	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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E. EXECUTIVE SUMMARY

1 Introduction

The Government of India has envisaged to create a world-class infrastructure facility, to boost the economic development in the country, for which Ministry of Road Transport and Highways (MoRTH) plays a key role. MoRTH has been entrusted to implement the development of some of the stretches of National Highways under National Highway Development Programme on EPC/BOT basis. As part of this endeavor, the Public Works Department (PWD) of Government of Goa has decided for the development of "Four Laning of Existing Maharashtra/Goa Border - Goa/Karnataka Border of NH-17 from Km 475.000 to 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode under NHDP-III (Patradevi to Karaswada section)".

2 Project Description

The Project Highway is a section of NH-17 between Patradevi and Karaswada, passing through villages Torxem, Tamboxem, Uguem, Poroscodem, Casnem, Pernem, Virnoda, Dargalim and Colvale. It connects Panvel (South of Mumbai city) to Kochi in Kerala, passing through the states of Maharashtra, Goa, Karnataka, and Kerala. The entire Project stretch is an important link connecting the states of Maharashtra, Goa and Karnataka starts at Patradevi Maharashtra-Goa border to Pollem, Goa-Karnataka border with length of 135.96 km. It has a great potential of growth in the passenger as well as freight movement in future due to tourism, agriculture and industrial growth in the project influence area. From Km 475.000 to Km 500.500, the right of way ranges from 8 m to 45m. The entire alignment passes through plain/rolling terrain. The Index Map of the project stretch is given as Figure E-1.



Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)

