ADB

Completion Report

Project Number: 34097
Loan Number: 1967
August 2008

People's Republic of China: Shanxi Road Development II Project

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

		At Appraisal (14 November 2002)	At Project Completion (as of 6 March 2008)
CNY1.00	=	$0.1208	$0.14047
$1.00	=	CNY8.277	CNY7.119

ABBREVIATIONS

AADT	–	average annual daily traffic
ADB	–	Asian Development Bank
CSE	–	chief supervision engineer
CSEO	–	chief supervision engineer office
DCSE	–	deputy chief supervision engineer
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
GDP	–	gross domestic product
HDM-4	–	highway design and maintenance standards model, version 4
ICB	–	international competitive bidding
IDC	–	interest and other charges during construction
IEE	–	initial environmental examination
IRI	–	international roughness index
MOC	–	Ministry of Communications
NCB	–	national competitive bidding
NTHS	–	national trunk highway system
O&M	–	operation and maintenance
PCR	–	project completion review
PPMS	–	project performance management system
PRC	–	People's Republic of China
PRIS	–	poverty reduction impact study
PRMP	–	poverty reduction monitoring program
REO	–	resident engineer office
RP	–	resettlement plan
SCD	–	Shanxi Communications Department
SCF	–	standard conversion factor
SEIA	–	summary environmental impact assessment
SEPA	–	State Environment Protection Administration
SFB	–	Shanxi Finance Bureau
SHEC	–	Shanxi Hou-yu Expressway Construction Company Limited
SKCC	–	Shaanxi Kexin Consultant Company
SPG	–	Shanxi provincial government
VOC	–	vehicle operating cost
YWNR	–	Yuncheng Wetlands Nature Reserve

WEIGHTS AND MEASURES

mu	–	A traditional land area measurement, it is equivalent to 666.66 square meters, or 0.1647 acres, or 0.066 of a hectare.
m/km	–	meters per kilometer
mg/m^3	–	milligram per meter cube
p.a.	–	per annum
ton/km	–	ton per kilometer

NOTES

(i) The fiscal year (FY) of the Government ends on 31 December.
(ii) In this report, "$" refers to US dollars.

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CONTENTS

BASIC DATA

A. Loan Identification

1.	Country	People's Republic of China
2.	Loan Number	1967-PRC
3.	Project Title	Shanxi Road Development II Project
4.	Borrower	People's Republic of China
5.	Executing Agency	Shanxi Provincial Communications Department
6.	Amount of Loan	$124.0 million
7.	Project Completion Report Number	PCR: PRC 1033

B. Loan Data

1.	Appraisal	
	– Date Started	15 August 2002
	– Date Completed	23 August 2002
2.	Loan Negotiations	
	– Date Started	5 November 2002
	– Date Completed	07 November 2002
3.	Date of Board Approval	12 December 2002
4.	Date of Loan Agreement	11 December 2003
5.	Date of Loan Effectiveness	
	– In Loan Agreement	11 March 2004
	– Actual	01 April 2004
	– Number of Extensions	1
6.	Closing Date	
	– In Loan Agreement	31 July 2007
	– Actual	06 March 2008
	– Number of Extensions	1
7.	Terms of Loan	London interbank offered rate-based variable
	– Interest Rate	Lending rate for US dollars
	– Maturity (number of years)	24
	– Grace Period (number of years)	4
8.	Terms of Relending	London interbank offered rate-based variable
	– Interest Rate	Lending rate for US dollars
	– Maturity (number of years)	24
	– Grace Period (number of years)	4
	– Second Step Borrower	Shanxi Hou-yu Expressway Construction Company Limited.

9. Disbursements

a. Dates

Initial Disbursement	Final Disbursement	Time Interval
01 April 2004	6 March 2008	47 months

Effective Date	Original Closing Date	Time Interval
01 April 2004	31 July 2007	40 months

b. Amount ($)

Category or Subloan[a]	Original Allocation	Last Revised Allocation	Net Amount Available	Amount Disbursed[b]	Undisbursed Balance
01A	91,900,000	108,819,375	108,819,375	108,865,007	0
01B	2,000,000	2,000,000	2,000,000	2,043,715	0
02	5,400,000	3,145,590	3,145,590	3,154,960	0
03	1,500,000	1,300,000	1,300,000	1,151,283	0
04	1,240,000	1,240,000	1,240,000	1,240,000	0
05	14,800,000	7,545,035	7,545,035	7,545,035	0
06	7,160,000	0	0	0	0
Total	**124,000,000**	**124,000,000**	**124,000,000**	**124,000,000**	**0**

[a] 01A=Civil Works Expressway, 01B=Civil Works Local Roads, 02=Equipment, 03=Consulting Services, 04=Front-end Fee, 05=Interest and other charges during construction, 06=Unallocated.
[b] Full amount of loan was utilized at final disbursement.

10. Local Costs (ADB-Financed)

	Appraisal	Actual
- Amount ($ million)	0	0
- Percent of Local Cost	0	0
- Percent of Total Cost	0	0

C. Project Data

1. Project Cost ($ million)

Cost	Appraisal Estimates	Actual
Foreign Exchange Cost	155.90	147.40
Local Currency Cost	170.90	139.60
Total	**326.80**	**287.00**

2. Financing Plan ($ million)

Cost	Appraisal Estimate	Actual
Implementation Costs		
Borrower Financed	196.80	154.05
ADB Financed	108.00	115.22
Subtotal	304.80	269.27
IDC Costs and Front-End Fee		
Borrower Financed	6.00	8.94
ADB Financed	16.00	8.79
Subtotal	22.00	17.73
Total	**326.80**	**287.00**

ADB = Asian Development Bank, IDC = interest and other charges during construction.

3. Cost Breakdown by Project Component ($ million)

Component	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
A. Base Cost						
1. Expressway Civil Works	111.70	79.90	191.60	128.66	79.88	208.54
1a. Buildings and Ancillary Features	3.10	3.40	6.50	3.59	3.94	7.53
2. Equipment	5.40	0.10	5.50	3.15	0.06	3.21
3. Land Acquisition and Resettlement	0.00	31.20	31.20	0.00	21.27	21.27
4. Consulting Services and Training	1.50	17.30	18.80	1.15	18.25	19.40
5. Local Road Program	2.00	9.30	11.30	2.05	7.27	9.32
Subtotal (A)	**123.70**	**141.20**	**264.90**	**138.60**	**130.67**	**269.27**
B. Contingencies						
1. Physical	8.70	10.00	18.70	-	-	-
2. Price	7.50	13.70	21.20	-	-	-
Subtotal (B)	**16.20**	**23.70**	**39.90**	-	-	-
C. Front End Fee	**1.20**	**0.00**	**1.20**	1.24	0.00	1.24
D. Financing Charge during Construction	**14.80**	**6.00**	**20.80**	**7.55**	**8.94**	**16.49**
Total	**155.90**	**170.90**	**326.80**	**147.39**	**139.61**	**287.00**

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants	August 2003	28 September 2004
Completion of Detailed Engineering Designs	March 2003	May 2004
Civil Works Contracts (Expressway)		
Date of Awards	October 2003	27 April 2004
Completion of Works	January 2007	December 2006
Civil Works Contracts (Buildings and Ancillary)		
Date of Awards	February 2005	8 September 2005
Completion of Works	November 2006	May 2007
Civil Works Contracts (Local Roads)		
Date of Awards	September 2003	April 2003
Completion of Works	January 2007	December 2006
Equipment Supplies		
First Procurement	December 2004	5 July 2006
Last Procurement		
Completion of Equipment Installation	November 2006	28 December 2006
Start of Expressway Operation		
Completion of Tests and Commissioning	January 2007	December 2006
Beginning of Start-up	February 2007	December 2006

Other Milestones:

1. 27 March 2006: Reallocation of loan proceeds.
2. 12 July 2007: Approval of extension of loan closing to 31 January 2008 and reallocation of loan proceeds.
3. 25 January 2008: Approval of change of ADB financing from 48% to 54% for expressway civil works.
4. 06 March 2008: Closing of loan accounts.

5. Project Performance Report Ratings

Implementation Period	Ratings	
	Development Objectives	Implementation Progress
From December 2002 to May 2003	Satisfactory	Satisfactory
From June 2003 to March 2004	Satisfactory	Unsatisfactory[a]
From April 2004 to September 2005	Satisfactory	Satisfactory
October 2005	Satisfactory	Partly Satisfactory[b]
From November 2005 to July 2006	Satisfactory	Highly Satisfactory
From August 2006 to March 2008	Satisfactory	Satisfactory

[a] Delay in loan signing by more than 6 months from loan approval and delay in loan effectiveness by more than 12 months from loan approval.

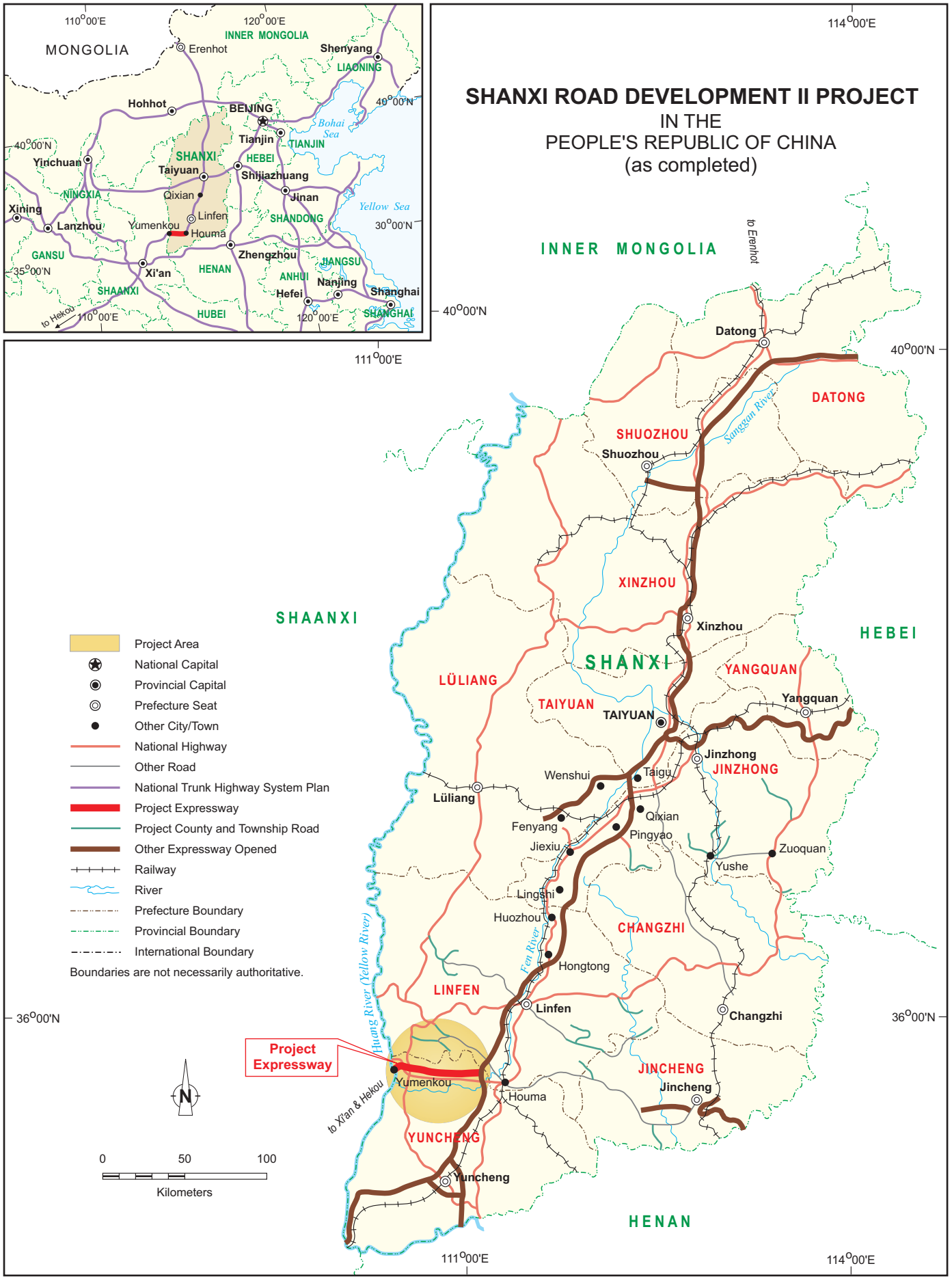
[b] Minor issues found in the 2004 Audit Report, which were later resolved.

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members[a]
Fact-Finding	2–12 April 2002	5	39	a, b, d, e, f
Appraisal	15–23 August 2002	6	54	a, b, c, d, e, f
Inception Mission	18–23 February 2004	5	30	a, f(2), g, h
Environmental Safeguard Review	16–20 December 2004	1	5	e
Review 1	04–09 April 2005	3	18	a, g, h
Midterm Review	05–11 September 2006	4	26	a, d, f, h
Review 2	23–26 April 2007	1	4	a
Project Completion Review[b]	15–23 April 2008	3	29	a, d, h

[a] a = engineer, b = financial specialist, c = counsel, d = economist, e = environment specialist, f = resettlement specialist, g = procurement, h = project analyst.

[b] The project completion report was prepared by Erdene Oyunchimeg, Transport Specialist (Roads)/Mission Leader; and Teresita S. Capati, Associate Project Analyst, assisted by staff consultant (a transport economist).



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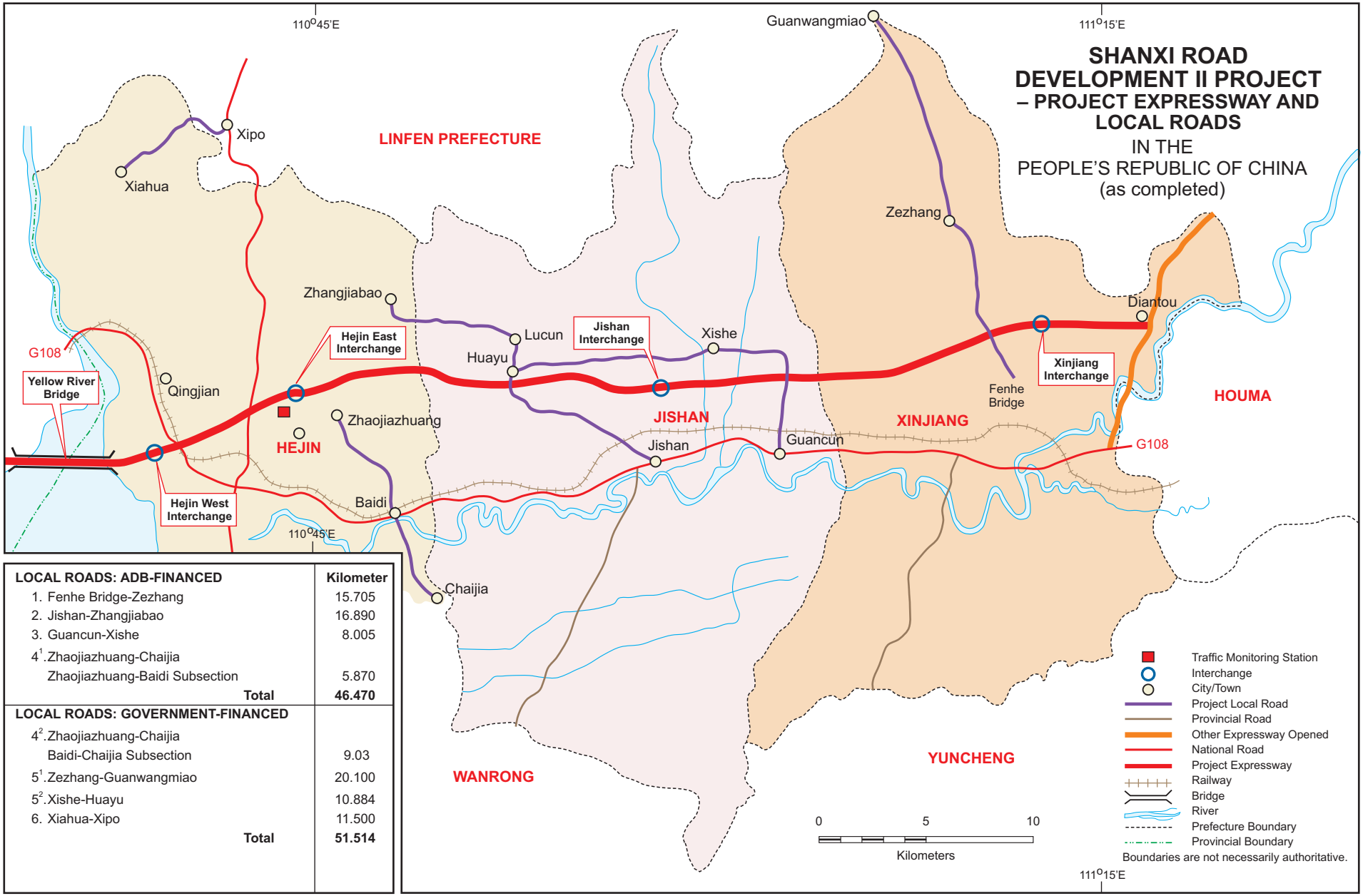
SHANXI ROAD DEVELOPMENT II PROJECT – PROJECT EXPRESSWAY AND LOCAL ROADS IN THE PEOPLE'S REPUBLIC OF CHINA (as completed)



LOCAL ROADS: ADB-FINANCED	Kilometer
1. Fenhe Bridge-Zezhang	15.705
2. Jishan-Zhangjiabao	16.890
3. Guancun-Xishe	8.005
4[1].Zhaojiazhuang-Chaijia Zhaojiazhuang-Baidi Subsection	5.870
Total	**46.470**
LOCAL ROADS: GOVERNMENT-FINANCED	
4[2].Zhaojiazhuang-Chaijia Baidi-Chaijia Subsection	9.03
5[1].Zezhang-Guanwangmiao	20.100
5[2].Xishe-Huayu	10.884
6. Xiahua-Xipo	11.500
Total	**51.514**

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Map 2

I. PROJECT DESCRIPTION

1. The economy of the People's Republic of China (PRC) has averaged annual growth rates of over 9% during the last 10 years and the demand for transport services is growing rapidly. Road development is a key component in the Government's strategy to provide the infrastructure needed to facilitate economic growth and reduce poverty through improved access to markets and services. In 1990, the national trunk highway system (NTHS) was launched. Its goal was to build 35,000 kilometers (km) of high-class highways to eliminate bottlenecks on major road transport corridors.

2. The Shanxi Road Development II Project (the Project) is located in the south of Shanxi province. The Project's goals were:

(i) To construct the 65 km Houma–Yumenkou expressway passing through Xinjiang and Jishan counties and Hejin city, forming an important part of the NTHS corridor between Erenhot in Inner Mongolia Autonomous Region and Hekou in Yunnan province, a total of 3,610 km.
(ii) To reduce congestion on national highway G108.
(iii) To provide an important link to other neighboring provinces, thereby promoting interprovincial trade and fostering new economic activities through the construction of the Yellow River Bridge.
(iv) To enhance the mobility of the residents of poor rural areas by upgrading local roads, thus giving them better access to growth centers for market and livelihood needs, employment opportunities, and better social services.
(v) To improve the efficiency of passenger and freight road operations and reduce transport costs, accidents, and vehicle emissions.
(vi) To promote private sector investments from domestic sources by improving road accessibility.
(vii) To boost investments in Shanxi, which would, in turn, create demand for goods and services provided by the people of remote areas.

The Project was classified as an economic growth project. Poverty reduction was listed as a secondary objective.

3. In the east, the Project is connected with the 176-km Qixian–Linfen Expressway[1] completed in 2003, by the 40-km Linfen–Houma Expressway that was financed by the Government. In the west, it links with the 176-km Yumenkou–Yanliang Expressway.[2] Once finished, the Project completed about 457 km of the Taiyuan–Xi'an corridor, covering the stretch from Qixian in Shanxi to Yanliang in the neighboring province of Shaanxi. The Project comprised the following components:

(i) Construction of a 65 km, four-lane access-controlled toll expressway from Houma to Yumenkou, including the 4,566-meter (m)-long Yellow River Bridge, four interchanges with four toll stations, a toll station on the Yellow River Bridge, 11 large bridges, and one service area.
(ii) Improvement of 70 km of local roads, including the rebuilding of 5 km of local link roads in Xinjiang county and 15 km of local roads in Jishan to meet Class II highway standards, the upgrading of 20 km of village roads in Xinjiang county

[1] ADB. 1999. *Report and Recommendations of the President on a Proposed Loan to the PRC for the Shanxi Roads Development Project*. Manila.
[2] ADB. 2001. *Report and Recommendations of the President on a Proposed Loan to the PRC for the Shaanxi Roads Development Project*. Manila.

and 30 km of local county roads in Hejin to Class III highway standards, and reconstruction of two bridges—of 300 m and 350 m in length—across the Fenhe and Fenxi rivers in Jishan county.

(iii) Procurement of equipment for road maintenance, toll collection, surveillance and communications, load testing, ecological monitoring, soil erosion control, and office administration.

(iv) Land acquisition and resettlement.

(v) Consulting services for construction supervision, environmental monitoring, resettlement monitoring and evaluation, the monitoring of the poverty-reduction impact, safety audit, project performance management system (PPMS), including socioeconomic performance indicators, vehicle emissions monitoring, and in-country and international training for capacity building.

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

4. The Project was designed to facilitate economic growth and reduce poverty through improved access to markets and services. The design included the provision of local roads to help ensure that the benefits of improved transport were readily available to the general public. The Project was in line with ADB's country operational strategy, which supported (i) construction of roads that connect major growth centers and promote linkages with hinterland economies; (ii) integration of the network so that the NTHS is supported by a system of local roads, particularly those that provide access to poor areas; (iii) promotion of road safety; (iv) institutional strengthening to increase the commercial orientation and efficiency of expressway organizations; (v) improvement of highway planning and evaluation techniques; (vi) adoption of appropriate pricing policies to ensure optimum use of road transport capacity; and (vii) use of alternative methods of investment financing, including private sector participation. All the objectives envisaged at appraisal were achieved upon completion. Although there were major and minor changes during implementation (paras. 7 and 15), these did not affect the relevance and design of the Project. The Project was prepared by the Shanxi provincial government (SPG) through the Shanxi Communications Department (SCD).[3] The government's feasibility study was based on experience gained in preparing feasibility studies for other expressways in Shanxi province and used nationally developed analytical tools acceptable to ADB.

B. Project Outputs

5. The Project's major outputs are described below. The project framework is in Appendix 1 and compares outcomes at appraisal with actual achievements.[4]

6. **Houma–Yumenkou Expressway**. The completed length of expressway is 66.84 km. It includes four interchanges, the extra large, double tower, cable-stayed Yellow River Bridge, with a total length of 4,566.00 m, nine large bridges with a combined length of 1,980.48 m, seven medium bridges with a total length of 518.48 m, and one service area at Hejin. The expressway has four lanes, each 3.75 m in width. The expressway and the Yellow River Bridge were constructed in accordance with technical standards for highway engineering issued by the

[3] The feasibility study of the Houma–Yumenkou expressway was prepared in December 1999 by the Second Highway Survey, Design and Research Institute of the Ministry of Communications.

[4] The Project Framework at appraisal has been modified to correspond with the revised Design and Monitoring Framework subsequently adopted by ADB.

Ministry of Communications (MOC) in 1998. Several variation orders were undertaken to enhance the expressway's technical soundness. Construction quality is good and the average pavement roughness, as measured by the international roughness index (IRI),[5] is 2.0 meters per kilometer, which provides for a comfortable ride and efficient vehicle operation. Safety features include crash barriers in the median and along the edge of the expressway, markings, and road signs made from good quality reflective material. Small bushes were planted between the median crash barriers to prevent headlight glare. These traffic safety devices have functioned effectively. No road accidents that could be blamed on the expressway's design or construction have occurred. Appendix 2 provides details of the project engineering features. A traffic monitoring station is located at the Hejin East toll plaza. The PCR Mission noted that the toll station at Hejin West was not operating because of dispute between a coal refining plant and the township government over the building of a bridge over the expressway. This dispute is expected to be resolved in October 2008, which would allow the toll station at Hejin West to be opened.

7. **Local Roads**. At appraisal, six local roads were designated for improvement. Improvements on three of these were implemented through other sources of financing and three other local road sections[6] were substituted. This was classified as a minor change in the project scope and increased the total length from 70.00 km to 97.98 km. Of these local roads, only four were financed by the ADB loan, although ADB financing remained unchanged at $2.0 million.[7] They totaled 46.47 km in length. All of the local roads were upgraded to either Class I, II or III standards, were well equipped with road safety signs and signals, and have been adequately maintained. The single lane section of the Zhaojiazhuang–Baidi road crossing railway underbridge has become damaged due to the large volume trucks that were traveling on two lanes on both sides of the railway underbridge. SCD has confirmed that it will add one lane to increase road capacity in 2009. The local roads component is further described in Appendix 3.

8. **Capacity Development.** Shanxi Hou-yu Expressway Construction Company Limited (SHEC) was established in October 2001. SHEC, headed by a chairman, has six[8] departments and was responsible for coordinating and monitoring all activities for the Project's expressway component. It is now in charge of operation and maintenance. SHEC needed to raise the level of its expertise for the construction phase. Training and workshops, in-house and overseas, were conducted successfully. Due to appreciation of the euro against the US dollar, training costs increased and the Project could accommodate only 36 person-months of international training within its budget, compared with the 45 person-months envisaged at appraisal. Six international training courses on project management, construction supervision, corporate management of expressways, road safety, traffic engineering, environmental protection and

[5] IRI is measured in meters per kilometer. The measurement of 2.0 is an estimate of the Project Completion Review Mission. As indicated by the MOC's 2004 manual on quality inspection and evaluation standards for highway engineering, the PRC employs a different roughness measurement method. IRI has been used here because it is an international norm for comparison of road roughness.

