

EXECUTIVE SUMMARY

0.1 Executive Summary

The State Government of Rajasthan acting through the Chief Engineer (roads), Public works Department is engaged in the development of state roads and as a part of this endeavour, the Authority has decided to undertake two laning of 4 roads as detailed below under package – 20 through Public Private Partnership on Design, Build finance, operate and transfer (DBFOT), basis:

Table: 0.1 : Location

S. No.	Project Highway Description	Length (Km.)	Project Highway Constituting of	Segment Nos.
1	Kapuriya–Khimsar–Roon–Merta City	Km. 0 - 120	MDR-37A / ODR-8 / SH-39	H - I
2	Merta City – Asop – Kherapa	Km. 0 - 76	SH-86 / MDR-58	H - II
3	Sathin – Gotan	Km. 0 - 31	MDR-75	H - III
4	Bhawi – Pipar – Khimsar	Km. 0 – 99	MDR-90	H - IV

In pursuance of the above, M/s STUP Consultants Pvt. Ltd. have been appointed to carry out the Feasibility Study for determining the technical feasibility and financial viability of these roads. The agreement was signed on 30.10.2014 and the services commenced on 07.11.2014.

Subsequently, the above mentioned roads have been upgraded vide state govt. notification no. F-7(442) Sec II-Part F/79/D-130 dated 21.08.2015 as per details given below:

S. No.	Classification of road As per earlier notification	Classification of road as per new notification
1	MDR-37A	SH-87
2	ODR-8	SH-87C
3	MDR-58	SH-86A
4	MDR-75	SH-86B
5	MDR-90	SH-86C

During discussions held at Jaipur on 11th August 2015, the H-2, H-3 and H-4 were restricted by the Authority as indicated in our letter No.: 13/6967/E/FC/GU/3075 dated 14th August 2015 (copy enclosed). Accordingly, the Modified Draft Feasibility Report was submitted to the Authority vide our letter No.: 13/6867/E/FC/GU/3335 dated 11th March 2016.

Based on the above, modified Draft Feasibility Report, the Feasibility Report was prepared and the same was also submitted vide our letter No.:

13/6967/E/FC:GU/3336 dated 12th March 2016. However, the final Feasibility Report was discussed in detail during discussions held at Jaipur on 14th and 15th March 2016. The same was modified accordingly and the present proposal is modified final feasibility report for H-IV.

The location of the project highway has been shown in Fig. 1.1 – Key Plan (Chapter-1). The project highway taking off from Ch. 59.700 of NH-112 end at CH. 217.200 of NH-65 after running along SH-86C Total length of the project highway is 97 Km. including the common portions with H-III (9.50Km.) and with H-II (4 Km.) the project highway falls in Jodhpur district except the portion beyond Mangeria (About 8Km.) which is in Nagaur District.

0.2 Start and End point of the project

0.2.1 Start Point

The start point of the project highway is at Bhawi on NH-112 (at its Ch. 59.700).

0.2.2 End Point

The end point of the project highway is at Km. Ch. 217.200 of NH-65.

0.2.3 Right of Way

As per the information gathered from the concerned agencies, the section – wise ROW is as given below in Table 2.2 of Chapter-2. However, subsequently, after collecting the revenue maps, it is noted that the ROW varies from 8.0 to 20.0 m.

0.3 Existing Carriageway and Pavement

The existing road is having single lane carriageway (width 3.0 m to 3.75m) in the entire length including katcha road in a length of about 5 Km beyond Mangeria. About 10.5 Km length from Pipar to Sathin and 4 km. length between Palri Ranawat and Lawari Piou is common with H-III & H-II respectively. There is no existing paved shoulder and the width of earthen shoulders varies from 1.00 to 2.00m. The surface of the carriageway is generally bituminous except in the stretches passing through in-habited areas where it is partly CC. The surface of shoulder is unpaved. The detail of carriageway is summarized in Table. 0.2 The

condition of the pavement varies from good to fair. It is good in about 50% of length and fair to poor in the remaining 50% of length. The condition of shoulders is fair to poor.

Table: 0.2 : Existing Carriageway & Pavement

S. No.	Chainage (Km.)		Length (Km)	Carriageway		Shoulder		Remarks
	From	To		Width (m)	Type	Width (m)	Type	
Bhawi to Sathin								
1	i) 0.000 (Bhawi)	20.900 (Pipar)	20.900	3.0 - 3.50	BT	1.0-2.0	Unpaved	CC (partly in Silari / Ghanamangra)
Sathin to PalriRanawat								
2	30.600	55.000	24.500	3.66	BT/CC	1.0-2.0	Unpaved	CC (Partly in Rathkuriya)
	55.000	70.800	15.800	3.50	BT	1.0-2.0	Unpaved	
Lawari-Piou to Khimsar								
3	74.750	96.976	22.226	3.00 to 3.75	BT	1.0-2.0	Unpaved	Includes Katcha Road about 5Km.

