

## ECONOMIC AND FINANCIAL ANALYSIS

### A. Introduction

1. The proposed project is to build a new six-lane bridge across the Ganges River near Patna in the state of Bihar, India. The Ganges River divides the state almost in the middle, and the limited number of crossings is a major constraint on the connectivity between north and south Bihar. The proposed bridge will improve the connectivity and reduce the congestion on an existing bridge near Patna, and will also provide all-year connectivity to the Raghapur Diara river island. Without project, its population of 250,000 depends on boats for a major part of the year, or a seasonal pontoon bridge, which makes the transport of passengers and goods very costly, and limits the ability to market the produce from this agriculturally rich island. The bridge will support the overall economic development of the state of Bihar. The project will yield substantial economic benefits to traffic participants in the influence area—savings in travel distance and time, lower vehicle operating costs overall, and reduced congestion and pollution on the existing river crossing near Patna.

### B. Economic Analysis

2. The economic analysis was carried out by comparing the with-project scenario, in which the proposed bridge is built as the construction or reconstruction of other bridges across the Ganges River is being completed, and the without-project scenario, in which only the bridges already under construction materialize. The economic analysis of the proposed project covers a period of 29 years from 2016, i.e., 4 years of construction and 25 years of operation.

#### 1. Demand Analysis

3. The travel demand assessment for the project is derived from the transport model developed as part of the Road Master Plan for Bihar's State Highways Development by Bihar State Road Development Corporation Limited (BSRDCL).<sup>1</sup> The study developed a transport model for the traffic movement on the state highway network based on road traffic surveys. It was used to predict traffic volumes on the road network in the project influence area for the with- and without-project scenarios during the analysis period. The travel forecast was made based on vehicle traffic growth forecasts for the next 20 years. The model has been used to assign traffic on the influence area road network for the without and with project scenarios. Bridges are under construction upstream and downstream at a distance of 20–50 kilometers (km) from the proposed bridge, and it is planned to rehabilitate the existing Mahatma Gandhi Setu Bridge. The without-project scenario considers the completion of all these construction and upgrading works, but not the construction of the proposed bridge.

4. The overall vehicle growth observed in Bihar in the past 5 years is 15.9 % per annum. The number of new vehicles registered increased to 0.55 million in fiscal year (FY) 2014, compared with 0.33 million in FY2010, a 70% increase. State economic growth in real terms for the same period was 10.4% per annum,<sup>2</sup> well above the all-India growth rate of 7.1% per annum.<sup>3</sup> The traffic growth rates estimated by the master plan and adopted for the analysis are in Table 1. The traffic estimates for the bridge crossings from the transport model are given in

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<sup>1</sup> ADB. 2012. *Technical Assistance for the Road Master Plan for Bihar's State Highway Development*. Manila (TA 8170-IND, \$1,000,000, approved on 20 September).

<sup>2</sup> Ministry of Finance, Government of Bihar. 2015. *Economic Survey, 2014–2015*. Patna.

<sup>3</sup> Ministry of Finance, Government of India. 2015. *Economic Survey of India, 2014–2015*. Delhi.

Table 2. The distance and time savings, and the travel speeds for the with- and without-project scenarios, are in Table 3.

**Table 1: Traffic Growth Rates**

Period	Car	2-Wheeler	Bus	Auto-Rickshaw	Goods	Tractor / Trailer
2016–2020	11.10	13.37	5.29	10.69	8.70	6.18
2021–2025	9.19	11.11	4.22	9.03	7.15	5.46
2026–2030	7.62	9.18	3.32	7.71	5.94	4.82
2021–2035	7.57	9.11	3.29	7.58	5.90	4.70
2036–2040	7.52	9.04	3.26	7.45	5.86	4.59

Note: Average occupancy observed was 3.6 for cars, 1.5 for two-wheelers, 38.0 for buses, and 3.0 for auto-rickshaws.

Source: Road Master Plan for Bihar's State Highway Development.

