

राजस्थान RAJASTHAN

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गौन प्रयुक्ति

THIS PARTNERSHIP AND DEVELOPMENT AGREEMENT is entered into on this the 7th day of August, 2005 at Jaipur, Rajasthan

amongst

THE GOVERNOR OF THE STATE OF RAJASTHAN acting through Principal Secretary, Public Works Department, Government of Rajasthan, hereinafter referred to as "GoR" (which expression shall include its successors and assigns) as first party

and

Road Infrastructure Development Company of Rajasthan Limited, a public limited company incorporated under the Companies Act, 1956 (Central Act 1 of 1956), having its registered office at *First Floor, LIC Jeevan Nidhi Building, Bhawani Singh Marg, Jaipur - 302 005* (hereinafter called "RIDCOR" which expression shall unless it be repugnant to the subject or context thereof include its heirs, assigns, successors, associates, subsidiaries and funds under management) as second party

and

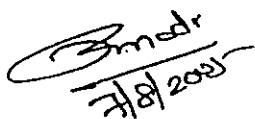
Infrastructure Leasing and Financial Services Limited, a public limited company incorporated under Companies Act, 1956 (Central Act 1 of 1956) having its registered office at *IL&FS Financial Centre, Plot C-22, G Block, Bandra-Kurla Complex, Bandra (East), Mumbai 400051* (hereinafter called "IL&FS" which expression shall unless it be repugnant to the subject or context thereof include its heirs, assigns, successors, associates, subsidiaries and funds under management) as confirming party

## WHEREAS

- A. The Government of Rajasthan (GoR) is pro-actively improving the State's infrastructure to boost its industrial and economic growth, with the aim of fully leveraging the State's locational advantage and its enormous tourism and business potential. Towards this, GoR has embarked on an ambitious programme to create world-class infrastructure facilities in the State of Rajasthan with the aim of making it the most favoured investment and tourism destination in the country;
- ✓ B. As part of this vision, GoR has conceptualized a comprehensive road improvement programme titled 'Mega Highways Project' envisaging improvement to important North-South road corridors aggregating a total length in excess of 1,000 km to two lane paved/hard shoulder configuration. The identified roads include Phalodi to Ramji-Ki-Gol, Hanumangarh to Kishangarh, Alwar to Sikandra, Lalsot to Kota and Baran to Jhalawar. These roads provide alternative and more efficient connectivity to National Highways and are expected to witness substantial traffic diversion. The development of these roads is expected to significantly enhance Rajasthan's attractiveness as an investment destination and could serve as a blue print for similar road development projects across the country;
- C. GoR wishes to implement the Project through the Public Private Partnership (PPP) framework, so as to leverage the limited budgetary resources for attracting private capital and ensure efficient utilisation of funds for creation, operations, maintenance and management of quality road assets;
- D. Infrastructure Leasing & Financial Services Limited (IL&FS) is a leading institution in the field of infrastructure development promoted by Unit Trust of India, Central Bank of India, and HDFC Ltd. Its other shareholders include State Bank of India, International Finance Corporation (Washington), Government of Singapore Investment Corporation, Orix Corporation, Japan and HSBC Bank. The IL&FS group of companies have successfully collaborated with several other State Governments including that of Andhra Pradesh, Gujarat and Tamil Nadu for assisting them in structuring, developing and implementing infrastructure projects under the PPP framework;
- E. IL&FS has the requisite know-how and skill to develop infrastructure projects and undertake mobilisation of required financial resources from both the domestic financial institutions and multilateral agencies and offer specialised services, inter-alia, in the areas of Operations and Maintenance, User Fee Management and other services relating to road infrastructure projects;
- F. ✓ In order to provide focussed attention and an institutional framework for development and implementation of the Project Roads and other infrastructure projects, GoR in association with IL&FS, has set up a Joint Venture Company by the name and style of Road Infrastructure Development Company of Rajasthan Ltd (RIDCOR). RIDCOR was incorporated on October 28, 2004, and the Shareholders' Agreement amongst GoR, IL&FS and RIDCOR was signed on January 31, 2005. The roles, responsibilities, duties & obligations of IL & FS are enumerated in Article 4 of this Shareholders' Agreement;

- G. ✓ The cost of Mega Highways Project estimated at Rs 1,200 Crores is proposed to be funded by an innovative financing plan. The Project is unique and one of its kind in the road sector in the country since, it is proposed to develop such long stretches of road under the PPP model for the first time, wherein the projected revenue stream is essentially predicated on diverted traffic;
- H. The proposed Mega Highways Project will be an important milestone in the development of Rajasthan into a preferred destination. IL&FS with its extensive expertise in developing similar road Projects in other States will actively assist the State Government of Rajasthan in positioning the Mega Highways Project as an Iconic Infrastructure Project in the country;
- I. Pursuant to the above, GoR hereby agrees that a valid grant of the necessary rights and authorisations, and the extension of complete and continued support to RIDCOR is of essence for the due implementation of the Project on a commercial basis, and is an essential pre-condition to enable RIDCOR to mobilise adequate financial resources from capital markets and/or lending agencies, and to efficiently perform its obligations;
- J. ✓ The Parties herein mutually acknowledge that this Agreement envisages grant of rights and authorisations to RIDCOR to develop the identified Project Roads and in lieu recover O&M expenses, taxes and recovery of costs with appropriate returns thereon;
- K. ✓ Accordingly, GoR has agreed to grant the necessary rights and authorisations to RIDCOR in accordance with the terms and conditions provided herein; the Parties also hereby agree that the usage of the word 'Partnership' in the title of the Agreement is merely for the purposes of giving an appropriate nomenclature for the Agreement reflecting the complementary and symbiotic relationship between the Parties with respect to this Project.

NOW THEREFORE in consideration of the mutual agreements herein contained and of other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, the Parties hereto agree as follows:

  
B. Madh  
7/8/2005



## E.0 EXECUTIVE SUMMARY

### E.1. Introduction

E.1.1 The Government of Rajasthan has embarked upon a massive State Highways Improvement Project in the state. Under this mega project about 1166 Km. of State Highways are proposed to be 2 laned with flexible carriageway with paved and hard shoulders. The Government of Rajasthan had, assigned the responsibility of implementation of the project to Rajasthan State Road Development Construction Corporation Limited (RSRDC). It has now been handed over to Road Infrastructure Development Company of Rajasthan Ltd. (RIDCOR Ltd.)

E.1.2 The Project Road from Kishangarh to Hanumangarh via Kuchaman, Didwana, Ladnun, Sujangarh, Chapper, Ratangarh, Sardarsahaer and Rawatsar is ~~411km long~~. This does not include portion of NH – 65 between Ladnun and Sujangarh (16 Km.) which is collinear to the Project Road. The proposed alignment is envisaged as a high quality State Highway road.