Project Description

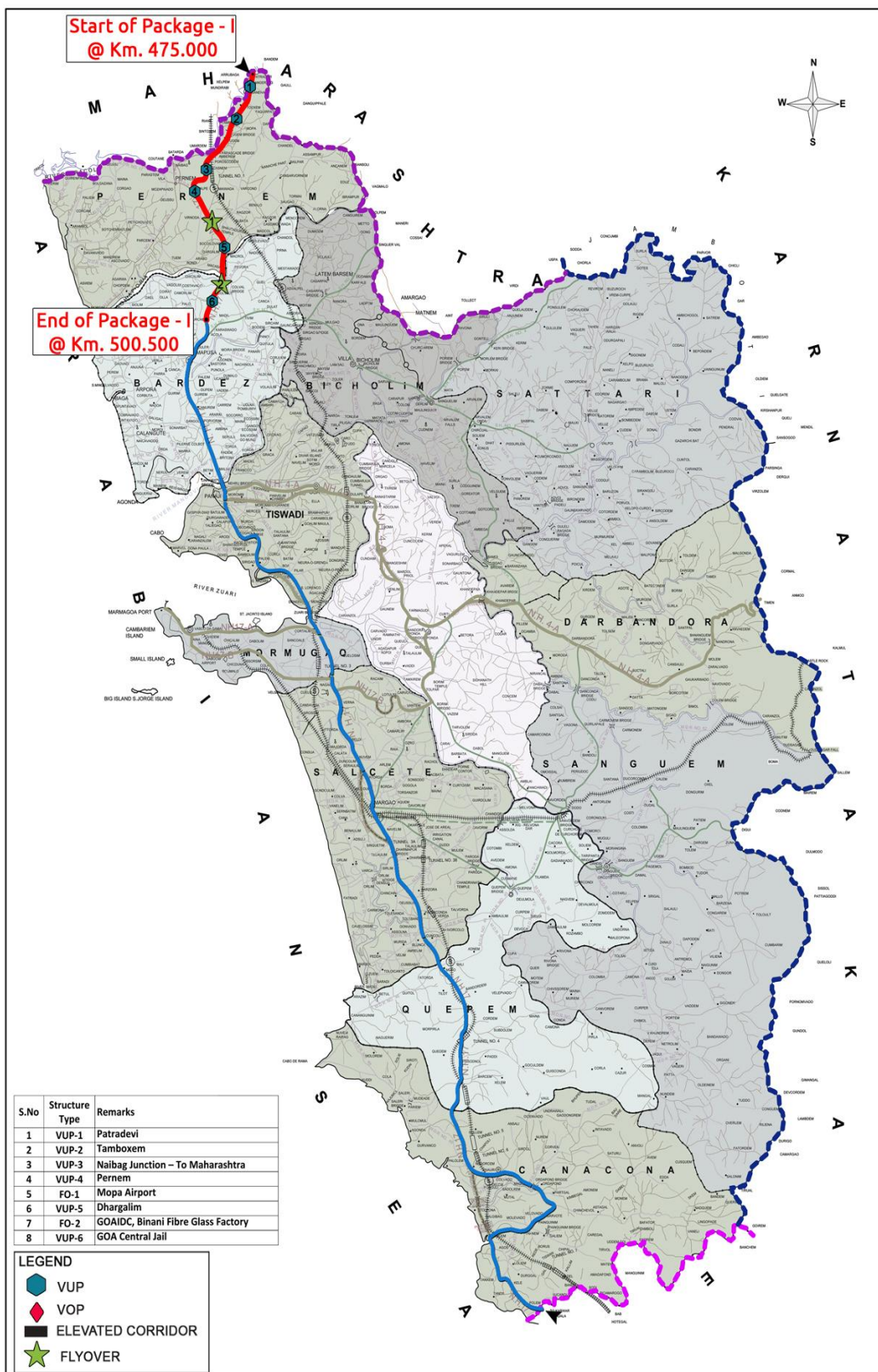



Figure: E.1 Index Map

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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3 Alignment Option Study

Reconnaissance, map studies and detailed investigations of the influence area were carried out for identifying the existing road network, land use pattern and industrial activities along the project corridor. Different alignment options are considered, evaluated and recommendations are presented in the subsequent sections. The improvement scheme of the options are mentioned below.

The following standards have been followed for improving the horizontal geometry. For the purpose of horizontal design, the project road is considered as follows.

Package I: From Km 475.000 to Km 500.500 (Plain/Rolling terrain).


The Project Highway starts with a mix of rolling/plain terrain from Km 475.000 at Goa/Maharashtra border to Km 500.500 near Karaswada. Existing alignment has substandard horizontal geometry. The existing speed on the highway is about 50 to 60 kmph. Minor realignments are proposed to meet the minimum design speed of 80KMPH for entire project stretch.

The existing alignment in Naibag location has substandard horizontal & vertical curves in particularly from Km 486.500 to Km 490.500. For this stretch realignment is proposed to improve the geometry.

4 Surveys and Investigations

The studies and investigations carried out during the feasibility study comprised mainly of the following:

- Detailed Inventory & Condition Surveys for Road
- Detailed Inventory & Condition Survey for Bridges
- Topographic Surveys along the existing alignment
- Traffic surveys viz., Classified Traffic Volume Count, Turning Movement Count, Axle Load, Origin Destination and Commodity Movement, Willingness to Pay etc., including collection of secondary data for traffic projections
- Investigations of the existing pavement and sub grade involving BBD test
- Collection and laboratory testing of soil samples from pits adjacent to the existing road
- Identification of borrow areas for different types of pavement and bridge construction material, collection of samples and their analysis

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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- Environmental baseline studies
- Public Consultations

5 Traffic Studies


Based on reconnaissance studies, the locations for conducting various traffic surveys were finalized. The traffic surveys viz., Classified Traffic Volume Count, Turning Movement Count, Axle Load, Origin Destination and Commodity Movement, Willingness to Pay, etc., including collection of secondary data for traffic projections were carried out in the month of June in 2015. Secondary data was collected for the purpose of determining the Seasonal Variation Factors and Growth Rates at various count stations for different vehicle categories.

E.6.1 Average Annual Daily Traffic (AADT)

The Annual Average Daily Traffic (AADT in no of vehicles) at the survey location is obtained by multiplying the Average Daily Traffic (ADT) with the seasonal correction factor. The AADT of vehicles for the year 2015 at Km 493.000 location of traffic volume count survey along the Project corridor is presented below.