**Table 2: Traffic Estimates on Bridges across Ganges River near Patna**

Bridge	AADT Estimates in PCUs						
	Base Year	Without Project			With Project		
	2015	2020	2026	2035	2020	2026	2035
1. Digha Bridge (upstream)	Under construction	12,490 (0.38)	18,300 (0.55)	34,600 (1.04)	11,050 (0.32)	16,200 (0.47)	30,610 (0.89)
2. Gandhi Setu (Patna) <sup>†</sup>	45,600 (1.96)	55,300 (2.37)	65,500 (0.86)	107,300 (1.40)	25,150 (1.08)	32,300 (0.44)	52,310 (0.71)
3. Proposed Bihar New Ganga Bridge	Proposed	-	-	-	31,700 (0.27)	40,275 (0.34)	76,120 (0.65)
4. Bakhtiyarpur (downstream)	Under construction	21,700 (0.28)	28,800 (0.37)	48,600 (0.62)	16,100 (0.21)	20,700 (0.26)	33,140 (0.42)

( ) = Volume-capacity ratio, AADT = annual average daily traffic, PCU = passenger car unit.

<sup>†</sup> On Gandhi Setu, only one lane in each direction is currently available; when rehabilitation is completed in 2025, the bridge will have two lanes in each direction.

Source: Output of Bihar Road Masterplan Transport Model.

**Table 3: Distance, Time, and Speed without and with Project**

Scenario	Network Length (km)	Daily Distance and Time	
		(PCU km)	(PCU hours)
1. Base year – 2015	2,390	6,739,133	207,676
2. Without project – 2035	2,401	36,200,465	738,570
3. With project – 2035	2,414	35,810,186	664,382
4. Reduction with the project in 2035		<b>390,279</b>	<b>74,188</b>
Speed Estimates (km/hour)			
Bridge	Base Year – 2015	Without Project – 2035	With Project – 2035
1. Digha Bridge (2 lanes) under construction	-	59	64
2. Gandhi Setu (operational 2 lanes at present; 4 lanes after rehabilitation)	11	32	48
3. Bihar New Ganga Bridge – 6 lanes	-	-	77
4. Bakhtiyarpur (4 lanes) under construction	-	79	80

km = kilometer, PCU = passenger car unit.

Source: Output of Bihar Road Masterplan Transport Model.

5. The proposed bridge will add the required capacity for crossing the Ganges River near Patna, and maintain an acceptable level of service; improve the network speeds and reduce travel distance and travel time. Without the project, the volume–capacity (V/C) ratio will be greater than 1 for two of the three bridges within 50 km (Table 2), and even with the proposed

bridge, the V/C ratios range from 0.42 to 0.89, indicating a service level of B (indicative V/C of 0.3 to 0.5) or C (indicative V/C of 0.5 to 0.7). A service level of B is desirable, a level of C is satisfactory. Besides, the existing Mahatma Gandhi Setu Bridge and its approaches will be substantially decongested, benefiting the city traffic.

6. In addition, the proposed bridge provides all-year connectivity to the Raghopur Diara river island (estimated population of 252,000 in 2015). Its residents now depend on boats for 7–8 months a year to travel to Patna or Hajipur, and on a narrow pontoon bridge for the remaining 4–5 months, which significantly increases the transport costs of passengers and goods and reduces people's ability to market the produce from this agriculturally rich island. The distance between Raghopur Diara river island and Patna is less than 15 km but now takes 2–3 hours to cover, whereas the proposed bridge will shorten the travel time to less than 0.5 hours. The new connectivity will allow the island residents to access education and health facilities as well as jobs in Patna, and the island will become a suburb of Patna. In the absence of connectivity, the residents make fewer trips to Patna. It was observed that during daytime, boats move every 10–15 minutes to and from the island carrying 40–50 passengers. Separate boats operate less frequently to carry goods.

7. The likely traffic volume generated from connecting Raghopur Diara river island was derived using three approaches: (i) based on trip rates of Patna city residents,<sup>4</sup> assumption of a very conservative per capita trip rate of 0.14 (25% of Patna city's per capita trip rate); (ii) vehicle ownership estimation based on population and trip generation per vehicle from the Masterplan transport model; and (iii) an estimate based on the passenger and goods traffic crossing the river at present, plus 100% generated traffic. The estimated daily traffic in the first year of operation under the respective approach is (i) 13,500 vehicles, (ii) 7,850 vehicles, and (iii) 5,900 vehicles. Considering the change in travel time and cost, the likely generated or induced traffic will be much higher than 100%, and probably closer to the estimate based on trip rates. For the analysis, the traffic generation from Raghopur Diara river island is taken as an average of the daily traffic estimated by the three approaches, resulting in 9,080 vehicles per day in the first year of operation.