[6] The roads originally designated for the Project were: (i) Zezhang–Guanwangmiao (20 km, Class III); (ii) Jishan–Zhangjiabao (15 km, Class II); (iii) Xiahua–Xipo (14 km, Class III); (iv) Fenhe Bridge Link Road (5.3 km, Class II); (v) Fenzi Bridge (0.35 km, Class II); and (vi) Xijiaokou–Beiwuquin (16 km. Class III). In a letter dated 28 October 2005, the Executing Agency proposed replacement of items iv–vi from this list with three new roads: Fenhe Bridge–Zezhang (15.7 km, Class II); (v) Guancun–Huayu (18 km, Class III); and (vi) Zhaojiazhuang–Chaijia (15 km, Class II).

[7] It was discovered at the time of the post facto approval of the bid evaluation report in September 2006 that two signed contracts for two of the approved local roads were ineligible for ADB financing because they were signed before the loan became effective and there was no provision for retroactive financing. For this reason, ADB financed only four of the six local roads.

[8] With the addition after the expressway opened of the trial operation department, which is in charge of maintenance management and toll collection, there are now seven departments.

monitoring, and bridge construction were carried out. The training was useful and applicable to the project road construction and its operation and maintenance. Training details are in Appendix 4**.**

9. An additional overseas training program for 2007 was approved by ADB and the Shanxi Finance Bureau (SFB) in December 2006 and April 2007, respectively, using loan savings. The program was to cover expressway maintenance and traffic control in winter, large bridge safety monitoring, pavement assessment and maintenance, advanced toll collection technology, and management of the expressway concession company. A delay in approving the training program by SFB resulted in an extension of the original loan closing date by 6 months until 31 January 2008. Subsequent SCD approval of the trainee candidates was not undertaken before the revised loan closing date and the additional training courses were not undertaken.

C. Project Costs

10. At appraisal, the Project was estimated to cost the equivalent of $326.80 million, of which $155.90 million, or 48%, was estimated to be the foreign exchange cost, $22.00 million for service charges and interest during construction. The total local currency cost was $170.90 million equivalent, or 52%, including taxes and duties. The ADB loan at appraisal was $124.00 million equivalent from Ordinary Capital Resources to finance 37.9% of the total project cost. ADB financing represented 79.5% of the total foreign exchange cost. No local currency costs were financed by ADB. The entire local currency requirement of $170.90 million was to be covered by MOC, SPG, and China Minsheng Bank (CMB).

11. The actual project cost estimated by the PCR Mission was $287.00 million equivalent, with a foreign exchange cost of $147.39 million equivalent, or about 51.4%, and a local currency cost of $139.61 million equivalent, or 48.6%. Actual costs were 12% lower than the appraisal estimate due to the variations in costs and exchange rate fluctuations. ADB financed $124.00 million equivalent, or 43.2% of the total project cost. The remaining cost, $163.00 million, was financed by MOC ($63.20 million), SPG ($34.20 million), and the CMB loan ($65.60 million).

12. The cost estimated at appraisal for the expressway civil works, buildings, and ancillary facilities was $232.02 million, including physical and price contingencies. The actual cost was $216.07 million.[9] The estimated cost at appraisal for the local road component was about $13.00 million, including physical and price contingencies, while the actual cost was $9.32 million. The cost of equipment estimated at appraisal was $5.50 million. Actual costs were lower, at $3.21 million, due to some equipment packages being cancelled (para. 27). Consulting services costs estimated at appraisal were similar to the actual—$18.90 million compared with $19.40 million, respectively. The actual cost of resettlement was 32% less than estimated at appraisal because the Project required less land and the relocation of fewer people than anticipated (paras. 41–42). The actual cost of resettlement was $21.27 million, compared with the appraisal estimate of $31.20 million.

[9] The appraisal estimate base cost for expressway civil works, buildings, and ancillary facilities totaled $198.1 million. Incorporating the estimates for physical and price contingencies made at appraisal, namely physical contingencies of 7% and price contingencies at 2.4% per annum, results in a total estimated cost at appraisal for expressway civil works, buildings, and ancillary facilities of $232.02 million.

D. Disbursements

13. No disbursement schedule was included in the Report and Recommendations of the President. However, the projected disbursements have been developed, based on the financial and economic analysis prepared at the time of appraisal, and are shown in Appendix 8 along with the actual disbursements during implementation. The initial disbursement was made in April 2004 and the final payment was made on 6 March 2008, the loan closing date. Loan proceeds were disbursed in accordance with ADB's Loan Disbursement Handbook.[10] Payment for civil works, both for the expressway and local roads components, were made through reimbursement procedures, while equipment procurement and consulting services were paid by direct payment procedures. There was no undisbursed balance.

14. Loan proceeds were reallocated due to contract variations for expressway civil works during implementation because the original allocation was insufficient to meet the ADB financing portion of 48% of the approved contract variations (para. 11). To partially meet a shortfall in the civil works contract variations, ADB on 12 July 2007 approved a request by the Borrower for reallocation to the expressway civil works category of the savings that arose from cancelled procurement of some equipment and the undisbursed interest during construction. The Borrower financed the balance.

15. On 28 November 2007, the Borrower asked ADB to increase the financing percentage for expressway civil works from 48% to 54% so that the loan proceeds could be fully utilized. The actual cost of expressway civil works amounted to CNY1.66 billion, of which ADB financed 48%, or CNY796.91 million ($99.07 million equivalent). The loan proceeds for the expressway civil works component allocation as of 21 January 2008 amounted to $108.82 million, indicating an expected loan savings of $9.75 million. Taking into consideration the shortfall for the local roads component, for which a reallocation of $90,000 was needed, the expected reallocation to the expressway component amounted to $9.66 million. ADB approved the Borrower's request through a major change in implementation arrangements on 25 January 2008. This financing increase was also made retroactive.

E. Project Schedule

16. ADB approved advance action in June 2002 for procurement of civil works contracts and recruitment of consultants. The loan was approved on 12 December 2002. The Loan Agreement was signed on 11 December 2003 and became effective on 1 April 2004. At appraisal, land acquisition and resettlement were expected to commence in March 2003. However, the start was delayed by 6 months due to the SARS[11] outbreak in early 2003. A major portion of the land acquisition and resettlement had been completed by May 2004. The original loan closing date was 31 July 2007 but was extended until 31 January 2008 to complete additional overseas training.

17. The Project was expected to be implemented over a period of 4 years, from 2003 through to the end of 2006. The expressway construction was to start in October 2003 and be completed by January 2007.[12] The expressway earthworks contracts were awarded only in April 2004 and site work started in May 2004, 7 months behind schedule (para. 24). Despite delays, the expressway was completed in December 2006, 1 month ahead of the appraisal schedule.

[10] ADB. 2001. *Loan Disbursement Handbook*. Manila. Updated in January 2007.
[11] Severe acute respiratory syndrome.
[12] Preconstruction activities had already begun under advance procurement action in May 2002.

The improvement of local roads was to start in September 2003 but actually began 3 months ahead of the schedule, in June. The local roads were completed in December 2006, 1 month ahead of the target date. The four ADB-financed local roads were opened to traffic between July and December 2006. The actual and the appraisal implementation schedules are compared in Appendix 9 and the chronology of major implementation events is set out in Appendix 10.

F. Implementation Arrangements

18. As envisaged at appraisal, SCD was the Executing Agency (EA) of the Project, responsible for overall project implementation. SHEC was the Implementing Agency (IA) coordinating and monitoring all project expressway activities. The general manager of SHEC was appointed as the project director. A chief supervision engineer office was established within SHEC to ensure quality of civil works. The chief supervision engineer was supported by two deputy chief supervision engineers. One deputy was the team leader of the international consultants and assisted the chief supervision engineer in project and contract management activities. In addition, three resident supervision engineer offices were established in Xinjiang, Jishan, and Hejin, operating under the chief engineer's office. SHEC employed about 30 full-time staff during project implementation. Since completing construction of the expressway, in December 2007, SHEC has been responsible for operation and maintenance of the expressway with the help of 307 full-time staff. The local roads component was implemented by the county communications bureaus under the supervision of SCD, which provided guidance on planning and upgrading (Appendix 3 refers). To facilitate land acquisition and resettlement, project implementation committees composed of officials from local agencies were established in Xinjiang and Jishan counties, and in Hejin city. Current organizational charts of SCD and SHEC are in Appendix 11.

G. Conditions and Covenants

19. No covenants were modified or waived during implementation. Details of compliance with the covenants under the loan are presented in Appendix 12. Covenants relating to implementation arrangements, construction quality, environmental protection, and land acquisition and resettlement were or are being generally complied with. Project accounts and financial statements have been audited and audited reports, including auditors' opinions, are being submitted to ADB in timely manner. The covenant on private sector financing has not been complied with. It was stipulated that SCD through SHEC should analyze the feasibility of attracting private sector investment prior to the opening of the project facilities. To date no action had been taken to comply with this covenant. SHEC, which was established under the Company Law of the PRC, does not have the legal authority to solicit private sector funding. The covenant should have assigned this role to SCD's planning division. Reporting requirements under the Project have been substantially met. SHEC was to prepare a corporate development plan but it has not complied with this covenant. SHEC submitted the draft corporate development plan to SCD in August 2007 but SCD has not reviewed and discussed the draft. The covenant on training programs was only partially complied with. Only 36 person-months of overseas training were undertaken, compared with the 45 person-months envisaged at appraisal. An approved additional overseas training program was not completed because of a delay in approval of the trainee candidates by the SCD.

H. Related Technical Assistance

20. Technical assistance (TA) for preparing the Shanxi and Shaanxi Roads Project in the PRC was approved by ADB in 1999. The TA (i) upgraded the feasibility study, environmental

impact assessment and resettlement plan for Shanxi and Shaanxi roads to meet ADB's requirements, (ii) prepared a summary environmental impact assessment, (iii) formulated a provincial local road improvement program, and (iv) assisted the SCD in corporatization of highway construction and operation entities. Subsequently, output of the TA has facilitated ADB's financing of the project roads to promote economic growth and contribute to poverty reduction in Shanxi province by removing transport bottlenecks and upgrading capacity for more safe and efficient movement of freight and passengers and providing better access to poorer areas of Shanxi. A total $736,416 was spent for the TA out of approved cost of $990,000.

I. Consultant Recruitment and Procurement

21. **Consultant Recruitment**. The international consultant recruitment was undertaken in accordance with ADB's guidelines.[13] The international consulting firm was selected through the quality-and-cost-based selection method to assist SHEC in construction supervision and provide other services. The recruitment took 11 months due to a delay in finalizing the Request for Proposal and Approval of Technical and Financial Proposals. The consultants started their services in October 2004, 5 months after the expressway civil works began. The actual input was 27.83 person-months, against the appraisal estimate of 38 person-months. Input at appraisal was comprised: (i) 29 person-months for project management and supervision of the expressway; (ii) 4 person-months for social and poverty reduction impact monitoring and evaluation—2 each for the expressway and local roads component; (iii) 2 person-months for road safety; (iv) 1 person-month each for protected area management and environmental compliance monitoring; (v) vehicle emissions control; and (vi) training engineering staff engaged in the local roads component. The actual inputs were 20.97 person-months for (i), 3.99 person-months for (ii), 1.08 person-months for (iii), 1 person-month for (iv), and 0.79 person-months for project coordination and support. Due to the late signing of the consultants' contract, the training expert's input was cancelled because start-up training was no longer required. In addition, the input of the vehicle emission control specialist and half of the input of the road safety expert were cancelled because the regulations concerning vehicle emission control and road safety had already become effective by the time the international consultants' services commenced. The service was completed in April 2007.

22. SHEC engaged national consulting firms in accordance with government procedures that were acceptable to ADB. The services carried out between September 2003 and July 2007 for construction supervision, resettlement and environmental monitoring, and evaluating of socioeconomic impacts of the project. In total, about 3,273 person-months of national consulting services were rendered, compared with the appraisal estimate of 2,300 person-months. SHEC also received advice on the Yellow River Bridge construction from two individual national experts.

23. **Procurement.** The procurement of goods was carried out in accordance with ADB's guidelines.[14] At appraisal, the Project consisted of: (i) 13 ADB-financed civil works packages for expressway construction, including subgrade, bridge, culverts, pavement work, and traffic engineering facilities,[15] using international competitive bidding (ICB) procedures; (ii) six ADB-financed packages for local roads, using national competitive bidding (NCB) procedures; iii) two

[13] See ADB's *Guidelines on the Use of Consultants*.
[14] See ADB's G*uidelines for Procurement*.
[15] Contract packages E1-E7 for earthworks and bridges, contract packages P1-P4 for pavement, and contract packages T1-T2 for traffic engineering facilities.

packages for buildings and ancillary facilities,[16] using NCB procedures financed by the Borrower; and (iv) six ADB-financed packages for equipment.[17]

24. **The Expressway.** The prequalification process for earthworks and bridge works contractors was started on schedule; ADB approved the prequalification documents in December 2002. However, the prequalification documents were not made available to interested bidders until June 2003, upon approval of the preliminary design by MOC.[18] ADB approved the prequalification of 50 bidders on 2 December 2003 and authorized the bidding documents the next day. Of the prequalified firms, 43 submitted 64 bids on 9 February 2004. Contracts E1–E7 were awarded on 27 April 2004. The prequalification documents for the pavement and the traffic engineering works contract packages were issued on 1 August 2004. Contracts P1–P4 and T1–T2 were signed on 18 October 2005. Four NCB contracts were signed in September 2005 for buildings and ancillary facilities works—i.e., toll stations and the service area—compared with the two packages envisaged at appraisal. SHEC explained that three packages were required for the toll stations, rather than the one envisaged at appraisal, because the stations were spread over three counties and separate contracts would facilitate management and speed construction.

25. **Local Roads.** Civil works were procured using NCB procedures. As agreed during implementation, bid evaluation reports and signed contracts for six local roads were sent to ADB in July 2006 for post-facto approval. However, two signed contracts were ineligible for ADB financing because they were signed before the loan became effective and there was no provision for retroactive financing. For this reason, only four local roads were approved for ADB's financing (Footnote 7).

26. **Equipment.** At appraisal, it was envisaged that equipment would be procured under six contract packages: (i) tolling, communication, and monitoring systems equipment under ICB procedures—EP1; (ii) lighting devices equipment under ICB procedures—EP2; (iii) maintenance equipment under ICB procedures—EP3; (iv) maintenance vehicles under international shopping procedures—EP4; (v) safety equipment under international shopping procedures–EP5; and (vi) environmental monitoring equipment under direct purchase procedures—EP6. Only two of the packages (EP1 and EP2) were procured and they were combined into one contract package, EP1. The bidding documents were submitted to ADB in November 2004, 5 months later than envisaged at appraisal, and were approved on 17 January 2005. Invitations to bidders were not sent out until 28 September 2005 because MOC took a considerable time to approve the documents approved by ADB. Bids were received on 29 November 2005. The bid evaluation report was not sent to ADB until 19 May 2006 because it was necessary to deal with several complaints on the bidding process before proceeding further. Contracts were eventually awarded on 28 June 2006.

27. On 28 November 2006, SHEC advised ADB that the remaining four packages would no longer be procured. The maintenance equipment under contracts EP3 and EP4 were no longer required because maintenance was to be contracted out to the private sector. The weigh bridge originally under contract EP5 was procured under EP1 through a variation order because a weight-based tolling system was introduced in Shanxi. The equipment under EP6 was purchased using the Borrower's own funds under the contract that was signed in October 2004

[16] Contract packages F1-F2 for service area and toll stations.
[17] Contract packages EP1-EP6, covering tolling and monitoring systems, lighting devices, maintenance equipment, safety equipment, and environmental monitoring equipment.
[18] In accordance with government requirements, issuance of the prequalification document is subject to approval of the preliminary design.

with Yuncheng Wetland Nature Reserve Station. The PCR Mission inspected the equipment that was procured and installed at Hejin East toll station and traffic monitoring center and noted that it was functioning properly.

J. Performance of Consultants, Contractors, and Suppliers

28. Both the international and national consultants performed well, as demonstrated by the good quality of the completed expressway, which the PCR Mission visited. The expressway, including the bridge at the Yellow River, was designed well and built properly. Safety audits were done (para. 35) and their recommendations were implemented. The environmental, resettlement, and social impact monitoring and reporting during the construction period were satisfactory. Environmental monitoring and monitoring of soil erosion and the bird population continue and reports are being submitted to ADB. The overall performance of the consultants was rated as satisfactory. The contractors for the expressway and the local roads, all national, carried out their work in a professional manner, on schedule, and had no major problems. The performance of the contractors was rated as satisfactory. The performance of the national supplier was rated as satisfactorily.

K. Performance of the Borrower, the Executing Agency, and Implementing Agency

29. SCD, which was the Borrower and the Executing Agency, performed satisfactorily. SCD was familiar with ADB's procedures and practices from a previous ADB-financed expressway project. Overall, the performance of the Implementing Agency—SHEC—is considered satisfactory. The Project was implemented with due concern for construction quality and was completed 1 month ahead of schedule, even though start-up had been delayed. SHEC was extremely cooperative with ADB during project implementation.

L. Performance of the Asian Development Bank

30. ADB conducted an inception mission, two review missions, an environment safeguard review mission, and a mid-term review mission. The missions included visits to the project road sites and the Yuncheng Wetland Nature Reserve Station. Three ADB project officers[19] were involved during implementation. Both SCD and SHEC recognized the roles performed by the ADB missions in providing advice on technical issues and providing timely approval of works variations, changes in project scope, implementation arrangements, and matters of loan administration. SHEC noted that ADB was slow in reviewing and approving the documents for engaging the international consulting firm. Overall, ADB's performance is rated satisfactory.

III. EVALUATION OF PERFORMANCE

A. Relevance

31. The Project was rated as highly relevant. The rationale for the project was sound. Supporting the NTHS is one of the important priorities of the Government of the PRC. The expressway completes the Taiyuan–Xi'an corridor of the NTHS. The Project was in line with the ADB's operational strategy in the PRC at the time of appraisal[20] (para. 4). It is also consistent with ADB's present operational strategy and is supported by the Government's development

[19] One project officer was involved only in the Inception Mission in 2004; the second project officer handled the Project in 2005; the third project officer handled the Project from 2006 through to completion in 2008.
[20] ADB. 2002. *People's Republic of China: Country Strategy and Program Update (2003-2005).* Manila.

strategy for road transport.[21] The strategy reflects an integrated approach to the development of the road network by addressing the need not only for expressway and highway systems but also for local roads to service poorer segments of the population in the region. The Project has expanded the expressway network in Shanxi province by completing Houma–Yumenkou expressway and has thus complemented the expressway construction that was undertaken from Qixian to Linfen (176 km) under the Shanxi Roads Development Project. Economic development in the project area has been stimulated by the expressway and the improved local roads provided under the Project, and this has led to rising living standards and poverty reduction.

B. Effectiveness in Achieving Outcome

32. The Project was rated effective. The outcome envisaged at appraisal has been substantially achieved, namely (i) to improve road infrastructure through the provision of increased capacity for more efficient movement of freight and passengers at lower cost, (ii) to provide improved access to poor counties, and (iii) to contribute to the strengthening of the institutional capacity of SHEC for contract management, construction, and operation of the expressway.

33. **Road Performance and Traffic.** The Houma–Yumenkou expressway was opened to traffic on schedule and is 19 km shorter than the old route, Highway G108. The expressway also provides safer, more efficient movement of passengers and freight at a lower cost. Traffic congestion and transport costs have also been reduced on G108 as more vehicles have begun to use the expressway. The local roads covered by the Project connect to the expressway interchanges, providing easier road access for people and goods and thereby distributing the benefits of the project expressway to the poor in the project areas. The average annual daily traffic of 9,000–11,000 vehicles per day on various sections of the expressway in 2007 was 21%–36% less that the 14,047 vehicles per day estimated at appraisal. Appendix 13 provides traffic volume details.

34. **Travel Time and Transport Costs.** Traffic speeds on the project expressway are efficient at between 85–95 km per hour for cars and 65–80 km per hour for trucks. The expressway reduced the travel time from Hejin to Houma by around 45 minutes, or about half the time needed to make the trip on the G108 route, which, at 69 km, is 19 km longer than the expressway. Due to the road's poor condition, it takes about 25 minutes to travel between Hejin and the Yellow River Bridge on G108, a distance of about 18 km. The same trip takes 10 minutes on the expressway and is 2 km shorter due to its alignment—a time savings of 60%. Freight charges before the Project averaged CNY0.45 per ton-kilometer (ton-km) but have been reduced to CNY0.35 per ton-km via the expressway. Passenger fares in the Project area have declined by CNY0.07 to about CNY0.18 per person-kilometer.

35. **Road Safety and Overloading.** Road safety audits were conducted during the expressway's detailed design and construction stages.[22] The recommendations made at the design stage included providing (i) improved interchanges to local roads with traffic signs and traffic lights, (ii) street lighting, (iii) communication and control systems, and (iv) service areas. These were incorporated. A further road safety audit determined that the expressway had no additional road safety deficiencies. Expressway safety was enhanced by (i) improving the performance of markings for night driving by adding glass beads to the thermoplastic white line

[21] ADB. 2008. *People's Republic of China: Country Partnership Strategy 2008-2010.* Manila.
[22] 2004. *Road Safety Audit–Detailed Design Stage*. 2006. *Road Safety Audit–Construction Stage.*

paint, (ii) planting bushes between crash barriers to prevent headlight glare, and (iii) using road signs made of good-quality reflective material. The Shanxi province road traffic safety plan was approved in November 2004 to implement the Road Traffic Safety Law, which was enacted in October 2003. An emergency response plan has been prepared in case of hazardous-chemical spills. The expressway has a traffic control plan for extreme weather, and a road safety plan for the Yellow River Bridge is also in place. All plans are being implemented effectively. SHEC has taken steps to minimize accidents. In 2007, 25 accidents were recorded in which three people died and nine were injured. Most of the accidents were blamed on tired drivers or reckless driving rather than expressway conditions. New caution signs have been installed as a result. Overloading is controlled by vehicle weighing equipment at the toll gate near the Yellow River Bridge. Expressway police escort overloaded trucks, which are fined, to the nearest exit in Hejin city.

36. **Vehicle Emissions**. Shanxi province has introduced the Blue Sky and Clean Water environment program and, to implement this plan, Yuncheng environmental protection bureau prepared a vehicle emission control plan in 2007. The regular testing of vehicle emissions, vehicle clearance is now in place, along with enforcement measures. Four private vehicle emission testing centers have been in operation in Yuncheng prefecture since September 2007 and one center for both vehicle emission testing and vehicle inspection is under construction.

C. Efficiency in Achieving Outcome and Outputs

37. **Financial Reevaluation.** The financial internal rate of return (FIRR) was recalculated as 8.1%, using the major assumptions given in Appendix 14. That is higher than the 7.58% arrived at during appraisal. Although the revenues calculated for the expressway are lower than those envisaged at appraisal, the effect of a lower capital cost than envisaged has resulted in a higher FIRR. The recalculated weighted average cost of capital after tax is 3.5%. The reevaluation shows that the project expressway is financially viable and has been rated as efficient. Sensitivity analysis of the FIRR shows that the results of the financial analysis are robust.

38. **Economic Reevaluation.** The Project was rated as highly efficient. Efficiency has been rated through a recalculation of the economic internal rate of return (EIRR) for the Project, based on updated data collected by the PCR Mission. At appraisal, the EIRR calculated for the Project as a whole was 16.17%—15.99% and 21.58% for the expressway and the local roads components, respectively. The recalculated EIRR for the Project as a whole is 19.5%, or 19.4% and 22.0% for the expressway and the local roads components. This EIRR compares favorably with the 12% economic opportunity cost of capital. The primary differences between reevaluation and appraisal are due to (i) revised economic costs derived from actual costs, (ii) traffic volume, (iii) slight differences in methodology, and (iv) differences in estimates of traffic growth at appraisal and reevaluation. Appendix 15 shows the recalculated EIRR as well as the supporting assumptions.

D. Preliminary Assessment of Sustainability

39. Maintenance of the project facilities is essential to sustain their economic life. The project roads have improved the efficiency of road transport in the Project area, provided easier road access to poor remote villages, and increased economic activity. This increased economic growth in the Project area will facilitate a steady stream of toll revenue for SHEC, which will enable them to maintain the expressway. The expressway is likely to be sustainable, given the sound construction technology adopted. The PCR Mission noted the good quality of the

expressway and judged the routine preventive maintenance that has been undertaken of the expressway to be adequate. All maintenance work on the project expressway is outsourced to private contractors. In 2007, SHEC spent CNY1.25 million on maintenance. The budget for maintenance under SHEC's plan for 2008 is about CNY1.56 million—the equivalent of about $226,000, or $3,384 per km of expressway. This is adequate at this time. It is expected that periodic maintenance through an overlay will be required every 10 years, or around 2017. SCD and local governments are committed to the development and maintenance of the local roads networks. The six local roads implemented under the Project received maintenance of about CNY1.37 million in 2007 (approximately $199,000, or about $2,200 per km of road). The local roads visited by the PCR Mission were well-maintained. In October 2005, the State Council launched a rural road policy framework that aims to improve local governments' capacity for road maintenance management, increase maintenance funding, and introduce outsourcing of maintenance works to potential contractors. SCD is following this new policy, which will ensure the sustainability of the project local roads in the province. Because of this, the Project is likely to be sustainable.

E. Other Impacts

40. **Environmental Impact.** The Project is classified as environmental category A. MOC's Research Institute of Highways prepared the environmental impact assessment, which was approved by the State Environment Protection Administration (SEPA) on 8 March 2002. The summary of the assessment was circulated to the ADB Board on 29 May 2002. An environmental division was set up in SHEC in 2003. An environmental protection management method was issued to the seven contractors and the three resident supervision engineers offices. The anticipated environmental impacts were (i) effects of the Yellow River Bridge construction on the wintering ground for gray cranes in the Yuncheng Wetlands Nature Reserve; (ii) soil erosion and water pollution caused by the construction of the Yellow River Bridge; (iii) impacts of dust, noise, and waste generation on construction workers and residents living along the alignment during the construction period; and (iv) vehicle emissions during the operational period. These impacts were minimized by implementing a gray crane wintering grounding protection plan, a soil erosion control plan, and proper mitigation measures under the civil works contracts. An environmental safeguard review mission from ADB visited SHEC in December 2004. The mission recommended (i) conducting two workshops for the construction workers on the appropriate collection and disposal of waste and best practices in construction activities; (ii) translating the summary of the environmental impact assessment into Chinese for the contractors and the resident engineers; (iii) monitoring carbon monoxide and nitrogen oxide, and (iv) developing an environmental action plan for the operational phase. These recommendations have been or are being satisfactorily implemented. The contracts for monitoring of environmental quality during construction and implementing the action plan for bird protection were signed in 2004 between SHEC and the external monitors. Waste management and dust and noise control at the construction sites were satisfactory. The gray crane population did not diminish and no land slide was reported. Monitoring of environmental factors, soil erosion, and bird population continues now that the expressway is open. Appendix 16 provides a detailed environmental impact analysis.

