**2x16.5**	**24m**	on NH-7
2	Hoskote Bypass	76.765	**2x14.5**	**15m + 45m + 15m**	SH-35 Crossing

Table 12: Proposed Viaduct

S. No.	Existing Chainage (km)	Design Chainage (From km to km)	Span Arrangement (m)	Vertical Clearance (m)	Remarks
1	Devanahalli Bypass	From km 53.470 to km 54.010	18x30.0*****	5.5	ROB approach portion
2	Devanahalli Bypass	From km 54.100 to km 54.160	2x30.0	5.5	ROB approach portion

proposal, considering the worst case, EIRR remains at cut-off rate. Thus it is conclude that the project is economically viable at current price.

9 RECOMMENDATIONS

- The proposed proposal will accommodated in line with the already approved 4lanes proposal with 45/60m ROW .
- Bypasses provision are consider in:
  1. Devanahalli
  2. Hoskote
- All proposed structures and its approaches will be provisioned as per six lanes manual IRC SP 87-2013.
- The already constructed portions of pavement in patches will reviewed as per structural requirements of pavement design and apt rehabilitation methods required if any will suggested to get back in usage.
- The proposed facility will have 50 culverts, 20no minor bridges, 1no ROBs, 09no VUPs, 06no LVUPs, 01 SVUP, 04no Grade separated structure and two viaduct structure in the Devanahalli bypass.