## 2. Project Economic Costs

8. The proposed bridge will be constructed as a six-lane divided carriageway with grade-separated access. The cost of civil works included in the project has been estimated based on the bill of quantities and unit costs. In addition to the civil works costs, the project cost includes land acquisition and resettlement, environmental impact mitigation, utility shifting, construction supervision, project management, and physical contingencies but excludes any price contingency and interest during construction. The economic costs of construction were derived from the financial construction cost by removing the transfer costs and applying a shadow exchange rate factor of 1.037<sup>5</sup> and a shadow wage factor of 0.74,<sup>6</sup> and valuation of the economic loss in case of land acquisition costs.<sup>7</sup> The periodic maintenance unit costs adopted are based on the estimates for the project. The cost estimates are based on 2015 prices.

<sup>4</sup> Wilbur Smith Associates and Ministry of Urban Development, Government of India. 2008. *Study on Traffic and Transportation Policies and Strategies in Urban Areas in India*. Delhi. The study gives a per capita motorized vehicle trip rate of 0.52 for Patna city residents based on a primary survey, which will increase to 0.56 by 2015.

<sup>5</sup> Estimated using trade data from Government of India websites: [www.commerce.nic.in](http://www.commerce.nic.in) and [www.indiabudget.nic.in](http://www.indiabudget.nic.in)

<sup>6</sup> Estimated using data from website of Ministry of Labour and Employment, Government of India ([labour.gov.in](http://labour.gov.in))

<sup>7</sup> The socioeconomic survey conducted indicates a net agricultural revenue of Rs15,000 per acre in the area. The land has been valued based on the discounted cash flow of net revenue from the land.

### 3. Project Economic Benefits

9. The proposed bridge adds to the capacity across the Ganges River and thus reduces the congestion on other bridges up- and downstream. The new bridge also provides shorter travel for traffic across Ganges River within its immediate influence area. Traffic diverted to the new bridge from other bridges will also reduce congestion on those bridges, which will improve speed, vehicle operating costs, and travel time on those bridges. Table 3 shows the savings in distance and time and the improvements in speed on other bridges. The benefits in monetary terms from the distance saved are computed using unit vehicle operating costs derived from the HDM-4 model, and benefits in monetary terms from the time saved are computed using value of passenger time and time value of goods in transit. The estimates in Table 3 assume that the Mahatma Gandhi Setu Bridge is rehabilitated to four-lane capacity. Now the bridge has just two lanes and it takes between 1 and 3 hours to cross it. Its rehabilitation is under consideration and it is expected that it will take at least 10 years from the start of technical studies to implementation, so given that the proposed Bihar New Ganga Bridge will be completed in 4 years, traffic on the existing two-lane Mahatma Gandhi Setu Bridge will benefit for 6 years.

10. The analysis takes into account savings resulting from connectivity to the Raghapur Diara river island—reduction in travel time to Patna from an average of 2.5 hours to 0.5 hours as well as changes in the cost of transportation. Raghapur Diara river island has a large fertile agricultural land area, so better marketing and pricing conditions provided by connectivity will increase agricultural production and productivity. The proposed bridge will also provide large additional benefits to the island residents in terms of better access to education, health facilities, and jobs, but these are neither quantified nor included in the analysis.

### 4. Project Economic Analysis

11. **Value of time for passengers and freight.** For passenger-carrying vehicles, the value of passenger work and nonwork time was calculated based on the per capita income in the state. The per capita income per employed person was worked out and the average hourly income derived by assuming 2,080 hours of work per year. The value of time in private passenger vehicles was equated to the income level of owners of these vehicles, which is substantially higher than for the population on average. The hourly cost for passengers in public transport vehicles in rural areas may at least be equated with the opportunity cost of labour, or minimum wage levels. The work time of bus passengers was valued at 0.5 times the average hourly income, that of two-wheeler passengers at 1.0 times, and that of car passengers at 2.0 times, considering the likely income range of bus, two-wheeler, and car passengers.<sup>8</sup> The value of passenger time was modified applying the shadow wage rate factor for unskilled labour. The value of nonwork time was taken as one-fourth of the value of work time. The value for the state gross domestic product per capita was obtained from Bihar's economic survey (footnote 2). A summary of the calculated values of time for each passenger-carrying vehicle is in Table 4.

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<sup>8</sup> The value of work time computed was used only for work trips; for all other trips, the value of nonwork time (taken as 25% of the work trip value) was used.