41. **Resettlement Impact**. SHEC's resettlement completion report estimated that 6,060 mu[23]—or about 400 hectares—of land were permanently acquired under the Project, 3.6% more than the estimates in the updated resettlement plan.[24] Plan called for 1,901 mu

[23] A mu is equivalent to 666.66 square meters, or 0.1647 acres, or 0.066 of a hectare.
[24] At appraisal, it was estimated that 411 hectares needed to be acquired.

(125.5 hectares) of temporary land to be acquired but only 1,380 mu (91 hectares) were actually acquired—27% less than first envisaged. The plan called for 20,472 people in 4,760 households to be affected by land acquisition. The actual numbers were about 26 per cent less—15,187 people from 3,532 households. Only 20 people from five households needed to be resettled; their new housing was completed in 2005. Only one of the six local roads required the acquisition of land.[25] The primary road design put the acquisition needs at 180 mu (11.9 hectares) of land but it was optimized and only 50 mu (3.3 hectares) was acquired in the end, a reduction of 72%. SHEC paid great attention to restoring the land used temporarily and to rehabilitating the livelihoods of villages by redistributing farmland to the people affected. Irrigation facilities were also improved, which resulted in a 67% rise in the average output value of crops. The Project had no significant adverse impact on household income; the majority of people appear to have improved their incomes through more intensive farming or non-farming activities.

42. Most of the land acquisition and compensation payments were completed in 2004. The amount paid in land acquisition and resettlement was CNY166.67 million, which was 64.5% of the amount, budgeted at appraisal. An external monitor hired by SHEC scrutinized implementation of the resettlement plan and prepared reports for land acquisition and resettlement activities for both the expressway and local roads. Resettlement monitoring and reporting was very comprehensive; SHEC also submitted quarterly reports prepared by an internal monitor to ADB. The overall impacts of land acquisition and resettlement for the Project were effectively mitigated. Resettlement activities and compensation payments were completed successfully. The livelihoods of all affected people were restored. Appendix 17 provides a detailed analysis of land acquisition and resettlement implementation.

43. **Socioeconomic Impact.** A project performance management system was established to examine the effects of the Project on the people in the project area. A social development action plan was prepared to enhance social inclusion for the poor. In 2003, SHEC engaged an external monitor to conduct investigations, collect data, monitor, prepare reports on social and poverty monitoring during implementation of the Project, and to assess the action plan's results. This contract was extended and social development and poverty alleviation will be monitored continuously until 2011. The changes in social and economic conditions in the project area will be reported to ADB.

44. Several positive social impacts were achieved during implementation and are analyzed in Appendix 18. They included (i) increased employment during the construction and operation period, (ii) increased labor mobility, (iii) enhanced agricultural development induced by lower transport prices for inputs and better access to markets, and (iv) upgraded local community development. Expressway contractors engaged 78,863 person-months of labor between May 2004 and December 2006, including 47,020 person-months from non-technical workers, of which 7,150 person-months were provided by female employees. Poor villagers in the project area accounted for 34,844 person-months, or 74% of all non-technical workers. During the expressway's first year of operation in 2007, 402 persons were employed, including 162 females (40%), and 382 from poor villages (95%). In 2002, the average per-capita net income of villagers was CNY1,543; in 2006, it had increased to CNY2,738, an annual average growth rate of 15.4%. Income per capita grew due to greater labor mobility and the increase in the number of small-scale village enterprises, such as shops.[26] Poverty in the three counties affected by the

[25] The Zhaojiazhuang–Chaijia road has four subsections, of which only Zhaojiazhuang–Baidi subsection required land acquisition.
[26] The number of village enterprises increased by 157% during the period.

project declined by 58.5%—from a poor population of 33,965 in 2002 to 14,106 in 2007. The standard of living also improved in project area villages. The number of people owning phones, radios, and TV sets increased by 86%, 55%, and 13%, respectively. Overall, the Project was assessed to have positive socioeconomic impact. Even though the social development action plan was not monitored systematically, its aims were implemented because local government was already committed to the plan's objectives. These actions were not imposed by ADB.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

45. The Project has been implemented as planned, with minor and major changes in scope and implementation arrangements. These involved the local road component, where three originally selected roads were replaced with three others, and the expressway civil works, where ADB's financing was increased through reallocation of loan proceed savings. The main objectives have been achieved as envisaged at appraisal. The Project has brought state-of-the-art construction technology to the PRC for the construction of the double tower, cable-stayed Yellow River Bridge, the largest ever financed by ADB. The Project also extended sector reforms initiated under previous ADB-financed projects, including road network integration, the introduction of toll pricing policies, enhancement of management efficiency, improvement of road safety, and reduction in vehicle emissions. The Project is considered successful. Appendix 19 includes the quantitative assessment of project performance to determine the project rating.

B. Lessons Learned

46. Key lessons learned from the Project include the need for (i) timely government approval of preliminary design, procurement documents, and overseas training activities, (ii) improving government's traffic data information and management system; and (iii) more prior discussion to establish what authority will comply with loan covenants that are not directly related to the project company. In future, more discussions should be held to identify the local road component of similar projects to ensure the local roads originally selected are implemented. In the case of this project, the government would have constructed the local roads with or without ADB assistance. Three of the original six roads selected at appraisal were built using other sources of financing.

47. Project lessons also highlight the benefit of integrating an expressway with nearby local road networks. Local road connectivity was able to maximize development impacts by further stimulating local economic transformations and social development.

48. Economic development initiated by improved connectivity in the project area was further advanced by local area development and complementary investments from local governments and the community.[27] In hindsight, this experience showed that local governments can further strengthen the development process spurred by a project by promoting the establishment of enterprises and by providing programs and funds to support technological services.

[27] For example: (i) establishment of local markets and industrial centers, (ii) microfinance schemes to enable development of new cottage industries through small loans, and (iii) training and assistance on the use of modern agriculture production techniques.

C. Recommendations

49. **Future Monitoring and Follow-Up Action.** SCD and Hejin Transport Bureau should add one more lane to the railway underbridge on the Zhaojiazhuang to Baidi road to ensure safe and efficient travel on the project local roads in 2009, and inform ADB upon completion. SHEC will inform ADB upon the opening of the toll station at Hejin West.

50. **Covenants**. SCD will discuss and endorse the draft corporate development plan. SHEC will submit the revised plan to ADB for review by December 2008.

51. SCD will submit an analysis to ADB by December 2008 on the feasibility of private sector funds for future investment, including private sector participation in operation, maintenance, and management of the project expressway.

52. SHEC will continue environment, soil erosion, and bird population monitoring for 2008, 2009, and 2010. Reports on the monitoring of progressive changes should be submitted to ADB.

53. SHEC will submit the audited project accounts and financial statements for fiscal years 2007 and 2008 to ADB.

54. **Timing of Project Performance Evaluation Report Preparation.** A project performance evaluation report should be prepared any time from 2011 onwards. By that time, the Project will have been fully operational for more than 5 years and its traffic, maintenance, physical condition, attainment of benefits, and impact on resettlement and poverty reduction can be assessed.

55. **General**. Maintenance of the project roads must be the top priority if the assets are to continue being used by the local people to ensure the social and economic growth in the project areas of Shanxi. Funds must be made available for timely and effective implementation of road maintenance works.

56. To overcome the capacity constraints of the executing and implementing agencies identified during project implementation, ADB should continue to provide training to the staff in future ADB-assisted projects.

PROJECT FRAMEWORK

Design Summary	Performance Indicators/Targets		Project Monitoring Mechanisms	Remarks
	Appraisal	Actual		
Impact				
1. Promote economic growth in Shanxi Province by improving access to markets, increasing effective transportation linkages, and attracting investments in the project area.	Economic growth for impacted cities and counties during 2002–2026. Tonnage of interprovincial trade by road. Increase in vehicle traffic to and from other regions.	Achieved. Economic growth in Xinjiang, Jishan, and Hejin counties between 2001 and 2007 increased in terms of gross domestic product by 14.5%, 20%, and 30% per annum, respectively. Approximately 30% of all vehicles were traveling interprovincially (about 3,400 vehicles per day in 2006). Interprovincial trade volume in 2007 was 4.10 million tons.	Annual economic reporting at the provincial and national levels, provincial statistical yearbooks, and county statistics. Traffic monitoring.	
2. Reduce poverty by improving living standards and creating employment, particularly during construction, in poor counties and townships in the project area.	Per capita incomes, poverty headcount, and access to social services in project implementing agency counties. Socioeconomic performance indicators on poverty townships and villages in the project area.	Achieved. Per capita income in 35 poor villages that were monitored increased from CNY1,543 in 2002 to CNY2,087 in 2006, an average compounded growth of 7.8% per annum.	Baseline socioeconomic surveys in poor townships and villages. Monitoring through project performance management system (PPMS). External monitoring for selection of labor teams from poor households.	Monitoring undertaken in PPMS (Appendix 18)
	Total additional income of poor laborers to be generated through the Project	From April 2004 to December 2006 contractors employed 78,863 person-months of labor, of which 34,844 person-months were from poor villages.	Annual monitoring through PPMS	
Outcome				
1. Improve road infrastructure through provision of increased capacity for more efficient movement of freight and passengers at lower cost.	Serious congestion on existing national highway 108, which runs parallel to the project expressway, removed through the construction of a four-lane controlled access expressway and the Yellow River Bridge.	Achieved. The average speed on national highway 108 (G108) was 40 km/h compared with 60 km/h after the expressway component was implemented. Expressway constructed as envisaged, i.e., access-controlled with four-lane.	Project Completion Report (PCR) Traffic counts and travel time survey for expressway and other roads	Appendix 13 gives details of traffic counts. Para. 34 refers to reduced travel times.
	East-west corridor capacity increased at opening in 2007. Access improved to townships and villages through interchanges to connecting roads and local road component. Average travel time between Houma and Yumenkou reduced by 1 hour in 2007.	Achieved. Average annual daily traffic (AADT) on east-west corridor in 2007 was about 20,000 vehicles per day (expressway and G108), compared with an AADT before the expressway of 7,000-8,000 on G108. Access improved through the introduction of six local roads and four interchanges with connections to expressway.	Direct measures of cost and travel time for trucks and buses. Direct measures of freight and passenger charges.	Traffic data is in Appendix 13.

Design Summary	Performance Indicators/Targets		Project Monitoring Mechanisms	Remarks
	Appraisal	Actual		
	Reduced vehicle costs and freight and passenger charges in the project area	Travel time between Houma and Yumenkou has been reduced by 50% since the introduction of the expressway, a reduction of over 1 hour. Vehicle operating costs have been reduced. The expressway has an international roughness index (IRI) measurement of 2m/km, compared with an IRI of 5 m/km on G108. Local roads IRIs have fallen from 6.0 to 3.5. Freight charges on G108 before the project averaged CNY0.45 per ton-kilometer and after the project the rate fell to CNY0.35 per ton-kilometer. Passenger fares fell from about CNY0.25 per person-kilometer to about CNY0.18 per person-kilometer.		Travel times are also referred to in para. 34. Appendix 15 provides details.
	Safer roads in the project area through separation of slow and fast traffic and separation of opposing flows.	Pre-project accident information was sparse. In the first year of operation of the expressway in 2007, 25 accidents recorded in which nine people were injured and three died. The majority of the accidents were due to driver error rather than bad conditions on the expressway. The expressway separates opposing flows and is safer than travel on G108, which does not separate opposing flows. Travel conditions on the local roads have been improved by providing asphalt pavement and traffic safety devices. This has reduced dust and improved traffic regulation on the local roads and made them safer.	Accident statistics for road corridor by number and severity	Para. 35 refers to accidents on the expressway. Appendix 3 provides details.
2. Provide improved access to poor counties.	Improved all-weather access on local road component	Achieved. In October 2007, in Xinjiang, Jishan, and Hejin counties. Improved access on the local roads under the project is now possible. Overall, out of 595 villages in the three counties, a total of 543 villages are now accessible by motor vehicle.	Participatory rural appraisal results, project administration missions, and reports of supervision consultants.	Appendix 3 and Appendix 18 provide details.

Design Summary	Performance Indicators/Targets		Project Monitoring Mechanisms	Remarks
	Appraisal	**Actual**		
	More reliable and reduced delivery time and lower transport costs for rural and agricultural inputs and outputs	Travel times have been significantly reduced by up to 50%. The average vehicle speed on the local roads (class II) is around 50 km/h compared to about 25km/h before improvement.	Direct measure of cost and time for small truck on road network	
	Increased volume and higher proportions of high-value agricultural products marketed	This was not measured in the PPMS. The only data refers to the increase in the price of fruit per mu (from CNY600 in 2001 to CNY700 in 2006) and the increase in the per-kilogram price of grain from CNY0.55 in 2001 to CNY0.65 in 2006. The increase in price obtained indicates an increase in production levels of these agricultural products.	Agricultural statistics	
	Increased mobility of the relatively poor and minorities	Mobility has increased, with several villages reporting outside employment opportunities. It has been estimated from surveys (PPMS) that the outgoing labor mobility increased 2001–2006 by 140%.	Monitoring through PPMS	Appendix 3 and 18 and para include details.
	Increased ownership of motorized vehicles in rural communities.	Vehicle registration in 2007 was 35,000 in Xinjiang, Jishan, and Hejin counties.	Vehicle registration statistics	
3. Catalyze restructuring of expressway agencies, as corporations improve expressway management, and create conditions to attract private sector financing.	Financial self-sufficiency with positive net income within 3 years of project completion.	Only 1 year of expressway services has been completed as of the PCR Mission. This should be assessed in the project performance evaluation report.	Project administration missions, progress reports, and PCR. Audits of corporation and project companies	
Component/Outputs				
1. Civil Works and Equipment:				
a. 65 kilometers of expressway and the Yellow River Bridge; 11 other large bridges; four interchanges and one service area.	Construction completed and open to traffic by the first quarter 2007	Achieved. The 66.84-km expressway was built. Construction completed in December 2006 and open to traffic in January 2007.	Project administration missions, progress reports, and PCR.	Para. 6 contains details.
b. Completion of about 70 kilometers of local road	Improvement completed by 2006.	Achieved. A total of 98 km of local roads were completed by 2006, compared with	Project administration missions, progress reports, and PCR.	Para. 7 and Appendix 3 refers.

Design Summary	Performance Indicators/Targets		Project Monitoring Mechanisms	Remarks
	Appraisal	Actual		
improvement.		70 km at appraisal.	Construction supervision by international/domestic consultants.	
c. Equipment for road maintenance and safety, toll collection, communications, traffic management, vehicle weight and emissions testing, and office administration	Equipment operational and incident response plans implemented	Achieved. Toll equipment, communications equipment, weighbridge are installed and functioning. Other equipment was not procured. The regular testing of vehicle emissions is being done by private vehicle emission testing centers in Yuncheng.	Project administration missions, progress reports, and PCR	Paras. 26–27 refer to equipment that was procured and equipment that was cancelled.
2. Consulting Services				
a. Strengthen Shanxi Hou-yu Expressway Construction Company Limited (SHEC) and Shanxi Communications Department (SCD) and national consultant capacity in project management, quality control, traffic engineering safety, monitoring, and evaluation.	On-the-job training of SHEC/SCD staff and domestic consultants. Implementation of a human resources development plan.	On-the-job training achieved. SHEC and SCD have increased their capacity in project management, construction supervision, corporate management of expressway, road safety, traffic engineering, environmental protection and monitoring, and long-span bridge construction.	Mid-term review and project administration missions. Supervision consultant's reports.	Referred to in paras. 8–9 and Appendix 4.
b. Establish and upgrade operation and maintenance, and management systems.	Monitoring of operation and maintenance costs	Achieved.	Annual reports	
	Level of service meets international standards.	Service level is good, with an IRI of 2.0 m/km.		
c. Establish monitoring and evaluation methodology.	Major economic, poverty, and environmental indicators; access to infrastructure, health, and education; crop production; per capita cash income; non-farm economic activities; living expenses; housing conditions; and major productive assets.	International consultant established PPMS. Shaanxi Kexin Consulting Service Ltd. Was engaged by SHEC and carried out socioeconomic surveys and reported the progressive changes to Asian Development Bank (ADB).	Survey results	Details in Appendix 18.
3. Resettlement and compensation				
a. About 411 hectares of land acquired.	Implementation of land acquisition and resettlement plan	Achieved. About 400 hectares of land was acquired for the expressway and about 12 hectares of land for local roads was acquired.	Resettlement monitoring, PPMS, and participatory rural appraisal.	Para 41–42 and Appendix 17 refers.

Design Summary	Performance Indicators/Targets		Project Monitoring Mechanisms	Remarks
	Appraisal	Actual		
b. About 3,500 people adversely affected	Welfare of those resettled was reestablished at least to level prevailing before acquisition.	After field survey, it was determined that 4,760 households would be affected. However, only 5 households needed to be resettled. The total number actually affected by land acquisition was 3,532 households, 25.8% less than anticipated. One of the six local roads required the acquisition of a small amount of land. None of the people affected by the project were worse off.	Independent consultant monitoring during resettlement implementation, at completion, and 2 years after.	
4. Environmental mitigation measures.	Implementation and monitoring plan based on summary environmental impact assessment agreed by SCD, SHEC, and ADB. Mitigation measures included in contractors' contracts	Achieved. Achieved.	Project administration missions, PCR, and monitoring and evaluation.	Appendix 16 and para. 40 contain details.
Activities 1. Provide adequate counterpart funds. 2. Recruit supervision consultants. 3. Carry out surveys and design. 4. Award contracts and procurement. 5. Construct expressway and Yellow River Bridge and improve selected provincial and county road sections. 6. Supervise construction and installation, and on-the-job training. 7. Provide capacity-building and human resources development to SHEC. 8. Acquire land, agree on compensation levels, restore livelihoods, and replace lost assets. 9. Incorporate appropriate environmental mitigation measures in project design.				**Inputs** Project Costs –Civil works (expressway and local roads), consulting services, and land acquisition $287.0 million Financing Plan –ADB financing, $124 million –Borrower financing, $163.0 million

AADT = average annual daily traffic, ADB = Asian Development Bank, IRI = international roughness index, PCR = project completion report, PPMS = project performance management system, SCD = Shanxi Communications Department, SHEC = Shanxi Hou-yu Expressway Construction Company Limited.

PROJECT ENGINEERING EVALUATION

1. **Background.** The project expressway is located in the southern part of Shanxi province and links Shaanxi Province with the Inner Mongolian Autonomous Region. The expressway runs about 66.84 km from Houma City in Shanxi to Yumenkou Daqian Village in Shaanxi and is a part of the 3,610 kilometer (km) National Trunk Highway System (NTHS) G240 Erenhot–Hekou (Inner Mongolia to Yunnan Province). The project road goes through the counties of Xinjiang and Jishan and the city of Hejin. Most of the route is across flat land, with altitudes ranging 430–540 meters (m) and a natural gradient of 0.8% degree.

2. The Project included: a 4,566-m, extra large, double-tower, cable-stayed bridge across the Yellow River; nine large bridges with total length of 1,980.48 m; seven medium bridges, with a total length of 518.48 m; one 54-m-long aqueduct; 57 separated intersection bridges totaling 4,073.35 m in length; 46 box culverts, 1,531.88 m in overall length; 91 box underpasses, with a total length of 2,821.9 m; four interchanges, at Xinjiang, Jishan, and East and West Hejin; and one service area, at chainage K47+515 in Hejin city, which included a restaurant, a small hotel with 20 rooms, a supermarket, toilet facilities, a vehicle repair workshop, and a long distance bus parking lot.

3. **Expressway Capacity and Level of Service**. The expressway was constructed in accordance with technical standards for highway engineering issued by the Ministry of Communications in 1998. The standards were appropriate in many respects, particularly regarding environmental protection and road safety. The expressway was designed with a carriageway of four 3.75-m-wide lanes and for a travel speed of 120 kilometers per hour to meet the expected traffic in 2026 of more than 50,000 vehicles per day. The expressway provides efficient traffic movement. The pavement surface was estimated to have a surface roughness, according to the international roughness index (IRI), of 2 meters per kilometer, indicating a very smooth road.

4. **Pavement Structure**. The expressway pavement is 16 centimeters (cm) thick, with three layers of asphalt—4-cm, medium-sized, 6-cm, medium-sized, and 6-cm, coarse grain—and two layers of base cement stabilized crushed stone and lime stabilized soil that are 35 cm–54 cm thick, depending on subgrade. This pavement is adequate to withstand the heavy vehicles use that is expected.

5. **Alignment**. Consideration in choosing the expressway alignment was given to minimizing resettlement, avoiding historic relics and irrigation facilities, and restricting the length of cut areas. The alignment was the best possible from the social and economic points of view because it required the reallocation of only five households while at the same time shortening the travel distance between Houma and Yumenkou by about 20 km, compared with the 86 km required on national highway G108.

6. **Extra large bridge of the Yellow River**. The bridge has 12 30-m prestressed concrete T beams, two 75m+2x125m+75m short tower cable stayed spans, 23 50-m prestressed concrete T beam, 174m+352m+174m double tower cable-stayed span, and 19 50-m prestressed concrete T beam. During bridge construction, a 50-m-long-span piers design was modified to better resist to spring break-up ice flows. The changes made were (i) from a rectangular base to a hexagonal base, and (ii) from double columns with 1.8 diameters to single wall pier. Despite an extremely cold winter in 2007, with heavy snow, high winds, and thick ice in the Yellow River, the expressway and the bridge structures and cables performed very well. Six variations were made in the expressway and bridge construction and all of these design

changes were deemed appropriate to improve the technical soundness and performance of substructures.

7. **Drainage and other facilities**. Roadside channels were set on both sides of the expressway in cut sections. To stabilize slopes, the design included greening and cement lining. These measures have been effective; no soil slides have occurred.

8. **Traffic Safety Devices**. Safety features include crash barriers in the median and along the edge of the expressway, traffic markings, and road signs made from good quality reflective material. Small bushes were planted between the median crash barriers to prevent headlight glare. Electronic speed signs were installed. These traffic safety devices have functioned effectively. No road accidents than could be blamed on the expressway's design or construction have occurred.

9. **Traffic Monitoring Station**. The traffic monitoring station at Hejin East toll plaza is equipped with nine computer monitors and a display board with 32 small, wall-mounted TV screens and four large TV screens. All the equipment is functioning effectively.

10. **Service Area**. The service area includes a restaurant, a small hotel with 20 rooms, a supermarket, toilet facilities, a long distance bus parking lot, and a vehicle repair workshop. All facilities are well maintained and remain in good condition.

11. **Toll Stations.** Four toll stations at Xinjiang, Jishan, and Hejin East and Hejin West are equipped with necessary tolling and communication equipment. With the exception of Hejin West toll station, the stations are functioning effectively under the Shanxi Hou-yu Expressway Construction Company's administration.

LOCAL ROADS COMPONENT

1. The local roads component of the Project was included to help provide the benefits of improved access to people in rural areas, especially in the poorer villages. At the central government level, the Ministry of Communications provides guidance and technical support to local governments by setting national policies, regulations, and design and construction standards and providing guidance in their application. The provincial highway bureaus, which fall under the auspices of the provincial communications departments, provide guidance and support for the provincial highway network. The provincial highway bureaus also supervise local roads through prefecture communications bureaus and their county communications bureaus.

2. During project preparation, 70 kilometers (km) of local roads were identified after consultations with provincial and local authorities. At project completion, 97.98 km of local roads had been improved to class I, II, or III in Xinjiang and Jishan counties and in the city of Hejin. Out of six roads, only the Zhaojiazhuang–Baidi road section—the Zhaojiazhuang–Chaijia road in Hejin City comprises four sections—–was newly built to Class II road with a total 9 m width. The remaining roads were upgraded from gravel with asphalt surfaces and equipped with road signs and markings. Of the overall 97.98 km of roads involved, 46.47 km were partially financed by ADB (Table A3.1). The local roads were opened to traffic between 2003 and 2006. The respective county communications bureaus were responsible for design, procurement of civil works, and supervision of the local roads construction. Six local consulting teams were engaged by the county communications bureaus to supervise construction on each of the local roads.

Table A3.1: Local Roads Implemented Under the Project
(kilometers)

County	ADB Financed	Government Financed	Total
Xinjiang	15.70	20.10	35.80
Jishan	24.90	10.88	35.78
Hejin City	5.87	20.53	26.40
Total	**46.47**	**51.51**	**97.98**

Source: Yuncheng Communications Bureau.

3. The road maintenance center in each of the county traffic bureaus is responsible for budgeting and maintenance of the local roads. Routine maintenance is carried out by force account and periodic maintenance is undertaken through competitive bidding by private companies. The Shanxi provincial government, through its provincial traffic bureaus, provides a subsidy for maintaining local roads, in line with national and provincial maintenance expense regulations. As requested by the ADB midterm and loan review mission conducted in 2006 and 2007, respectively, and the international road safety expert, the budget for maintenance for 2007 included provision for road signs and markings and greening and the traffic safety devices were installed accordingly. The maintenance budget for 2008 for the six local roads implemented in the Project amounts to CNY435,000—about CNY67,800 or approximately $700 per km. This should be adequate; only routine maintenance will be required. Table A3.2 shows the maintenance budget for each of the local roads for 2007 and 2008.