0.4 Alignment

0.4.1 The alignment is passing through Plain terrain in entire length. The land use along the project highway is mainly agriculture and residential in built up area. It can cater to the design speed of about 80 km/hr except in some of the built-up area where it may have to be restricted up to 50-65 km/hr., however, in some portion of the project highway (Km. 41+500 – 42+000) passing through Rathkuriya where geometrics are very bad will need short re-alignment. A proposal for the same has already been prepared and the proposal approved by the authority. However topographic survey could not be done due to public agitation. The vertical alignment is generally smooth.

The existing road is mainly a having single lane carriageway (width 3.0m to 3.75m) in entire a length of 64km (77%). Further there is Katcha road in a length of about 5 Km. beyond Mangeria. About 10 Km. length from Pipar to Sathin and 4 km. length between PalriRanawat and Lawari Piou is common with H-II & H-III. There is no

existing paved shoulder and the width of earthen shoulders varies from 1.00 to 2.00 m.

The height of the embankment is around 1.0m.

0.5 Settlement

There are about 10 major and minor settlements along the project highway. Out of which Silari, Pipar, Rathkuriya, Bhopalgarh and Gajsinghpura are the major settlements. Details are in Table 2.1 (Chapter-2).

0.6 Major and Minor Intersections

There are about 26 intersections, most of these intersection lead to nearby village. Details in Table 2.3 (Chapter-2).

0.7 Existing Bridges / Culverts

There is no bridge in the entire project highway. However, there are 3 culverts and 17 causeways existing on the project road. Details in Annexure 2.3 (Chaptr.-2)

0.8 Underpasses / Overpasses

There are no existing vehicular or cattle / pedestrian underpasses on the project highway.

0.9 Railway Crossing

There is one unmanned level crossing single line (Salva - Bilara) at km. 0.800 on the Project Road. There is another manned Railway crossing (Ch. 563 / 3-4) in Km. 39 (Merta – Jodhpur) of project highway. The numbers of train passing at this crossing are about 30 per day and average gate closing time on each occasion is about 10 minutes as per the information collected from the site. The TVU as on 10/13 are 37557 only. Presently the cost of construction of this ROB has not been included in the Project Cost.

0.10 Traffic Survey

- Classified traffic volume survey at 4 locations.
- Turning movement survey at 3 important junctions.
- Axle load survey at 2 locations.
- Pedestrian / Animal crossing survey

0.11 Homogeneous Sections

Considering the type of road, traffic volume, project highway is divided in homogeneous sections having similar pattern of traffic. These homogenous sections are identified as below:

Table - 0.3: Homogenous Sections

Homogenous Section	Chainage (Km-Km)	Length (km)	Remarks
HS-1	0.000-31.000 (Bhawi-Sathin)	31	SH-86C (the length includes a length of 9.5Km. common with H-III)
HS-2	Km. 31-55 (Sathin to Bhopalgarh)	24	SH-86C
HS-3	Km. 55-71 (Bhopalgarh to Palri)	16	SH-86C
HS-4	Km. 75-97 (LawariPiou to Khimsar)	22	SH-86C

Table 0.4: Traffic Survey locations and Schedule

S. No.	Location	1 st traffic Survey (Nov.-Dec. 2014)	2 nd traffic Survey (May-Jun. 2015)	Remarks (Duration)
		Period	Period	
1	SH-86C KM-1+500	12.12.14 – 18.12.14	24.06.15 to 30.06.15	7 days
2	SH-86C-KM-55-500	10.12.14 – 16.12.14	26.06.15 to 02.07.15	7 days
3	SH-86C Mangeria Village	09.12.14 – 15.12.14	26.06.15 to 02.07.15	7 days
4	SH-86C Ghana Magra Village	16.12.14 – 22.12.14	24.06.15 to 30.06.15	7 days

Average Daily Traffic (ADT)

Table 0.5: Average Daily Traffic (ADT)

S. No.	Location	Tollable Traffic		Exempted Traffic	
		Vehicle	PCU	Vehicle	PCU
1	SH-86C KM-1+500	1310	3064	1664	851
2	SH-86C-KM-55-500	843	1737	1593	802
3	SH-86C Mangeria Village	118	264	218	117
4	SH-86C Ghana Magra Village	122	289	139	75

0.11.1 Axle Load Survey

The VDF values as per Axle Load Survey are as given below:

Table 0.6: VDF Value

Location	Vehicles Type						
	Bus	Mini Bus	Mini LCV	LCV	2-Axle Truck	3-Axle Truck	4-6-Axle Vehicle
SH-86C KM-1+500	1.27	0.28	0.045	1.61	8.87	6.64	4.83
SH-86C KM-55+500	1.11	-	0.055	1.86	11.62	9.72	6.50

Growth Rate

A growth rate of 5% (five per cent) as per ToR has been adopted.