SH 7

E.1.3 The proposed road will be a part of the development of N-S corridor, connecting Punjab & Haryana in the North and M.P & Gujarat in the South

E.1.4 The work of consultancy service for preparation of detailed feasibility report for two lanning of section SH – 7. MDR & ODR was awarded to SOWiL Limited. The general scope of services cover proposal for widening of existing two lane/intermediate lane road to 7.0m two lane carriageway with 2.0 m wide paved shoulder and 1.5 m wide hard shoulder on either side of the road. The paved shoulders will be constructed in continuation with the main carriageway. The hard shoulders will be constructed with selected material. The work includes engineering, economic and environmental / social feasibility studies; and preparation of **Detailed Feasibility Study and Engineering Report** along with cost estimates

### E.2.0 Technical / Engineering Features

E.2.1 Kishangarh –Hanumangarh Road, starts at Km. 69.00 on SH 7 (considered as 0.00 km for the Project) at Kishangarh bypass and ends at Hanumangarh (i.e. 411.00km excludng NH-65). The entire 411 km length of road falls in the state of Rajasthan.

The inventory survey was undertaken by actual measurement or visual assessment of the following elements:

- Type of Terrain
- Land Use
- Name of Villages / Towns
- Height of Embankment / Cut
- Formation Width
- Carriageway Type / Width / Condition
- Shoulders Type / Width / Condition
- Right of Way
- Riding Quality
- Details of Cross Roads
- Submergence
- Railway Level Crossings
- Major and Minor Bridges
- Culverts

These elements were recorded for every kilometer for the entire length of the Project Road.

E.2.2 The alignment has easy gradient and terrain is generally flat to rolling. The road embankment height varies from 0.00m to maximum 1.5 m. The highway is on an embankment where it traverses through the paddy fields and is on level ground in built up areas.

E.2.3 Forestland exists between Sujangarh to Chapper (between KM 172 to KM 174) and between Hanumangarh to Sangaria.

E.2.4 The available Carriageway width in Package I is 3.5m (3%), 5.5m (67%) and 7.0m(30%) and in package II is 3.5 m (0.0%), 5.5m (94%) and 7.0m (6%) respectively with 1.50m to 2.00m soft shoulders on either side.

E.2.5 Riding quality all along the project road varies from poor to fair.

E.2.6 ROW along the existing road is 13m to 30m. ROW along the existing bypass is 30m. In order to accommodate 2-lane road with paved and hard shoulders, 30 m ROW is required.

E.2.7 Typical Cross Sections of the road to be adopted are shown in Fig 4.1 to Fig 4.7. The configuration of the carriageway is as follows:

Carriageway	-	7.00 m
Paved Shoulder	-	2.00 m
Hard Shoulder	-	1.50 m

### **E.2.8 Widening**

For the purpose of converting the existing carriageway to 2-lane highway with paved shoulders, concentric widening has been considered based on

- Number of residential / business / social and religious premises requiring relocation and the related R & R costs.
- Existence of utility services requiring relocation; and
- The presence of physical barriers or obstructions.

### **E.2.9 By passes**

(a) Bypasses already exist at following 2 locations.

- Hanumangarh (from Km. 412.700 to Km. 417.400)
- Sangaria Town (from Km. 438.300 to Km. 439.900)

(b) Considerable development has taken place along the Project Road. Huge marble industries have come up in Kishangarh and near Hanumangarh towns. Due to limited availability of ROW in the towns/villages, even concentric widening will pose a severe R and R problem at Parbatsar, Kuchaman, Didwana town, etc. In the interest of early completion of the project, new bypasses are proposed at following places: -

- Sursura Village
- Rupangarh Village
- Parbatsar Town
- Kuchaman Town
- Didwana Town
- Ladnun – Yashwantgarh – Sujangarh (NH Portion)
- Chapper Town & Forest area

There will, thus be 9 (nine) bypasses including two existing bypasses.

### **E.2.10 Major / Minor Bridges**

The Inventory and Condition Survey of bridges were carried out in accordance with the provisions of IRC:SP-35-1990.

Three major bridges exist at Km.95/1, Km. 200/1 and at km 212/3 respectively. One major bridge is proposed at km 231/1 (at Hanumangarh

bypass). For the bridge located at 212/3, sub structure needs to be raised and super structure needs to be replaced.

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31 min  
The Project Road has 17 minor bridges. Out of these, the bridges between Kishangarh to Kuchaman at KM 94.20; KM 95.18 and KM 100.10, the sub-structures need to be raised and super-structures need to be replaced. For the bridge at Km. 85.20, only super structure needs to be replaced.

#### E.2.11 Culverts

Inventory and Condition Survey of existing culverts was carried out as per IRC SP:35-1990.

The survey was undertaken by actual measurement and visual inspection of the following elements:

- Location
- Type of culvert
- Number of pipes with diameter for pipe culverts
- Carriageway width
- Width of Culvert
- Span arrangement and total ventway
- Thickness of slab
- Adequacy of water way
- Condition of various features viz. Slab / Pipe / Arch / Box Head Wall / Wing wall / Return wall / Parapet
- Presence of scour
- Details of Protection works

A list of culverts located in the Project Road, giving a summary of the features is given in Annexure III.

The Project Road will have 157 culverts including new culvert 23 nos. in dip portion. 27 nos. in bypasses respectively and 3 existing culverts are to be replaced due to poor condition

#### E.2.12 Railway Level Crossings

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There are 8 level crossings, details are given below in Table E.1. The TVU values are expected to cross 50000 in about 5 years. particularly after the road is upgraded. It is, therefore, proposed to provide ROB's at all 8 level crossings.

**Table E.1 TVU at Level Crossings**

Sr. No	Chainage	Gauge	Crossing No.	No. of Gate Closure	(Motorised Traffic (ADT) Excluding 2-wheelers)	TVU
1	59.03 of SH-7	BG	C - 32	12	2036	24432
2	120.000 of SH-7	MG	C - 64	8	1454	11632
3	166.60 of SH-20	MG	C - 21	10	1613	16130
4	194.40 of SH-7	MG		10	1609	16090
5	201.40 of SH-7	MG	C - 9 / E - 2	10	1609	16090
6	219.00 of SH 7	BG	194 / C	14	1331	18634
7	219.80 of SH-7	MG	1 C	4	1331	5324
8	411.60	MG	C - 9	10	1684	16840

#### **E.2.13 Flyover**

Traffic and site conditions do not require any flyover.

#### **E.2.14 Grade Separator**

Traffic and site conditions do not warrant any grade separator in the Project Road.

#### **E.2.15 Under Passes**

Site conditions do not warrant any underpass.

#### **E.2.16 Toll Plaza**

Consideration the nature of traffic and the destinations the siting of Toll Plazas have been planned on following considerations:

- The distance between two Toll Plazas should not exceed 50 Km.
- The location should be such that the sieving of toll paying traffic is limited to minimum possible.
- Land Acquisition at Toll Plaza locations should be easy.
- The Toll plazas should be away from built up areas so that congestion is avoided.