Table A3.2: Road Maintenance Budget for Local Roads in 2007 and 2008
(CNY)

Road	2007 Budget	2008 Budget
Fenhe Bridge–Zezhang	58,200	60,000
Jishan–Zhangjiabao	57,000	51,000
Guancun–Huayo	80,000	24,000
Zhaojiazhuang–Chaijia	130,000	100,000
Zezhang–Guanwangmiao	100,000	100,000
Xipo–Xiahua	520,000	100,000
Total	**945,200**	**435,000**

Source: Yuncheng Communications Bureau.

4. Discussions with local village people along the improved local roads indicated several types of benefits. Overall, of 595 villages in the three counties, 543 are now accessible by motor vehicle. Between 2001 and 2006 the outgoing labor mobility increased by 140%. Travel times have been reduced by up to 50%. The average vehicle speed on the local roads (class II) is now around 50 kilometers per hour, double the previous average. Vehicle registration in 2007 was 35,000 vehicles in Xinjiang, Jishan, and Hejin counties.

5. Residents of several villages found temporary employment during project road construction. People also obtained skills training in farming techniques during the Project, which also benefited the many apple producers in the project area, where apples are the main crop. The cost transporting apples decreased after the Project from about CNY1.4 per kilogram (kg) to around CNY0.8 per kg. The increase in the cost of fruit per mu was from CNY600 in 2001 to CNY700 in 2006, while the increase in the cost of grain from CNY0.55 per kilo in 2001 to CNY0.65 per kg in 2006.

6. Project villages now have more telephones than before, when some villages had only one. The number of television sets has also risen. Villagers report that their access to social services, hospitals, and schools has increased, and economic activity, job opportunities, and the mobility of labor have improved rapidly since project completion. Appendix 18 provides further details on the Project's socioeconomic impact.

CAPACITY DEVELOPMENT

1. The Shanxi Communication Department (SCD) was the Executing Agency (EA) for the Project. Shanxi Hou-yu Expressway Construction Company Limited (SHEC), the Implementing Agency, was established in October 2001 for the purpose of construction, maintenance, and operations of the Houma–Yumenkou expressway. In November 2003 SHEC organized six departments for the undertaking, covering engineering, planning, procurement, resettlement, finance, and general affairs. A chief supervision engineer office (CSEO) was also established with the three resident supervision engineer offices in Xinjiang, Jishan, and Hejin. Project preparation established that SHEC required staff training to strengthen its expertise at various levels.

2. The plan at appraisal called for in-house training by (i) international consultants for 40 SHEC staff and domestic consultant personnel in construction supervision, quality control, and contract management; and (ii) by the domestic consultants financed by SHEC for SHEC staff in financial management, resettlement policies and implementation environmental monitoring. In addition, 45 person-months of international training were planned that aimed at developing the human resources of SHEC, of which 15 person-months were in construction supervision, and 30 person-months in environmental protection and monitoring, expressway corporate management, large-span bridge construction and control techniques, traffic engineering, road safety, highway engineering, and project management.

3. Several in-house training sessions and workshops were successfully conducted by domestic consultants in contract management, construction supervision, project performance, and environmental monitoring for the engineers, contract managers, and SHEC staff. A detailed overseas training program was prepared by the international consultant and approved by the Shanxi Finance Bureau (SFB). Only 36 person-months, about 80% of the international training as envisaged at appraisal, were provided, although the budget allocated at appraisal of $0.5 million was largely utilized ($471,000). Six international training programs involving 45 staff on project management, construction supervision, corporate management of expressways, road safety, traffic engineering, environmental protection and monitoring, and long-span bridge construction were carried out between October 2005 and January 2007 in France, the United Kingdom, Australia, Italy and New Zealand. The training was found to be useful and a considerable amount of the knowledge acquired was applicable to the project road's construction, operation, and maintenance. The trainees conducted workshops and delivered their findings from the training. To enhance SHEC's understandings of ADB's procurement procedure ADB Inception Mission conducted a project implementation and procurement seminar in February 2004 on procurement procedure, project performance monitoring, and reporting. Twenty-seven staff from SHEC and the tendering company participated.

4. SHEC decided to use the loan savings under the following category: international consulting services for additional overseas training in expressway maintenance during winter, bridge safety monitoring, pavement maintenance, toll collection technology, and management of concession company to be conducted in 2007. The training program was approved by ADB and the SFB in December 2006 and April 2007, respectively. SFB's delay in approving the training resulted in an extension of the original loan closing date by six months until 31 January 2008. Subsequent SCD approval of the trainee candidates was not undertaken before the revised loan closing date and the training courses were not undertaken.

APPRAISAL AND ACTUAL PROJECT COST AND FINANCING

Table A5.1: Project Cost
($ million)

Project Component	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
A. Base Cost						
1. Expressway Civil Works	111.70	79.90	191.60	128.66	79.88	208.54
2. Buildings and Ancillary Features	3.10	3.40	6.50	3.59	3.94	7.53
3. Equipment	5.40	0.10	5.50	3.15	0.06	3.21
4. Land Acquisition and Resettlement	0.00	31.20	31.20	0.00	21.27	21.27
5. Consulting Services and Training	1.50	17.30	18.90	1.15	18.25	19.41
6. Local Road Program	2.00	9.30	11.30	2.04	7.27	9.32
Subtotal (A)	**123.70**	**141.20**	**264.90**	**138.60**	**130.67**	**269.27**
B. Contingencies						
1. Physical Contingencies	8.70	10.00	18.70	0.00	0.00	0.00
2. Price Contingencies	7.50	13.70	21.20	0.00	0.00	0.00
Subtotal (B)	**16.20**	**23.70**	**39.90**	**138.60**	**130.67**	**269.27**
C. Front-End Fee	**1.20**	**0.00**	**1.20**	**1.24**	**0.00**	**1.24**
D. Interest During Construction	**14.80**	**6.00**	**20.80**	**7.55**	**8.94**	**16.49**
Total	**155.90**	**170.90**	**326.80**	**147.39**	**139.61**	**287.00**

Source: Asian Development Bank.

Table A5.2: Financing Arrangement
($ million)

Item	Appraisal				Actual			
	Foreign Cost	Local Cost	Total Cost	Percentage of Total (%)	Foreign Cost	Local Cost	Total Cost	Percentage of Total (%)
ADB Loan	124.00	0.00	124.00	37.90	124.00	0.00	124.00	43.20
MOC	0.00	56.80	56.80	17.40	0.00	63.20	63.20	22.00
Shanxi Government Funds	31.90	65.80	97.70	29.90	23.39	10.81	34.20	11.90
CMB Loan	0.00	48.30	48.30	14.80	0.00	65.60	65.60	22.90
Total	**155.90**	**170.90**	**326.80**	**100.00**	**147.39**	**139.61**	**287.00**	**100.00**

ADB = Asian Development Bank, CMB = China Minsheng Bank, MOC = Ministry of Communications.
Source: Asian Development Bank.

CURRENCY EQUIVALENTS

1 January–31 December	CNY to $1.00
2003	8.28715
2004	8.28723
2005	8.20329
2006	7.98189
2007	7.61720
2008[a]	7.14794

[a] 2008 exchange rate is for the period 1 January–19 April 2008.
Source: Asian Development Bank.

SUMMARY OF CONTRACTS FOR CIVIL WORKS, EQUIPMENT, AND CONSULTANTS

Description	Length (km)	Mode of Procure-ment*	ADB Approval	Contract Signing	Commence-ment	Completion	Name of Contractor/Supplier/ Consultant	Country of Origin	Contract Amount							PCSS No.	ADB Financing	
									Original (in contract currency)	Rate (at contract award)	$ Equiv.		Final (in contract currency)	Rate (at completion)	$ Equiv.		In Contract Currency	$ Equiv.
									A	B	C = A/B		D	E = G/H	F = D/E		G	H
A. Civil Works-Expressway																		
ADB-Financed																		
1. Subgrade, Bridge/Culvert																		
E1 K0+000~K14+900	14.90	ICB	25-Mar-04	27-Apr-04	28-May-04	30-Aug-05	Jilin Provincial Communications Construction Group, Ltd.	PRC	CNY 110,511,159	8.2894	13,331,623	CNY	113,030,477	8.0210	14,091,817	0001	CNY 60,400,126	7,530,248
E2 K14+900~K25+300	10.40	ICB	25-Mar-04	27-Apr-04	28-May-04	30-Aug-05	Daqing Oilfield Highway & Bridge Engineering Co., Ltd.	PRC	CNY 78,800,000	8.2894	9,506,116	CNY	83,014,665	8.0100	10,363,900	0002	CNY 44,827,919	5,596,506
E3 K25+300~K35+600	10.30	ICB	25-Mar-04	27-Apr-04	28-May-04	30-Aug-05	Taiyuan Road & Bridge Construction Company, Ltd.	PRC	CNY 59,303,283	8.2894	7,154,110	CNY	79,774,646	8.0311	9,933,204	0003	CNY 43,078,309	5,363,930
E4 K35+600~K45+500	9.90	ICB	25-Mar-04	27-Apr-04	28-May-04	30-Aug-05	The First Engineering Co., Ltd. of Shanxi Road & Bridge	PRC	CNY 108,837,159	8.2894	13,129,679	CNY	124,596,438	8.0245	15,526,990	0004	CNY 65,951,786	8,218,796
E5 K45+500~K60+100	14.60	ICB	25-Mar-04	27-Apr-04	28-May-04	30-Aug-05	Shanxi Yuncheng Road and Bridge Company, Ltd.	PRC	CNY 97,355,396	8.2894	11,744,565	CNY	169,550,763	8.0190	21,143,695	0005	CNY 87,529,863	10,915,343
E6 K60+100~K63+602 (plus pavement)	3.50	ICB	25-Mar-04	27-Apr-04	28-Jun-04	Dec 2006	Zhong Tie Major Bridge Engineering Group Company, Ltd.	PRC	CNY 338,861,780	8.2894	40,878,927	CNY	411,467,008	8.0273	51,258,457	0006	CNY 203,649,661	25,369,634
E7 K63+602~K66+840.7 (plus pavement)	3.24	ICB	25-Mar-04	27-Apr-04	28-Jun-04	Dec 2006	Zhong Tie Major Bridge Engineering Group Company, Ltd.	PRC	CNY 192,303,724	8.2894	23,198,751	CNY	194,810,525	8.0416	24,225,492	0007	CNY 99,654,549	12,392,454
Subtotal (A1)	**66.84**								**CNY 985,972,501**		**118,943,772**	**CNY**	**1,176,244,522**		**146,543,554**		**CNY 605,092,213**	**75,386,911**
2. Pavement																		
P1 K0+000~K15+000, Xinjiang	15.00	ICB	13 Jul 2005	18-Oct-05	18-Nov-05	Oct 2006	Taiyuan Road and Bridge Construction Ltd. Company	PRC	CNY 97,802,960	8.2889	11,799,269	CNY	78,610,398	7.8417	10,024,685	0009	CNY 42,449,615	5,413,330
P2 K15+000~K30+000, Xinjiang (3.27 km) and Jishan (11.73 km)	15.00	ICB	13 Jul 2005	18-Oct-05	18-Nov-05	Oct 2006	Shanxi Yuncheng Road Bridge Co., Ltd.	PRC	CNY 138,633,181	8.2889	16,725,160	CNY	123,109,533	7.8203	15,742,324	0010	CNY 66,479,148	8,500,855
P3 K30+000~K45+500, Jishan 11.16 km) and Hejin (4.34 km)	15.50	ICB	13 Jul 2005	18-Oct-05	18-Nov-05	Oct 2006	Shanxi Road Bridge Construction Group Co., Ltd.	PRC	CNY 113,057,944	8.2889	13,639,680	CNY	91,247,652	7.8316	11,651,209	0011	CNY 49,273,732	6,291,653
P4 K45+500~K60+100, Hejin	14.60	ICB	13 Jul 2005	18-Oct-05	18-Nov-05	Oct 2006	Shanxi Road and Bridge the First Engineering Co., Ltd.	PRC	CNY 135,908,565	8.2889	16,396,454	CNY	142,751,181	7.7709	18,369,894	0012	CNY 77,085,638	9,919,743
Subtotal (A2)	**60.10**								**CNY 485,402,650**		**58,560,563**	**CNY**	**435,718,764**		**55,788,113**		**CNY 235,288,133**	**30,125,581**
3. Traffic Engineering																		
T1 K0+000~K35+000	35.00	ICB	05-Jul-05	18-Oct-05	01-Mar-06	Nov 2006	Shanxi Luda Industry General Corp.	PRC	CNY 31,376,249	8.2889	3,785,333	CNY	26,704,873	7.7858	3,429,965	0013	CNY 14,420,631	1,852,181
T2 K35+000~K66+840.7	31.84	ICB	05-Jul-05	18-Oct-05	01-Mar-06	Nov 2006	Shenyang Sanxi Highway Eng. Co., Ltd.	PRC	CNY 27,262,143	8.2889	3,288,994	CNY	21,592,085	7.7714	2,778,398	0014	CNY 11,659,726	1,500,335
Subtotal (A3)	**66.84**								**CNY 58,638,392**		**7,074,327**	**CNY**	**48,296,958**		**6,208,363**		**CNY 26,080,357**	**3,352,516**
B. EA-Financed																		
1. Building and Ancillary																		
F1 Xinjiang and Jishan Toll Stations		GP	-	08-Sep-05	Oct-05	Dec-06	Shanxi Wufeng Architecture Company	PRC	CNY 7,651,853	8.2892	923,115	CNY	7,535,565	7.6506	984,964		CNY 0.00	0.00
F2 East Hejin Toll Station		GP	-	08-Sep-05	Oct-05	Dec-06	Shanxi Hongtu Architecture Company	PRC	CNY 9,219,148	8.2892	1,112,192	CNY	9,891,742	7.6506	1,292,937		CNY 0.00	0.00
F3 Service Area		GP	-	08-Sep-05	Oct-05	May-07	Taiyuan First Architecture Co. Ltd.	PRC	CNY 20,917,850	8.2892	2,523,516	CNY	20,320,503	7.6506	2,656,067		CNY 0.00	0.00
F4 Toll Shed, Main Road Station, and Hejin West Station		GP	-	08-Sep-05	Oct-05	Dec-06	Shanxi Provincial Architecture Parent Company	PRC	CNY 11,836,015	8.2892	1,427,889	CNY	19,843,694	7.6506	2,593,743		CNY 0.00	0.00
Subtotal (B1)									**CNY 49,624,866**		**5,986,712**	**CNY**	**57,591,504**		**7,527,711**		**CNY** 0.00	0.00
Total Civil Works-Expressway									**CNY 1,579,638,409**	**8.2892** (average)	**190,565,374**	**CNY**	**1,717,851,748**	**7.9228** (average)	**216,067,741**		**CNY 866,460,703**	**108,865,007**

Description	Length (km)	Mode of Procure-ment*	ADB Approval	Contract Signing	Commence-ment	Completion	Name of Contractor/Supplier/ Consultant	Country of Origin	Contract Amount							PCSS No.	ADB Financing		
									Original (in contract currency)	Rate (at contract award)	$ Equiv.		Final (in contract currency)	Rate (at completion)	$ Equiv.		In Contract Currency		$ Equiv.
									A	B	C = A/B		D	E = G/H	F = D/E		G		H
C. Civil Works-Local Roads																			
ADB-Financed			(post facto)																
1. Fenhe Bridge–Zezhang, Xinjiang	15.705	GP	29-Sep-06	22-Dec-05	25-Dec-05	Dec 06	Yuncheng Kangda Communication Construction Ltd.	PRC	CNY	13,377,711	7.8000	1,715,091	CNY	13,204,900	7.6791	1,719,590	0016	CNY	5,281,960	687,836
2. Jishan–Zhangjiabao Highway (1st and 4th stages)	11.060	GP	29-Sep-06	25-Jul-05	02-Aug-05	Dec 06	Linyi Wuai Highway Engineering Ltd.	PRC	CNY	7,719,396	7.8000	989,666	CNY	7,717,248	7.6791	1,004,968	0017	CNY	3,086,899	401,987
(2nd and 3rd stages), Jishan	5.830	GP	29-Sep-06	25-Jul-05	02-Aug-05	Dec 06	Shanxi Kanghui Highway and Bridge Ltd.	PRC	CNY	4,023,282	7.8000	515,805	CNY	3,990,090	7.7683	513,635	0018	CNY	1,596,036	205,454
3. Guancun–Xishe (1st stage/1st contract)	4.309	GP	29-Sep-06	05-Apr-06	10-Apr-06	Jul 06	Yuncheng Kangda Communication Construction Ltd.	PRC	CNY	2,029,859	7.8000	260,238	CNY	2,027,060	7.7684	260,938	0019	CNY	810,824	104,375
(2nd stage/2nd contract), Jishan	3.696	GP	29-Sep-06	05-Apr-06	10-Apr-06	Jul 06	Henan Highway and Bridge Engineering Ltd.	PRC	CNY	1,596,133	7.8000	204,632	CNY	1,593,215	7.7684	205,090	0020	CNY	637,286	82,036
4.[1] Zhaojiazhuang–Chaijia Highway, Zhaojiazhuang Village to Baidi, Hejin	5.870	GP	29-Sep-06	20-Feb-06	08-Mar-06	Sep 06	Hejin Xiaoliang Construction Ltd.	PRC	CNY	10,685,200	7.8000	1,369,897	CNY	10,685,200	7.6048	1,405,065	0021	CNY	4,274,080	562,026
	46.470								**CNY**	**39,431,581**		**5,055,331**	**CNY**	**39,217,713**	**7.7113**	**5,109,285**		**CNY**	**15,687,085**	**2,043,715**
EA-Financed														(average)					
4.[2] Zhaojiazhuang–Chaijia, Hejin Baidi–Huangcun	2.300	GP	-	15-Mar-03	20-Mar-03	Nov 03	Hejin No. 5 Architecture Engineering Ltd.	PRC	CNY	1,203,200	7.8000	154,256	CNY	1,203,200	7.7113	156,030		CNY	0.00	0.00
Huangcun–Wancang	1.950	GP	-	28-Jul-05	05-Aug-05	Oct 05	Yuncheng Kangda Communication Construction Ltd.	PRC	CNY	1,332,500	7.8000	170,833	CNY	1,332,500	7.7113	172,797		CNY	0.00	0.00
Wancang–Chaijia	4.780	GP	-	20-Apr-03	01-May-03	Nov 03	Hejin Municipal Engineering Ltd.	PRC	CNY	2,982,500	7.8000	382,372	CNY	2,982,500	7.7113	386,768		CNY	0.00	0.00
5. Zezhang–Guanwangmiao, Xinjiang	20.100	GP	-	03-Apr-03	10-Apr-03	Oct 04	Shanxi Wantong Road & Bridge Engineering Limited Co.	PRC	CNY	14,158,403	7.8000	1,815,180	CNY	14,158,403	7.7113	1,836,049		CNY	0.00	0.00
Xishe–Huayu, Jishan Contract 1	4.600	GP	-	25-Mar-04	28-Mar-04	28-Jul-04	Road Construction Maintenance Center under Jishan Traffic Bureau	PRC	CNY	2,950,196	7.8000	378,230	CNY	2,950,196	7.7113	382,579		CNY	0.00	0.00
Xishe–Huayu, Jishan Contract 2	6.284	GP	-	25-Mar-04	28-Mar-04	28-Jul-04	Hejin Road & Bridge Engineering Company	PRC	CNY	3,887,835	7.8000	498,440	CNY	3,887,835	7.7113	504,171		CNY	0.00	0.00
6. Xipo–Xiahua, Hejin	11.500	GP	-	08-Jun-03	10-Jun-03	Sep 04	Hengyuan Lt. Co.,Yuanfang Road & Bridge Group	PRC	CNY	5,930,000	7.8000	760,256	CNY	5,930,000	7.7113	768,997		CNY	0.00	0.00
	51.514								**CNY**	**32,444,634**		**4,159,568**	**CNY**	**32,444,634**		**4,207,391**		**CNY**	0.00	0.00
Total Civil Works-Local Roads	**97.984**								**CNY**	**71,876,215**		**9,214,899**	**CNY**	**71,662,347**		**9,316,676**		**CNY**	**15,687,085**	**2,043,715**
D. Equipment																			
ADB-Financed																			
EP1 Traffic Monitoring, Communication, and Toll Collection System		ICB	21-Jun-06	28-Jun-06	05-Jul-06	28-Dec-06	Shanxi Traffic Information Communication Company/Shanghai Electrical Scientific Research Institute (Group) Co. Ltd. (JV)	PRC	CNY	18,980,853	8.0970	2,344,183	CNY	24,143,170	7.6524	3,154,960	0015	CNY	24,143,170	3,154,960
EA-Financed																			
Yuncheng Wetland Monitoring Equipment		GP	-	10-Oct-04	10-Oct-04	08-May	Yuncheng Wetland Nature Reserve Station	PRC	CNY	400,000	8.2894	48,254	CNY	400,000	6.9963	57,173		CNY	0.00	0.00
Total Equipment									**CNY**	**19,380,853**		**2,392,437**	**CNY**	**24,543,170**		**3,212,133**	0015	**CNY**	**24,143,170**	**3,154,960**

Description	Length (km)	Mode of Procure-ment*	ADB Approval	Contract Signing	Commence-ment	Completion	Name of Contractor/Supplier/ Consultant	Country of Origin	Contract Amount: Original (in contract currency) A	Rate (at contract award) B	$ Equiv. C = A/B	Final (in contract currency) D	Rate (at completion) E = G/H	$ Equiv. F = D/E	PCSS No.	ADB Financing: In Contract Currency G	$ Equiv. H
E. Consultant																	
International (ADB-Financed)																	
Construction Supervision and Training		QCBS	03-Sep-04	28-Sep-04	24-Oct-04	May-07	Scetauroute International	FRA	**Euro** 1,157,162 US$ 110,000	**1.996**	**1,498,131** (reduced prce)	**Euro** 897,485 -	**0.78**	**1,151,283**	0008	**Euro**	**897,485**	**1,151,283**
National (EA-Financed)																	
1. Chief Supervision Engineer Office		GP	-	04-Apr-04	28-May-04	Nov-06	Shanxi Provincial Highway Project Supervision Consulting Corp.	PRC	CNY 14,832,723	8.2894	1,789,360	CNY 14,832,723	7.7858	1,905,099		CNY	0.00	0.00
2. No. 1 Resident Engineer Office (E1, E2, E3, P1, P2, T1)		GP	-	04-Apr-04	28-May-04	Nov-06	Supervision Centre of the Traffic Engineering, Weifang	PRC	CNY 5,796,666	8.2894	699,287	CNY 6,032,166	7.7858	774,765		CNY	0.00	0.00
3. No. 2 Resident Engineer Office (E4, E5, P3, P4, T2)		GP	-	04-Apr-04	28-May-04	Nov-06	Shanxi Provincial Communication Construction Engineering Supervision Co.	PRC	CNY 4,511,922	8.2894	544,300	CNY 5,000,785	7.7858	642,296		CNY	0.00	0.00
4. No. 3 Resident Engineer Office (E6, E7)		GP	-	04-Apr-04	28-May-04	Nov-06	Construction Suervision. Corp. of Xi'an Highway Communications University	PRC	CNY 6,983,184	8.2894	842,423	CNY 6,983,184	7.7858	896,913		CNY	0.00	0.00
5. Supervision for House Building		GP	-	08-Sep-05	18-Nov-05	Nov-06	Constr. Sup. Corp. of Taiyuan Science and Engineering College	PRC	CNY 767,984	8.2894	92,647	CNY 688,533	7.6524	89,976		CNY	0.00	0.00
6. Supervision for Electromecha-nical Works		GP	-	05-Apr-06	05-Jul-06	28-Dec-06	Beijing Xingtong Traffic Engineering Supervision Co., Ltd.	PRC	CNY 567,776	8.0116	70,869	CNY 617,776	7.8149	79,051		CNY	0.00	0.00
7. Monitoring and Evaluation and Resettlement		GP	-	01-Sep-03	01-Sep-03	Aug-07	Shaanxi Kexin Consulting Company	PRC	CNY 1,380,000	8.2894	166,478	CNY 1,380,000	7.5567	182,619		CNY	0.00	0.00
8. Monitoring of Yuncheng Wetland Nature Reserve		GP	-	10-Oct-04	10-Oct-04	08-May	Yuncheng Wetland Nature Reserve Station	PRC	CNY 350,000	8.2894	42,223	CNY 350,000	6.9963	50,026		CNY	0.00	0.00
9. Environment Monitoring (during implementation)		GP	-	16-May-04	01-Jun-04	Jun-07	Shanxi Environment Monitoring & Testing Center of Communication	PRC	CNY 1,630,000	8.2894	196,637	CNY 1,630,000	7.6155	214,037		CNY	0.00	0.00
10. Environment Monitoring (during operation)		GP	-	07-Jul-07	07-Jul-07	7 Jul 09	Shanxi Environment Monitoring & Testing Center of Communication	PRC	CNY 160,000	6.9963	22,869	CNY 160,000	6.9963	22,869		CNY	0.00	0.00
11. Soil Erosion and Monitoring (during operation)		GP	-	10-Jul-07	10-Jul-07	10 Jul 09	Shanxi Hou-Yu Expressway Project Water Erosion Protection Monitoring Service	PRC	CNY 180,000	6.9963	25,728	CNY 180,000	6.9963	25,728		CNY	0.00	0.00
									CNY 37,160,255		**4,492,820**	**CNY 37,855,167**		**4,883,380**		**CNY**	0.00	0.00
Preliminary/Detailed Design and Project Preparation (EA-Financed)																	
1. Engineering Quality Supervision		GP	-	04-Apr-04	28-May-04	Dec 06	Shanxi Quality Supervision Station	PRC	CNY 2,154,958	8.2894	259,965	CNY 2,154,958	7.9228	271,995		CNY	0.00	0.00
2. Norms Preparation and Management		GP	-	04-Apr-04	28-May-04	Dec 06	Shanxi Norms Station	PRC	CNY 2,442,286	8.2894	294,628	CNY 2,442,286	7.9228	308,261		CNY	0.00	0.00
3. Engineering Design		GP	-	04-Apr-04	28-May-04	Dec 06	China Communications Second Highway Survey Design & Research Institute	PRC	CNY 59,676,342	8.2894	7,199,115	CNY 34,850,432	7.9228	4,398,765		CNY	0.00	0.00
4. Research and Test		GP	-	04-Apr-04	28-May-04	Dec 06	Wuhan Bridge Science Academe Company Ltd. Of China, Zhongtie Major Bridge Eng. Group Co. Ltd.	PRC	CNY 3,956,000	8.2894	477,236	CNY 3,956,000	7.9228	499,320		CNY	0.00	0.00
5. EA Adminstrative Expenses		GP	-	01-Sep-03	28-May-04	Dec 06	Shanxi Zhongqiang Construction Cost Consulting Co., Ltd.	PRC	CNY 27,492,640	8.2894	3,316,602	CNY 27,492,640	7.9228	3,470,076		CNY	0.00	0.00
6. Other Costs		GP	-	01-Sep-03	28-May-04	Dec 06	Chang'an University, etc.	PRC	CNY 35,035,104	8.2894	4,226,495	CNY 35,035,104	7.9228	4,422,074		CNY	0.00	0.00
									CNY 130,757,330		**15,774,040**	**CNY 105,931,420**		**13,370,491**		**CNY**	0.00	0.00
Total Consultants											**21,764,991**			**19,405,154**				**1,151,283**
F. Land Acquisition and Resettlement (EA-Financed)		GP	-	01-Sep-03	01-Sep-03	Dec 06	Special Resettlement Offices - Xinjiang, Jishan, Hejin	PRC	CNY 168,491,580	8.2894	20,326,149	CNY 168,491,580	7.9228	21,266,732				
Total Contracts											**244,263,851**			**269,268,436**				**115,214,965**

Equiv. = equivalent,
FEF = front-end fee,
IDC = interest and other charges during construction.
* ICB = international competitive bidding,
GP = government procedures,
QCBS = quality- and cost-based selection method.
Sources: ADB's loan financial information system and implementing agency's data.

