India

National Highway-2 Improvement Project

Evaluator: Keishi Miyazaki (OPMAC Corporation)

Field Survey: November 2006

1. Project Profile and Japan's ODA Loan

Map of project area

NG-2 between Mathura and Agra

1.1. Background

National Highway-2 was a major corridor linking Delhi (capital of India) and Kolkata (formerly Calcutta), a commercial city with a population of more than 10 million. Along the approximately 1,500km long highway are dotted major cities such as Mathura, Agra, Kanpur and Varanasi. However, since NH-2 is primarily a 2-lane road, it is often congested and its transport capacity is noticeably reduced. The challenge was to ensure adequate transport capacity by, among other things, widening NH-2. Thus the 4-laning of NH-2 was promoted, and the 4-laning of the 37km section between Delhi and Bangalore was completed. Also the Asia Development Bank had been assisting the four-laning improvement project for the Ballabgarh-Mathura section (111km) of NH-2 since 1989.

In the state of Uttar Pradesh (UP State), where the target road of this project is located, industrial cities are concentrated along NH-2. Enhancing the functions of the sections between these cities, and those of the sections of NH-2 that are linked to Delhi, Kolkata, and some other cities was considered essential for the development of Uttar Pradesh as a whole. However, the volume of traffic in the Mathura-Agra section (two-lane road) of NH-2, the section targeted in this project, is in excess of 20,000PCU[1]/day, which far exceeds the standard

[1] PCU(Passenger Car Unit) represents the "number of vehicles in terms of passenger cars" calculated by converting vehicle units of different types (e.g., trucks, buses, motorcycles) into passenger car units and multiplying the latter by a certain coefficient.

15,000 PCU/day for 4-laning roads in India. Thus, there was a need to widen the Mathura-Agra section from a two-lane road to a 4-lane road.

1.2. Objective

The project aims to widen and upgrade National Highway-2 between Mathura and Agra (51.33km long) to raise the transport capacity and to alleviate traffic congestion, thereby contributing to the growth of the regional economy.

1.3. Borrower/Executing Agency

Borrower: The President of India

Executing Agency: The Ministry of Surface Transport (now called the Ministry of Shipping, Road Transport and Highways)

1.4. Outline of Loan Agreement

Loan Amount / Loan Disbursed Amount	4,855 million JPY / 3,958 million JPY
Exchange of Notes / Loan Agreement	December 1991 / January 1992
Terms and Conditions - Interest Rate - Repayment Period (Grace Period) - Procurement	 2.6% 30 years (10 years) General untied
Final Disbursement Date	October 2000
Main Contractors	Progressive Construction Ltd.((India) Oriental Structural Engineers Ltd.(India)
Consultants	Nippon Koei Company Limited (Japan) Consulting Engineering Services (India) Pvt. Ltd.(India)
Feasibility Study (F/S), etc.	1991 Preliminary Project Report (prepared by Ministry of Surface Transport)

2. Evaluation Result

2.1. Relevance

2.1.1. Relevance at the time of appraisal

The road sector development policy of the 7th Five Year Plan (Fiscal 1985/86−1989/90) shifts emphasis away from construction of new roads, a course adopted since the 1950s, toward rehabilitation and maintenance of the existing road network, decrease of traffic accidents, and development of national highways. Additionally, in the 7th Five Year Plan, public investment (PI) in the transport sector was 12.6% of total PI, in which PI in the road sub-sector shared the second largest portion (22.6%) after the railway sub-sector (53.7%). Investment in the road sub-sector accounted for 2.9% of total investment, while investment in the railway sub-sector

accounted for 6.7% of total investment.

The major targets of the 20-Year Road Development Plan (1981−2001) established in 1984 were (i) development of national highways, (ii) energy saving through improvement of existing roads, and (iii) strengthening of traffic safety. Furthermore, the four-lane improvement project for the Ballabgarh-Mathura section (111 km) on NH-2 had been in operation with assistance from the Asia Development Bank since 1989. After the completion of the target section of the project (Ballabgarh-Mathura), the whole section between Delhi and Agra (199 km) was to be upgraded to a four-lane road, thereby demonstrating the high priority the Government of India placed on improving NH-2.

National Highway-2 is a major corridor linking Delhi and Kolkata (formerly Calcutta). Since there are industrial cities along the NH-2, strengthening its functions was important for the economic growth of Uttar Pradesh. Furthermore, since NH-2 sections were nearly all two-lane roads, NH-2 was unable to deal effectively with the increased traffic volume, resulting in traffic congestion and low transport capacity. Thus maintaining smooth traffic by widening existing roads and making other improvements had become an important issue.
Hence the relevance of the project plans at the time of appraisal is acknowledged to be high.