Based on the above considerations Toll Plazas are proposed at the following ten locations;

**Package I**

- Between Kishangarh and Parbatsar (Km 13.00)
- Between Parbatsar and Kuchaman (Km 64.00)
- Between Kuchaman and Didwana (Km 101.00)
- Between Didwana and Ladnun (Km 142.00)
- Between Ladnun and Chapper bypass (Km.172.00)
- Between Chapper and Ratangarh (Km.193.00)

**Package II**

- Between Ratangarh and Sardarsher (Km.235.00)
- Between Sardarsher and Pallu (Km.296.00)
- Between Pallu and Rawatsar (Km.361.00)
- Between Rawatsar and Hanumangarh (Km 403.00)

**E.2.17 Truck Lay byes**

Traffic in the Project Corridor is quite heavy and is likely to increase may folds in the near future. The land being very precious and because of the intervening built up and village areas all along, it is proposed to have truck parking facilities of 100 to 150m long wherever proposed. The lay bye will have average width of 20-30 m. There are 12 such numbers proposed at major habitat / village locations and these will be located at the outskirts of all the major towns on the Project Road. The location wise statement is given in Table E.2.

**Table E.2 Location of Truck Lay byes**

S. No	Name of town / village	Location
1	Near Kishangarh	km 3.00
2	Between Sursura and Rupangarh	km 21.00
3	Near Parbatsar	km 36.00
4	Near Kuchaman	km 69.00
5	Near Didwana	km 113.00
6	On Bypass between Ladnun - Chapper	km 175.00
7	Near Ratangarh	km 216.00
8	Near Sardarsher	km 266.00
9	Near Pallu	km 332.00
10	Before Rawatsr	km 373.00
11	After Rawatsar	km 377.50
12	Near Hanumangarh	km 409.00

### E.2.18 Bus bays

There are a number of major villages, towns and habitats all along the Project Road. The development is not only along the Project Road, but the interior villages as well. There is bus traffic on the Project Road connecting important towns and cities as well as interior villages.

It is proposed to provide Bus Bays at important locations, both on the left and right side. There are about 21 such locations where Bus Bays are proposed along the Project Road. The location wise statement is given in Table E.3.

**Table E.3 Locations of Bus Bays**

S. No	Name of town / village	Location
1	Kishangarh	km 1.00
2	Sursura	km 15.00
3	Rupangarh	km 22.50
4	Parbatsar	km 35.50
5	Kuchaman	km 70.50
6	Ranasar	km 81.50
7	Nimod	
8	Rasidpura	km 91.70
9	Maulasar	km 95.00
10	Didwana	km 113.50
11	Ladnun	km 149.00
12	Chapper	km 175.50
13	Ratangarh	km 218.00
14	Malasar	km 241.00
15	Sardarsher	km 260.80
16	Hardeshar	km 293.25
17	Pallu	km 330.70
18	Purbatsar	km 345.70
19	Dhannasar	km 361.15
20	Rawatsr	km 373.50
21	Hanumangarh	km 411.50

### E.2.19 Way side Amenities

The Project Road is passing through well – developed townships and villages. Eateries and general shopping facilities are available all along the Project Road. However, wayside amenities for food, toilet facilities and

shopping etc. are proposed at 3 locations to cater to the needs of tourists. The location wise statement is given in Table E.4

**Table E.4 Locations of Way side Amenities**

S. No.	Location	Change
1	Near Kuchamn	Km 69.00
2	Near Chapar	Km 175.00
3	Near Pallu	Km 332.00

### E.3.0 Traffic Surveys and Analysis

#### E.3.1 Traffic Surveys

The following traffic surveys were carried out at different locations:

- Classified Volume Count Surveys for 7 days at -10 locations
- Origin – Destination Surveys for 24 hours at 19 locations.
- Axle Load Surveys for 48 hours at 4 locations
- Turning Movement Surveys at 16 major junctions
- Speed and Delay Studies along the Project Road
- Traffic Accident Data Collection

#### E.3.2 Classified Volume Counts

Based on seven days Traffic Volume Count conducted at ten homogenous locations, Average Daily Traffic (ADT) data was arrived at, which is summarized below in Table E.5

**Table E.5 ADT at Various Locations**

Sl.No	Name of the Homogeneous Section	Location of count Station	Total Veh/Day	Total PCU/Day
Package I				
1	Kishangarh-Parbatsar	85/0 of SH-7	2405	4903
2	Parbatsar-Kuchaman	132/0 of SH-7	2309	4992

3	Kuchaman-Didwana	Km 165/0 of SH-7	2044	4092
4	Didwana-Ladnun	Km 199/0 of SH-7	1617	3899
5	Sujangarh-Chapar	Km 8/0 of SH-20	1915	4011
6	Chapar-Ratangarh	Km 20/0 of SH-7	1790	4235
<b>Package II</b>				
7	Ratangarh-Sardarshehar	Km 53/6 of SH-7	1543	3436
8	Sardarshehar-Pallu	Km 114/0 of SH-7	1129	2662
9	Pallu-Ravatsar	Km 192/0 of SH-7	1613	4327
10	Ravatsar-Hanumangarh	Km 225/0 of SH-7	1976	4815

#### Average Annual Daily Traffic (AADT)

Traffic volume normally varies because of seasonal factors like crop season etc. A seasonal factor of 1.05 has been arrived using the toll traffic data on NH 8 given in Chapter 2 and the same has been used to convert the Average Daily Traffic (ADT) to Average Annual Daily Traffic (AADT), which is presented in Table E.6.

**Table E.6 AADT at Various Count Locations**

Sl.No	Name of the Homogeneous Section	Location of count Station	Total Veh/Day	Total PCU/Day
<b>Package I</b>				
1	Kishangarh-Parbatsar	85/0 of SH-7	2526	5148
2	Parbatsar-Kuchaman	132/0 of SH-7	2425	5242
3	Kuchaman-Didwana	Km 165/0 of SH-7	2146	4297
4	Didwana-Ladnun	Km 199/0 of SH-7	1698	4094
5	Sujangarh-Chapar	Km 8/0 of SH-20	2011	4211
6	Chapar-Ratangarh	Km 20/0 of SH-7	1879	4447
<b>Package II</b>				
7	Ratangarh-Sardarshehar	Km 53/6 of SH-7	1620	3607
8	Sardarshehar-Pallu	Km 114/0 of SH-7	1185	2795
9	Pallu-Ravatsar	Km 192/0 of SH-7	1694	4543

10	Ravatsar-Hanumangarh	Km225/0 of SH-7	2075	5056
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### E.3.3 Traffic Growth Rates

Traffic growth rate is to be formulated from Historical Traffic Growth (based on traffic data for the past years - time series trends), Motor Vehicle Registration Data, Elasticity of Traffic Demand (based on socio-economic parameters) and temporal trend in the growth rate of economy of the states. This analysis helps to arrive at reasonable and defensible estimate of growth rates. Considering the merits and demerits of the above approaches and the over riding considerations of arriving at a conservative estimate, the Traffic Growth Rates as provided by RSRDC have been used, which is summarized as given in Table E.7

Table E.7 Traffic Growth Rates

Year	Type of Vehicles					
	Car/Jeep	LCV	Mini Bus/Bus	2 & 3 -Axle Trucks	Multi Axle Trucks	2-Wheelers
2005-2015	7.00	5.00	3.00	3.00	10.00	8.00
2016-2025	6.30	4.50	2.70	2.70	9.00	7.20
2026-2035	5.67	4.05	2.43	2.43	8.10	6.48
2036-2045	5.10	3.65	2.19	2.19	7.29	5.83

### E. 3.4 Diverted Traffic

The traffic is expected to be diverted from parallel routes. The estimated divertable traffic section wise in the year 2005 and 2007 is presented in Table E.8 and Table E.9.