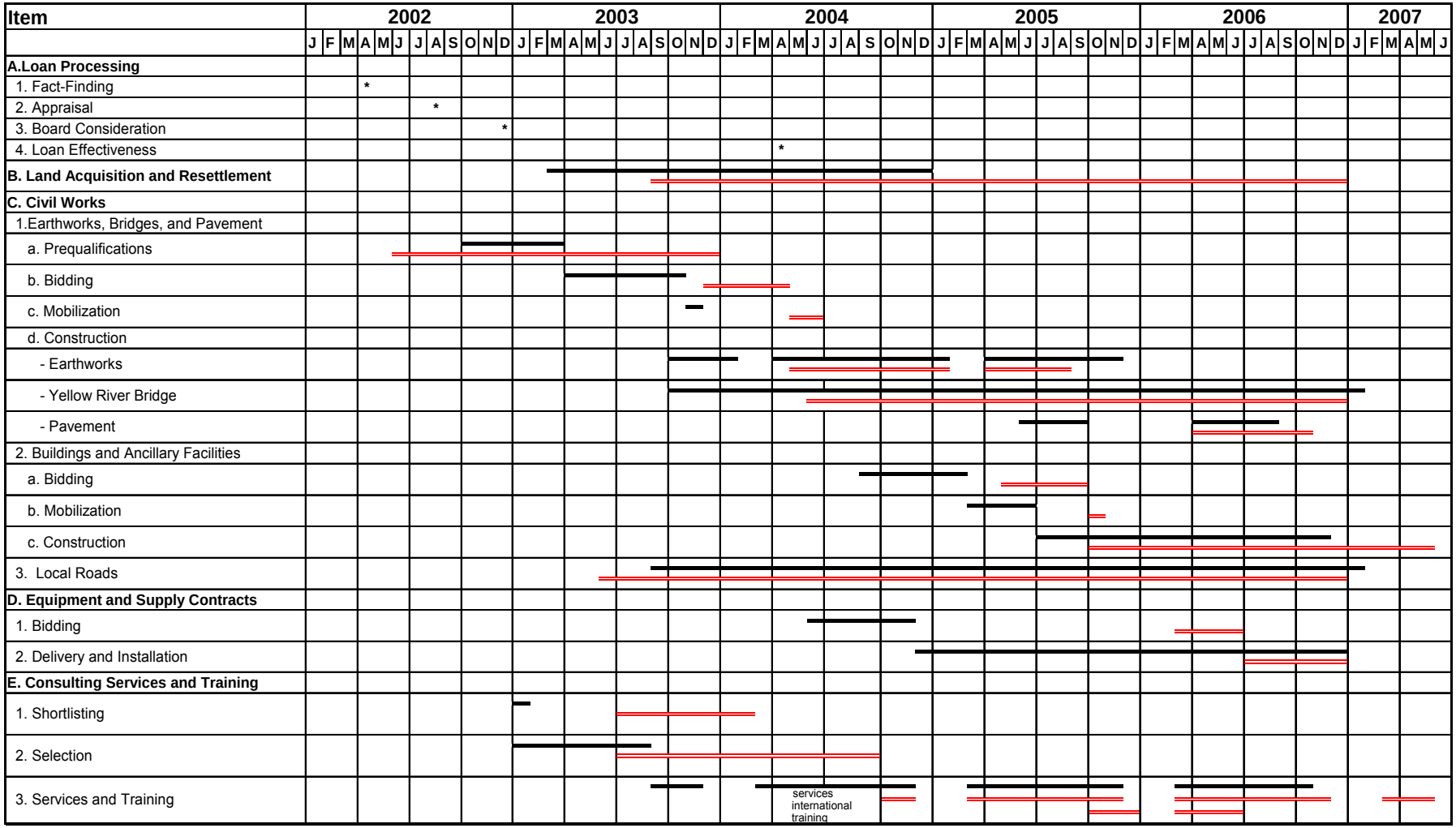
FEF	1,240,000	FEF	1,240,000
IDC	$ 16,485,248	IDC	$ 7,545,035
Project Cost	$ 286,993,684	ADB Loan	$ 124,000,000

PROJECTED AND ACTUAL DISBURSEMENTS
($ million)

Year	Appraisal	Actual
2003	24.80	
2004	37.20	28.15
2005	37.20	22.72
2006	24.80	36.07
2007		25.99
2008		11.07
Total	**124.00**	**124.00**

Source: Asian Development Bank.

PROJECT IMPLEMENTATION SCHEDULE



appraisal

actual

Sources: Asian Development Bank and implementing agency's data.

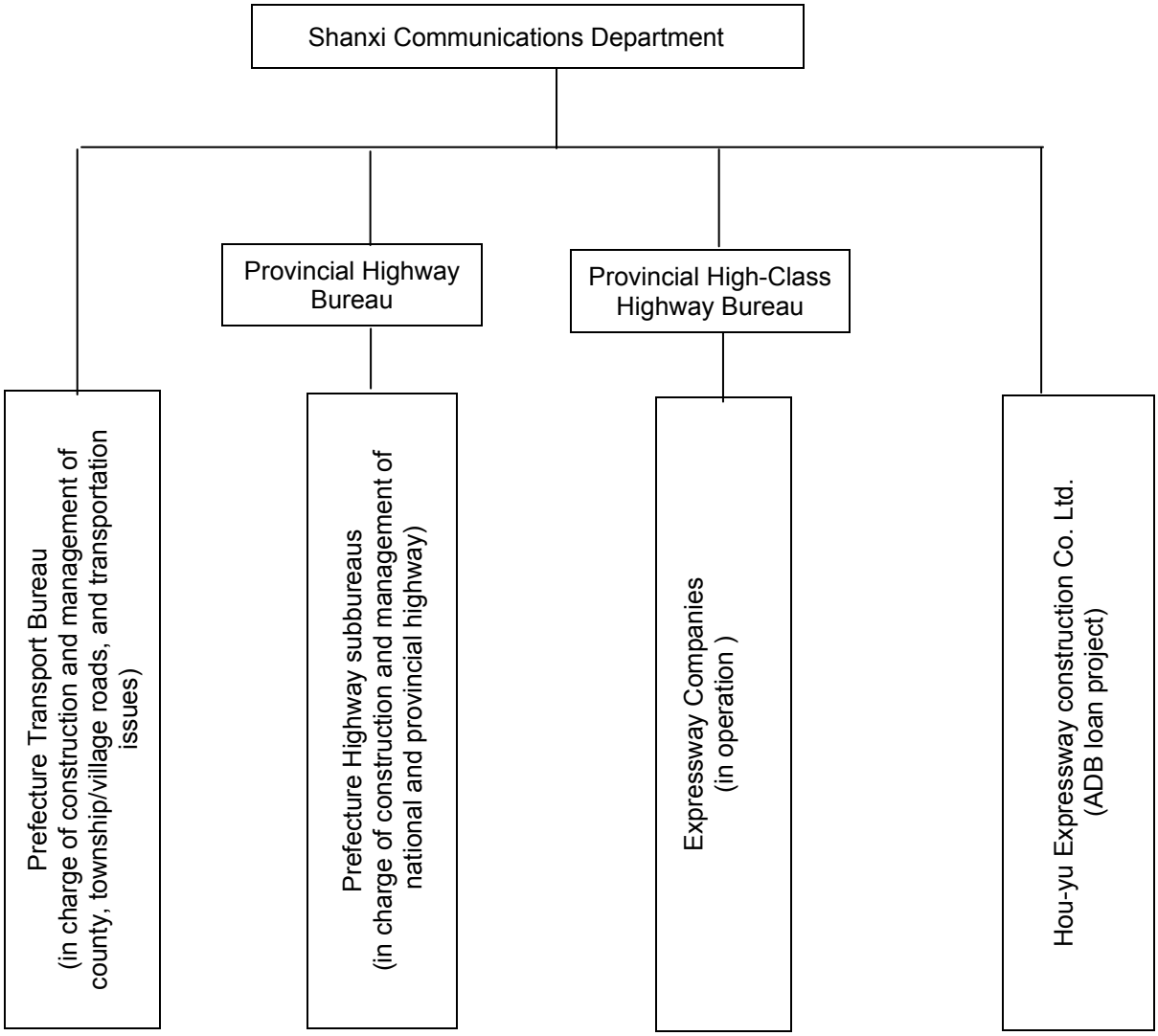
CHRONOLOGY OF MAJOR EVENTS

Date	Project Events
2–12 April 2002	- Fact-Finding Mission.
3 June 2002	- Management Review meeting.
15–23 August 2002	- Appraisal Mission.
23 September 2002	- Staff Review Committee meeting.
5–7 November 2002	- Loan negotiations.
12 December 2002	- Loan of $124,000,000 approved.
20 March 2003	- Commencement of local roads construction.
1 September 2003	- Start of land acquisition and resettlement as well as the services of the national consultants for monitoring and evaluation and resettlement.
11 December 2003	- Loan and Project Agreements signed.
18–23 February 2004	- Inception Mission.
11 March 2004	- Original date of loan effectiveness.
15 March 2004	- One-month extension of loan effectiveness unitl 11 April 2004, approved.
25 March 2004	- Asian Development Bank (ADB) approval for the award of seven civil works contracts (E1-E7) for subgrade works.
1 April 2004	- Loan effectiveness.
4 April 2004	- Contract signing of Executing Agency-financed national consultants for construction supervision.
27 April 2004	- Contracts signing of E1-E7.
28 May 2004	- Start of work for Contracts E1-E5 and the national consultants for construction supervision.
28 June 2004	- Start of work for Contracts E6-E7.
6 August 2004	- Onlending Agreement between Shanxi Provincial Government and Shanxi Hou-Yu Expressway Construction Company Ltd. was signed.
3 September 2004	- ADB approval of the final ranking for international consultant for construction supervision and training.
28 September 2004	- Contract signing for the international consultant.
4 October 2004	- Commencement of services of the international consultant.
16–20 December 2004	- Environment Safeguard Review Mission.
4–9 April 2005	- Review Mission 1.
5 July 2005	ADB approval for the award of two civil works contracts (T1-T2) for traffic engineering works.
13 July 2005	- ADB approval for the award of four civil works contracts (P1-P4) for pavement works.
30 August 2005	- Completion of works for Contracts E1-E5.
8 September 2005	- Contract signing for Executing Agency-financed building and ancillary works (Contracts F1-F4).
October 2005	- Start of building and ancillary works Contracts F1-F4.
18 October 2005	- Contract signing of P1-P4 and T1-T2.
5 November 2005	- Minor change in project scope approved. replacing three local road sections with another three local road sections and increasing the length of the ADB-financed local roads from 70 km to 97.7 km.
18 November 2005	- Start of work for Contracts P1-P4.

Date	Project Events
1 March 2006	- Start of work for Contracts T1-T2.
27 March 2006	- First reallocation of loan proceeds approved: ($7.16 million) from the unallocated category to civil works ($7.10 million) and consulting services ($0.06 million) categories.
21 June 2006	- ADB approval of the award of equipment contract for traffic monitoring, communication, and toll collection system (Contract EP1).
28 June 2006	- Contract signing of EP1.
5 July 2006	- Start of works for EP1.
5–11 September 2006	- Mid-term Review Mission.
29 September 2006	- ADB post-facto approval of the award of the local roads contracts.
October 2006	- Completion of work for Contracts P1-P4.
November 2006	- Completion of work for Contracts T1-T2.
December 2006	- Completion of work for Contracts E6-E7, F1, F2, F4, and the local roads. Also, completion of the land acquisition and resettlement works.
28 December 2006	- Completion of work for Contract EP1.
28 December 2006	- Opening to traffic of the project expressway.
1 February 2007	- Toll collection started.
23–26 April 2007	- Review Mission 2.
May 2007	- Completion of work for building and ancillary Contract F3.
12 July 2007	- Extension of the loan closing date by six months, from 31 July 2007 to 31 January 2008, approved along with second reallocation of loan proceeds ($9.819 million).
31 July 2007	- Original loan closing date.
August 2007	- Completion of the services of the national consultant for monitoring and evaluation and resettlement.
25 January 2008	- Increase in ADB financing percentage from 48% to 54% for civil works-expressway approved.
31 January 2008	- Loan closing date.
6 March 2008	- Final disbursement and effective date of loan closing.
15–23 April 2008	- Project Completion Review Mission.

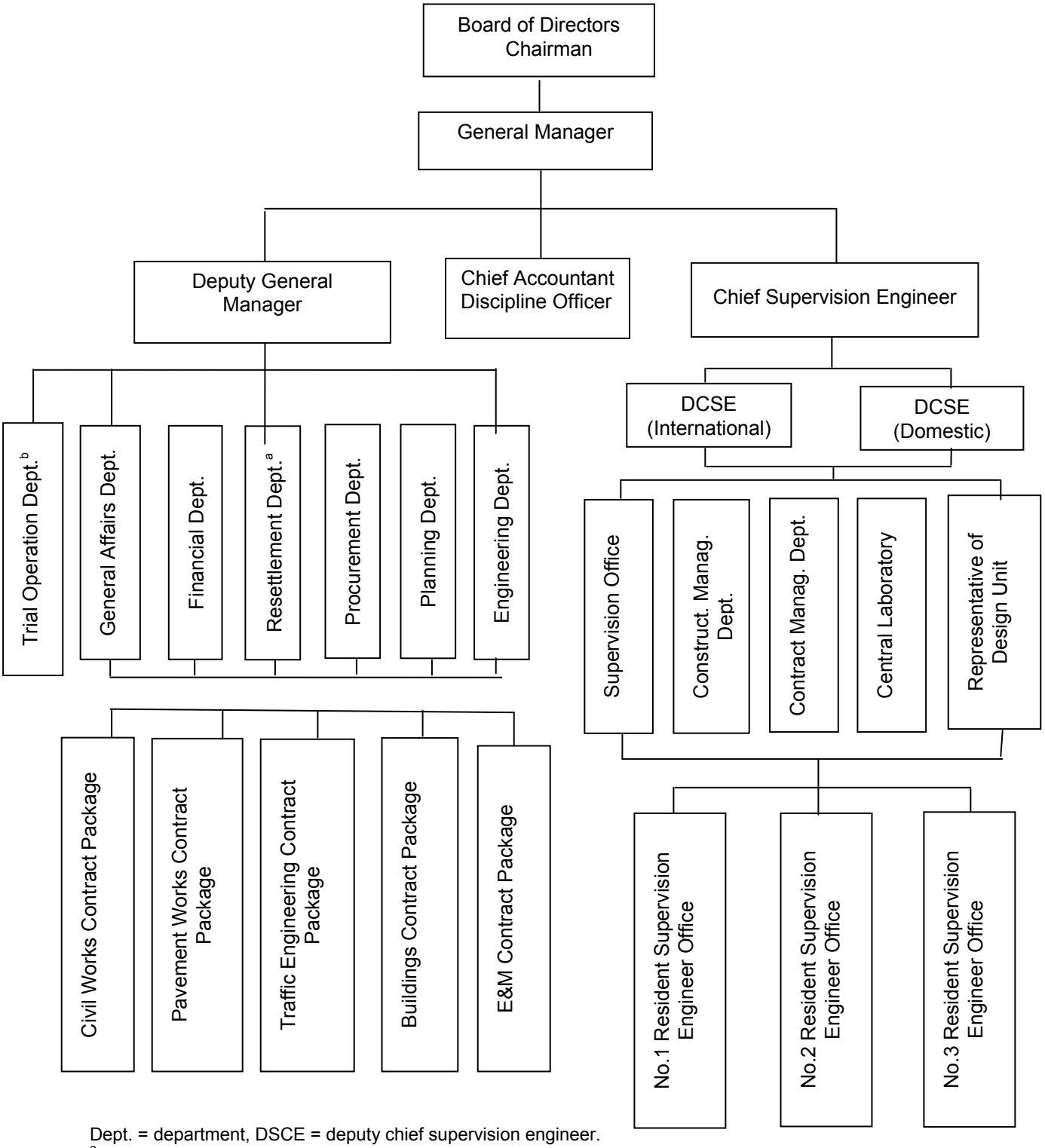
ADB = Asian Development Bank.

ORGANIZATION CHART OF SHANXI PROVINCIAL COMMUNICATIONS DEPARTMENT



Source: Shanxi Hou-Yu Expressway Construction Company Ltd.

ORGANIZATION OF SHANXI HOU-YU EXPRESSWAY CONSTRUCTION CO., LTD



Dept. = department, DSCE = deputy chief supervision engineer.

[a] The Resettlement Department is in charge of environmental monitoring in the period of construction and trial operation.

[b] The Trial Operation Department is in charge of maintenance management of expressway, toll collection, and traffic monitoring.

Source: Shanxi Hou-Yu Expressway Construction Company Ltd.