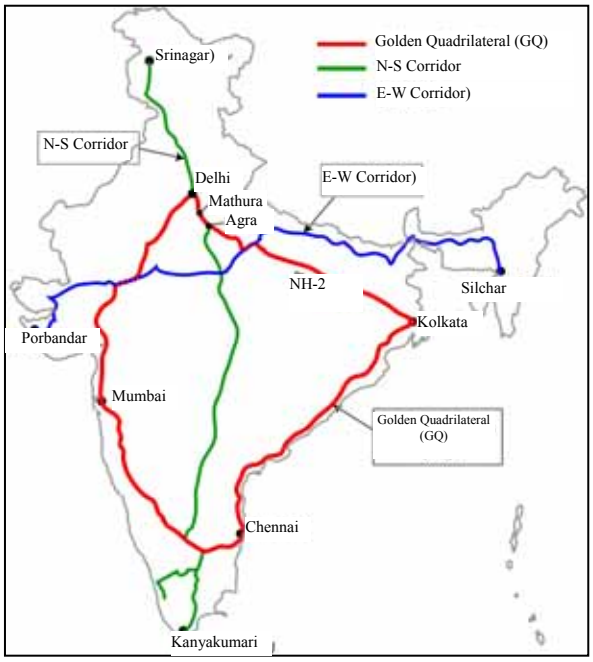
2.1.2. Relevance at the time of evaluation

Responding effectively to the growing demand for transport accompanying the government's GDP growth target is one of the policy objectives of the 7th Five Year Plan (FY2002/03−FY2007/08). Four-laning the Golden Quadrilateral (GQ)[2] that connects major cities in India such as Delhi, Mumbai, Chennai, and Kolkata, along with four-laning the East-West and North-South Corridors,[3] is given top priority in road-sector development. In the 10th Five Year Plan, public investment in the transport sector accounts for 16.5% of total PI, in which PI in the road sub-sector and PI in the railway sub-sector shared the largest portion at 40% and 41%, respectively. Investment in the road sub-sector accounted for 6.8% of total investment, while investment in the railway sub-sector accounted for 6.7%. These rates are higher than they were at the time of project appraisal.

[2] Golden Quadrilateral (GQ) is a 5,846 km-long national highway linking the four principal cities of Delhi, Mumbai, Chennai, and Kolkata. The whole section between Delhi and Kolkata is scheduled to be upgraded to a four-lane road sometime in 2007.

[3] The East-West Corridor is a 3,640 km-long national highway that runs east and west across the northern part of India linking Silchar in Assam state and Porpadar in Gujarat state. Some sections of the Corridor overlap with the Golden Quadrilateral. The North-South Corridor is a 4,076km-long national highway that runs north and south across central part of India. As of the end of October 2006, 840 km (11.5%) of the 7,300 km of the East-West and North-South Corridors have been upgraded to a four-lane road, and the four-laning improvement of 5,055 km (69%) is currently being implemented. The four-laning improvement of the entire East-West and North-South Corridors is scheduled to be completed by 2008.

Fig. 1: Location of the Project within the National Highway



The objectives of the National Highway Development Plans (I, II) (2002－2007) include four-laning the Golden Quadrilateral (5,846 km), the N-S/E-W Corridors (7,300 km). As of October 2006, 93% of the entire GQ and 100% of the Delhi-Mumbai section (1,419 km) have been upgraded to four-lane roads. Since the 10th Five Year Plan is regarded in India as an important national project, the Government of India is continuing to expand GQ to meet the growing transport demand. In the future, six-laning development for GQ and the N-S/E-W Corridors is on the agenda. The project comprises part of the GQ, so its priority remains high (see Fig. 1).

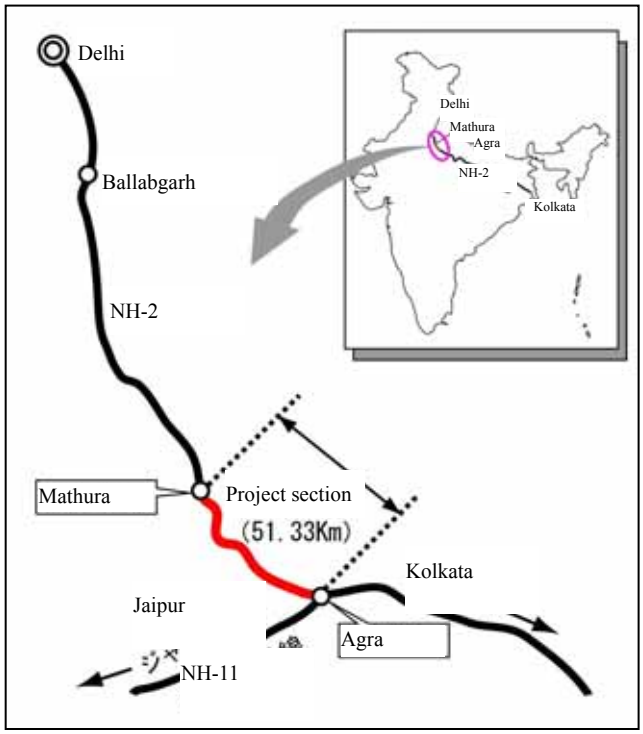
Agra, the target area of the project, along with Delhi and Jaunpur, is one of the most popular tourist destinations in northern India. From the perspective of the tourist industry, the national highway linking these three cities, dubbed the Golden Triangle, is regarded as the most important road. Meanwhile, Mathura is a great holy site of Hinduism where a large number of pilgrims from all over India visit every year. Given these features, at this point of evaluation, the project continues to be highly relevant.

2.2. Efficiency

2.2.1. Outputs

The project's main outputs included the widening and improvement of the existing road (51.33km) between Mathura and Agra on NH-2 from a two-lane road to a four-lane road, construction of a flyover (elevated bridge), and provision of a tollgate. The project's outputs were implemented as planned. Additional outputs were the construction of a 700 m-long lay-by, basic reinforcement work, and

Fig. 2: Map of Project Area



overlaying of old pavements.