E-8 Divertable Traffic in the Year 2005 (Based on O-D and Network Analysis )

#### THROUGH TRAFFIC

	2 Axle Trucks	3 Axle Trucks	Multi Axle Trucks	% of Total Traffic
Diverted Traffic from NH-8	97	65	45	5.11%
Diverted Traffic from NH-89	51	34	37	7.30%
<b>Total</b>	<b>148</b>	<b>99</b>	<b>82</b>	

### Additional Diversion from Ratangarh

	2 Axle Trucks	3 Axle Trucks	Multi Axle Trucks	% of Total Traffic
Diverted Traffic from NH-11	34	21	9	10.9%

### Divertable Traffic Section Wise (2005)

	2 Axle Trucks	3 Axle Trucks	Multi Axle Trucks
<b>PACKAGE I</b>			
Section 1	182	120	91
Section 2	182	120	91
Section 3	182	120	91
Section 4	182	120	91
Section 5	182	120	91
Section 6	182	120	91
<b>PACKAGE II</b>			
Section 7	148	99	82
Section 8	148	99	82
Section 9	148	99	82
Section 10	148	99	82

Table E-9 Divertable Traffic Section Wise (2007)

	2 Axle Trucks	3 Axle Trucks	Multi Axle Trucks
<b>PACKAGE I</b>			
Section 1	193	127	110
Section 2	193	127	110
Section 3	193	127	110
Section 4	193	127	110
Section 5	193	127	110
Section 6	193	127	110
<b>PACKAGE II</b>			
Section 7	157	105	99

Section 8	157	105	99
Section 9	157	105	99
Section 10	157	105	99

### E.3.5 Generated/Induced Traffic

Post evaluation studies carried out along few completed Highway Project roads as well the actual observations on similar completed roads indicate that following completion of the road improvements, new developments have occurred along the road which includes industry, educational institutions, commercial and residential buildings. As a result of this development, generated traffic can be expected but has not been quantified as yet. Thus, the proposed Improved Highway facility for the Project Road is also likely to attract generated and Induced traffic in view of its better performance characteristics such as higher operating speeds and better riding quality. However, in the absence of precise information, it is reasonable to assume a 10% increase in the road traffic due to generated/Induced traffic in the 2007 when the facility becomes operational.

### E.3.6 Axle Load Survey

Axle Load Studies were conducted at 4 locations for a continuous period of 24 hours at each location covering traffic from both directions.

#### Vehicle Damage Factor (VDF)

Vehicle Damage Factor (VDF) use assessed for each category of vehicle that contribute significantly to pavement distress for the Project Road, as under:

- Light Commercial Vehicles (LCV)
- Two Axle Single Unit Commercial Vehicle (2 Axle)
- Three Axle Single Unit Commercial Vehicle (3 Axle)
- Multi Axle Vehicle (MAV)
- Bus

The combined VDF calculated for all the four locations is given below in Table E. 10

Table E.10 VDF Values at Various Locations

Veh Type	VDF			
	Km 132/000 of SH-7 Kishangarh-Kuchaman Section	Km 199/000 of SH-7 Kuchaman-Ratangarh Section	Km 114/000 of SH-7 Ratangarh-Pallu Section	Km 114/000 of SH-7 Pallu-Hanumangarh Section
LCV	0.88	0.78	0.98	0.83
2 Axle Truck	5.49	5.44	5.3	4.38
3 Axle Truck	5.72	4.66	5.02	4.98
Multi Axle Trucks		7.89	10.8	6.77
Combined VDF	4.98	4.99	5.38	4.52

### E.3.7 Origin – Destination Surveys

The objective of Origin – Destination (O-D) Surveys was to gather information regarding travel characteristics by different mode of vehicles at various locations. Results of O-D Surveys were used to describe the user characteristics, both of passengers and goods vehicles, such as distribution of local and through traffic. This information would also be useful for network assignment for the links, which are having alternate routes.

The Origin – Destination Survey as well as Commodity Movement Survey was carried out adopting road side interview method. The Survey was carried out for passenger and commercial vehicles for 24 hours at 19 locations (10 locations on the Project Road, 5 location on alternate routes and 4 location on feeder roads)

The characteristics of goods and passenger vehicles are given in **Annexure VI**.

#### O-D Matrices

The O-D Matrix and Desire line for goods and passenger vehicles observed at all O-D locations are also given in **Annexure VI**.

### E.3.8 Speed and Delay Studies

Speed and Delay Studies along the Project Road were carried out to gather information on road sections subjected to undue traffic congestion and delay



or other factors resulting in reduced travel speeds so that suitable remedial measures can be initiated to improve the overall travel speeds on the Project Road.

The details of average travel speeds along the Project Road are given in Chapter 2.

The average speed along the Project Road in the morning is 41.26 kmph, which rises to about 43.08 kmph in the afternoon and then falls to 40.19 kmph in the evening.

### **E.3.9 Traffic Accident Data Collection**

In order to assess the economic savings likely due to reduction in traffic accidents and their severity resulting from any highway improvement scheme, it is necessary to analyse past traffic accident data on the study section.

Detail of traffic accident which occurred on the Project Road during the past 5 years were collected year wise from the Police records and analysed. The accident data collected year wise with number of accidents in respective years has been given in chapter 2.

### **E.3.10 Turning Movement Surveys**

The Turing Movement Surveys were carried out at 12 major intersections to determine the directional movement of the traffic in order to assess the measures required to improve the junctions to regulate safe traffic movement. The directional traffic counts were carried out for 3 hours during morning peak hours and 3 hours during evening peak hours. The details of peak hour traffic are given in Annexure VII.

### **E.4.0 Design Standards**

IRC standards and specification applicable/proposed in this project are listed in the report. Where ever IRC standards are not available AASHTO and BS are being followed. The highway is being designed for a speed of 100/80 Km per hour and standards and norms relating to this will be followed from IRC and other standards as applicable.