Table E.1: Average Annual Daily Traffic

Mode	Km 493.000
Two Wheelers	6132
Three Wheelers	12
Car / Jeep / Van	5231
Car Yellow board	176
Tata Magic	19
RTC Bus	155
Private Bus	237
School/College bus	3
Mini Bus	80
2 Axle	706
3 Axle	149
M Axle	197
HEM	15
LCV/LGV	787
Mini LCV	466
Three Wheeler goods	2
Tractor	5
Tractor with trailer	2
Non-Motorized Vehicles	7
Govt. Exempted Vehicles	28
Tollable Traffic (vehicles)	8220

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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Mode		Km 493.000
Tollable Traffic (PCU's)		11894
Total Vehicl es	Motorized	14400
	Non-Motorized	7
	Total Traffic	14407
Total PCUs	Motorized	15024
	Non-Motorized	26
	Total Traffic	15050

6 Highway Improvement Proposals

6.1 General

Primarily, the scope of the project is '4-laning' of the existing 2-lane carriageway. The project corridor is to be designed as a 'partially access controlled highway' by providing service roads, grade separated intersections, acceleration and deceleration lanes, vehicular and pedestrian underpasses / overpasses etc. with an objective to segregate the local traffic from the through traffic.


The various upgrades required for enhancing the project road to 4 lane configuration as per the guidelines given in the Four laning manual (IRC-SP:84-2014) are brought out. In congested locations, various alternative upgrade options such as bypasses or elevated highway have been considered before recommending the feasible option.

6.2 Typical Cross Sections

It is proposed to widen the existing 2-Lane carriageway to 4-lane carriageway with two lane service road on either side of the project highway where ever required. The existing right of way varies from 8 m to 45 m for the project stretch. Typical Cross Sections (TCS) have been developed duly considering various aspects. The entire alignment passes through plain/rolling. Description of each type of cross section is listed in the Table shown below.

Table E.9: Typical Cross Section (TCS)

TCS type	Description
2.4A	4 Lane Cross Section-Concentric widening-1.50m median-30m PROW
2.6A	4 Lane Cross Section-Concentric/Eccentric widening-1.50m median-Service roads (5.50m) on both sides-40m PROW
2.9A	4 Lane Cross Section in Ghat Section (Cut Section)-30m PROW
7.8A	6 Lane Cross Section-Approaches to PUP/ LVUP/VUP/Flyover -0.6m median-Slip roads (5.50m) on both sides-40m PROW in Existing Alignment
7.8B	6 Lane Cross Section-Approaches to PUP/ LVUP/VUP/Flyover -0.6m median-

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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TCS type	Description
	Slip roads (7.00m) on both sides-43m PROW in Existing Alignment
7.8C	6 Lane Cross Section-Approaches to CUP-0.6m median-Without service roads-30m PROW in Existing Alignment

6.3 Service Roads/Slip Roads

As per clause 2.1.ii (a) of four lane manual (IRC: SP-84-2014), service roads shall be provided on both sides of the main highway in built-up areas and interconnected through underpasses, overpasses and grade separators. However, keeping the project viability in view, service roads have been proposed at built-up locations and major villages along the project corridor on both sides of the 4 lane carriageway depending on the nature and extent of village/town development. Service roads are designed to carry two-way traffic with turning areas where required and are linked to the main carriageway by one-way deceleration and acceleration lanes with 'taper-merge' arrangements. Service roads are generally kept at existing ground level to serve the adjacent properties, whereas the main carriageway is constructed as per the requirements of design vertical profile of highway. Service roads are proposed in the following locations as shown in Table below.