2.2.2 Project period

The project period was planned to be 4 years and 6 months, from January 1992 to June 1996, but actually lasted 8 years and 4 months, from January 1992 to April 2000, a delay of 4 years and 2 months, or 185% longer than the planned schedule. The main reasons for the delay are: (i) the delay in obtaining government sanctions such as the Expenditure Finance Committee (EFC) clearance, the Cabinet Committee on Economic Affairs (CCE) clearance, and environmental clearance; (ii) the delay in site acquisition caused by the delay in obtaining environmental clearance; (iii) the delay in design and construction works caused by additional scope (iv) the delay in construction works caused by relocation of electric poles and water distribution pipes along the road side, and bad weather; and (v) the delay in construction works caused by lack of monitoring capacity of local consultants.

2.2.3 Project cost

The actual project cost is 4,856 million yen (ODA loan portion: 3,958 million yen) against planned 6,089 million yen (ODA loan portion: 4,855 million yen), thereby resulting in a reduction of 1,233 million yen, or 80% of the original cost. However, comparing the project cost on a rupee basis reveals that the actual project cost is 1,490 million rupees (1 rupee = 3.26 million yen) against 1,130 million rupees (1 rupee = 5.39 yen) of the original cost, which means that the actual project cost constitutes a 32% cost overrun of the original cost. This difference is due to the exchange rate used at the time of project appraisal and that used at the time of ex-post evaluation.

2.3. Effectiveness

2.3.1. Traffic volume

Table 1 is a comparison of the predicted traffic volume and actual traffic volume in sections of the Mathura-Agra section of NH-2 in 2002 and 2006

Table 1: Comparison of Predicted Traffic Volume and Actual Traffic Volume in 2002 and 2006

(unit: vehicle/day)

	1991		2002		2006		
	Actual	Estimate	Actual	Achieved	Estimate	Actual	Achieved
Section 1 (Km 148.33 – Km 159.00)(*)							
Motorcycle	2,432	4,786	3,627	76%	6,701	n.a.	-
Car	1,436	2,825	5,380	190%	3,962	n.a.	-
Truck/lorry	3,968	7,806	4,103	53%	10,948	n.a.	-
Bus	732	1,440	755	52%	2,020	n.a.	-
Total	8,568	16,855	13,865	82%	23,640	n.a.	-
PCU/day (ref.)	26,376	32,956	21,768	66%	46,217	-	-

Section 2 (Km 159.00 – Km 183.50)(*)							
Motorcycle	2,079	4,090	1,668	41%	5,736	3,181	55%
Car	1,478	2,907	4,615	159%	4,078	6,745	165%
Truck/lorry	3,377	6,643	3,438	52%	9,317	7,522	81%
Bus	304	598	580	97%	839	1,240	148%
Total	7,238	14,238	10,301	72%	19,970	18,688	94%
PCU/day (ref.)	26,376	26,675	17,503	66%	37,414	34,622	93%
Section 3 (Km 183.50 – Km 199.66)(*)							
Motorcycle	2,573	5,416	3,894	72%	7,099	n.a.	-
Car	1,438	3,027	5,554	183%	3,967	n.a.	-
Truck/lorry	4,451	9,369	4,088	44%	12,280	n.a.	-
Bus	1,229	2,587	832	32%	3,391	n.a.	-
Total	9,691	20,399	14,368	70%	26,737	n.a.	-
PCU/day (ref.)	23,950	41,603	22,261	54%	54,530	-	-

Note * Distance from Delhi

Note 1: The above figures do not include low speed vehicles such as bicycles and rickshaws. Jeeps and vans are included in the actual traffic volume for the car category.
Since no survey has been conducted on the traffic volume in 2006 for sections 1 and 3, the traffic volume for these sections is unknown.

Note 2: PCU/day is indicated for reference. The following PCU conversion coefficients were used: 2-wheeler=0.5, car=1.0, truck/lorry=3.0 and bus=3.0 (Indian Road Congress standards)

Source: The estimated traffic is based on JBIC appraisal data. The actual traffic is based on the results of traffic surveys conducted in March 2002 and June 2006 by the National Highways Authority of India (NHAI)

The traffic volume by section in 2002 is as follows: (i) the actual traffic in Section 1 was 82% of the estimated traffic (13,865 vehicles/day against 16,855 vehicles/day); (ii) the actual traffic in Section 2 was 72% of the estimated traffic (10,301 vehicles/day against 14,238 vehicles/day); and the actual traffic in Section 3 was 70% of the estimated traffic (14,369 vehicles/day against 20,399 vehicles/day). Since 2002 the traffic volume has increased constantly. In 2006, the actual traffic in Section 2 was 18,688 vehicles/day against 19,970 vehicles/day, which is 94% of the estimated traffic. However, the figures for motorcycles and trucks/lorries at 55% and 81%, respectively, were lower than the estimation. However, the number of cars and buses increased to more than the estimation as their figures in 2006 were 165% and 148%, respectively. But the overall traffic volume in 2006 was nearly that of the target volume. Just for reference, it is noted that in the comparison of traffic volume in terms of PCU/day, the actual traffic in 2006 was 93% of the estimated traffic, so the traffic in terms of PCU/day was also nearly that of the target volume.

2.3.2. Time saving

The traveling time between Mathura and Agra has been decreased from 80–90 minutes before the project to 45 minutes after the project (see Table 2). The time saving effect is thus confirmed.

Table 2: Time Saving (minutes)

Section	Before the project (two-lane)	After the project (four-lane)
Mathura-Agra (51.3 km)	80–90 min.	45 min.