### **E.5.0 Pavement Evaluation and Design**

Pavement investigations of existing carriageway comprised Pavement Condition Survey, Roughness Survey, Benkelman Beam Deflection Studies and Pavement Composition including sub grade characteristics. These information have been gathered and analysed, for the purpose of delineation with respect to above pavement responses. Uniform sections of pavement responses with respect to roughness, characteristic deflection and sub grade characteristics (CBR from DCP tests) have been established using cumulative difference approach. Such delineation of existing carriageway into homogeneous sections been considered in the rehabilitation design. The project road has been divided into 10 homogenous sections, accordingly.

The pavement condition survey along the Project Road was carried out. The road from Km.257.00 to Km.315.00 in Package II is in very bad condition and needs to be reconstructed. The details are annexed at **Annexure II**.

#### **E.5.1 Pavement Condition Survey**

Pavement Condition Survey of the Project Road was carried out alongwith road inventory to assess the existing pavement condition. The Condition Survey was undertaken by visual assessment of pavement surface and distress indicators such as:

- Pavement – Composition, Type & Thickness
- Shoulder – Composition and Condition
- Riding Quality indicating speed, quality, cracking, ravelling, potholing, ruts and patching etc.
- Pavement Edge Drop
- Embankment Condition
- Road side Drains

General Condition and extent of slope erosion of embankment were also assessed and recorded. Details of Pavement Condition Survey are given at **Annexure II**.

#### **E.5.2 Pavement Evaluation Studies**

Benkelman Beam Deflection measurements were taken on the Project Road as per guidelines given in IRC:81-1997. Pavement temperature and subgrade moisture measurements were also recorded for carrying out temperature and seasonal corrections to the deflection measurements. The characteristic

Deflection has been determined to work out the thickness of overlay over the existing road crust.

### E.5.3 Roughness Survey

The Roughness studies were carried out on the Project Road with Roughometer for quantitative integrated evaluation of surface irregularities on a digital counts.

#### Riding Quality:

The value of roughness adopted for various classifications of riding quality of pavement are as under

a)	Excellent	<2000 mm / km
b)	Good	2000 to 2500 mm / km
c)	Fair	2500 to 3500 mm / km
d)	Poor	3500 to 4500 mm / km
e)	Bad	> 4500 mm / km

### E.5.4 Pavement Crust

To determine the existing pavement thickness of the Project Road and its composition, trial pits were dug at the edge of existing pavement in each kilometer at every 500 m interval. The results obtained from the trial pits are annexed at Annexure III.

### E.5.5 Soil Investigations

Dynamic Cone Penetration Tests have been conducted to determine the filed CBR of the subgrade soil at the approved locations based on different sections of uniform performance along the alignment of the existing pavement and the widening portion.

Soil investigations for portions to be widened, realignment sections and bypasses have been conducted to identify the soil types and to establish the characteristics soils on the alignment. It was accomplished by reviewing available soil information by conducting supplementary soil investigation. The results indicate presence of suitable soil through out the stretch.

E.5.6 A material survey was conducted to locate potential soil borrow sources and extraction sites including rock quarries for use in the construction of various components of the Project Road. Soil borrow sources suitable for

embankment and sub grade construction are available within economic hauling distance of the Project Road.

**E.5.7** Similarly rock quarries to supply aggregates for bituminous and non bituminous works, and river sand for concrete works are also available in the project vicinity. In Package II between Ratangarh and Hanumangarh no rock quarries are available.

**E.5.8** Flexible pavement design finds itself to adoption mainly due to ease of widening and strengthening the existing pavement which is flexible. Even for the purpose of new construction on bye passes and alignment change, flexible pavement is the preferred choice considering site conditions, material availability, construction ease and finally economics.

The pavement has been designed for 15 years life with cumulative MSA 60 for package I and 50 for package II and CBR value of 10. The total pavement thickness comes to 605 mm and 600 mm for packages I and II respectively. For strengthening the existing pavement, the design overlay thickness varies from 98 mm to 205 mm for the six different homogenous section.

#### **E.6.0 Environmental Social Impact Assessment**

The very process of development is inter related with Environmental and Social concerns and the assessment of those concerns in Initial Environmental and Social Impact Study formulates the objective of the study. The goal is to minimize the adverse environmental and social impacts with the best possible engineering solutions at the most optimal cost making the project people and environment friendly.

##### **E.6.1 Environmental Assessment**

A preliminary environmental and social impact assessment was carried out to gauge the expected environmental and social impact due to the widening of the road and suggest viable widening options and mitigation measures.

Preliminary Observations of the stretch have revealed that a number of settlements, commercial units exist on both side of the ROW. Some religious structures within ROW and encroachments by squatters and encroachers are also observed. Mild vegetation is the commonly observed feature except Reserve Forests in few stretches of the project road.

Base line conditions seem to be within prescribed limits.

- ❖ Main tree species are Babul, Karengi, , some where Sheesam, Bargad and Peepal ( near habitations)
- ❖ Main land use is seasonal agriculture. However irrigated land is found between Rawatsar & Hanumangarh.
- ❖ Project road passes along two forest areas (near Chapper village & Hanumangarh).
- ❖ Industrial activities exit in Kishangarh & Hanumangarh.
- ❖ Ground water depth varies from 100 ft. to 350 ft.
- ❖ Presence of School, Hospitals & Temples are a common feature.
- ❖ Black buck (Black deer) and endangered species are present in a sanctuary near Chapper. An option may be to avoid widening in the sanctuary area.

#### **E.6.2 Preliminary Social Impact Assessment**

In order to make the Road development plan people and Environmental friendly, Social and Environmental Impact Assessments in the project influence areas have been made which have revealed that while executing the project social and environmental issues should be given due weightage for avoiding adverse impacts and mitigation measures adopted.

The Project Road passes through four districts of Rajasthan i.e. Ajmer, Nagaur, Churu and Hanumangarh. The existing ROW is limited ranging between 13 to 30 in at various locations and widening will cause adverse impact on people and their properties – i.e. residences, markets, religious buildings / structures, Community structures – schools, hospitals etc. petrol pumps. Dhabas and Hotels, Sanctuary etc (see annexure I of this Chapter). Project affected persons Constitute both men and women, squatters, vulnerable groups, petty traders / shopkeepers, farmers and poor. ST population is considerable while ST Population is negligible. However, if proper mitigation measures are not adopted, these poor and vulnerable PAPs may enter the stage of impoverishment and marginalisation.

The 7 critical stretches / hotspots i.e. Sursura, Rupangal, Parvatsar, Kuchawan, Dindwana, Chapper and Hanumangarh – where the impacts are anticipated to be severe and therefore for these places provisions of bypasses are recommended. Other alignment options are also recommended as per requirements / needs of the local population. Details of properties affected, Project affected persons, critical areas are summerised and accordingly 442

properties, 2200 persons and 403 families are being affected in addition to those whose land will be acquired under land acquisition.

The tentative R&R cost is estimated to be of the order of Rs.4.5 crores in addition to the cost of land.

There is a need for a full resettlement plan so that adverse impacts on households are mitigated and they are brought again in the main stream of Socio – Economic life of the community.