Table E.10: Service Roads/Slip Roads

S. No.	Design Chainage (Km)			Slip/Service Road	Remarks
	From	To	Length		
1	475.110	475.830	0.720	Slip Road	VUP (to Patradevi)
2	480.060	480.720	0.660	Slip Road	VUP (to Mopa village and Tamboxem village)
3	485.020	485.300	0.280	Slip Road	VUP (Road to MH border Existing Road @ Naibag junction)
4	485.300	485.740	0.440	Slip Road	VUP (Along Re-Alignment of Existing Highway)
5	487.660	488.710	1.050	Slip Road	VUP Pernem
6	488.710	489.300	0.590	Slip Road	Pernem Railway Station
7	489.300	490.200	0.900	Slip Road	LVUP Govt College
8	490.200	490.300	0.100	Service Road	Service Road
9	492.170	493.040	0.870	Slip Road	Fly Over (Road to Mopa New Airport)
10	493.310	494.000	0.690	Slip Road	PUP (Gaowada)
11	494.000	494.940	0.940	Slip Road	VUP (Devalwada)
12	496.530	497.300	0.770	Slip Road	LVUP Colvale-Chikali
13	497.300	497.700	0.400	Slip Road	2 Lane PUP
14	497.700	498.630	0.930	Slip Road	FO/Viaduct (GOAIDC, Binani Fibre Glass Factory)
15	499.640	500.260	0.620	Slip & Service	VUP to Central Jail

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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S. No.	Design Chainage (Km)			Slip/Service Road	Remarks
	From	To	Length		
				Road	
16	500.260	500.500	0.240	Slip Road	Till End of Project Stretch

6.4 Underpass/Overpass/Elevated Corridors


In order to avoid conflict of traffic on project road with the traffic on cross roads, Vehicular underpasses (VUPs) or Vehicular Overpass (VOPs) or Elevated Corridors are proposed at the intersections of major cross roads with the project highway. It is proposed to provide 6 no's of VUPs, 2 no's of LVUPs, 4 no's of PUP/CUPs and 2 Fly Overs along the project highway at the following locations as given in below.

Table E.11: Vehicular Underpasses (VUP)

S. No.	Existing Chainage (Km)	Design Chainage (Km)	Span / Opening (m)	Underpass	Remarks
1	475.400	475.400	1 x 20.0 x 5.5	VUP	To Patradevi
2	480.829	480.526	1 x 20.0 x 5.5	VUP	To Mopa - Tamboxem
3	481.800	481.603	1 x 10.5 x 3.0	CUP	To Uguem
4	486.100	485.320	1 x 20.0 x 5.5	VUP	To Shiroda
5	490.200	488.357	1 x 20.0 x 5.5	VUP	To Pernem
6	491.600	489.744	1 x 10.5 x 4.5	LVUP	To Govt. College
7	495.500	493.650	1 x 7.0 x 3.0	PUP	To School
8	496.400	494.446	1 x 20.0 x 5.5	VUP	To Industrial Area
9	497.800	495.864	1 x 7.0 x 3.0	CUP	Access for Cultivation
10	498.850	496.908	1 x 10.5 x 4.5	LVUP	To Colvale - Chikali
11	499.450	497.459	1 x 7.0 x 3.0	PUP	Existing 2 Lane PUP
12	501.850	499.901	1 x 40.0 x 5.5	VUP	To Central Jail

Table E.12: Fly Over

Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Span / Opening (m)	Remarks
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	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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1	494.400	492.554	15 + 30 + 15	To Mopa Airport
2	500.048	498.209	15 + 30 + 15	Binani – GOA IDC

7 Structures Improvement Proposals

Recommendation of structure improvements, including widening, repair and reconstruction / new construction of bridges, other cross drainage structures and the proposals are given below. Where Minor bridges are proposed to be widened, it is recommended that the existing railing to be replaced with RCC crash barrier by chipping the edge of deck and exposing the reinforcement and then casting the RCC crash barrier.

Widening of existing pipe culverts smaller than 900 mm shall be replaced with 1200 mm dia Pipe Culverts. Existing 900 mm dia pipe culverts can be widened using 900 mm dia pipes.

7.1 Rehabilitation scheme for Existing Structures

Rehabilitation measures for existing bridges & other structures are described briefly below:


The basic measures to be taken into account are:

- Repair of existing scour protection/bed protection or slope protection (wherever necessary).
- Replace existing wearing coat on all structures
- Replace expansion joints in all bridges.
- Replace bearings for bridges.
- Repair corroded reinforcement.
- Repair of cracks by epoxy injection – RCC elements.
- Repair of cracks by PMC mortar – Stone masonry elements.