Source. National Highways Authority of India

2.3.3. Increase in average velocity

The average velocity between Mathura and Agra improved from 35 km/h before the project to 55 km/h (average all car) after the project, which is 1.6 times faster than before. In particular, the average velocity of normal cars increased to 80 km/hr, or more than two times faster than before (see Table 3). The increase in average velocity is thus acknowledged.

Table 3: Increase in Average Velocity

Section	Before the project (two-lane)	After the project (four-lane)
Mathura-Agra (51.3 km)	35 km/h	55 km/h (average all car) 80 km/h (normal car) 60 km/h (bus, truck/lorry)

Source: National Highways Authority of India

2.3.4. Congestion length decrease and time saving

The traffic congestion between Mathura and Agra that extended 22 km and lasted 90 minutes before the project was reduced to 11 km and 40–55 minutes, respectively. However, in the streets of Agra and Mathura, at peak rush hours, one can see congestions extending 10 km and 1 km, respectively (see Table 4). Thus there is a positive impact on the alleviation of traffic congestion.

Table 4: Congestion Length Decrease and Time saving

Section	Before		After (four-lane)	
	Length (km)	Time (min.)	Length (km)	Time (min.)
Mathura-Agra (51.3 km)	22 km	90	10 km (Agra) 1 km (Mathura)	40–45 (normal car) 50–55 (heavy car)

Source: National Highways Authority of India

2.3.5 Number and frequency of traffic accidents

A glance at the average number of accidents per month since 2003 in the section of NH-2 between Mathura and Agra shows an upward trend with the average of 4.6 accidents per month in 2003 increasing to 8.5 in 2004 and to 10.75 in 2005 (see Table 5). The main reasons for the increase in the number of accidents are speeding and lack of respect for traffic rules on the part of drivers. Also, the increase in traffic volume is naturally related to the increase in the number and frequency of accidents.

Table 5: Number and Frequency of Traffic Accidents

	2003	2004	2005
No. of accidents (per month)	55 (4.6)	102 (8.5)	43 (10.75)

Note: January-April 2005
Source: National Highways Authority of India

2.3.6 Economic internal rate of return (EIRR)

The economic internal rate of return (EIRR) at the time of project appraisal was 22.9%. EIRR was calculated by counting building costs, consulting service fees, and maintenance costs as expenses and the effects of cutting travel expenses as benefits, as well as by regarding the duration of 15 years after the project completion as the life of the project. In the

post-evaluation, the result of the recalculation of the EIRR of the project under the same conditions as at the time of project appraisal was 31.7%. The main reason the result of the recalculation of EIRR was higher than the original projection is that the actual project cost was lower than that of the original. In addition, delays in the construction extended the period for recalculating the EIRR and thereby reduced the ratio of the cost of initial infusion, which in turn lowered the cost of the project. As a result, the internal rate of return increased.

2.4. Impact

2.4.1. Impact on the alleviation of traffic congestion

It is recognized that the project has a positive impact on the alleviation of traffic congestion. Due to the upgrading of road width in the section targeted in the project from two lanes to four lanes, the congestion length was halved and the traveling time was reduced from 80–90 minutes to 45 minutes. However, the traffic congestions in Agra city and Mathura city have not been completely alleviated. This is evidenced by the fact that at rush hours congestion extends to lengths of 10 km and 1 km, respectively.

This is partly because of increase in the number of registered vehicles as a result of the recent growth of Agra and Mathura and the sharp increase in the number of vehicles going into and passing through Agra and Mathura, causing the traffic volume on NH-2 near Agra city and Mathura city to exceed its capacity. This is believed to be the reason why traffic is congested. During the 13-year period from FY1993/94 to FY2005/06, the number of registered vehicles more than doubled in Agra and Mathura. In Agra, it increased from 190,000 to 480,000; in Mathura, from 63,000 to 150,000 (see Table 6).

Table 6: Number of Registered Vehicles

(unit: vehicles)

	1993/94	1997/98	2001/02	2005/06
Agra	190,209	227,083	309,018	479,635
Mathura	63,786	57,142	78,151	149,939

Source: UP State Government

2.4.2. Impact on the decrease in traffic accidents

As far as traffic data available for the period between 2003 and 2005 are concerned, not much progress has been made in reducing the number of traffic accidents. Instead, it has been on the increase. According to the National Highways Authority of India (NHAI), installation of center dividers and lay-bys may have helped reduce accidents that used to occur frequently including minor collisions with oncoming traffic or those involving cars traveling on the wrong way on one-way streets. That may be so, but the impact of the project in decreasing traffic accidents has not been as noticeable as was expected. The results of a survey of beneficiaries that will be discussed later also show that the increase in traffic accidents was most often cited as a direct negative impact of the project.

At the time of project appraisal, many traffic accidents were caused by drivers being forced to recklessly overtake other cars because of the traffic congestion. But now, because the road is no longer congested, accidents are caused by drivers driving over the speed limit or by the fact that they can more easily take over other cars. The present increase in the number of accidents is believed to be caused by issues related to (1) road design and road structure; and (2) road users' attitude toward traffic safety and their driving manners. Road design and structural issues refer to the fact that (i) the road is not a highway designed exclusively for use by motor vehicles; instead, all types of vehicles including bicycles, rickshaws, farm tractors, and even animal drawn carriages are mixed in the traffic side by side with high motor vehicles (lay-bys exclusively for local residents and low speed vehicles are installed only in some sections); (ii) there are no crossing facilities such as flyovers or underpasses for local residents and animals; and (iii) there are only a few intersections with traffic signals. The issues related to road users' attitudes toward traffic safety and their driving manners are (i) drivers' ignorance of traffic rules and regulations; (ii) unlawful occupation of road shoulders and vehicular roads by local residents, shopkeeprs, etc; (iii) on-the-street parking of large trucks, buses and the like; and (iv) reckless road crossing by local residents and free entry of cattle into the road.