Table: 0.7 : Growth Rate (Traffic Projection)

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-2021
As per ToR	5%	5%	5%	5%	5%	5%
Adopted Growth Rate	5%	5%	5%	5%	5%	5%

0.11.2 Projected Traffic Volume

Traffic demand projection for the horizontal year (as per our traffic report) computed based on adopted growth rates and are summarized below in table 0.8:

Table 0.8 Average Traffic Projection (AADT and PCUs) - For All Vehicles (1st& 2nd traffic survey)

Location	Growth Rate	SH-86C KM-1+500		SH-86C KM-55+500		SH-86C Mangeria		SH-86C Ghana Magra		Average PCU for entire Highway
		AADT	PCU	AADT	PCU	AADT	PCU	AADT	PCU	
Traffic as on 31.03.15	Base Year	3312	4503	2648	2792	361	411	266	366	2018
2015-16	5%	3478	4729	2780	2932	379	432	279	385	2119
2016-17	5%	3652	4965	2919	3079	398	454	293	404	2225
2017-18	5%	3834	5213	3065	3232	418	476	308	424	2337
2018-19	5%	4026	5474	3218	3394	439	500	323	445	2453
2019-20	5%	4227	5748	3379	3564	461	525	340	468	2576
2024-25	5%	5395	7336	4313	4548	588	670	433	597	3288
2029-30	5%	6886	9362	5505	5805	750	855	553	762	4196
2034-35	5%	8788	11949	7026	7409	957	1092	706	972	5356
2039-40	5%	11217	15250	8967	9456	1222	1393	901	1241	6835
2044-45	5%	14315	19464	11444	12068	1560	1778	1150	1584	8724

Capacity Analysis

Keeping in view the guideline vide clause 1.14 and 2.16 of IRC: SP: 73-2007 and the present / projected traffic, following lane improvement are proposed:

Table: 0.9 – Lane Improvement Details

S. No.	Section (Km. to Km.)	Lane Configuration	Remark
1	0.000 – 21.000* (SH-86C)	2-Lane width earthen Shoulder	*This excludes common portion with H-III.
2	31.000 – 71.000 (SH-86C)	2-Lane width earthen Shoulder	Km. 72-76 is common with H-II.
3	76.000 – 97.000 (SH-86C)	2-Lane width earthen Shoulder	In the stretches passing through built up area, 1.5m wide paved shoulder are proposed

0.12 Improvement Proposals

0.12.1 Widening

As stated earlier, it is proposed to widen the single lane / intermediate lane section to 2-lane with or without paved shoulders as mention in Table0.8.

0.12.2 Geometric Alignment

The existing alignment is having some sub-standard curves which have been improved within the available land to the extent possible; however, still there are several curves particularly in built up areas which cannot be improved further without land acquisition. Therefore, the speed will be restricted to 65/50 kmph in such stretches with an exception to 40kmph in very few locations. Notwithstanding the above, there is still one location at Rathkuriya village (Km. 41.500 to 42.000) where a short realignment will still be needed as per site conditions (LA along the existing road would be difficult). The proposal for the said realignment has already been accepted by the Authority. However, the local public did not allow carrying out topographic survey along the proposed alignment therefore, the detailed proposal along the new alignment could not be made in the estimate.

0.12.3 Cross Drainage Structure

There are 20 CD structures (17 causeways and 3 culverts) on the existing alignment of the project highway. The existing causeways are proposed to be replaced by providing RCC pipe culvert of suitable capacity and the existing sub-standard pipe culverts are proposed for reconstruction, with pipes of dia 1.20m. However, the existing culverts which are in good condition will be widened suitably. The improvement proposals are shown in Table 0.10 below:-

Table: 0.10 : Cross Drainage Structure

Type of Structure	Conversion to Culvert	Widening of existing Culvert	Reconstruction Pipe Culvert	Total
Causeway	17	-	-	17
Pipe Culvert	-	-	1	1
Slab Culvert	-	2	-	2
Total	17	2	1	20

0.13 Sub-grade and Material Investigations

Based on the sub-grade material (Borrow areas) investigations a value of CBR-10% has been adopted for design of pavement for widening of existing pavements as well as for construction of new pavement for realigned stretch.