**Table 4: Adopted Values of Passenger Work and Nonwork Time**

State	Estimated Net State GDP Per Capita at Current Prices, FY2015 (Rs)	Bus (Rs per hour)		Car (Rs per hour)		Two- and Three-Wheelers (Rs per hour)	
		Work	Nonwork	Work	Nonwork	Work	Nonwork
Bihar	41,084	18.2	4.5	72.8	18.2	36.4	9.1

FY = fiscal year, GDP = gross domestic product.

Source: Asian Development Bank estimates.

12. For goods-carrying vehicles, a value of time for cargo was calculated using the method suggested in the HDM manual—taking the opportunity cost of cargo. The value of time for freight is calculated as time value of goods in transit, i.e., the value of the goods carried times the commercial interest rate paid by the owners as an inventory cost. Considering the predominance of regional trade and main goods carried, a cargo value of Rs65,000 per ton is assumed, and the opportunity cost of cargo delay or value of time for cargo is estimated considering that 75% of cargo benefits and assuming an interest rate of 12%. The value of cargo time thus estimated is Rs.0.67 per ton per hour. The estimated proportion of goods traffic on the proposed bridge is 54.5%.

13. **Salvage value.** A straight-line depreciation method is used to calculate the salvage value of project elements at the end of the analysis period. Among the project elements, bituminous components are assumed to have a life of 20 or fewer years, with periodic renewal as needed, and will have no salvage value. The pavement structure below the bituminous layer in the widening portion is assumed to have a 40-year life for salvage value calculation. Bridges and cross-drainage structures can have a life of more than 50 years. Assuming a 40-year life for all structures, the salvage value was calculated in a straight-line depreciation method. The salvage value estimated is 35% at the end of the analysis period.

14. The economic analysis results and annual cost–benefit streams are in Table 5. The economic internal rate of return for the project is estimated at 16.0%, indicating that the project is viable in social cost–benefit terms.

15. Sensitivity analyses were carried out to investigate the robustness of the economic viability of the project to cost overruns and benefit reductions. The cases analysed are:

- Case I Base cost and base benefits
- Case II Increase in capital costs by 10% and base benefits
- Case III Base cost and decrease in benefits by 10%
- Case IV Increase in capital costs by 10% and decrease in benefits by 10 %
- Case V 1-year delay in construction

16. The results of the sensitivity analyses are in Table 6. As shown, with an increase in capital costs by 10% and a reduction in benefits by 10%, both project corridors still have an economic internal rate of return of above 12%. Project procurement has been completed with a fixed-price contract, and the contractor has begun mobilization, so the risks of cost overruns and significant construction delays are very low. Based on the economic analysis of the project options, as well as on the engineering and traffic assessment, the proposed project is recommended for implementation.