Mixture of high and low speed vehicles

Unlawful occupancy of the road and road shoulder

Free entry of cattle into the road

2.4.3. Impact on development of the regional economy

The number of tourists visiting Mathura and Agra increased significantly after the project. For instance, during the 11 years from FY1993/94–FY2003/04, the number of tourists to Agra increased 2.4 times, from 1.142 million to 2.685 million (average annual growth of 8.1%), while the number of tourists to Mathura increased 3.7 times, from 1.668 million to 6.176 million (an average increase of 12.6%) (see Table 7). Agra, home to the world famous historic landmark, Taj Mahal, is a popular tourist site in India that attracts many tourists from home and abroad. Mathura, revered as the birthplace of Krishna, is a Hindu pilgrimage site that attracts even

Table 7: Number of Tourists

(unit: 1000)

	1993/94	1998/99	2000/01	2003/04	Growth rate
Agra	1,142	2,268	2,371	2,685	8.1%
Mathura	1,668	5,651	5,899	6,176	12.6%

Note: Growth rate is the average for 1993/94～2003/04
Source: UP Government Tourist Bureau

more tourists than Agra. Those who visit Mathura are mostly pilgrims from other parts of India.

In tandem with the growing number of visitors to Agra and Mathura, during the 6 years from FY1998/99–FY2003/04, the number of lodging facilities increased 1.9 times (average annual growth of 11.3%) in Agra and 7.2 times (average annual growth of 38.9%) in Mathura (see Table 8). In the hearings for the Agra Chamber of Commerce and Industry and UP Government Tourist Bureau, it was recognized that the project had a significant impact on the development of local tourism.

Table 8: No. of Beds in Lodging Facilities

(unit: beds)

	1993/94	1998/99	2000/01	2003/04	Ave. growth
Agra	n.a.	5,195	n.a.	9,881	11.3%
Mathura	n.a.	795	n.a.	5,711	38.9%

Note: Growth rate covers the 6 years between 1998/99 and 2003/04.
Source: UP Government Tourist Bureau

These days the traditional shoe industry in Agra, centered mostly on medium- and small-sized companies, has developed as an export-oriented industry producing high value and quality products by taking advantage of government industrial promotion incentives,[4] and new factories are being built along the Mathura-Agra road. While the number of registered factories in all industries stagnated for a while, it increased steadily from 502 to 521 during the 5-year period from FY2000/01–FY2004/05 (see Table 9). Most of the shoes produced in Agra are exported via Delhi, and according to a hearing to the Agra Chamber of Commerce and Industry, the reduced transit time between Delhi and Agra has indirectly contributed to the development of the shoe industry.

Table 9: No. of Registered Factories

(unit: factories)

	1993/94	1998/99	2000/01	2003/04	2004/05
Agra	n.a.	472	502	398	521
Mathura	n.a.	196	211	178	184

Source: UP State Government

Table 10: NSDP and Per Capita NSDP

	1993/94	1998/99	2000/01	2003/04	Growth rate
NSDP(1 million Rupee)					
Agra	197.4	287.0	244.7	296.6	4.2%
Mathura	134.2	130.5	149.4	183.1	3.2%
Per Capita NSDP(Rupee)					
Agra	6.691	8,489	6,856	7,698	1.4%
Mathura	7,682	7,669	7,287	8,387	0.9%

Note: The above is the constant price with 1993/94 as benchmark years. The growth rate covers the 11 years from 1993/94–2003/04.
Source: UP State Government

After the project, noticeable progress was made in the development of the area along the Mathura-Agra section of NH-2 as evidenced by the launch of a number of projects including a housing development plan, a college and a vocational school, a private general hospital, a gas

[4] For example, preferential treatment including partial tariff refunding, low-interest bank loans, exemption from paying sales tax on the sale of raw materials and finished goods, and exemption from the payment of corporate tax for 5 years for companies setting up in undeveloped areas.

station[5], a shopping mall, and a restaurant.

In light of the foregoing, it is acknowledged that the project had a positive impact on the development of local industries such as tourism and indigenous industries such as the shoe industry. It also had positive impact on the living conditions of residents along the Mathura-Agra section as evidenced by the launch of a housing development plan, educational institutes, medical facilities, and private commercial services.

2.4.4. Impact on job creation

In Agra, directly or indirectly, 300,000 people are engaged in the tourism industry and another 300,000 are engaged in the shoe industry, and the assumption is that the project had a positive impact on job creation in these industries.

2.4.5. Impact on the environment

The environment in the Mathura-Agra section of NH-2 was last monitored in 2001, so there is no scientific data on atmospheric contamination, vibration, noise and other forms of pollution. According to the executing agency, there has not been any serious negative impact on the environment so far.