STATUS OF COMPLIANCE WITH LOAN COVENANTS

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
	Sector		
1.	Implementation of Local Roads. The local roads component of the Project shall be implemented by the concerned county communications bureaus under the supervision of SCD.	LA, Sch. 6, para. 3 and PA, Schedule, para. 3	Complied. 97.98 km class I, II, or III roads opened to traffic between September 2004 and December 2006.
2.	Construction Quality. Shanxi, through, SCD, and SHEC shall ensure that the Project be constructed and maintained in accordance with technical standards of highway engineering issued by MOC and with reference to the Highway Design Manual developed under ADB-financed TA 2573-PRC: Review of Highway Design Standards. SHEC shall ensure in particular that the construction quality of Yellow River Bridge shall be strictly assured taking account of the special geological conditions of the river bed.	PA, Schedule, para. 5	Complied. Project roads were designed/built in accordance with national highway design standards and construction specifications; and meet international standards.
3.	Construction Quality. SHEC shall appoint the team leader of the international consultant engaged under the Project as the deputy chief supervision engineer, who will assist the chief supervision engineer (CSE) in Project and contract management activities and certify contractor's progress payments and contract variations prior to their approval by the CSE.	PA, Schedule, para. 6	Complied. International consultants fielded in October 2004, and Team Leader was assigned as Deputy Chief Supervision Engineer.
4.	Road Safety. Shanxi, through SCD, and SHEC shall implement the road signs, communication, hazard barriers, traffic monitoring, vehicle weighing and road safety audits. Shanxi shall ensure that SCD, SHEC and Shanxi Public Security Dept. (SPSD) cooperate closely to implement necessary road safety measures. Shanxi shall cause SPSD to prepare and implement the provincial road safety guidelines and action plan for road safety prior to opening of the project expressway. SCD in consultation SPSD, shall also submit a report on the road safety action plan including the results of safety audit report reviewed by the international consultant engaged under the project and emergency response plan to cover events such as hazardous material spills, earthquake, fire and other severe accidents for ADB's review before opening of the Project expressway. Recommendations made under TA 3341-PRC: Capacity Building in Traffic Safety, Planning, and Management shall be considered for implementation.	PA, Schedule, para. 7	Complied. (i) Road safety audits were carried out during construction and before opening the roads to Public. (ii) Shanxi Province Road Traffic Safety Plan was approved in November 2004 to implement Road Traffic Safety Law which was enacted in October 2003. (iii) Emergency response plans on incident of hazardous chemicals, traffic control plan for expressway under extreme weather; and safety plan on road and Yellow River Bridge are in place and are being effectively implemented.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
5.	Overloading. Shanxi shall cause SCD to, through SHEC, take appropriate measures following the regulations of the Borrower to prevent overloading on the Project expressway by installing vehicle axle load and weighing equipment at selected entry points. SHEC shall make suitable arrangements for operation of such equipment. Before opening of the Project expressway, SHEC shall submit to ADB a plan for operation of the vehicle weigh stations, including the prescribed axle load limits and penalties for infringement.	PA, Schedule, para. 25	Complied. Initial toll station with separate weighbridge was changed to weight-based toll station. This weight-based toll station checks weights of the trucks and simultaneously estimates toll fees, and made able to prevent a premature damage of the expressway.
6.	Monitoring and Evaluation. Shanxi, through SCD, and SHEC shall monitor, evaluate and report to ADB Project impacts through a Project Performance Monitoring System to ensure that the Project facilities are managed effectively and the benefits, particularly to the poor, are maximized. Shanxi, through SCD, and SHEC shall, collect data agreed with ADB prior to Project implementation, Project completion and annually for 3 years after the Project completion.	PA, Schedule, para. 26	Complied. Shaanxi Kexin Consulting Company (SKCC) was engaged; and conducted/is conducting a monitoring and evaluation during project implementation and operation until 2010.
	Environmental		
7.	Shanxi, through SCD, and SHEC shall ensure that the Project expressway and facilities are designed, constructed and operated and local roads are upgraded and maintained in accordance with national and local government environmental law and regulations, procedures, and guidelines and ADB's guidelines and procedures on environment.	PA, Schedule, para. 14	Complied. Adequate environmental mitigating measures had been included in the design and in the civil works contracts.
8.	SHEC shall ensure that any adverse environmental impacts arising from construction and operation of the Project expressway and upgrading and operation of the local roads will be minimized by implementing mitigation measures, environmental monitoring program, and other recommendations presented in the Environmental Impact Assessment. In particular, SHEC shall ensure implementation of (i) the comprehensive soil erosion control plan approved by the Ministry of Water Resources and the State Environmental Protection Administration (SEPA) of the Borrower; and (ii) the action plan for the protection of wintering ground of the gray crane in the Yuncheng Wetland Nature Reserve (YWNR). In addition, Shanxi shall cause the relevant local governments and SHEC to implement the other measures recommended by SEPA in March 2002 for the protection of the wintering ground of the migratory birds in the YWNR.	PA, Schedule, para. 15	Complied. (i) SHEC engaged Shanxi Environmental Monitoring and Testing Center to monitor implementation of mitigation measures and soil erosion control plan; and these contracts were extended for another 2 years to monitor impacts during operation. (ii) Yuncheng Wetland Nature Reserve Station was hired by SHEC to implement the Action Plan and monitor migration of birds. Plans were adequately implemented monitoring is ongoing.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
9.	Shanxi, through SCD, and SHEC shall submit to ADB a comprehensive environmental status report on a bi-annual basis starting from Dec 2002 to the completion of project implementation, including (i) progress made on the mitigation measures, (ii) monitoring data, (iii) problems encountered, (iv) enforcement plan, and (v) if being cited as violating any safety or environmental standards, or any laws and regulations of the Borrower, confirmation from the relevant agency of the Borrower showing that the violation has been corrected or a plan to correct the violation has been accepted.	PA, Schedule, para. 16	Complied.
10.	Vehicle Emissions. SHEC shall review the recommendations under ADB financed TA 5973-REG: Action Plans for Reducing Vehicle Emissions. SHEC shall cooperate with and assist the Shanxi Environmental Protection Bureau in controlling vehicle emissions on the Project expressway and consult with the State Environmental Protection Administration to facilitate accreditation of clearances and permits issued by other provincial environmental protection bureaus to the vehicles using the Project expressway. SHEC shall submit to ADB, before opening the Project expressway, the emission regulation limits prescribed by the Borrower, penalties for their infringement, and the plan for enforcement of vehicle emission control for the Project expressway.	PA, Schedule, para. 23	Complied. Yuncheng Environmental Protection Bureau introduced vehicle emission control plan in 2007 to implement "Blue Sky and clean water" program approved by Shanxi Government. Regular testing of vehicle emissions, vehicle clearance, and enforcement measures are in place.
	Land Acquisition and Resettlement		
11.	Shanxi, through SCD, and SHEC shall implement the Resettlement Plan (RP) and shall ensure that all land and rights-of-way required by the Project will be made available in a timely manner and that the provisions of the RP, including compensation and entitlements for affected persons (APs), will be implemented in accordance with all applicable laws and regulations, and ADB's Policy on Involuntary Resettlement.	PA, Schedule, para. 7	Complied. Resettlement for the expressway and local roads has implemented in compliance with the RP.
12.	Shanxi, through SCD, and SHEC shall ensure timely provision of counterpart funds for land acquisition and resettlement activities specified in the RP, and meet any obligations in excess of the RP budget estimate in order to satisfy resettlement objectives. Shanxi, through SCD, shall ensure that counterpart funds for compensation and entitlements under the RP are fully provided directly to APs and the relevant village organizations prior to displacement from housing and prior to loss of land, livelihood, income or other assets and ensure that the APs will be at least well of as they would have been in the absence of the Project.	PA, Schedule, para. 8	Complied. Resettlement compensation was paid on time. Resettlement Completion Report indicated affected people are better off.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
13.	Shanxi, through SCD, and SHEC shall ensure that (i) adequate staff and resources are committed to supervision and internal monitoring of the implementation of the RP and quarterly reports on resettlement progress will be forwarded to ADB; and (ii) an independent domestic monitoring agency will be contracted, in accordance with procedures acceptable to ADB, to carry out systematic monitoring twice each year during the period of land acquisition, conduct two annual evaluations after completion, and forward reports to ADB.	PA, Schedule, para. 9	Complied. Resettlement offices were established, monitoring reports were regularly submitted. SHEC extended external monitor's service for another 3 years to monitor the effects during operation.
14.	Shanxi, through SCD, and SHEC shall ensure that all affected people, including host people who provide land to APs, are provided adequate information and regularly consulted in advance of signing household compensation agreements and other decisions that affect their livelihood and living conditions as a result of the Project. SHEC shall, and Shanxi shall cause local resettlement offices to, keep records of consultation and make such records available to ADB on request.	PA, Schedule, para. 10	Complied. The affected persons were adequately informed and consulted on their entitlements. Villagers determined the means of using land compensation to restore lost income.
15.	Shanxi, through SCD, and SHEC shall update the RP as necessary and submit such changes for ADB's concurrence.	PA, Schedule, para. 11	Complied. The RP was updated based on the detailed measurement survey in April 2004.
16.	Shanxi, through SCD, and SHEC ensure that the APs are provided full opportunity to participate in resettlement planning and implementation, particularly income restoration measures, as set out in the RP.	PA, Schedule, para. 12	Complied.
17.	Shanxi, through, SCD, and SHEC shall ensure that civil works contractors' specifications include requirements to fully comply with the RP policy and entitlements for permanent and temporary impacts to APs or entities, which result from works carried out by the contractor. SHEC shall supervise the contractors to ensure compliance with requirements of RP, law and ADB policy.	PA, Schedule, para. 13	Complied. The requirements were included in the civil works contacts; compliance of the requirements was adequately supervised by the SHEC and county resettlement officers.
18.	Poverty Reduction. Shanxi, through SCD, and SHEC shall (i) promote that the contractors maximize the employment of local poor persons for construction of the Project expressway and local roads, and (ii) encourage that local villagers working for the local roads component of the Project will receive a salary based on market rates.	PA, Schedule, para. 18	Complied. Seven contractors employed 78,863 person-months labors on expressway construction. More were hired for the local roads. Unskilled workers received daily wages of 30 to 40 yuan, which are market rates.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
	Shanxi, through SCE and SHEC shall monitor the Project impacts on poverty during and after Project implementation in accordance with selected socioeconomic indicators. Shanxi, through SCD and SHEC shall provide semi-annual monitoring reports to ADB during construction, as part of the quarterly reports, and an evaluation report 3 years after Project implementation.		SHEC has regularly submitted reports on poverty monitoring.
19.	Gender and Development. Shanxi shall cause SCD to, and SHEC shall follow ADB's policy on gender and development during project implementation, take all necessary actions to encourage women living in the Project area to participate in planning and implementing the Project, and monitor the effects on women during Project implementation through, where relevant, gender-disaggregated data collected pursuant to the terms of the Resettlement Plan and through the monitoring and evaluation system referred to in para. 26 of the Loan Agreement (Monitoring and Evaluation).	PA, Schedule, para. 24	Complied. 84,445 women villagers received various training; are being actively involved in the market place.
20.	Health Risks. With assistance from the Shanxi Provincial Department of Health and the relevant local authorities, Shanxi, through SCD, and SHEC shall encourage contractors to distribute information on the risks of socially transmitted diseases to those employed during Project construction and SHEC shall assist the relevant health departments to distribute the same information to transport operators during operation of the Project expressway and facilities.	PA, Schedule, para. 28	Complied. Health campaigns were carried out among contractors. After opening the expressway on operation SHEC has disseminated information booklets on the risk of socially transmitted diseases to the transport operators.
21.	Women and Child Labor. Shanxi, through SCD, and SHEC shall, ensure that (i) there is no differentiate payment between men and women for work of equal value and (ii) civil works contractors do not employ child labor in the construction and maintenance activities in accordance with the relevant laws and regulations of the Borrower.	PA, Schedule, para. 29	Complied. No child labor was involved. Women received equal payment for equal work.
	FINANCIAL		
22.	Tolls. Shanxi, through SCD, and SHEC shall ensure that tolls for the Project expressway and the Yellow River Bridge will be set considering affordability and at levels sufficient to cover the required debt service coverage, the operation and maintenance costs, and depreciation in excess of debt service. If an adjustment of the toll level is required, SHEC shall submit for ADB concurrence the toll adjustment plan, prior to finalizing and submitting the plan to Shanxi for its approval.	PA, Schedule, para. 19	Complied. SHEC informed that there is no plan to adjust toll level at the moment. It was agreed that if any adjustment is required, SHEC would submit to ADB, for its concurrence, the toll adjustment plan prior to SCD's review and approval.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
23.	Corporatization and Corporate Governance. Shanxi shall cause SCD to, and SHEC shall, enter into a Concession Framework Agreement at the latest by 31 Dec 2004 to (i) define the relationship between SCD and SHEC; (ii) ensure autonomy of management and operations of SHEC; (iii) encourage the establishment of road facility performance indicators; and (iv) facilitate future refinancing of the Project expressway. Shanxi shall not revoke, repeal, suspend or withdraw, or transfer or assign to any third party the rights of SHEC in respect to construction, operation and maintenance of the Project expressway, and collection of tolls on the Project expressway without ADB's prior agreement.	PA, Schedule, para. 20	Complied. The Concession Framework Agreement was signed in Apr 2002.
24.	Corporatization and Corporate Governance. SHEC shall prepare a corporate development plan to achieve the objectives of (i) operating SHEC on the commercial basis; (ii) improving its efficiency; and (iii) ensuring its operation in compliance with its Charter and the Company Law of the Borrower. SHEC shall submit such a plan to ADB and discuss the measures to be taken to implement the corporate development plan to strengthen its corporate governance.	PA, Schedule, para. 21	Not complied. SHEC has submitted the draft corporate development plan to ADB and SCD in August 2007. SCD review and discussion of the draft have not been taken.
25.	Non-government Financing. Prior to commercial operation of the Project expressway, Shanxi shall cause SCD to, through SHEC, analyze the feasibility of attracting private sector funds for future investment, including private sector participation in operation, maintenance and management of the Project expressway, and inform ADB of its conclusion.	PA, Schedule, para. 22	Not complied.
26.	Shanxi shall cause SCD to, and SHEC shall, (i) maintain separate accounts for the Project and for SCD's operations, to the extent relevant to the Project, and SHEC's overall operations; (ii) have such accounts and related financial statements (balance sheet, statement of income and expenses, and related statements) audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors whose qualifications, experience and terms of reference are acceptable to ADB; and (iii) furnish to ADB, promptly after their preparation but in any event not later than nine months after the close of the fiscal year to which they relate, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto (including the auditors' opinion on the use of the Loan proceeds and compliance with the covenants of the Loan Agreement as well as on the use of the procedures for statement of expenditures), all in the English language. SHEC shall furnish to ADB such further information concerning such accounts and financial statements and the audit thereof as ADB shall from time to time reasonably request.	PA, Section 2.09(a)	Complied.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
	GENERAL		
27.	SCD shall be the Project Executing Agency, responsible for overall implementation of the Project, carrying out of the local roads component of the Project through local communication bureaus and supervision of the implementation of the local roads component. (PA, Schedule, para. 1). SHEC shall be the Project Implementing Agency responsible for construction, maintenance and operation of the Project expressway and shall coordinate and monitor other activities related to the implementation of the Project expressway. The general manager of SHEC shall be the Project Director, responsible for overall management of the Project expressway component.	PA, Schedule, para. 2	Complied. About 30 full-time staff had been engaged by IA. Three project site offices have been established in Xinjiang, Jishan, and Hejin. Local road construction was handled respective local governments' transport bureau. The general director of SHEC was appointed as the Project Director for expressway component.
28.	Fielding of Consultants	LA, Schedule 5	Complied. International consulting services commenced on 24 October 2004.
29.	Counterpart Financing. The Borrower shall ensure that SCD and SHEC obtain, through equity injection and local financial institutions' loans, on a timely basis, all funds and resources necessary for construction of the Project expressway and local roads in accordance with the financing plan for the Project as agreed by ADB. In case of Project cost overrun, the Borrower shall cause Shanxi Province and SHEC to provide additional equity in local currency for completion of the Project. In case that the total foreign exchange cost of the Project exceeds the estimated total cost of the Project, the Borrower shall ensure that Shanxi and SHEC shall obtain sufficient foreign exchange as needed to finance the construction of the Project.	PA, Schedule, para. 4	Complied.
30.	Coordination Arrangements. The Borrower shall ensure that Shanxi and Shaanxi Province coordinate with each other to construct the respective expressway sections, including the Yellow River Bridge, on a timely basis and to the technical standards acceptable to ADB.	LA, Sch. 6, para. 5	Complied.
31.	Change in Ownership. If (i) any change in ownership of the project facilities, or (ii) sale, transfer, or assignment of SCD's interest in the Project expressway is anticipated, the Borrower, Shanxi and SHEC shall consult ADB at least six months before the change. The Borrower, Shanxi, and SHEC shall ensure that any proposed change in ownership of the Project facilities be carried out in a legal and transparent manner.	LA, Sch. 6, para. 6 and PA, Schedule, para. 30	Is being complied. SHEC will advise ADB on its intention on change in ownership, if any, in due course.

	Covenants	Reference in Loan Agreement (LA) and Project Agreement (PA)	Status of Compliance
32.	Human Resource Development and Training. SHEC in consultation with SCD shall prepare a human resource development plan. Before undertaking international training, SHEC shall prepare, for ADB's concurrence (i) a training plan and number of trainees, (ii) a program of workshops to be delivered by those trained internationally, and (iii) a list of training equipment and aids required strengthening SHEC's training programs. Upon completion, SHEC shall submit to ADB an evaluation of the international training.	PA, Schedule, para. 27	Partially complied. Some overseas training program was not completed due to delay in approval of training courses and trainee candidates by the SFD and SCD.
33.	Mid-Term Review. A mid-term review shall be carried out 1 year after the commencement of Project construction or at another time agreed by ADB and SHEC.	PA, Schedule, para. 31	Complied.
34.	EA should seek ADB's prior approval for contract variations exceeding $100,000.		Complied. Six batches of variation orders for civil works were approved by ADB.

TRAFFIC ANALYSIS AND FORECASTS

A. Introduction

1. Project traffic was analyzed for all key roads associated with the Project, namely, (i) the existing national highway 108 (G108) that was the route between the Houma and Yumenkou before the expressway was constructed, (ii) the expressway, and (iii) the local roads.

2. The traffic forecasts have been revised to take into account the actual traffic on the project expressway and the alternative road, G108. The assumptions underlying the traffic forecasts made at appraisal have been reviewed and updated based on prevailing economic conditions at the Project Completion Review (PCR) Mission.

3. On G-108, traffic data was collected from surveys that had been undertaken for 2003–2007 at several locations—e.g., Xinjiang, Jishan, and Hejin. Traffic volumes for the expressway data was obtained directly from Shanxi Hou-yu Expressway Company (SHEC) for 2007, the initial year of operation. The local roads traffic data was collected from surveys that had been undertaken from 2003 to 2007 on each of the six roads being analyzed under the Project: (i) the Fenhe Bridge to Zezhang road, (ii) the Jishan–Zhangjiabao road, (iii) the Guancun–Xishe road, (iv) the Zhaojiazhuang–Chaijia road, (v) the Zezhang–Guanwangmiao road, and (vi) the Xipo–Xiahua road.

B. National Highway G108

4. At appraisal, G108, the existing road parallel to the proposed project expressway was examined in terms of its traffic capacity and traffic flows. Once opened, the expressway was expected to divert a large amount of traffic from the congested road conditions along G108.

5. In 1998, the appraisal recorded traffic counts at survey locations in Houma, Xinjiang, Jishan, and Hejin along G108. The average annual daily traffic (AADT) recorded at appraisal for all of these survey locations amounted to 11,050 vehicles per day. The PCR Mission also collected traffic count information for various traffic locations along G108 for the periods 1998 and 2003–2007, (Table A13.1) and data on the vehicle composition in 2006 (Table 13.2). The traffic figures supplied by SHEC for 1998 differ considerably from those given at appraisal. At appraisal, average traffic volume on G108 was reported to be 11,050 vehicles per day. The figures provided by SHEC to the PCR Mission were 4,851 vehicles per day in 1998. The appraisal figures showed that traffic was already beyond G108's design capacity of 10,000 vehicles per day. The traffic data collected by the PCR Mission for G108 for the period 2003–2007 indicate that the design capacity has not been reached.

6. Based on volume indicated in the appraisal—11,050 vehicles per day—traffic on G108 was projected to reach 20,170 vehicles per day in 2007 in a without-project situation, with an annual average growth rate of 6.9% as long as the expressway was not built as an alternative. Data collected by the PCR Mission in 2006, the last year of a without-project situation, showed traffic of 7,277 vehicles per day on G108, 36% below that appraisal forecast.

7. In the without-project situation, the appraisal forecast traffic increases of 6% per annum on G108 for the period 2007–2015, and of 3.7% a year for 2016–2026.

8. The traffic data collected by the PCR Mission showed that G108 traffic increased by 3.5% annually between 1998 and 2006, the year before the project expressway opened.

9. The conflicting data collected by the appraisal mission and the PCR Mission could be due to differences in survey site locations. However, AADT figures were calculated for the whole length of the road between Yumenkou and Houma, so the figures should be reasonably comparable. In the economic evaluation, average values for traffic have been used due to differences in survey site locations.

Table A13.1: Average Traffic Volume on G108 between Houma and Yumenkou, 1998 and 2003–2007 (motor vehicles per day)

1998	2003	2004	2005	2006	2007
4,851	7,841	4,463	5,652	7,277	6,603

Source: Shanxi Hou-yu Expressway Construction Company Limited, implementing agency.

Table A13.2: Traffic Composition at Selected Sites in 2006 on G108
(motor vehicles per day)

Survey Location[a]	Small Truck	Medium Truck	Large Truck	Truck Trailer	Car	Bus	Total
Gujiao	762	720	936	663	2,149	626	5,855
Xiafei	1,099	511	809	570	1,089	546	4,626
Baidi	629	1,244	1,884	1,092	5,238	1,088	10,316
Average[b]	**822**	**865**	**1,284**	**808**	**3,062**	**793**	**7,277**

[a] The location of the survey stations is different from those at appraisal. At appraisal the survey sites were Hejin, Jishan, and Xinjiang. It is not indicated at appraisal the exact location of these sites. The survey stations above are located in the vicinity of these towns but exact locations were not available.

[b] The average traffic, as calculated by Yuncheng Communication Bureau, was derived based on the fact that at some traffic count stations there was a variation in the total number of hours that traffic was counted for. The resulting average has therefore been calculated by "weighting" the number of hours of traffic counts that was undertaken at each traffic survey location to arrive at an average traffic count for each vehicle category.

Source: Yuncheng Communications Bureau.

C. The Expressway

10. The traffic forecasts at appraisal for the expressway had four components: (i) normal traffic trend, (ii) diverted traffic from G108, (iii) traffic shifted from the railroad to the expressway, and (iv) induced traffic. The comparison of the total traffic estimated in 2007 at appraisal with the actual traffic in 2007, the year expressway opened, is shown in Table A13.3.

Table A13.3 Expressway Traffic at Appraisal and Actual – 2007
(vehicles per day)

Road Segment	Appraisal	Actual
Houma–Xinjiang	14,888	9,253
Xinjiang–Jishan	14,330	8,158
Jishan–Hejin East	14,348	9,863
Hejin East–Hejin West	11,057	9,863
Hejin West–Longmen Bridge	13,147	11,528

Note: At the time of the Project Completion Report Mission the toll station at Hejin West was not open and the traffic volume is assumed to be the same as at Hejin East.

Source: Shanxi Hou-yu Expressway Construction Company Limited, implementing agency.

11. The appraisal estimated that 18.00% of the existing road traffic on G108 would divert to the new expressway. Some existing rail traffic was also expected to switch to the expressway, although this would likely be mainly passenger traffic because it was considered economically feasible to shift bulk freight traffic to the new road. Only 0.40% of the traffic forecast to use the expressway in its opening year–or an average of 55 of 14,047 vehicles per day–was projected be diverted from rail. An examination of the economic internal rate of return (EIRR) estimated at appraisal for the expressway component of 15.99% was subjected to the test of excluding rail diverted traffic. At appraisal, this would have reduced the EIRR from 15.99% to 15.93%. The PCR Mission considered this insignificant enough to not try to calculate with any accuracy the diversion of passenger traffic from rail to the new project expressway as it would involve considerable origin-destination surveys. Although the PCR Mission did obtain both freight and passenger traffic information on the railroad, it was in terms of total traffic and origin–destination traffic was not available. For this reason, the PCR Mission has not considered a diversion from rail traffic to the project expressway and believes this is fairly insignificant in terms of the economic evaluation benefits that is in Appendix 15.

12. Actual traffic figures range between 11% and 43% lower than those estimated at appraisal. Annual traffic growth rates were assumed in the appraisal to be those indicated in the feasibility study[1] undertaken in 1999—6.3% in 2007–2015 and 4.1% in 2016–2026. Based on data supplied by the Shanxi Communications Department and the PCR Mission's assessment, average traffic growth rates for the project expressway were adjusted and estimated at 6% for 2007–2015, and 4% for 2016–2026. These lower growth rates are conservative. As will be seen in the economic reevaluation, a sensitivity test has been undertaken to reduce the economic benefits by 20%. The revised traffic forecast shows that the traffic level will be about 12,368 vehicles per day in 2015, and 19,041 vehicles per day in 2026, compared with the appraisal estimate of 22,901 vehicles per day in 2015 and 35,630 vehicles per day in 2026.

13. One reason for the lower-than-expected traffic volume may be that the project appraisal overestimated the amount of traffic that would be diverted from G108 to the expressway. In addition, G108 is still preferred by many coal-shipping trucks because its travel costs are perceived to be lower and overloading regulations are less strictly enforced. A number of large industrial projects, including thermal power plants, coking plants, and steel mills built in the project area, use locally produced coal and coke, reducing the demand for long-haul shipping on the expressway.

D. Local Roads

14. No traffic counts were undertaken on the local roads because the economic methodology employed at appraisal used increase in per capita income rather that traffic measures to estimate the economic benefits of the local road component. The PCR Mission, however, obtained traffic count information from Yuncheng Communications Bureau for each of the local roads implemented under the Project in order to undertake a more conventional economic appraisal dependent upon vehicle operating cost savings for traffic along the roads. The traffic counts information obtained is shown in Table A13.4.

[1] The feasibility study of the Houma–Yumenkou expressway was prepared in December 1999 by Second Highway Survey Design and Research Institute of the Ministry of Communications.

Table A13.4: Traffic Counts on Local Roads under Project 2003–2007
(vehicles per day)

Road and Year	Vehicle Type							
	Car and Van	Bus	Small Truck	Medium Truck	Large Truck	Trailer Truck	Container Truck	Total
Fenhe Bridge–Zezhang								
2003	251	22	136	105	135	80		729
2004	281	23	189	112	178	98		881
2005	301	25	215	145	221	102		1,009
2006	325	30	251	154	258	115	2	1,135
2007	385	32	267	175	287	134		1,280
Jishan–Zhangjiabao								
2003	104	4	103	190	158	27		586
2004	115	10	113	218	167	35		658
2005	125	18	126	227	179	48		723
2006	203	22	145	237	185	50		842
2007	258	24	150	241	221	89		983
Guancun–Xishe								
2003	246	18	125	110	160	90		749
2004	269	18	130	126	280	107		930
2005	289	20	145	140	295	109		998
2006	305	20	160	155	308	124		1,072
2007	323	20	178	159	338	133		1,151
Zhaojiazhuang-Chaijia								
2003	120	6	176		120	11		433
2004	136	8	198		128	18		488
2005	224	10	262		130	21		647
2006	320	16	301		132	26		795
2007	700	26	676		308		5	1,715
Zezhang–Guanwangmiao								
2003	85	8	65	35	85	40		318
2004	96	10	75	58	98	45		382
2005	102	12	82	75	107	59		437
2006	112	15	93	86	158	73		537
2007	121	15	102	95	203	85		621
Xipo–Xiahua								
2003	190	12	220		120	35		577
2004	200	8	230		128	47		613
2005	280	20	260		230	50		840
2006	395	26	280		300	52		1,053
2007	420	30	320		380		8	1,158

Source: Yuncheng Communications Bureau.

15. Traffic growth from 2003 to 2007 along these local roads has ranged from 11.3% per annum (Guancun–Xishe) to 41% per annum (Zhaojiazhuang–Chaijia). As can be seen from the socioeconomic surveys (Appendix 18 refers) incomes and economic activity in these local roads

areas has increased significantly, with annual per capita incomes growing over 8% per annum. Despite these growth rates, which are significant on each of the local roads and the large increases in labor mobility, incomes, and the number of village enterprises, traffic growth is expected to now slow to a more moderate pace. A conservative estimates annual traffic growth from 2007 to 2015 at 6% and 4% from 2016 to 2026—the same rates expected for traffic growth on the expressway, for use in the economic evaluation in Appendix 15.

FINANCIAL PERFORMANCE AND FINANCIAL REEVALUATION

A. Financial Performance

1. It was estimated at appraisal that Shanxi Hou-yu Expressway Construction Company (SHEC) would maintain (i) a debt-to-equity ratio of less than 65:35, (ii) a debt-service-coverage ratio of not less than 1.2 times, and (iii) a working ratio of not more than 12%. SHEC reported the following financial performance for its first year's operation of the expressway in 2007: (i) a debt-to-equity ratio of 65:35, (ii) a debt service coverage ratio of 2.5 times, and (iii) a working ratio of 10.9%. SHEC started repayment of the loan in May 2007; to date, loan capitalization has amounted to $13.3 million. Based on SHEC's good financial performance during its first year of operation and its current loan repayment status, SHEC's financial performance is likely to be sound. SHEC's financial performance will be reassessed during project performance evaluation missions that are expected to take place in 2011 or later.

B. Financial Reevaluation

2. The financial internal rate of return (FIRR) of the project expressway was reevaluated using a with- and without-project comparison. The major assumptions in calculating the FIRR are as follows:

(i) All components of the FIRR calculations were expressed in constant 2007 prices and covered the period from 2004 to 2026—the construction period and 20 years of operation.

(ii) Capital costs include all capital expenditures related to the construction and equipment associated with the expressway but exclude interest during construction and the cost of local roads. They reflect actual costs incurred.

(iii) Operation and maintenance (O&M) costs were based on actual costs in 2007. From 2007 onward, the costs were assumed to increase in line with projected increases in traffic volume. Periodic maintenance was assumed to take place in 2017 (10 years after opening), as verified by SHEC at an estimated cost of CNY118.0 million.

(iv) Incremental revenues beyond those documented for 2007 were based on the revised forecasts for traffic volume until 2026. Toll rates were assumed to remain at 2007 levels. The current level of toll rates is shown in Table A14.1. Toll rates were not stated in the appraisal.

(v) Assuming that the expressway will be corporatized, a business tax and a corporate income tax are included. The corporate tax at appraisal of 33% was applied.

(vi) A residual value was also calculated based on the assumptions at appraisal.[1]

[1] It was noted at appraisal that this is based on the Ministry of Communications standards for expressways.

Table A14.1 Expressway Toll Levels
(CNY/vehicle-kilometer)

Class	Limit of Axle and Wheels	Total Height Limit (meters)	Toll	Typical Vehicle
A	2 axles 4 wheels	≤ 1.3	0.36	Car
B	2 axles 4 wheels	> 1.3	0.54	Van
C	2 axles 6 wheels	≤ 2.5	0.87	Small Truck
D	2 axles 6 wheels	> 2.5	1.41	Medium Truck
	3 axles ≤ 8 wheels		1.41	Medium Truck
E	≤ 4 axles & 8 wheels ≤ 10 wheels		1.86	Large Truck
F	≤ 4 axles & 10 wheels ≤ 14 wheels		2.41	Truck Trailer
G	≥ 5 axles		3.20	Container Truck

≤ = less than or equal to, > = greater than.
Source: Shanxi Hou-yu Expressway Construction Ltd., Shanxi Province Expressway Toll Standard by Vehicle Type.

3. The recalculated FIRR for the Project, computed on an after-tax basis is 8.1% (Table A14.2), compared with 7.58% at appraisal after corporate tax. The main reason for the higher recalculated return is that actual capital cost was lower than that estimated at appraisal (after inclusion of contingencies at appraisal). The revenues generated in the recalculated FIRR are only slightly lower than the appraisal estimates, even though the actual traffic on the expressway is considerably less than estimated at appraisal. Although it was not indicated at appraisal, it is believed that the toll rates used in the FIRR calculation at appraisal were relatively high. The recalculated FIRR is higher than the real weighted average cost of capital for the Project, which was estimated at 3.5%,[2] also on an after-tax basis, and is thus considered financially viable.

4. A sensitivity analysis of the FIRR was carried out to test the effects of possible unfavorable scenarios with respect to O&M costs and revenues. The scenarios tested were a 20% increase in O&M costs and a 20% decrease in toll revenues. A combination of these two scenarios was also tested. The result shows that the Project is not very sensitive to changes in O&M costs but is sensitive to changes in toll revenues, i.e., traffic volume and toll rates. Under the worse-case scenario—a combination of a 20% increase in O&M costs and 20% reduction in revenues throughout the analysis period—the FIRR would decline to 5.7%, still far in excess of the WACC, indicating a strong financial viability. The results of the sensitivity tests are shown in Table A14.3.

[2] The weighted average cost of capital was calculated following the methodology in ADB's *Guidelines for the Financial Management and Analysis of Projects*, with the assumed costs of capital of 5.6% for the ADB loan, 12% for equity capital from the Government, 6.21% for the domestic bank loan, and a 5% domestic inflation rate, and 33% corporate tax. The recalculated WACC was 3.5%.