**Table 5: Cash Flow Stream for Project Road Sections (Rs million)**

Year	Increase in Road Agency Costs		Decrease in Road User Costs								Net Benefits
	Capital Costs	Maintenance Costs	Vehicle Operating Costs				Time Costs				
			Diara Traffic		Network traffic		Diara Traffic		Network traffic		
			Passenger	Goods	Passenger	Goods	Passenger	Goods	Passenger	Goods	
2016	3078.7	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3078.7
2017	6157.5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6157.5
2018	10775.6	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-10775.6
2019	10775.6	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-10775.6
2020	0	153.9	351.4	179.5	523.8	1332.4	745.5	33.8	1740.4	275.4	5028.3
2021	0	153.9	379.5	193.9	566.4	1441.3	805.1	36.5	1865.1	296.0	5430.0
2022	0	153.9	409.9	209.4	612.5	1559.1	869.5	39.5	1998.8	318.2	5863.0
2023	0	153.9	442.6	226.2	662.4	1686.6	939.1	42.6	2142.2	342.1	6329.8
2024	0	153.9	478.1	244.3	716.3	1824.4	1014.2	46.0	2295.9	367.8	6833.0
2025	0	153.9	516.3	263.8	774.6	1973.6	1095.3	49.7	2460.8	395.4	7375.6
2026	0	769.7	557.6	284.9	194.7	624.6	1183.0	53.7	1530.9	147.1	3806.8
2027	0	153.9	602.2	307.7	211.5	678.4	1277.6	58.0	1632.0	156.8	4770.2
2028	0	153.9	650.4	332.3	229.7	736.8	1379.8	62.6	1739.8	167.1	5144.6
2029	0	153.9	702.4	358.9	236.8	759.6	1490.2	67.6	1785.2	171.5	5418.3
2030	0	153.9	758.6	387.6	244.2	783.1	1609.4	73.0	1831.7	176.0	5709.6
2031	0	153.9	796.6	407.0	251.7	807.4	1689.9	76.7	1879.4	180.5	5935.2
2032	0	153.9	836.4	427.3	259.5	832.4	1774.4	80.5	1928.4	185.3	6170.2
2033	0	769.7	878.2	448.7	267.6	858.2	1863.1	84.5	1978.6	190.1	5799.3
2034	0	153.9	922.1	471.1	275.9	884.8	1956.2	88.8	2030.2	195.0	6670.1
2035	0	153.9	968.2	494.7	284.4	912.2	2054.0	93.2	2083.1	200.1	6935.9
2036	0	153.9	1016.6	519.4	298.6	957.8	2156.7	97.9	2187.2	210.1	7290.4
2037	0	153.9	1067.5	545.4	313.6	1005.7	2264.6	102.7	2296.6	220.6	7662.7
2038	0	153.9	1120.8	572.7	329.2	1056.0	2377.8	107.9	2411.4	231.7	8053.5
2039	0	153.9	1176.9	601.3	345.7	1108.8	2496.7	113.3	2532.0	243.2	8463.9
2040	0	769.7	1212.2	619.3	363.0	1164.2	2571.6	116.7	2658.6	255.4	8191.2
2041	0	153.9	1248.5	637.9	381.1	1222.4	2648.7	120.2	2791.5	268.2	9164.6
2042	0	153.9	1286.0	657.0	400.2	1283.5	2728.2	123.8	2931.1	281.6	9537.5
2043	0	153.9	1324.6	676.8	420.2	1347.7	2810.0	127.5	3077.6	295.7	9926.1
2044	-10775.61	153.9	1364.3	697.1	441.2	1415.1	2894.4	131.3	3231.5	310.4	21107.0
										EIRR (%)	16.0%
										NPV @ 12%	8315.0

EIRR = economic internal rate of return, NPV = net present value.

Source: Asian Development Bank assessment.

**Table 6: Results of Sensitivity Analysis**

Sensitivity Scenario	EIRR (%)	NPV (Rs million)	Switching Value (%)
Case-I Base cost and base benefits	16.0	8315.0	...
Case-II Increase capital costs by 10% and base benefits	14.7	6031.7	36.0
Case-III Base cost and decrease benefits by 10%	14.5	5200.2	26.5
Case-IV Increase capital costs by 10% and decrease benefits by 10%	13.7	3667.5	18.0
Case-V 1-year delay in construction	14.9	6224.9	6 years

... = not available, EIRR = economic internal rate of return, NPV = net present value.

Source: Asian Development Bank estimates.

## B. Financial Analysis

17. The Government of Bihar intends to collect user fees in the form of toll charges on the bridge, except for traffic from Raghapur Diara river island. Financial analysis was carried out to assess the viability of the proposed project investment based on the toll revenue. The analysis was done on an incremental basis using the discounted cash flow method, and calculating the financial internal rate of return (FIRR) of the project:

- (i) Capital costs are based on the estimated project costs for 2015. They include construction of the bridge and its approaches, physical contingencies, land acquisition and resettlement costs, and project management costs.
- (ii) The operation and maintenance costs include routine and periodic maintenance of the facility and toll collection costs. The estimates from the feasibility report have been adopted in the analysis.<sup>9</sup>
- (iii) Revenue is generated from toll charges ranging from Rs150 to Rs450 for cars, buses, and trucks, in line with the bridge toll rates as per National Highway Authority of India Toll Policy, but discounted by 50% to make the toll affordable.
- (iv) All financial projections are shown in 2015 nominal Indian rupees, with no adjustment for inflation. Toll collection costs are assumed to increase in real terms by 2% per annum.
- (v) The revenue and cost streams are compared for a 25-year period, excluding the construction period. In the last year, the residual value of the bridge was included according to the economic life by applying the straight-line depreciation method.

18. The estimated FIRR for the project in real terms is 4.6%, which is above the estimated weighted average cost of capital of 2.3% for BSRDCL for the proposed project.<sup>10</sup> The results of the financial analysis in real terms are in Table 7. The analysis did not consider exchange rate fluctuations over the analysis period.

19. A sensitivity analysis was carried out over the base case with respect to adverse changes in the costs and revenues. The analysis results in Table 8 show that the proposed project has a FIRR higher than the weighted average cost of capital in all sensitivity tests.