7.2 Major Bridge

A) Construction of New Major Bridge

Sl. No	Ex. Chainage Km	Design chainage km	Proposed structural Configuration	Proposed structure type	Proposed span arrangement	Total Width of the structure(m)	
						LHS	RHS
1	481+385	481+048	4 lane width	PSC I-girder	3x25.0	12.5	12.5

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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B) Rehabilitation & Repair of Existing Major Bridges

S. No	Ex. Chainage Km	Design chainage km	Proposed structural Configuration	Proposed structure type	Proposed span arrangement	Total Width of the structure(m)	
						LHS	RHS
1	498+253	496+425	2 lane width	PSC Box girder	1x51+3x60+1x21	12.5	Existing

Note: RR= Repair and Rehabilitation

7.3 Minor Bridge

A) New Construction and Reconstruction of New Minor Bridges

S. No.	Existing chainage	Design Chainage (Km)	Proposed structural Type	Existing span arrangement (m)	Proposed span arrangement (m)	Total width (m)
1	-	477+665	Box	-	1x8	12.5+12.5
2	-	485+490	Box	-	1x12	12.5+12.5
3	-	486+007	Box	-	1x8	12.5+12.5
4	492+267	490+418	RCC Girder	2x5.8	1x20	12.5+12.5
5	500+520	498+546	Box	1x7.5	1x7.5	12.5+12.5

7.4 Road Over Bridge

Sl. No	Existing Chainage (km)	Proposed Chainage (km)	Proposed structure configuration	Proposed structure Type	Proposed Span arrangement (m)	Total Width(m)	
						LHS	RHS
-Nil-							


8 Project Facilities

The project facilities are summarized below:

Table E.13: Project Facilities

S. No.	Design Chainage (Km)	Location	Side (LHS/RHS)
Truck Lay-bye			
1	499.097	Truck Lay-bye	RHS
2	499.247	Truck Lay-bye	LHS

S. No.	Bus bay(BB) or Bus shelter (BS)	Design Chainage (Km)	Name of Village	Side (LHS/RHS)
1	BS	475.250	Patradevi	LHS

	Four Laning of Existing Maharashtra/Goa Border-Goa/Karnataka Border Section of NH-17 (New NH-66) from Km 475.000 to Km 500.500 (Existing Km 475.000 to Km 502.500) in the state of Goa on EPC Mode (Patradevi to Karaswada Section)	Project Description
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S. No.	Bus bay(BB) or Bus shelter (BS)	Design Chainage (Km)	Name of Village	Side (LHS/RHS)
2	BS	475.550	Patradevi	RHS
3	BS	480.400	Tamboxem	LHS
4	BS	480.610	Tamboxem	RHS
5	BS	481.473	Uguem	LHS
6	BS	481.773	Uguem	RHS
7	BS	484.519	Naibag Junction	LHS
8	BS	485.937	Naibag Junction	RHS
9	BS	488.152	Pernem Rural	LHS
10	BS	488.469	Pernem Rural	RHS
11	BS	489.601	Bhutwadi Junction	LHS
12	BS	489.934	Bhutwadi Junction	RHS
13	BS	492.399	Mopa Airport	LHS
14	BS	492.799	Mopa Airport	RHS
15	BS	493.578	Dhargalim	LHS
16	BS	493.808	Dhargalim	RHS
17	BS	494.348	Industrial Area	LHS
18	BS	494.648	Industrial Area	RHS
19	BS	496.741	Colvale	LHS
20	BS	496.798	Colvale	RHS
21	BS	497.063	Colvale	LHS
22	BS	497.521	Colvale	RHS
23	BS	498.062	GOAIDC	LHS
24	BS	498.347	GOAIDC	RHS
25	BS	499.755	Central Jail	LHS
26	BS	500.085	Central Jail	RHS

9. Civil Cost:

Civil of the project is 447 Cr.