#### E.7.0 Cost Estimate

Capital cost of the project including Contingency, Supervision and agency charges, Land Acquisition, R&R, Environmental Costs is estimated as Rs 779.301 crores (with flexible pavement). The cost is based on unit rates developed for various items of work and quantities estimated from field. The cost will, however, reduce substantially to Rs.474.266 crores without 2.0 m paved shoulders. In addition Rs.128.48 Cr have been estimated for land banking. Operation and Maintenance of toll plaza is estimated to cost Rs.30 lac per plaza per year. A periodic cost of Rs.20 lacs / Km. has been considered every 6 years. Refer Table 7.2 to table 7.4.

#### E.8.0 Land Banking

The upgradation of this project corridor will enhance the value of the adjoining land on both sides within its area of influence. This appreciation in land value can be recovered to part finance the project.

Following land areas are identified for land banking:

##### Area of Land Identified for Banking

Place name	Area of Land Identified for Banking
Near Kishangarh	600 acre
Sursura town bypass	150 acre
Parbatsar bypass	500 acre
Kuchaman bypass	790 acre
Near Didwana	400 acre
Near Chapper	300 acre
Pallu town bypass	150 acre
Rawatsar town bypass	500 acre
Near Hanumangarh	200 acre
Near Ratanpura	100 acre

### E.9.0 Economic Analysis and EIRR

Economic appraisal has been carried out using the HDM-IV. The model is used to generate cash flow streams of VOC and value of time to compute the net economic benefits, as inputs for the estimation of the EIRR and NPV for the Project Evaluation.

Sensitivity Analysis has been carried out to examine the effect on economic viability of the Project due to the changes in the level of the key input factors as follows

Condition I: 15% increase in project cost, while traffic volume remains unaffected as per demand estimates.

Condition II: 15% decrease in traffic volume, project costs remaining unchanged

Condition III. 15 % increase in the project costs and 15 % decrease in traffic materialization – worst case scenario.

Economic analysis results for Base case and Sensitivity Analysis results is given in Table E 11 and attached as Appendix to the Chapter 11

### E.10.0 Financial Analysis

The financial analysis based on preliminary assessment of the demand scenario and cost estimate reveals that Project Road with 11.0m carriageway (7.0+2.0m paved shoulders on either side)+1.5 m hard shoulders on either side carries just **4.05 percent ROE** in the concession period of 20 years for Case 1 (12% interest during construction 12% interest on debt), **5.01 percent ROE** in the concession period of 20 years for Case 2 (8% interest during construction 10% interest on debt)

Alternatively, for a concession period of 20 years and 20% subsidy by government the project carries just **6.80 percent ROE** in the concession period of 20 years for Case 1 (12% interest during construction 12% interest on debt), **7.86 percent ROE** in the concession period of 20 years for Case 2 (8% interest during construction 10% interest on debt)

In the second option for a concession period of 20 years, the Project Road without paved shoulders carries **12.12 percent ROE** for Case 1 (12% interest during construction 12% interest on debt), **13.36 percent ROE** in the concession period of 20 years for Case 2 (8% interest during construction 10% interest on debt)

Alternatively, for a concession period of 20 years with 20% subsidy by government Project Road without paved shoulders carries **15.43 percent ROE** for Case 1 (12% interest during construction 12% interest on debt), **16.66 percent ROE** in the concession period of 20 years for Case 2 (8% interest during construction 10% interest on debt)

### **E.11.0 Conclusion**

Upgradation of the road to 7m width with 2.5m hard shoulders on either side only (No paved shoulders) is financially viable and may be considered for implementation. The proposed configuration will be adequate for the anticipated traffic.





## 11.0 ECONOMIC & FINANCIAL ANALYSIS

### 11.1 Economic Analysis

#### 11.1.1 Introduction

The economic analysis has been carried out within the broad framework of social cost-benefit analysis. The appraisal compares the total transport costs in situations of "with" the Project and "without" the Project alternatively called the "base case" or the "do minimum case" for the Project highway. It is based on comparisons of costs with benefits/savings.

The underlying objective of Economic Analysis for Viability Study is to maximize the returns on the investments. The concept behind the economic appraisal of the Project is that if it is implemented, the resulting benefits will be the decreased Vehicle Operating Costs (VOC) and travel time when compared to the same of the 'base' situation. This objective is accomplished by determining the appropriate improvement alternative that leads to the minimum total transport costs.

The total transport costs comprise two basic components, viz. road supplier costs and road user costs. These are depicted in Table 11.1

Table 11.1 Total Transport Costs

Road Supplier Costs	Road User Costs
Construction Costs	Vehicle Operating Costs (VOC)
Maintenance Costs	Other User Costs i.e. Travel Time Costs
Replacement Costs	
Costs of Environmental Impact Mitigation Measures	
Costs of Rehabilitation and Resettlement (R&R) measures	

The above classifications has been used to estimate the cash flow streams of VOC and value of time savings for carrying out the economic analysis by using the DCF techniques.

All costs and benefits considered in the analysis are valued in money terms at the market prices. For economic analysis, these are expressed as economic costs for avoiding distortions in the prices of inputs such as labour, materials, equipment, machinery and foreign exchange arising due to market imperfections. Economic evaluation of the road was carried out by using the HDM-4 software developed by the World Bank. The benefits to the project road users were estimated by comparing the differences between the costs in the "without" project case to those in the "with" project case. The without-project case in the economic evaluation

represents the current situation. The with-project case is represented by rehabilitating and widening the Project roads to a dual two-lane carriageway. The improved road will reduce vehicle operating costs (VOCs), which will lead to a stimulus in economic growth. The model compared the annual streams of economic capital and operating costs and benefits and computes the Net Present Value (NPV) and the economic internal rate of return (EIRR). All costs and benefits were expressed in 2004 constant prices. The analysis period is for the construction period followed by 20 years of operation.

## **11.2 Road Condition and Traffic**

### **11.2.1. Road Condition**

The existing road condition has been investigated by topographic survey, pavement condition survey, and roughness survey. Following a review of the traffic flows and the condition of the existing pavement, the Project road was divided into two homogeneous sections. Surface roughness levels in accordance with the International Roughness Index (IRI) for each section of the existing road was 6.00. The rate of road deterioration used in the economic Analysis is based on the IRIs that existed before the Project was implemented i.e. the without project case which are compared with the IRIs in the with project case and the calculation of vehicle operating cost.

### **11.2.2 Traffic Volume**

Classified traffic volumes on the Project road were undertaken at various locations in 2004. Each of the traffic counts was for a period of 7 days. Origin-Destination counts were also conducted at some of the traffic survey stations. These survey results were normalized through the application of seasonal factors to obtain annual average daily traffic for the base year. The traffic counts were split into motorized traffic (cars, pick-up, buses, trucks, light commercial vehicles, and motor-cycles) and non-motorized traffic (bicycles and animal drawn vehicles).