**Table 7: Results of Financial Analysis for the Bihar New Ganga Bridge (Rs million)**

Year	Capital Cost	Operation and Maintenance	Toll revenue	Net revenue
2016	4185.1	0.0	0.0	(4185.1)
2017	8370.1	0.0	0.0	(8370.1)
2018	14647.7	0.0	0.0	(14647.7)
2019	14647.7	0.0	0.0	(14647.7)
2020	0.0	167.4	1533.6	1366.2
2021	0.0	170.8	1630.0	1459.2
2022	0.0	174.2	1732.6	1558.4
2023	0.0	177.6	1841.9	1664.3
2024	0.0	181.2	1958.3	1777.1
2025	0.0	184.8	2082.4	1897.5
2026	0.0	1025.5	2214.5	1189.0
2027	0.0	192.3	2355.3	2163.0

<sup>9</sup> IDFC, IDeCK, and RITES. 2013. Development of Six Lane Suspension Cable Green Field Bridge over Ganges River from Kacchi Dargah on NH-30 to Bidupur in Dist Vaishali on NH-103.

<sup>10</sup> To calculate the weighted average cost of capital, the cost of Asian Development Bank funding (67.1% of the cost) is taken at a spread of 0.5% over the 10-year swap rate (a total of 3.05% including the maturity premium), and the Government of Bihar funding of the remaining 32.9% is considered at a cost of 8.91% per annum (10-year India Government Treasury Bond rate).

Year	Capital Cost	Operation and Maintenance	Toll revenue	Net revenue
2028	0.0	196.1	2505.3	2309.2
2029	0.0	200.1	2665.2	2465.1
2030	0.0	204.1	2835.6	2631.5
2031	0.0	208.1	3017.2	2809.0
2032	0.0	212.3	3210.8	2998.5
2033	0.0	1053.6	3417.2	2363.6
2034	0.0	220.9	3637.3	3416.4
2035	0.0	225.3	3872.0	3646.7
2036	0.0	229.8	4065.6	3835.8
2037	0.0	234.4	4268.9	4034.5
2038	0.0	239.1	4482.3	4243.2
2039	0.0	243.9	4706.4	4462.6
2040	0.0	1085.8	4941.8	3856.0
2041	0.0	253.7	5188.9	4935.1
2042	0.0	258.8	5448.3	5189.5
2043	0.0	264.0	5720.7	5456.7
2044	(12559.1)	264.0	6006.7	18301.9
<b>FIRR (%)</b>				<b>4.6</b>
<b>NPV@WACC (RS. Million)</b>				<b>16491.4</b>

( ) = negative value, FIRR = financial internal rate of return, NPV = net present value, WACC = weighted average cost of capital.

Source: Asian Development Bank assessment.

**Table 8: Results of Financial Sensitivity Analysis**

Sensitivity Scenario	FIRR (%)	NPV (Rs million)	Switching Value (%)
Case-I Base case	4.6	16491.4	-
Case-II Project cost increased by 10%	3.9	11810.3	41.0
Case-III Toll revenue decreased by 10%	3.8	10249.6	29.0
Case-IV Operation and maintenance costs increased by 50%	4.2	13917.0	420.0
Case V With residual value not considered	3.9	10179.8	-
Case-VI Project cost increased by 10%, and revenue reduced by 10%	3.4	7910.6	20.0

FIRR = financial internal rate of return, NPV = net present value.

Source: Asian Development Bank estimates.

### C. Financial Sustainability

20. BSRDCL was incorporated on 20 April 2009 under the Companies Act of 1956, and is a wholly owned company of the Government of Bihar, established to develop, execute, manage, and maintain all types of roads, highways, and bridges. Its total revenue grew from Rs9,150 million to Rs12,212 million during 2011–2015, for an average annual growth rate of 7.5%. The increase in total revenue is a result of accelerated road and bridge infrastructure investments in the state. BSRDCL's profitability is high, its average net profit margin for the last 5 years was 5.9% (ranging from 5.1% to 8.2%). The current ratio has been maintained within a stable range of 105%–107% in the same period. Recurrent costs for the project, such as operation and maintenance cost, are 2.8% of BSRDCL's annual expenditure. BSRDCL's total revenue is expected to keep growing, as the state intends to take up more of brownfield investment in bridges and roads to improve connectivity within the state and between neighbors. The financial sustainability of the project is considered adequate.