In the original project plan, it was determined that 16,000 trees (11,500 in Mathura and 4,500 in Agra) would have to be replanted over a 34-ha area of land (25 ha in Mathura and 9 ha in Agra) to make up for trees that would have to be cut down to implement the project for widening the Mathura-Agra section of NH-2. In reality, however, the scale of afforestation was about 3 times the original plan: 48,837 trees (32,437 in Mathura and 16,400 in Agra) were replanted over a 34.2-ha area.

2.4.6. Impact on site acquisition and relocation of inhabitants

Regarding site acquisition, in reality, 23.3 ha of land was acquired (the area of public land acquired is unknown) as opposed to the 34.2 ha that was deemed necessary at the time of project appraisal. Squatters who had set up stalls unlawfully on the planned construction site were evicted, but local inhabitants were not relocated. Site acquisition, eviction of unlawful occupants, and the like were carried out pursuant to India's Site acquisition Act.

2.4.7. Results of a beneficiary survey

A beneficiary survey was conducted to determine what kind of impact the project would have

[5] As of November 2006, the National Highways Authority has confirmed that since April 2000, gas stations have been built in five locations in the Agra-Muthara section of NH-2, and three more are currently under construction.

on the livelihood and environment of people living in the target area of the project. 70 general households, 50 commercial carriers, and 30 traders in the Mathura-Agra section of HW-2 were surveyed.[6]

(1) Change in means of transport

Before the project, the means of transport most often used by local residents were motorcycles (29%), buses (24%), bicycles (21%), and own vehicles (17%). After the project, the means of transport shifted to motorcycles (41%), own vehicles (36%), and bicycles (6%). Meanwhile, the means of transport most often used before the project by traders were buses (33%), motorcycles (33%), bicycles (17%), and own vehicles (7%). After the project, the means of transport project shifted to motorcycles (53%), buses (17%), own vehicles (10%), and taxis (10%). After the project, the use of privately owned means of transport like motorcycles and own vehicles increased for both local residents and for traders (see Table 11).

Table 11: Change of Means of Transport

＜General households＞ (%)

	Before project	After project
Private car	17	36
Motorcycle	29	41
Bicycle	21	6
Bust	24	0
Taxi	3	3
Auto rickshaw	1	2
Rickshaw	0	2
Others	5	10

＜Small businesses and shops＞

	Before project	After project
Private car	7	10
Motorcycle	33	53
Bicycle	17	7
Bust	33	17
Taxi	3	10
Auto rickshaw	3	0
Other	4	3

(2) Improvement of public/private service accessibility

94 percent of local residents responded that access to public and private services improved after the project. Of the various services, access to public transport services and access to health and medical services were perceived to have improved most noticeably. 87% of consumer carriers responded that the frequency of transport services increased after the project, and 53% said that passenger and cargo volume both increased after the project. It is assumed that the increase in frequency of transport services by commercial carriers, who are the main public transport service providers, led to improved public/private service accessibility. This improvement resulted in increased passenger and cargo transport volume.

(3) Improvement of traffic convenience

97 percent of local residents responded that convenience of traffic improved after the project.

[6] The beneficiary survey was conducted on a sample of 150 subjects (70 local residents, 50 commercial carriers, and 30 traders) randomly selected (by randomly selecting a number of settlements in the Mathura-Agra section of NH-2 and also randomly selecting survey samples in each of the selected settlements). The 150 subjects were interviewed using a prepared multiple-answer questionnaire. The sample was drawn from Agra's population of 5.86 million (2001 census).

The alleviation of traffic congestion, reduction of travel expense, and time saving were perceived to have improved most noticeably after the project (in the order of importance).

(4) Impact on socio-economic environment

100 percent of local residents and 90% of traders regarded the overall impact the project has had on the socio-economic environment as positive (see Table 12). Forms of favorable impact keenly perceived by both local residents and traders were (i) increase in the creation of new business, (ii) increase in land development and housing development projects, (iii) improvement in access to educational, health/medical and commercial services, (iv) increase in employment opportunities, (v) increase in business opportunities, (vi) rise in land prices, and (vii) increase in population (see Table 13). In addition, a comparison of increases in income before and after the project reveals that local residents enjoyed on average a 30% increase; commercial carriers, 17%; and traders, 25%. In particular, the increase in income of commercial carriers may be directly attributed to the reduction of travel expenses and the reduction of administrative and maintenance expenses.

Table 12: Awareness of the Impact on Improvement of Socio-economic Environment

(%)

	Local residents	Traders
Greatly improved	100	10
Somewhat improved	0	80
Very little improved	0	7
Not improved at all	0	3

Table 13: Awareness of Change in Socio-economic Factors

(%)

	Local Residents			Traders		
	Increase	Decrease	Unchanged	Increase	Decrease	Unchanged
New business creation	96	4	0	86	4	10
Land/housing development	100	0	0	90	0	10
Improvement of accessibility to educational/health-medial/ commercial services, etc.	100	0	0	82	18	0
Employment opportunity	100	0	0	85	0	15
Business opportunity	100	0	0	93	4	4
Land price	94	6	0	100	0	0
Population	94	3	3	100	0	0

(5) Environmental impact

Most respondents perceived that 4 aspects of environmental pollution – air, noise, vibration and garbage – have deteriorated (air 86%, noise 88%, vibration 80%, and garbage 70%)(Table 14). The increase in traffic volume is cited as the main cause for deterioration of the environment. Accompanying the increase in traffic volume is a tendency for the four aspects of pollution to increase in the area along the Mathura-Agra section of NW-2.