## **11.3 Traffic Growth Rate Assumptions**

Traffic growth rates were suggested by RSRDC were used to project the traffic. The traffic growth rates adopted varied between 3% per annum and 10% per annum depending on the vehicle type in the first 10 years.

### **11.3.1 Costs**

The Project's economic costs were derived from the financial costs and include the cost for construction, and maintenance costs. Economic costs exclude price contingencies, taxes, duties, and interest during construction. A standard conversion factor of 0.90 was applied to financial costs of nontraded inputs to calculate economic prices. The Project road is expected to have an average economic life of 20 years.

The incremental operation and maintenance costs were calculated as the difference between the maintenance requirements for the proposed highway and the existing highway. In both the without and the with project scenario, routine maintenance as well as periodical surface renewal will be required.

#### 11.3.2 Benefits

In the with-project scenario, the upgraded highway will allow improved traffic flow, higher vehicle speeds, and shorter travel time, all resulting in lower vehicle operating costs (VOCs). The main economic benefits estimated for the Project are (a) VOC savings for normal traffic, and (b) time savings for passengers and cargo transport.

The HDM-4 model was used to estimate the benefits over time. The model predicts pavement deterioration and estimates yearly vehicle operating costs over the life of the investment. In both the 'with' and 'without' project cases the IRI varies from year to year according to traffic movement and the maintenance applied which has a direct impact on the VOC and hence on the level of benefits. The model then compares life cycle costs for the 'with' and the 'without' project situation and computes the NPV and estimates the EIRR.

#### 11.3.3 Economic Internal Rate of Return

The economic evaluation discounts the stream of costs and benefits over the period 2005 to 2027 and values them at present 2004 levels. The EIRR was calculated for each of the road sections and for the road as a whole, as summarized in Table 11.2 below.

#### 11.3.4 Sensitivity Analysis

The sensitivity of the total EIRR shown in Table 11.2 was analyzed with respect to changes in the benefit and cost streams. The sensitivity tests examined the following scenarios, (i) an increase in construction costs by 15%, (ii) a reduction in benefits by 15%, (iv) a combination of an increase in capital costs of 15% and a reduction of benefits by 15%.

Table 11.2 summarizes the EIRR for the base case and the sensitivity tests. The EIRR for the Project Road as a whole is 21.97%. The economic viability under various sensitivity tests show that the Project road remains economically viable as the EIRR remains above the opportunity cost of capital of 12%.

The detailed calculations are given in Appendix.

Table 11.2 RESULTS OF ECONOMIC ANALYSIS

	EIRR (%)					
	Package I		Package II		Complete Road	
	With Time Savings	Without Time Savings	With Time Savings	Without Time Savings	With Time Savings	Without Time Savings
Base Case	23.59%	15.42%	19.85%	12.73%	21.83%	14.16%
Sensitivity Condition 1	21.10%	13.49%	17.60%	10.94%	19.46%	12.30%
Sensitivity Condition 2	20.72%	13.19%	17.25%	10.65%	19.09%	12.00%
Sensitivity Condition 3	16.01%	9.45%	12.97%	7.14%	14.59%	8.37%

## 11.4 Financial Analysis

### 11.4.1 The Approach

The financial internal rate of return (FIRR) for the project road was calculated on the basis of incremental financial costs and revenues resulting from the project. The basic objective of the financial analysis of the project is to determine whether the construction of new road can be developed using the Build-Operate-Transfer (BOT) model and if so, under what conditions.

Project costs are comprised of capital costs and operation & maintenance costs (O&M). Capital costs include civil works, environmental improvement works, land acquisition, relocation of utilities and resettlement costs, construction supervision, and taxes and duties. Capital costs are to be incurred over a 2-year period starting in 2005 and ending in 2006. O&M costs include annual routine maintenance and periodic maintenance. The costs used for O&M are those used in the economic evaluation but in financial prices. Routine maintenance cost is taken in the analysis is Rs. 80,000 per km and periodic maintenance cost (applied every six years) is Rs. 2.00 Million per km.

The major source of revenue for the project will be tollable traffic. Other minor sources of revenue like wayside hoardings etc. has not been considered in the analysis because of their insignificance in terms of quantum. The PWD Rajasthan toll fee rates were used in the analysis.

### 11.4.2 FIRR

The FIRR for the project road (With Paved Shoulders 7m Carraigeway+2mPaved Shoulders on either side+1.5 m Hard Shoulders on either side) sections was calculated and given in Tables 11.3-11.14 Package wise and Case wise with sensitivity conditions respectively.

The FIRR for the project road (Without Paved Shoulders 7m Carraigeway+2.5m Hard Shoulders on either side) sections was calculated and given in Tables 11.15-11.26 with sensitivity conditions respectively.

## 11.5 Assumptions For Economic And Financial Analysis

### 11.5.1 Economic Analysis

#### General

- 'Without' Project - existing Project road
- 'With' Project - new Improved Road
- Project implementation period: 2 year construction 2005-2006 and 20-years of economic benefits 2007-2026
- Costs and benefits expressed in 2005 prices

### Economic Costs

- Capital costs allocated over 2 years assuming breakdown of 40% / 60%
- No residual value of road
- Standard conversion factor of 0.9 for nontraded items

### Economic Benefits

- Vehicle Operating Cost (VOC) savings calculated using HDM-4 Model for "normal" traffic growth only (no generated traffic)
- VOC savings for both motorized traffic and non-motorized traffic
- Time savings for passengers and freight calculated using the HDM-4 Model
- Traffic base year volumes and traffic growth rates by vehicle type

The following vehicle types were used:

#### Motorized Traffic

- Car/Jeep
- Mini Bus/ Bus
- Light Commercial Vehicle
- Trucks
- Multi Axle Trucks
- Motorcycles

Traffic growth rates to be used as follows:

Year	Buses	LCVs	Trucks	Multi Axle Trucks	Cars/Jeeps	2-Wheelers
2005-15	3	5	3	10	7	8
2016-25	2.7	4.5	2.7	9	6.3	7.2
2026-35	2.43	4.05	2.43	8.1	5.67	6.48
>2035	2.187	3.645	2.187	7.29	5.103	5.832

Source: Suggested by RSRDC

### 11.5.2 Sensitivity Analysis

#### Conditions of Sensitivity Tests:

1. Capital Costs increased by 15%
2. Decrease in Benefits by 15%
3. Capital Costs increased by 15% and Benefits Reduced by 15%

### 11.5.3 Financial Analysis

#### General

- Without Project - existing Intermediate road
- With Project - new Two lane road with Paved Shoulders and new two lane without paved shoulders

- Debt Equity Ratio 70:30
- Corporate Tax Rate 36.70%
- Project implementation period: 2 year construction 2005-2006 and 35-years of financial benefits 2007-2041

#### Financial Costs

##### Capital Cost with Paved Shoulders

Package I (Kishangarh-Ratngarh)---	3900.461 Millions
Package II(Ratangarh-Hanumangarh)---	3726.361 Millions
Total	7626.822 Millions

##### Capital Cost without Paved Shoulders

Package I (Kishangarh-Ratngarh)---	2340.277 Millions
Package II(Ratangarh-Hanumangarh)---	2235.817 Millions
	4576.093 Millions

- Capital costs allocated over 2 years assuming breakdown of 40% / 60%
- No residual value of road
- Maintenance Costs (With Paved Shoulders)
  - Routine: Rupees 80, 000 per km per year
  - Periodic: Rupees 2,00,000 per km every 6 years
- Maintenance Costs (Without Paved Shoulders)
  - Routine: Rupees 65, 000 per km per year
  - Periodic: Rupees 13,00,000 per km every 6 years

#### Interest Rates

Case 1 Interest During Construction 12%

Interest on Debt 12%

Case 2 Interest During Construction 8%

Interest on Debt 10%

#### Financial Benefits

Toll levels based on PWD Prices 1997 rates indexed by inflation factor of 10.0% in every 2 years.