Table A14.2: Financial Internal Rate of Return
(CNY million)

Year	Toll Revenue	Capital Cost	Operating and Maintenance Cost	Corporate Tax	Total	Cash Flow (After Tax)
2004		466.2			466.2	(466.2)
2005		376.2			376.2	(376.2)
2006		587.9			587.9	(587.9)
2007	200.4	414.1	12.5	(74.7)	351.9	(151.6)
2008	212.4	176.4	15.2	6.9	198.4	13.9
2009	225.1		15.2	69.3	84.5	140.7
2010	238.6		15.2	73.7	88.9	149.7
2011	253.0		15.2	78.5	93.7	159.3
2012	268.1		15.2	83.5	98.7	169.5
2013	284.2		15.2	88.8	104.0	180.2
2014	301.3		15.2	94.4	109.6	191.7
2015	319.4		15.2	100.4	115.6	203.8
2016	332.1		15.2	104.6	119.8	212.3
2017	345.4	118.0	15.2	147.9	281.1	64.3
2018	359.2		15.2	113.5	128.7	230.5
2019	373.6		15.2	118.3	133.5	240.1
2020	388.5		15.2	123.2	138.4	250.1
2021	404.1		15.2	128.3	143.5	260.6
2022	420.3		15.2	133.7	148.9	271.4
2023	437.1		15.2	139.2	154.4	282.6
2024	454.5		15.2	145.0	160.2	294.4
2025	472.7		15.2	151.0	166.2	306.5
2026	491.6	(651.2)	15.2	361.1	(274.9)	766.5
					FIRR	**8.1%**

( ) = negative, FIRR = financial internal rate of return.
Source: Asian Development Bank.

Table A14.3: Sensitivity Analysis
(%)

Item	FIRR
1. Base Case	8.1
2. Increase in Operation and Maintenance Costs by 20%	8.0
3. Decrease in Toll Revenues by 20%	5.9
4. Combination of 2 and 3	5.7

FIRR = financial internal rate of return.
Source: Asian Development Bank estimates.

ECONOMIC REEVALUATION

A. Evaluation Approach and Assumptions

1. An economic reestimation was carried out by comparing the costs and benefits of the with-project and without-project cases for the two components of the Project, namely, (i) the expressway, and (ii) the local roads.

2. The economic internal rate of return (EIRR) compared the annual streams of economic capital and operating costs and benefits using the highway design and maintenance model version 4 (HDM-4). The analysis covered the construction period and the following 20 years of operation. Costs and benefits were expressed in 2007 constant prices, excluding taxes and duties. A standard conversion factor of 0.93[1] was applied to the local currency costs of those items that were nontradable.

B. Appraisal and PCR Methodology

3. The Project Completion Review (PCR) Mission reviewed the economic evaluation that had been undertaken at appraisal. In undertaking the economic reevaluation, the PCR has had to modify in some ways the manner in which the economic evaluation was undertaken at appraisal. These changes to the economic reevaluation method, however, are not major and in no way change the overall economic evaluation methodology adopted at appraisal. The modifications made by the PCR Mission have been undertaken for both project components, i.e., the expressway component and the local roads component. The modifications were made for several reasons: (i) updated information collected during the Mission, (ii) lack of sufficient data in some areas—e.g., accident rates), (iii) a simplification of the appraisal evaluation, and (iv) a more appropriate methodology for the local roads component. The way in which each of the components of the Project has been reevaluated is described for the individual components—i.e., the expressway and the local roads—in the following sections.

C. Traffic

4. The traffic data used in the economic reevaluation and the adopted growth rates for future traffic has been described in Appendix 13, Traffic Forecasts. Table A13.1 in Appendix 13 summarizes the annual average daily traffic (AADT) for the expressway for 2007. Table A13.2 presents the AADT data for G108 (the national highway). Table A13.4 provides the AADT for the local roads from 2003 to 2007.

5. At appraisal, traffic growth rates for the expressway were derived for different periods, namely, (i) 2007–2015 at 6.3% per annum (p.a.), and (ii) 2016–2026 at 4.1% p.a. These estimates took account of growth in gross domestic product, gross industrial and agricultural output for three scenarios, low, medium, and high. The medium scenario was used for the traffic forecasts. The traffic forecasts were based on four types of traffic: generated traffic, diverted traffic, a shift from railroad traffic, and induced traffic.

6. Considering these growth rates, the PCR Mission has forecast the average traffic growth for 2007–2015 at 6% p.a. and for 2016–2026 at 4% p.a., which is slightly lower than the

[1] The SCF of 0.93 was also used at appraisal, except that it was a shadow exchange rate factor of 1.08 (i.e. the inverse of the SCF), as the price level used was the domestic price numeraire. The analysis here uses the world price numeraire. The use of either price numeraire produces the same economic internal rate of return. The SCF used is consistent with other projects in the PRC.

appraisal mission estimates. This is conservative in view of the fact that GDP of the counties in the project area has been increasing rapidly over the last few years (Appendix 18 refers).

D. Economic Analysis

1. Expressway Component

7. Before the project expressway was opened to traffic in December 2006, vehicle traffic used the existing road, national highway G108. G108 extends from Houma to Yumenkou and links several towns and villages. The highway is approximately 86 kilometers (km) long between Houma and Yumenkou and is prone to congestion and accidents. Average roughness by the international roughness index (IRI) was between 5.0 to 8.0 meters per kilometer (m/km). The average daily traffic volume from 2004 to 2006, prior to the expressway's opening, was between 5,000 to 7,000 motor vehicles per day, of which about 52% were trucks. Because of the road's poor condition and congestion near the towns, average vehicle speeds were less than 30 km per hour. Without the expressway, G108 would have remained in poor condition and vehicle operating costs (VOCs) would have continued to rise. Traffic diverted to the expressway after it opened, resulting in improved road conditions for the users of G108, reduced VOCs, and higher vehicle speeds. Traffic that was diverted to the expressway also gained an economic benefit.

8. At appraisal, the economic evaluation considered several benefits that would occur with the introduction of the expressway: (i) vehicle operating cost (VOC) savings on national highway G108 due to less congestion as some traffic diverted to the new expressway; (ii) generated traffic benefits[2] (VOCs) due to an increase in economic activity; (iii) traffic that would shift from the railway to the new expressway (mainly passengers); (iv) a reduction in accidents along G108, which would represent a cost saving; and (v) savings in travel time due to the new and improved route between Houma to Yumenkou. The economic evaluation at appraisal showed an economic internal rate of return (EIRR) for the project expressway of 15.99%.[3]

9. The PCR Mission examined the appraisal economic evaluation and saw that some of the benefits examined at appraisal were fairly insignificant. For example, the benefits from traffic diverted from the railway to the new expressway represented only 0.6% of total benefits. Excluding railway traffic benefits reduced the EIRR from 15.99% to 15.93%. Benefits from a reduction in accidents were also a small component of overall benefits. If accident benefits were not considered, the overall EIRR at appraisal would reduce from 15.99% to 15.33%. Eliminating both accident benefits and rail traffic benefits due to traffic shifted to the expressway would reduce the overall EIRR at appraisal from 15.99% to 15.26%. In total, VOC savings and travel time savings benefits account for about 95% of all benefits of the expressway.

10. The PCR Mission has concentrated its economic reevaluation on the benefits derived from (i) VOC savings, to traffic diverted from G108, to existing traffic on G108 (savings in congestion through reduced VOCs), and to generated traffic to the expressway due to the increase in economic activity, and (ii) time saving benefits. Accident and traffic diverted from the railway have not been examined. These benefits are a small component of overall benefits.

[2] The benefits associated with generated traffic are taken to be equal to half the difference between the transport cost that would be incurred without the road improvement and the transport cost that would be incurred with the road improvement. The theoretical basis for this assumption is, briefly, as follows. Demand will extend to the point at which perceived costs to consumers equal the marginal benefits derived from consumption. A reduction in transport cost, if passed on as a reduction in user cost, will increase demand to the point at which perceived cost again equals the marginal benefits.

[3] The EIRR at appraisal was quoted to 2 decimal places.

Accident data was not available in sufficient detail for G108 both before and after the introduction of the expressway. The costs of traffic accidents, moreover, are a matter of dispute all over the world. In fact, it is very difficult to predict whether the road sections being investigated are going to yield any traffic safety benefits at all. Due to increased speeds on the improved road surface, there could even be a negative benefit. The diversion of traffic from the railway to the new expressway is small and the assumption made at appraisal may not have occurred. By concentrating on the more tangible benefits—time savings, and VOC savings to traffic remaining on G108, traffic diverting to the expressway and generated traffic benefits, the economic evaluation becomes simpler without any great loss in accuracy. The PCR Mission has undertaken the economic reevaluation for the expressway by concentrating on the above two elements. This is a more conservative approach then the appraisal economic evaluation but still accounts for about 95% of overall benefits.

11. The PCR Mission also examined the economic evaluation that was done at the mid-term review in September 2006. It was discovered that the economic evaluation undertaken at that time examined the increase in traffic since appraisal and merely updated the benefits estimated at appraisal by applying a factor for the growth in traffic to the appraisal benefits, i.e., a percentage increase in each component of the appraisal benefits due to the increase in the percentage of traffic. There was, therefore, no real economic reevaluation at the mid-term review.

12. The unit VOC applicable to the expressway component was estimated on the basis of vehicle type, class of road, terrain, geometric parameters of alignment, and level of congestion on G108. Based on the traffic projections, savings in VOCs were calculated for each forecast year by comparing the total economic value of VOCs of all vehicles traveling on the expressway and the existing road for the with-project and without-project scenarios. The value of passengers' time savings was calculated based on the average number of passengers per vehicle for cars and buses, the percentage of business trips, and the average passenger incomes. Time savings were calculated for each forecast year by comparing the total time value for all vehicles in with- and without-project scenarios. The benefits to generated traffic were approximated as half of the savings accruing to normal traffic.

2. Local Roads Component

13. At appraisal, the economic analysis of the local roads component computed the benefits using a conservative 1% estimated increase in rural GDP for the expansion in rural production reflecting increases in (i) agricultural products, particularly fruit, vegetables, and livestock; (ii) small industries; (iii) construction; (iv) transport services; and (v) commerce. The benefits from local roads were purely considered as 1% of total GDP. The VOC savings on the local roads were not considered.

14. The PCR Mission undertook economic evaluation of each of the six local roads in the Project: (i) the Fenhe Bridge–Zezhang road, (ii) the Jishan–Zhangjiabao road, (iii) the Guancun–Xishe road, (iv) the Zhaojiazhuang–Chaijia road, (v) the Zezhang–Guanwangmiao road, and (vi) the Xipo–Xiahua road. The PCR Mission decided that, due to increases in economic activity along these roads, an economic analysis of benefits in terms of VOC savings from the without-improvement situation compared with the with-improvement situation to be a more appropriate methodology. It is also a more conventional approach for economic evaluation and the estimation of the benefits from local roads. Traffic data was collected for each of the project local roads.

15. At the time of the PCR Mission, it was estimated that the IRI on the local roads was around 3.5–4.0 m/km. Before the roads were improved, the PCR Mission was informed that the the IRI was in the range of 6.0–8.0 m/km. In the economic evaluation, it was assumed that resurfacing of the local roads would occur when the surface roughness reached an IRI 5.0 m/km. This will have the effect of reducing roughness to an IRI of 3.0 m/km. It was also assumed that routine maintenance practices would remain the same with and without the Project.

3. Results

16. The recalculated EIRR was 19.4% for the expressway component (Table A15.1) and 22.0% for the local roads (Table A15.2). The EIRR for the entire Project was 19.5%.

17. The EIRRs for the expressway component calculated in the appraisal was 15.99%. The mid-term review calculated the EIRR for the expressway component as 18.9%. For the local roads component, the EIRR at appraisal was 21.58%. The appraisal did not calculate separate EIRRs for each local road. For the whole Project, the appraisal estimated the EIRR as 16.17%. The new calculated EIRR for the Project of 19.5% is attributable to several factors. The capital costs were lower than envisaged at appraisal. The economic evaluations have used the HDM-4, which has a road deterioration model inherently built into it. It is not clear whether a road deterioration model was built into the appraisal methodology. Differences in VOC calculations between appraisal and the PCR Mission are another factor. The PCR Mission input updated VOC information into HDM-4. It is uncertain which economic evaluation model was used at appraisal. Assumptions have also been made for the without-project situation on the maintenance that would need to be done on G108 if the expressway was not built. It does not appear that this was done at appraisal.

Table 15.1: Economic Evaluation of the Expressway
(CNY million)

	Economic Costs			Economic Benefits			
Year	Capital Cost	Operating and Maintenance Cost	Total Cost	VOC Savings	Passenger Time Savings	Total Benefits	Net Benefit
2004	461.09		461.09				(461.09)
2005	372.15		372.15				(372.15)
2006	585.88		585.88				(585.88)
2007	417.15	12.0	429.15	243.33	6.52	249.84	(179.30)
2008	171.99	14.7	186.69	259.13	8.36	267.49	80.80
2009		14.7	14.70	280.89	10.97	291.86	277.16
2010		14.7	14.70	310.84	14.35	325.18	310.48
2011		14.7	14.70	351.77	18.73	370.50	355.80
2012		14.7	14.70	421.87	25.01	446.88	432.18
2013		14.7	14.70	595.02	36.44	631.45	616.75
2014		14.7	14.70	677.54	39.67	717.21	702.51
2015		14.7	14.70	625.86	33.72	659.57	644.87
2016		14.7	14.70	646.99	35.27	682.26	667.56
2017	114.00	14.7	128.70	670.33	36.85	707.18	578.48
2018		14.7	14.70	699.46	38.65	738.11	723.41
2019		14.7	14.70	734.67	40.91	775.58	760.88
2020		14.7	14.70	758.08	42.91	801.00	786.30
2021		14.7	14.70	783.91	44.97	828.88	814.18
2022		14.7	14.70	817.08	47.25	864.32	849.62
2023		14.7	14.70	858.59	49.99	908.58	893.88
2024		14.7	14.70	886.12	52.55	938.67	923.97
2025		14.7	14.70	916.78	55.20	971.98	957.28
2026	(637.32)	14.7	(622.62)	956.44	58.13	1,014.57	1,637.19
						EIRR	**19.4%**

( ) = negative, EIRR = economic internal rate of return, VOC = vehicle operating cost.
Source: Asian Development Bank estimates.

Table A15.2: EIRRs of the Local Roads Component
(%)

Local Road	EIRR
ADB-Financed	
Fenhe Bridge–Zezhang	25.3
Jishan–Zhangjiabao	20.5
Guancun–Xishe	32.1
Zhaojiazhuang–Chaijia	23.4
Government-Financed	
Zezhang–Guanwangmiao	13.8
Xipo–Xiahua	29.7
All Local Roads	22.0

EIRR = economic internal rate of return.
Source: Asian Development Bank estimates.

E. Sensitivity Analysis

18. A sensitivity analysis was undertaken of the Project as a whole to examine the effects of changing key variables—e.g., benefits, operation and maintenance costs, and no time savings. The results of the analysis are in Table A15.3. It can be seen that the Project maintains a high level of economic viability even under these adverse scenarios.

Table A15.3: Results of Sensitivity Analysis

(%)

Item	EIRR
1. Base case	19.5
2. Benefits 20% lower	16.5
3. Operation and maintenance costs 20% higher	19.4
4. No time savings	18.8

EIRR = economic internal rate of return.
Source: Asian Development Bank estimates.

ENVIRONMENTAL IMPACT ANALYSIS

A. Introduction

1. The research institute of highways of the Ministry of Communications prepared the environmental impact assessment (EIA) for the Project in August 2001. The EIA was approved by the State Environment Protection Administration (SEPA) on 8 March 2002. The summary environmental impact assessment (SEIA) was circulated to the ADB Board on 29 May 2002. The EIA covered not only the expressway but also the borrow sites and access roads for construction.

2. The anticipated environmental impacts listed in the SEIA were (i) impacts of construction of Yellow River Bridge on the wintering ground for gray cranes in the Yuncheng Wetlands Nature Reserve (YWNR); (ii) possible soil erosion and water pollution resulting from the construction of the Yellow River Bridge; (iii) impacts of dust, noise, and waste generation on construction workers and residents living along the alignment during the construction period; and (iv) vehicle emissions during the operational period.

3. The four alternative routes, with different locations for the Yellow River Bridge, were evaluated and compared in terms of potential environmental impacts in the EIA report. Public input, including comments from the Shanxi province forestry department, YWNR administration, and other local government agencies, were included in the decision-making process. The alignment selected was preferable in terms of engineering, geological, safety, ecological, environmental, and economic factors, and hence was recommended.

B. Implementation of the Environment Management Plan

4. Shanxi Hou-yu Expressway Construction Company Limited (SHEC) established a division responsible for environmental management 2003. In June 2004, SHEC issued an environmental protection management method to the expressway contractors and the three resident engineer offices (REOs). The responsibilities of SHEC, the contractors, and the REOs for implementing environmental mitigation measures are defined within the method. Each contractor assigned a senior manager responsible for overall implementation of environmental mitigation measures. At each of the REOs, a road engineer was assigned part-time to supervise the implementation of environmental mitigation measures. Three training workshops on appropriate collection and disposal of solid wastes and wastewater, wildlife protection, minimization of vegetation damage, and noise and air pollution control were conducted for contractors' managers and workers and Chinese version of SEIA was distributed to the contractors and resident engineers.

5. On 16 May 2004 a three-year contract was signed for environmental quality monitoring and reporting during the construction phase between SHEC and the Shanxi Communications Environmental Monitoring Center (SCEMC), an external monitor. The contract called for the monitoring of: total suspended particulate matter once a month; smoke and asphalt twice a year; day and night noise, monthly; and suspended solids, chemical oxygen demand, lead, potential of hydrogen, and oil, all twice a year at the Yellow River Bridge. It also required monthly construction site visits to inspect solid wastes and wastewater collection and disposal. Although carbon monoxide and nitrogen oxide were not included, based on the SEIA, it was recommended by an ADB environmental safeguard review mission that these items still be monitored before and after operation of the expressway.

6. Monitoring reports showed: (i) total suspended particulate had declined from 0.39 milligram per meter cube (mg/m^3) to 0.38 mg/m^3 but was still higher then national standard of 0.30 mg/m^3 due to strong wind and use of coal in the project area; (ii) suspended solids concentration at the upstream point of the Yellow River Bridge was only slightly higher than that at the downstream point of the bridge, indicating that the increase was mainly due to precipitation with minor contribution of the construction works; (iii) other requirements were satisfactorily complied with; (iv) the level of noise increased during construction although it remained within standard limits; and (v) sewage was collected in tanks and linked to the local sewage system while wastewater was collected and stored in open basins and disposed of. To minimize the dust generated, the contractors consistently sprayed water on the roads. During the construction period, high-noise machinery was not allowed to operate from 10:00pm to 06:00am. This was adhered to throughout the road construction implementation period. The PCR Mission noted that contractors' camps were removed and temporary land used for contractors' camps as well as the borrow pit and waste pit were adequately restored.

C. Action Plan for Gray Crane Wintering Ground Protection

7. On 10 October 2004, SHEC and the YWNRS signed an agreement for implementing the Action Plan for Gray Crane Wintering Ground Protection.[1] Training workshops were conducted to raise the awareness of contractor managers and monitoring staff of the need to comply with laws and regulations for protection of nature preserves. SHEC funded and the reserve station implemented a food enrichment program and fed cranes every 5 days during the winter season to attract cranes away from construction sites. The reserve station set up a facility with appropriate monitoring equipment and carried out ecosystem monitoring. The action plan was effectively implemented, with the result that there was no change in the population of gray cranes, no trees were cut, and no vegetation was destroyed. The YWNRS has reported that integrating the station into the project design has improved its capacity and enhanced the management of the ecosystem.

D. Soil Erosion Control

8. The soil erosion control and management plan was approved by the Ministry of Water Resources in 2002. The plan was adequately implemented. In total, CNY700,000 was paid as compensation to Xinjiang, Jishan and Hejing counties for restoration of affected land. No major landslide has occurred. Trees were planted on both sides of the road, as well as in center dividers, and cut and fill sites. Excavated areas were re-cultivated. Eight monitoring points at key road sections were established in July 2007 to monitor slope stability for a further 2 years, and reports will be submitted to ADB in September 2008 and 2009.

E. Conclusion

9. SHEC was committed to the implementation of the environmental management plan and the degree of compliance with environmental requirements was satisfactory. The mitigation measures were adequately implemented during the expressway construction and greenbelts were built in some critical sections to stabilize moving sand. The institutional arrangement, the Action Plan for Gray Cranes Wintering Ground Protection and the Soil Erosion Control Plan, and the recommendations given by ADB safeguard mission were also satisfactorily implemented. No adverse environmental impacts are reported. The other protection measures have been applied well and in accordance with the law and the EIA. Continuous monitoring of environmental, soil erosion, and bird population is ongoing during expressway operation.

[1] The Action Plan was developed as part of the EIA report.

LAND ACQUISITION AND RESETTLEMENT

A. Background

1. The Project constructed a 66.84-kilometer (km) expressway between Yumenkou and Houma and upgraded 97.98 km of local roads. A resettlement plan was prepared in December 2001 and updated in March 2004. The area affected by the Project includes 60 villages in 13 townships of three counties—Xinjiang, Jishan, Hancheng and Hejin city. Table A17.1.

Table A17.1: Project Influence Area

County/City	Township	Village
Xinjiang	Sanquan	Leli, Beipingyuan, Fuyouzhuang, Jizhuang, Xiaoling, Shuixi, Xicun
	Longxing	Shicun, Wangzhuang
	Quanzhang	Yongfeng, Yonghua
	Gujiao	Liujianzhuang, Dongxueguo, Xixueguo, Donghan, Quanzhang
Jishan	Jifeng	Xiaodu, Taidu, Shangbai, Jiayu, Taoliang, Xinzhuang, Yaocun
	Xishe	Zhongshe, Xishe, Dongzhuang, Renyi, Xuejiazhuang
	Huayu	Fujiazhuang, Xingjiazhuang, Xingjiabao, Huayu, Huayu town, Lucun, Huayuxibao, Ningzhai, Ningzhaibao, Weilin
Hejin	Cenglou	Guozhuang, Hejiazhuang, Beiwangbao
	Zhaojiazhuang	Fubo, Guanzhuang, Yitang, Fanjiazhuang, Dongzhuang
	Qingjian	Xizhuang
	City zone	Mijiawan,[a] Xiguan, Xiyaotou, Dongyaotou, Yangjiaxiang
	Yangcun	Dongxinfeng, Xixinfeng, Taiyang, Sanqian, Yong'an, Junling, Cangtou
Hancheng	Longmen	Daqian

[a] Mijiawan was merged into Xiguancun in 2005.
Source: Shanxi Hou-yu Expressway Corporation Ltd. 2007. *Resettlement Completion Report*.

2. Shanxi Hou-yu Expressway Corporation Ltd. (SHEC) hired Shaanxi Kexin Consultant Company (SKCC) to conduct external monitoring and evaluation of implementation of the resettlement plan and to prepare reports on land acquisition and resettlement activities for both the expressway and local roads.

B. Land Acquisition and Resettlement

3. According to the resettlement completion report prepared by SKCC in July 2007, a total of 15,187 people from 3,532 households were affected by land acquisition, compared with the updated resettlement plan estimate of 20,472 people from 4,760 households, 25% less than envisaged. This was due to slight changes in the road alignment during project implementation. Only 20 people from five households were resettled. The other people were affected in terms of removing buildings including shelters, orchards, temporary houses etc.

4. **The Expressway.** Plans called for the acquisition of 5,851.77 mu[1] of land but 6,060 mu were actually acquired, 3.57% more than planned. The amount of temporary land eventually required was 27% less than envisaged—1,380 mu, compared with the estimate of 1,901 mu. Altogether, 8,783 square meters (m^2) of buildings were removed. Other facilities affected included greenhouses, wells, ditches, power poles, electricity cables, transformers, and

[1] A mu is equivalent to 666.66 square meters, or 0.1647 acres, or 0.066 of a hectare.

telephone poles. Table A17.2 and Table A17.3 show the details of land acquisition and buildings removed for the expressway component of the Project.

Table A17.2: Land Acquisition for the Expressway Component

County/City	Area of Land Acquisition (mu)								Temporary Acquired Land[a]	Household Affected by Land Acquisition
	Total	Irrigated Land	Vegetable Land	Orchard	Dry Land	Woodland	Waste Land	Others		
Xinjiang	1,639	1,089	103	425	22				675	1,161
Jishan	2,041	1,792	63	158	6		22		208	917
Hejin	2,349	1,451	161	433	125	142	21	16	370	1,437
Hancheng	31	5					26		127	17
Total	**6,060**	**4,337**	**327**	**1,016**	**153**	**142**	**69**	**16**	**1,380**	**3,532**

[a] All of the temporary land was dry land.
Source: Resettlement completion report.

Table A17.3: Buildings Affected by Expressway Component

County/City	Area of House Removed (m^2)					Attachment Building		Number of Household Affected	Number of Household Removed
	Total	Brick and Concrete	Brick and Wood	Earth and Wood	Simple	Fencing Wall (m)	Doorcase		
Xinjiang	2,201	1,167	526	391	117	1,695	3	111	
Jishan	2,308	851	348	541	568	4734		86	3
Hejin	4,206	1,947	1,495	578	186	908	2	190	2
Hancheng	68		68						
Total	**8,783**	**3,965**	**2,387**	**1,510**	**871**	**7,337**		**387**	**5**

Source: Resettlement completion report.

5. **Local roads.** Only one of the six roads—the Zhaojiazhuang–Baidi road section—was newly built and thus required land acquisition. The primary design foresaw the acquisition 36 mu of irrigable land, 90 mu of dry land, and 54 mu of orchard—or 180 mu in all in two towns and six villages in Hejin. Optimizing the road reduced the amount actually acquired to 50 mu of waste land. No houses were removed.