0.14 Pavement Design

The VDF as per axle load survey of various type of vehicles is as given in table 0.11. The cumulative standard axle based on VDF and the traffic has been computed and is tabulated below (Table-0.11) along with BBD summary.

Table 0.11: Vehicle Damage Factor (VDF)

Location	Vehicle Type						
	Bus	Mini Bus	Mini LCV	LCV	2-Axle truck	3-Axle Truck	4-6 Axle vehicle
SH-86C KM-1+500	1.27	0.28	0.045	1.61	8.87	6.64	4.83
SH-86C KM-55+500	1.11	-	0.055	1.86	11.62	9.72	6.50

10/20 MSA has been adopted for the new pavement and 10% CBR value of the sub-grade soil has been taken for the laying of pavement.

Table 0.12: Calculation Traffic and other details

S. No.	Homogeneous Section	From (Km.)	To (Km.)	Length (Km.)	Traffic msa
1	I	0.000	31.000	31	15 / 20
2	II	31.000	71.000	40	15 / 20
3	III	76.000	96.000	21	5 / 5

Proposed composition of widening of existing and construction of new pavement:-

Table: 0.13 : Widening of Existing and Construction

S. No.	Section (Km.)	Design MSA	Layer Thickness (mm)				
			BC	DBM	WMM	GSB	Total
1	0-55	15	40	65	250	200	555
2	55-71	10	40	50	250	200	540
3	75-89& 95-97	5	25	50	250	150	475
4	89-95	5	25	50	250	150	475

0.15 Strengthening of the existing pavement

Based on the BBD test results for the existing pavement and compliance to IRC codes / guidelines, a strengthening bituminous overlay of minimum of 50mm DBM overlaid with 50mm BC with appropriate profile corrective course with DBM has been proposed.

0.16 Cost Estimate

Preliminary cost estimate for the project highway is finalised based on the improvement proposal the preliminary cost estimate is worked out based on the block quantities calculated for major item of works to be executed in the project and also rates as per latest BSR of the area (Jodhpur District) duly updated with escalation @ 5% per year. For the items not included in the said BSR have been analysed as per MoRTH standard data book.

Table 0.14: Option wise cost of Civil Works

Section	Proposed Length (Km.)	Base Cost (Rs.) Cr.	Cost per Km. (Rs. in Cr.)
Bhawi-Pipar-Khimsar	83.275 (effective length as per design)	131.06	1.57

0.17 Environmental Features

The project road already in operation and will be improved / upgraded, no major changes in ecological and environment features are anticipated. On both sides of the project highway, there are trees which will need to be cut. The project highway does not cross any minor / major river. However, one short re-alignments will need to be constructed. The project highway, also, does not pass through any sensitive ecological areas or wild life sanctuary etc.

0.18 Financial Viability

The main objective of undertaking this study is to assess whether the project is financially viable or not. It is important to note that the proposal should be an attractive proposition for private sector participation under Build, Operate and Transfer (BOT) system. The basic methodology followed for estimating the financial viability of the project is to calculate the FIRR (Financial Internal Rate of Return) on the investment for the project.

0.19 Results and Analysis

The calculations of VGF at the Point of Post-Tax Project IRR 12% and Equity FIRR 15% for different concession period are as under:-

Table 0.15 – VGF

Calculations of VGF at the Point of Post-Tax Project IRR 12%+ and Equity FIRR 15%	Concession Period For 25 year	Concession Period for 20 Year	Concession Period for 15 year
Viability Gap Funding (VGF)	99.00% (Rs 162.19 Crores)	99.00% (Rs162.19Crores)	99.00% (Rs162.19Crores)

0.20 Conclusion

From the above BOT analysis with 25 years as concession period, which is including the construction period of 1.5 years and VGF 99.00%, Since VGF is greater than 40% hence the project is **not viable for BOT. Hence the projects should go for Annuity for viability of the project.**

0.21 Annuity

The assumption for analysis for the above said projects is taken as per notification no ACE/PPP/PA dated 08-10-2015. And the cost taken is under:

Table 0.16: Annuity

S. No.	Description	Amount Rs.(Crore)
1	Total Civil Construction cost including three Toll Plaza Cost	131.06
2	Add:-15% is added over and above to the civil construction cost for Price Contingencies & Physical Contingencies as per point 2 of the office order dated 08/10/2015	19.66
3	Civil Cost for Annuity after added 15%	150.72

0.22 Calculation of Annuity

The calculations of Annuity for 10 year from the date of COD is **Rs 52.93** crores where the present value of outflow equal to present value of inflow after considering the assumption as per notification no. ACE/PPP/PA dated 08-10-2015.