#### Financial Models

##### With Paved Shoulders (Package wise and for Total Project Road)

Case 1 Interest During Construction 12%

Interest on Debt 12%

Case 2 Interest During Construction 8%

Interest on Debt 10%



**Without Paved Shoulders (Total Project Road)**

Case 1 Interest During Construction 12%

Interest on Debt 12%

Case 2 Interest During Construction 8%

Interest on Debt 10%

**Sensitivity Analysis**

Case 1: 15% increase in capital costs

Case 2: 15% decrease in toll levels

Case 3: 15% increase in Capital Costs and 15% Decrease in Toll Levels

Table 11.3 RESULTS OF FINANCIAL ANALYSIS (PACKAGE I)

(Case 1)

(Without Subsidy)

(a) Base Case

Concession Period (Excluding Construction Period of 2 Years)	Promoters Equity		Project Feasibility	
	FIRR (%)	NPV @ 12%	FIRR (%)	NPV @ 12%
20	5.51%	(1,331.50)	4.04%	(2,572.62)
23	7.47%	(1,103.21)	5.70%	(2,344.33)
25	8.18%	(1,001.64)	6.34%	(2,242.76)
28	9.39%	(790.52)	6.34%	(2,031.63)
30	9.90%	(682.31)	7.98%	(1,923.42)
33	10.70%	(480.22)	8.78%	(1,721.34)
35	11.12%	(350.57)	9.22%	(1,591.69)

(b) Sensitivity Condition 1

Concession Period (Excluding Construction Period of 2 Years)	Promoters Equity		Project Feasibility	
	FIRR (%)	NPV @ 12%	FIRR (%)	NPV @ 12%
20	3.83%	(1,856.26)	2.82%	(3,283.54)
23	5.97%	(1,627.45)	4.58%	(3,054.73)
25	6.76%	(1,525.67)	5.27%	(2,952.96)
28	8.10%	(1,314.37)	5.27%	(2,741.66)
30	8.66%	(1,206.09)	7.03%	(2,633.38)
33	9.55%	(1,003.98)	7.90%	(2,431.26)
35	10.02%	(874.31)	8.37%	(2,301.60)

(c) Sensitivity Condition 2

Concession Period (Excluding Construction Period of 2 Years)	Promoters Equity		Project Feasibility	
	FIRR (%)	NPV @ 12%	FIRR (%)	NPV @ 12%
20	2.80%	(1,782.12)	2.06%	(3,023.24)
23	5.14%	(1,589.83)	3.96%	(2,830.94)
25	5.94%	(1,511.23)	4.65%	(2,752.34)
28	7.41%	(1,333.24)	4.65%	(2,574.36)
30	7.99%	(1,246.64)	6.52%	(2,487.76)
33	8.96%	(1,076.03)	7.45%	(2,317.15)
35	9.48%	(966.49)	7.96%	(2,207.60)

(d) Sensitivity Condition 3

Concession Period (Excluding Construction Period of 2 Years)	Promoters Equity		Project Feasibility	
	FIRR (%)	NPV @ 12%	FIRR (%)	NPV @ 12%
20	1.23%	(2,306.88)	0.91%	(3,734.17)
23	3.77%	(2,114.06)	2.91%	(3,541.34)
25	4.64%	(2,035.26)	3.65%	(3,462.54)
28	6.24%	(1,857.09)	3.65%	(3,284.38)
30	6.88%	(1,770.42)	5.63%	(3,197.71)
33	7.94%	(1,599.78)	6.64%	(3,027.07)
35	8.50%	(1,490.23)	7.18%	(2,917.51)

11.12.14 का प्रोजेक्ट की अंदाज़ाशी का जानकारी स्टैंडर्ड

क्र.सं.	जिला	वर्ग	ग्राम	अंदाज़ाशी	कुल	जिला	वर्ग	ग्राम	अंदाज़ाशी	कुल
1.	अजमेर	विशाल	सोवतसर	1	18	5	अजमेर	सुजागा	131	03
		बालू	सुजुरा	41	06			सुजागा	1	12
		बालू	खपनगा	69	06			देवाली	57	07
		बालू	खपनगा	3	00			खपनगा	1	13
		बालू	खपनगा	5	06			खपनगा	48	08
		बालू	खपनगा	123	12			खपनगा	48	06
2.	नागौर	परवतसर	परवतसर	160	09			खपनगा	36	05
		परवतसर	खपनगा	3	11			खपनगा	4	09
		परवतसर	खपनगा	4	05			खपनगा	2	17
		परवतसर	खपनगा	3	05			खपनगा	326	09
		परवतसर	खपनगा	172	08			खपनगा	3	03
3.	"	नांकी	पनवाड़ी	2	19			खपनगा	6	16
		नांकी	खपनगा	28	57			खपनगा	1	15
		नांकी	खपनगा	4	70			खपनगा	0	02
		नांकी	खपनगा	1	73			खपनगा	0	15
		नांकी	खपनगा	2	92			खपनगा	1	09
		नांकी	खपनगा	0	82			खपनगा	10	00
		नांकी	खपनगा	0	56			खपनगा	15	15
		नांकी	खपनगा	3	80			खपनगा	50	15
		नांकी	खपनगा	40	52			खपनगा	6	02
		नांकी	खपनगा	250	07			खपनगा	4	13
4.	"	जिंदवा	पहागेवा	74	17			खपनगा	3	10
		जिंदवा	खपनगा	180	05			खपनगा	0	15
		जिंदवा	खपनगा	26	06			खपनगा	15	00
		जिंदवा	खपनगा	2	00			खपनगा	3	54
		जिंदवा	खपनगा	2	02			खपनगा	14	00
		जिंदवा	खपनगा	4	09			खपनगा	2	14
		जिंदवा	खपनगा	1	12			खपनगा	8	10
		जिंदवा	खपनगा	17	15			खपनगा	5	84
		जिंदवा	खपनगा	10	05			खपनगा	27	19
		जिंदवा	खपनगा	91	19			खपनगा	147	12