6. The Shanxi provincial government approved the compensation standards of land acquisition and resettlement for the Project in accordance with to the PRC's Land Law. The rates of compensation were agreed to by the people affected and approved by ADB. The same standards of compensation for land acquisition and resettlement were adopted for both the expressway and the local roads components. The compensation rates for houses, land, agricultural areas, and other facilities are shown in Table A17.4 to Table A17.7 respectively.

Table A17.4: Compensation Rates for Houses
(CNY/ m^2)

Brick and Concrete House		Brick and Wood House		Earth and Wood House		Simple House	
RP	**Disbursed**	**RP**	**Disbursed**	**RP**	**Disbursed**	**RP**	**Disbursed**
200–350	350	150–200	200	100–150	150	80–100	100

RP = Resettlement plan.
Source: Resettlement completion report.

Table A17.5: Compensation Rates for Land
(CNY/ mu)

	Vegetable Land		Irrigated Land		Orchard		Dry Land		House Foundation Land	
Category	**RP**	**Disbursed**	**RP**	**Disbursed**	**RP**	**Disbursed**	**RP**	**Disbursed**	**RP**	**Disbursed**
Compensation for land	11,290	11,290	4,320	4,340	6,140	1,655	2,160	2,160	4,320	4,320
Subsidy for resettlement	7,060	7,060	2,700	2,687	3,830	9,940	1,350	1,350	2,700	2,700
Total	**18,350**	**18,350**	**7,020**	**7,027**	**9,970**	**11,595**	**3,510**	**3,510**	**7,020**	**7,020**

RP = Resettlement plan.
Source: Resettlement completion report.

Table A17.6: Compensation Rates for Cropped Land
(CNY/ mu)

	Vegetable Land		Others	
Category	**RP**	**Disbursed**	**RP**	**Disbursed**
Rates	600–1,000	600–1,000	500	500

RP = Resettlement plan.
Source: Resettlement completion report.

Table A17.7: Compensation Rates for Other Facilities
(CNY)

Fruit Tree not in Large Area (Nos.)		Without Fruit Tree not in Large Area (Nos.)		Can Used Tree (Nos.)		No. Used Tree (Nos.)		Green-house (mu)		Brick Fencing Wall (m^2)		Earth Fencing Wall (m^2)		Tomb	
RP	Disbursed	RP	Disbursed	RP	Disbursed	RP	Disbursed	RP	Disbursed	RP	Disbursed	RP	Disbursed	RP	Disbursed
50–120	120	8–20	20	10–20	20	5–10	10	9,000–13,000	13,000	30	30	15	15	350–600	600

RP = Resettlement plan
Source: Resettlement completion report.

7. Expenditure on land acquisition and resettlement was CNY166.67 million, or 64.55% of the CNY258.20 million amount budgeted. The amount paid to villagers and village collectives for compensation and resettlement costs was CNY116.34 million, or 73.8% of the total budgeted amount, contingency included. Items for which expenses were less than budgeted include: (i) the subsidy for land reclamation, only CNY5.59 million, or 13.61% of the budgeted CNY41.03 million, because of Shanxi provincial government regulations setting a lower rate of subsidy for land reclamation than planned, CNY1,000 per mu; and (ii) expenses of contingency, only CNY12.83 million, 20.56% of that budgeted. Compensation payment for land acquisition and resettlement is shown in Table A17.8.

Table A17.8: Compensation Payment for Land Acquisition and Resettlement
(CNY million)

Item	RP	Completed
A. Basic fee	178.30	147.35
1. Compensation for land acquisition	26.42	31.44
2. Subsidy for resettlement	16.50	22.28
3. Subsidy for land reclamation	41.03	5.58
4. Farmland use tax	6.15	5.19
5. Compensation for soil and water loss	2.05	0.75
6. Compensation for temporary occupied land	11.98	5.57
7. Compensation for houses	0.96	2.37
8. Compensation for other structures	0.74	12.64
9. Compensation for crops and trees	23.90	22.15
10. Compensation for power and communication facilities	18.89	24.33
11. Restoring of irrigation pipes and ditches	26.70	12.59
12. Subsidy for villagers resettlement	0.01	0.00
13. Transition fee for affected villagers	0.02	0.01
14. Moving expense for enterprises	0.45	0.00
15. Cultural relics exploring fee	2.50	2.40
B. Overhead (3% of basic fee)	5.30	2.57
C. Service fee (3% of basic fee)	5.30	1.78
D. Supervision and evaluation fee (0.5% of basic fee)	0.90	1.49
E. Contingencies (30% of basic fee)	62.40	12.83
F. Others	6.00	0.62
Total	**258.20**	**166.67**

RP = resettlement plan.
Source: Resettlement completion report.

C. Economic Recovery of the Affected People

8. SHEC had recultivated the 1,380 mu of land used temporarily for project construction by the end of May 2007. In addition, 150 mu of land was reclaimed in Dongxinfeng village in Hejin city. SHEC began rehabilitation of irrigation facilities in December 2004. Under the subgrade, steel tubes were installed to replace the broken water pipes and channels, and PVC pipes were used to resume connections. Along the alignment, 206 steel pipes totaling 11,330 m in length were installed at a cost of CNY9 million. About 19,000 m of plastic piping was also installed. For areas that could not be connected to the original water source, 20 power-operated wells were sunk. The total cost of irrigation facilities rehabilitation was CNY12.59 million. SHEC also paid attention to flood prevention facilities for the villages and farmland along the expressway and built 71 evaporation ponds.

9. Villagers whose lands were acquired by the Project were given a replacement farmland of an equal area by their villages to minimize the disruption to their lives. Their standards of living were restored to levels at least equal to those before the Project.

10. A livelihood rehabilitation plan was prepared, with the participation of the villagers. The offices responsible for land acquisition and resettlement at the county and township levels used two methods to implement it. The first covered the 34 villages where land was redistributed to replace land acquired by the Project. This approach focused on measures to restructure the villagers' industries, including (i) enlarging planting areas of cash crops, vegetables and fruits; and (ii) developing aquatic breeding. A large amount of the land compensation fees were invested in improvement of irrigation facilities, which greatly increased the average output value of the affected villagers' farmland. According to the resettlement completion report, CNY2.9 million was invested in irrigation facilities in the 34 villages that redistributed land, accounting for 12% of total compensation. Improved irrigation raised the average output value per mu above CNY1,600, up 67% from 2001. After the restructuring of industry production, livestock breeding, and household-based industries, the 2006 annual average gross income per capita in Xishe and Huayu villages of Jishan county reached CNY29,000 and CNY13,200, respectively. In Xizhuang village of Hejin, where 26 households received redistributed land to compensate for the 149 mu that they lost, the main living resource is farmland work, and half of the land is used to plant apples and the other half is used to plant grain crops.

11. The second livelihood rehabilitation plan method was applied in villages that could not undertake land redistribution because there was no land available. Rehabilitation here concentrated on the development of processing industries and trade. In Cangtou village in Hejin county, for example, farmers were helped to expand the planting of asparagus in wasteland on the banks of the Yellow River for processing and for sale. Asparagus cultivation expanded from 1,000 mu in 2001 to 4,000 mu in 2006, producing a net income of CNY2, 000 per mu. Income from this measure alone increased by CNY6 million, or an average of CNY3,000 per person. The number of motor vehicles in the village rose from 30 in 2001 to 50 in 2007 and each had contributed CNY10,000 to annual income by transporting materials for the construction of the Yellow River Bridge. In order to raise villagers' technology capability, CNY50,000 was spent on providing 300 villagers with skills training. In 2006, the average income per capita of the village reached CNY4,300—triple what it was in 2001. The net per capita income of 58 villages shown in Table A17.1 rose from CNY1,950 in 2001 to CNY3,002 in 2006.

12. The analysis of data collected from five villages with large land losses also indicated good economic rehabilitation. Table A17.9 shows the comparisons of primary indicators from the five between 2001 and 2006. Xiyaotou in Hejin was one of the villages where average

farmland per capita decreased the most—to only 0.5 mu after land acquisition. When it relied only on farming, the average income per capita was CNY1,225 and the net income per capita about CNY800, even when calculations were based on the highest production value of CNY2,500 per mu. Because this village is close to the city's industrial park, it enabled to set up five small enterprises, 60 transport-specialized households, 10 shops, and 10 restaurants that catered to about 900 people in the nearby factories. As a result, the average net income per capita of the village reached CNY5,300 in 2006, an increase of 84% compare to CNY2,875 in 2001. Eighty village households purchased cars and motorcycles. Many people have mobile phones. All of the households now have TVs, 90% have washing machines and fixed-line telephones, 50% have drinking water, 30% have refrigerators and 10% have air-conditioning. The standard of living has substantially increased. The result of implementation of the livelihood rehabilitation plan was satisfactory.

Table A17.9: Comparison of Main Indicators in Villages with Land Loss
(2001–2006)

Village	Xishe	Dongzhuang	Huayu	Xiyaotou	Junling
Population increase (%)	2.7	3.8	14.2	3.4	0.8
Farmland reduce (%)	10.4	23.7	8.1	6.1	20.0
Farmland reduce per capita (%)	21.4	25.92	33.33	28.6	20.0
Average output value increase per mu (%)	130	144	150	50	129
Net income increase per capita (%)	121.4	72.5	63.3	20.4	160
No. of persons working as laborers in 2006	200	300	150	330	300
Income from working as laborers in 2006 (CNY10,000)	200	180	60	198	210
Gross income increase in 2006 (CNY10,000)	279	206	94	156	424
Anticipated increase (CNY10,000)	260	200	20	20	20

Source: Resettlement completion report.

D. Conclusion

13. The land acquisition and resettlement activities for the project roads, including compensation payments, were completed successfully and the livelihoods of all affected persons were restored because (i) efficient organization and management were in place; (ii) the resettlement plan was effectively promoted through TV, broadcast, and other media; (iii) the livelihood rehabilitation plan was implemented effectively; (iv) compensation was paid on time to the people affected; (v) the progress in the implementation of the resettlement plan and of other activities was monitored regularly and timely corrective measures were taken; (vi) SHEC provided good work opportunities for the local people; and (vii) ADB provided timely guidance on the reports received and the site works during missions.

SOCIOECONOMIC IMPACTS OF THE PROJECT

A. Introduction

1. The project expressway between Houma and Yumenkou and the local roads were completed in Xinjiang, Jishan, and Hejin counties between 2004 and 2006. A project performance management system (PPMS) was established with help of international consultants to undertake socioeconomic surveys and collect statistical data in the project area both before and during construction to examine the effects of the Project on the people in the project area. A social development action plan (SDAP) was also prepared during project processing and the Shanxi Hou-yu Expressway Corporation (SHEC) engaged Shaanxi Kexin Consulting Company Ltd. (SKCC) as an external monitor to conduct investigations, collect data, monitor, and prepare reports on social and poverty impacts during implementation of the Project, and to assess the SDAP results. The main aim of the SDAP was to enhance social inclusion for the poor. Several positive social impacts were achieved during project implementation, including (i) increased employment during the construction and operation period, (ii) increased labor mobility, (iii) enhanced agricultural development induced by lower transport prices for inputs and better access to markets, and (iv) upgraded local community development.

B. Poverty Reduction Impacts

2. **Employment Opportunities**. To maximize the poverty-reduction impact of the project, it was agreed during project preparation that: (i) all roads financed under the project would utilize wage labor, with wages set at market rates that currently corresponded to approximately CNY20 per day for unskilled labor; and (ii) construction companies involved in civil works for the expressway, Yellow River Bridge, and local roads would commit to hiring the highest possible share of the labor force from poor villages.

3. According to the Project Performance Management System and Social Development and Poverty Alleviation Report (the Report) prepared by SKCC,[1] the contractors employed 78,863 person-months of labor during expressway construction between May 2004 and December 2006. About 47,020 person-months non-technical workers were employed, of whom, 7,150 person-months were female, accounting for around 15.2% of all non-technical workers; 34,844 person-months of the non-technical workers were from poor villagers, accounting for 74% of all non-technical workers. The average wage of non-technical workers was CNY817 per person-month (CNY27.23 per day which was higher than the appraisal estimate). Male and female workers were paid equally.

4. The expressway employed 402 people in its first year of operation, of whom 162, or 40.3%, were female. Of these workers, 382 came from poor villages—95%. The average wage was CNY650 per person-month. Expressway maintenance employed 577 laborers in 2007, 82, or 14.2%, of them women, and 495, or 85%, from poor villages. The average wage for these workers was about CNY880 per person-month.

5. The main social development indicators showed a fast growth tendency in the project area. The population of the three project counties increased from 0.976 million in 2001 to 1.045 million. The gross domestic product (GDP) reached CNY22.89 billion in 2007, an increase of 306.8% from 2001, or 20.5% per annum. Living standards improved. The per-capita net

[1] SKCC. 2007. *The Social Development and Poverty Alleviation Report*.

incomes of villagers in the three counties rose from CNY2,274 in 2001 to CNY4,322 in 2007, a growth rate of 90.06% or 11.3% a year. The per-capita net incomes of villagers in the 35 poor villages in the project area increased from CNY1,543 in 2002 to CNY2,738 in 2007, up 77.4%, or an annual average of 12%.The percentage of population in the project area with water facilities increased from 66% to 99% over the same period. Households with telephones rose from 64% to 95% in the same period. All of these indicators show an improvement in the standard of living. Social development statistics for the project counties are shown in Table A18.1.

Table A18.1: Social Development Statistics in the Project Area
(2001–2007)

Monitoring Indicator	Year	Xinjiang	Jishan	Hejin	Total
Total population (10,000 persons)	2001	29	32.5	36.1	97.6
	2007	32.2	33.8	38.5	104.5
	Increase (%)	10	3.7	8.0	7.07
GDP (CNY10,000)	2001	107,499	93,893	361,295	562,687
	2007	242,360	280,000	1,766,678	2,289,038
	Increase (%)	125.0	162.0	337.3	306.80
Primary industry (CNY10,000)	2001	26,133	15,609	10,380	52,122
	2007	27,463	50,000	29,807	107,270
	Increase (%)	40.9	79.5	107.2	105.81
Secondary industry (CNY10,000)	2001	45,150	42,988	258,490	346,628
	2007	138,669	150,000	1,342,575	1,631,244
	Increase (%)	135.9	248.9	237.2	370.60
Tertiary industry (CNY10,000)	2001	36,216	35,296	92,425	163,937
	2007	97,428	80,000	400,198	577,626
	Increase (%)	172.3	92.7	643.2	624.97
Net income per capita of villagers (CNY)	2001	2,011	2,080	2,731	2,274
	2007	3,616	3,100	6,250	4,322
	Increase (%)	52.2	41.8	112.4	90.06

Sources: Project performance management system and social development and poverty alleviation report.

6. **Gender.** Small loans were provided by the Rural Credit Corporation and the Agricultural Bank to 58 affected villages and 35 poor villages to assist in small-scale development of industry for purchasing small processing machines and building aquaculture areas and vegetable greenhouses. The average loan per household was about CNY55,000. During 2004–2007, loans were extended to 98,676 households, 25% of them poor. The main aim was to assist women and 47.5% of the loans went to households headed by women, a common situation in the project area because of the large number of local men who leave home to find work elsewhere. Table A18.2 gives details of village loans in the project area.

Table A18.2: Village Loan Statistics in the Project Influence Area
(2004–2007)

County/City	Total Amount of Village Loan (CNY10,000)	Loan Target		
		Number of Villages	Number of Households	Number of Household with a Female Head
Xinjiang	83,982	220	45,075	23,522
Jishan	289,396	200	46,551	22,100
Hejin	170,000	141	7,050	1,250
Total	**543,378**	**561**	**98,676**	**46,872**

Sources: Project performance management system and social development and poverty alleviation report.

7. In addition, 84,445 women villagers received technical training during the 2004–2007 period in such skills as vegetable production, herbal planting, and aquaculture. The training, organized by the county governments, covered 595 villages in three counties, including the 58 project-affected villages, where 1,288 women benefited, and 35 poor villages, in which 533 women participated. On average, every family had at least one woman trained and, in some cases, two. This enabled the women to develop the industrial structure of their villages by teaching others the techniques they had learned, not only in industrial enterprises but also in business at local markets. The Report shows that 4,450, or 59%, of all the stalls in the 64 project area local markets are kept by women and that they account for CNY56.52 million, or 58.8%, of annual average turnover. The number of shops in the area increased from 507 in 2001 to 732 in 2006. About 90% were kept by women and had an average annual turnover of CNY25,000. About 84% of the stores in the project area were kept by women. Table A18.3 - Table A18.5 give details of the training of women and of village stalls and stores operated by women in the project area from 2004–2007.

Table A18.3: Village Women Training Statistics in the Project Area

County/City	Total Number of Women Trained	Planting	Breed Aquatics	Industrial Technology	Business and Service
Xinjiang	23,522	5,008	17,518	0	996
Jishan	27,293	8,932	13,248	3,872	1,241
Hejin	33,630	2,357	9,852	12,688	8,733
Total	**84,445**	**16,297**	**40,618**	**16,560**	**10,970**

Sources: Project performance management system and social development and poverty alleviation report.

Table A18.4: Statistics of Stalls Kept By Village Women in the Project Area

County/City	Year	Total Number of Markets	Number of Stalls and Turnover Amount		
			Total	Kept by Women	Average Annual Turnover (CNY10,000)
Xinjiang	2004	5	280	90	0.80
	2007	10	860	230	1.00
Jishan	2004	22	3,750	2,230	1.70
	2007	27	5,360	3,200	2.00
Hejin	2004	23	1,150	910	0.60
	2007	27	1,350	1,020	0.80
Total	2004	50	5,180	3,230	1.03
	2007	64	7,570	4,450	1.27

Sources: Project performance management system and social development and poverty alleviation report.

Table A18.5: Store Statistics Kept By Village Women in the Project Area

County/City	Year	Store in Counties		
		Total	Kept by Women	Average Annual Turnover (CNY10,000)
Xinjiang	2004	360	348	2.00
	2007	480	460	3.00
Jishan	2004	720	530	3.60
	2007	940	700	5.00
Hejin	2004	430	380	1.20
	2007	450	410	1.50
Total	2004	1,510	1,258	2.27
	2007	1,870	1,570	3.17

Sources: Project performance management system and social development and poverty alleviation report.

8. **Poverty Alleviation.** In 2000, the three project area counties had one poor town, 35 poor villages, and a poor population of 33,965. By 2007, after 7 years of socioeconomic development, the net income of most of the poor population had improved by more than CNY1,000 per person. (The poverty level in 2000 was a per capita income of CNY865 and, in 2007, CNY1,000). The number of poor in the project area had declined in 2007 to 14,106, a decrease of 58.5%. Table A18.6 shows the poverty status in the project area and Table A18.7 shows the distribution of the poor villages before and after implementation of the project.

Table A18.6: Poverty Status in the Project Influence Area

	2001				2007			
County/City	Poor Town	Poor Village	Poor Household	Poor Population	Poor Town	Poor Village	Poor Household	Poor Population
Xinjiang	1	14	2,227	9,260	0	0	1,763	8,109
Jishan	0	19	5,200	23,070	0	0	1,156	5,317
Hejin	0	2	390	1,635	0	0	170	680
Total	**1**	**35**	**7,817**	**33,965**	**0**	**0**	**3,089**	**14,106**

Sources: Project performance management system and social development and poverty alleviation report.

Table A18.7: Poor Village Distribution in the Project Influence Area

2001			2007		
County/City	Town	Village	County	Town	Village
Xinjiang	Zhibeizhuang	Qucun, Donqucun, Beilanzhuang, Shijiaya, Liuya, Baoli, Lancun, Shijiazhuang, Dongwang, Wolongzhuang, Dongkang, Xiwang, Zhishe	Xinjiang	Zhibeizhuang	Qucun, Donqucun, Beilanzhuang, Shijiaya, Liuya, Baoli, Lancun, Shijiazhuang, Dongwang, Wolongzhuang, Dongkang, Xiwang, Zhishe
Jishan	Huayu	Foyukou, Liujiazhuang, Sihezhuang, Weilin, Ningzhaibao, Lijiazhuang, Mawucun	Jishan	Taiyang	Yangjiazhuang, Liujiaping, Shifogou, Sanpo, Shangwangyin, Emei
	Xishe	Shandi, Maguduo, Mashenpo, Caojiazhuang, Putou, Xiaojiazhuang, Yangjiazhuang			
	Taiyang	Yangjiazhuang, Liujiaping, Shifogou, Sanpo, Shangwangyin			
	Zhaidian	Emei			
Hejin	Senglou	Liujiabao, Lijiabao	Hejin		

Sources: Shanxi Hou-yu Expressway Corporation Ltd. 2007. *Project Performance Management System and Social Development and Poverty Alleviation Report.*

C. Monitoring and Evaluation.

9. Several positive social impacts were achieved during the implementation of the Project. In the poverty monitoring reports for the period 2002–2006, 21 indicators were used to track impacts in the project area's 35 poor villages. The integrated data is shown in Table A18.8. The PCR Mission spoke with several of the residents in the project area and found that living standards had increased, and mobility and employment opportunities had improved. The trip time from Xizhuang village to Hejin city had been reduced to 15 minutes from the one hour needed before the project was undertaken. Travel time to Xi'an in Shaanxi Province, which had

previously been 5 hours due to poor road conditions, was down to 2.5 hours. The improved road transport conditions meant more people could now seek employment opportunities outside the village at nearby factories, including a large aluminum factory close to Hejin.

Table A18.8: Poverty Alleviation Statistics for the Poor Villages

Monitoring Indicators	2002	2006	Increase or Decrease, %
Annual income per capita (RMBY)	1,543	2,087	35.3
% of population with drinking water	82.1	88.3	7.6
% of school-age children in school	96.0	100.0	4.0
Number of qualified teachers	130	135	3.8
% of adult literacy	88.2	91.0	3.2
Number of nurse/doctor	33	36	9.1
% of serious disease can be treated immediately	36.9	57.1	54.7
Distance to the nearest hospital (km)	6.4	6.4	
Convenient traffic distance to the nearest city or market (km)	10	12	2.0
Inconvenient traffic distance to the nearest city or market (km)	8	4	(50)
Number of outgoing laborer	1,161	2,792	140.5
Number of village enterprise	14	36	157.1
Number of other enterprise	16	25	56.3
Loan amount of household (CNY10,000)	100.3	293.0	192.1
Average holding of irrigated land (mu[2] per capita)	0.7	0.7	0
Average holding of non-irrigated land (mu per capita)	1.44	1.44	0
Average mean price of grain (RMBY/kg)	0.55	0.65	18.2
Average mean price of fruit, vegetable, and economic crops (RMBY/mu)	600	700	16.7
Number of phone	2,247	4,179	86
Number of radio	327	507	55
Number of TV set	5,249	5,952	13.4

Sources: Project performance management system and social development and poverty alleviation report.

10. From the data in Table A18.8 it can be seen that the base values of social development indicators of poor villages have improved. The major indicators from Table A18.8 are:

- The net income per capita increased from CNY1,543 in 2002 to CNY2,087 in 2006, an overall growth rate of 35.3%. The project area overall has reduced its poverty level, as measured by the present poverty standard of the PRC. In 2002, the net incomes per capita of two villages was lower than CNY800, those of 13 villages fell below CNY1,000, and those of 15 villages did not reach CNY1,500 per capita income. In 2006, the average net income per capita of all the villages was more than CNY1,000. Twenty-two villages had a net income per capita greater than CNY2,000.

[2] A mu is equivalent to 666.66 square meters, or 0.1647 acres, or 0.066 of a hectare.

- Several things account for the increase in net income per capita. Labor mobility has increased, which is partly due to the improvement of the roads in the project area; the number of outgoing laborers rose by 140%. The number of village enterprises and other enterprises in the project area has increased by 157% and 56%, respectively. The amounts loaned to households to establish small-scale village businesses and the training given to women have risen, enabling additional income generation.

- The indicators in Table A18.8 also show that the living standard has improved in the poor villages. In fact, except in some remote mountainous villages facing difficult ecological conditions, including poor soil and a lack of water, poverty has nearly been eradicated. This can be seen from the increases in the ownership of telephones, radios, and TVs.

D. Conclusion

11. The expected benefits envisaged at appraisal in relation to poverty reduction and social and economic development were realized as follows: (i) reduced transportation costs have benefited local residents (see Appendix 15 on Economic Reevaluation); (ii) residents along the road increased their incomes by supplying the Project with labor, materials, and services during construction of the expressway; (iii) some poverty alleviation and social projects located in poor villages along the expressway were facilitated by the expressway, resulting in increased incomes and income diversification among poor and nonpoor households (see Appendix 3 Local Roads); and (iv) improved access to economic and social facilities and services will have a long-term impact on development.

12. It can also be concluded that efforts to enhance social inclusion were successful. The poor was targeted and gained benefits from the Project. This was largely attributable to the understanding of the local officials and SHEC. Even though the SDAP was not monitored systematically, its aims were implemented because local government was already committed to the plan’s objectives and undertaking the desired actions, which were not imposed by ADB.

QUANTITATIVE ASSESSMENT OF OVERALL PROJECT PERFORMANCE

1. Overall Rating

Criteria	Assessment	Rating (0–3)	Weights (%)	Weighted Rating
Relevance	Highly Relevant	3	20	0.60
Effectiveness	Effective	2	30	0.60
Efficiency	Highly Efficient	3	30	0.90
Sustainability	Likely	2	20	0.40
Overall Rating	**Successful**			**2.50**

Note:
Relevance: - Project objectives and outputs were relevant to strategic objectives of the Government and ADB.
Effectiveness: - Project achieved its outcome.
Efficiency: - Project achieved objectives in an efficient manner.
Sustainability: - Project benefits and development impacts are sustainable.

2. Rating System

Rating Value	Relevance	Effectiveness	Efficiency	Sustainability
3	Highly Relevant	Highly Effective	Highly Efficient	Most Likely
2	Relevant	Effective	Efficient	Likely
1	Partly Relevant	Less Effective	Less Efficient	Less Likely
0	Irrelevant	Ineffective	Inefficient	Unlikely

Rating:	Greater than 2.7	=	Highly Successful
	Between 1.6 and less than 2.7	=	Successful
	Between 0.8 and less than 1.6	=	Partly Successful
	Less than 0.8	=	Unsuccessful