Table 14: Awareness of Changes in the Environment (overall)

(%)

	Increase	Decrease	Unchanged
Air pollution	86	12	2
Noise	88	7	5
Vibration	80	5	15
Garbage	70	21	9

(6) Satisfaction with the project and challenges

Table 15: Satisfaction with the Project

(%)

	Local Residents	Commercial Carriers	Traders	Overall
Very satisfied	0	6	7	3
Satisfied	97	90	73	90
Not very satisfied	3	4	13	5
Not satisfied at all	0	0	7	2

93% of overall respondents expressed satisfaction with the project (97% of local residents, 96% of commercial carriers, and 80% of traders) (see Table 15). When asked to name negative impact directly related to the project, 79% of local residents cited increase in traffic accidents, a view echoed by 51% of commercial carriers, and 31% also cited increase in speed. Increase in traffic accidents was cited by 33% of traders while high toll was cited by 28%. For commercial carriers the factors most responsible for the increase in traffic accidents were speeding, followed by increase in traffic volume. Many commercial carriers proposed promoting safety education as a measure to prevent traffic accidents.

2.5. Sustainability

2.5.1. Executing agency

The National Highways Authority of India (NHAI) is the agency that operates and maintains the facilities provided under this project. The Ministry of Surface Transport (today the Ministry of Shipping, Road Transport and Highways) and the Public Works Department of the state of Uttar Pradesh implemented the project from the planning stage to the implementation stage of the project). After the project completion, the National Highways Authority of India took over the operation and maintenance of the project facilities. The National Highways Authority of India was established pursuant to the law concerned (1988) as an agency in charge of executing the construction and O&M of national highways. NHAI commenced its activities in February 1995. At present, there are 65,600 km of national highways in India, of which 41% (27,110 km) is under NHAI management.[7]

2.5.1.1. Technical capacity

Technical capacity of NHAI is acceptable since NHAI has a wide range of experience in the construction and O&M of the national highways of India.

Mahuban Tollgate
(Mahuban Tall Plaza)

2.5.1.2. Operation and maintenance system

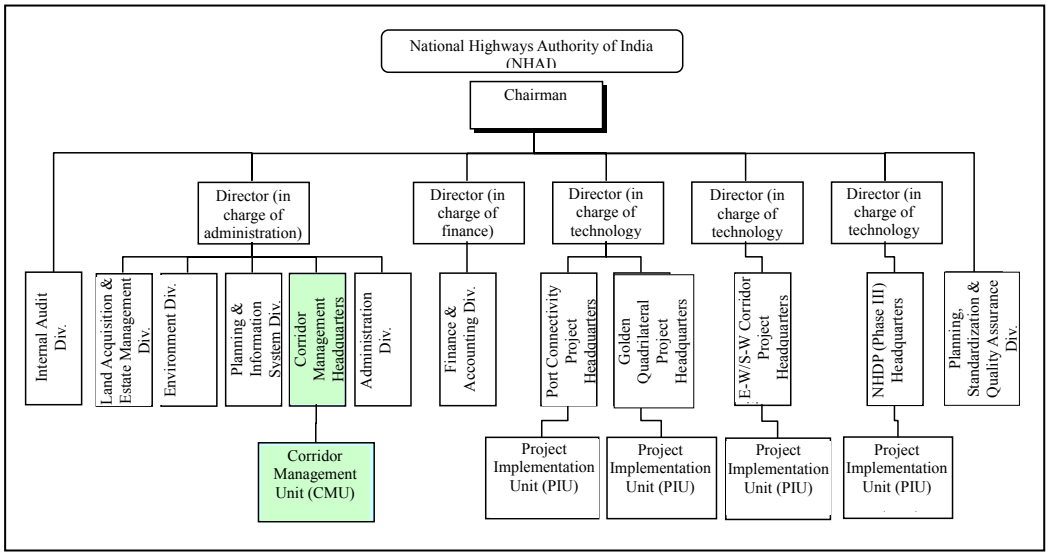
The Corridor Management Unit (CMU) is the unit responsible for O&M of the project. The Mathura CMU,[8] which is under the direction of CMU in the

[7] As of end of October 2006.

[8] Corridor Management Units)(CMUs) are established at certain intervals across the country by mainly targeting

NHIA headquarters, executes the O&M of the project. The actual execution of O&M activities in the field, including the management of a tollgate, is subcontracted to private O&M contractors as well as supervisory consultants commissioned by NHAI, and Mathura CMU manages and supervises the O&A services that they execute.[9] The tripartite O&M system comprising CMUs, management consultants, and supervisory consultants" was introduced in Mathura CMU in NHAI with a pioneering spirit. An organizational chart of NHAI is shown in Figure 3.

Fig. 3: Organizational Chart of NHAI



Source: NHAI

2.5.1.3. Financial status

O&M expenditure for facilities built under the project will basically be covered by toll revenue. Although a tollgate is set up in the Mathura-Agra section of NH-2, the revenue from the tollgate is pooled at NHAI and the state treasury together with the revenue collected at other tollgates across the country, after which it is allocated in the budget as O&M expenditure of national highways under NHAI supervision. According to NHAI toll revenue from all of its highways exceeds its O&M expenditure (see Table 16). Thus, it is believed that there are no significant issues related to sustainability on the financial front.

Table 16: Revenue from All NHAI Tolls and O&M Expenditure

(1 million rupees)

	2002/03	2003/04	2004/05	2005/06
Toll Revenue	3,130	3,594	4,605	7,980
O&M Expenditure	2,005	2,752	2,786	2,448

Source: NHAI

national highways that are the targets of the Golden Quadrilateral (GQ) and the E-W/S-N corridors. In sections where a CMU has not been set up, the Project Implementation Unit (PIU) of each section will double as a CMU.

[9] O&M of the Mathura-Agra section of NH-2 was started in August 2002, when the O&M contractors were commissioned by NHAI. However, in June 2004, management consultants were commissioned. As a result, a tripartite O&M system was established comprising CMUs, management consultants, and O&M contractors.

2.5.2. Operation and maintenance status

O&M of project facilities are kept in good repair by implementing measures for daily maintenance, traffic accident management, and preventive maintenance in accordance with the O&M manual issued by the National Highways Authority of India. Daily maintenance measures include (i) managing the planting of trees along the roadside and along the center divider, (ii) cleaning the vehicular road, (iii) repairing pot holes, (iv) periodically inspecting the traffic signals, and (v) cleaning the draining facilities on bridges and along the roadside. Traffic accident management measures include conducting daily patrols, mobilizing ambulances when accidents occur, and towing vehicles damaged in accidents. Preventive maintenance measures include overlaying pavements and replacing road traffic signs that have been stolen or damaged.

According to the National Highways Authority of India, a problem developed when the road in the section targeted in the project temporarily could not be operated and maintained as stipulated in the contract because of financial difficulties faced by the contractor in charge of the section concerned. Subsequently, NHAI hired a new contractor and has been conducting O&M operations under a new regime since January 2006.

The section of NH-2 targeted under the project has a lot of traffic and is part of a tourist route in northern India known as the Golden Triangle that links Delhi, Agra and Jaipur. Hence special effort is made to implement effective traffic safety measures. For example, in the Mathura district CMU conducts traffic safety education campaigns in which a team is dispatched once every three months to hotels, restaurants and other places along the road where drivers gather and rest to educate and awaken the public on the importance of traffic safety. There the team distributes traffic safety pamphlets and gives lectures on traffic safety to the drivers and local residents.[10] At the present, there are no problems on the O&M front.

[10] Generally, each dispatched team carries out traffic safety activities for 5–10 days. Each campaign attracts more than 400 drivers and local residents in total.

3. Feedback

3.1. Lessons Learned

It is conceivable that the lack of crossing facilities such as an underpass for local residents and cattle is one of the factors responsible for traffic accidents. Considering the safety of residents living along the roadside, the project should have provided such crossing facilities at least in heavily populated areas near the road.

3.2. Recommendation to NHAI

According to NHAI, in the next phase of the project, the four-lane road will be upgraded to a six-lane road. The upgrade will involve the implementation of road safety measures such as providing a separate service road for low speed vehicles, an underpass for pedestrians, and a parking zone for heavy vehicles. However, even before providing such transport safety measures, NHAI should take steps to tackle the following issues:

(a) Promotion of traffic safety education and traffic safety awareness campaign for all road users including drivers and local residents.

(b) Especially in and near urban areas, many cases are observed in which squatters unlawfully occupy the road by setting up stalls, and drivers do the same by parking their trucks and buses. These stalls and heavy vehicles obstruct the flow of traffic and cause traffic accidents. NHAI should take strong action to solve these problems in cooperation with the local organizations concerned such as the local administrative authority and the local police.

Comparison of Original and Actual Scope

Item	Plan	Actual
(a) Outputs		
(1) Widen and upgrade the existing two-lane to four-lane road	- Section: 51.33 km between Mathura and Agra - Bridge construction: 3 locations - Set up tollgate: 1 location - Construct drainage facilities - Pave the road with asphalt and concrete	As planned
(2) Convert intersections in Agra to overhead crossings	- Build elevated bridge: 1 location	As planned
(3) Consulting Services ・Review of detail design ・Overseas training ・Execution management	- International consultant: 13M/M International consultant: 174M/M	- International consultant: As planned - International consultant: 107M/M
(4) Additional Project Scope		- Build 700-m service road - Undertake foundation protection work in some parts of the section and overlay pavements
(b) Project Period		
From signing of L/A to the end of consulting services and construction works	January 1992	January 1992
Site acquisition	April 1991–March 1992(12 months)	Unknown–October1997
Consultant A((detail design review and overseas training)) selection	Oct.1991–March 1992 (6 months)	March 1992–June 1993 (16 months)
Consultant B(execution management) selection	April 1992–Sep.1993 (18 months.)	Dec.1995–Jan.1996 (2 months)
Consulting services (Consultants A/B)	April 1992–June 1996 (51 months)	Unknown–April 2000
Contractor selection	Oct. 1991–Dec.1992 (15 months)	Nov.1994–Dec.1995 (14 months)
Civil engineering work	Jan.1993–June 1996 (42 months)	Dec.1995–April 2000 (53 months)
Project completion	June 1996	April 2000
(c) Project Cost		
Foreign Currency	1,337 mil. yen	293 mil. yen
Local Currency	4,754 mil. yen (882 mil. rupees)	4,563 mil. yen (1,400 mil. rupees)
Total	6,089 mil. yen	4,856 mil. yen
ODA Loan Portion	4,855 mil. yen	3,958mil.yen
Exchange Rate	1 rupee＝5.39 yen (as of July 1991)	1rupee＝3.26yen (1992–2000 average)