



Completion Report

Project Number: 33459
Loan Number: 2024
December 2011

People's Republic of China: Xi'an Urban Transport Project

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

		At Appraisal (31 October 2003)	At Project Completion (5 August 2010)
CNY1.00	=	\$0.1208	\$0.1477
\$1.00	=	CNY8.2768	CNY6.7722

ABBREVIATIONS

ADB	–	Asian Development Bank
CNG	–	compressed natural gas
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
EMP	–	environment management plan
GDP	–	gross domestic product
ICB	–	international competitive bidding
O&M	–	operation and maintenance
PCR	–	project completion report
PRC	–	People's Republic of China
TA	–	technical assistance
TRR	–	third ring road
VOC	–	vehicle operating cost
XMG	–	Xi'an municipal government
XMURCC	–	Xi'an Municipal Urban and Rural Construction Commission
XTRRCDC	–	Xi'an Third Ring Road Construction and Development Company

WEIGHTS AND MEASURES

km	–	kilometer
m ²	–	square meter
mu	–	Chinese unit of measurement (1 <i>mu</i> = 666.67 m ²)
pcu	–	passenger car unit

NOTE

- (i) In this report, "\$" refers to US dollars, unless otherwise stated.

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BASIC DATA

A. Loan Identification

1.	Country	People's Republic of China
2.	Loan Number	2024
3.	Project Title	Xi'an Urban Transport Project
4.	Borrower	People's Republic of China
5.	Executing Agency	Xi'an Municipal Urban and Rural Construction Commission
6.	Amount of Loan	\$270 million
7.	Project Completion Report Number	PRC 1289

B. Loan Data

1.	Appraisal	
	– Date Started	24 July 2003
	– Date Completed	6 August 2003
2.	Loan Negotiations	
	– Date Started	21 October 2003
	– Date Completed	24 October 2003
3.	Date of Board Approval	27 November 2003
4.	Date of Loan Agreement	27 April 2004
5.	Date of Loan Effectiveness	
	– In Loan Agreement	26 July 2004
	– Actual	8 December 2004
	– Number of Extensions	2
6.	Closing Date	
	– In Loan Agreement	30 June 2008
	– Actual	5 August 2010
	– Number of Extensions	2
7.	Terms of Loan	
	– Interest Rate	ADB's LIBOR-based lending facility
	– Maturity	24
	– Grace Period	4
8.	Terms of Relending	
	– Interest Rate	ADB's LIBOR-based lending facility
	– Maturity	24
	– Grace Period	4
	– Second-Step Borrower	Xi'an Third Ring Road Construction and Development Company

ADB = Asian Development Bank, and LIBOR = London interbank offered rate

9. Disbursements

a. Dates

Initial Disbursement	Final Disbursement	Time Interval
8 December 2004	25 June 2010	67 months
Effective Date	Original Closing Date	Time Interval
8 December 2004	30 June 2008	43 months

b. Amount (\$'000)

Category	Original Allocation	Last Revised Allocation	Amount Canceled	Net Amount Available	Amount Disbursed
Civil works	197,500	204,320	2,543	201,777	201,777
Urban transport improvement	24,050	18,560	1,668	16,892	16,892
Traffic management and safety	5,300	5,438	3	5,435	5,435
CNG stations	5,900	4,130	33	4,097	4,097
Mobile inspection system	200	322	6	316	316
Maintenance equipment	8,500	3,120	5	3,115	3,115
Road maintenance	3,900	5,300	1,621	3,679	3,679
Urban transport modeling	250	250	0	250	250
Equipment	18,700	20,070	16	20,054	20,054
Consulting service and training	2,700	2,100	19	2,081	2,081
Front-end fee	1,350	1,350	0	1,350	1,350
Interest and commitment charge	18,600	23,600	1,607	21,993	21,993
Unallocated	7,100	0	0	0	0
Total	270,000	270,000	5,853	264,147	264,147

Source: Asian Development Bank.

C. Project Data

1. Project Cost (\$ million)

Cost	Appraisal Estimate	Actual
Foreign Exchange Cost	296.00	264.15
Local Currency Cost	466.00	1,068.85
Total	762.00	1,333.00

2. Financing Plan (\$ million)

Cost	Appraisal Estimate	Actual
Implementation Costs		
Borrower Financed	472.50	872.76
ADB Financed	250.05	240.80
Total	722.55	1,113.56
IDC Costs		
Borrower Financed	19.50	196.10
ADB Financed	19.95	23.34
Total	39.45	219.44

ADB = Asian Development Bank, and IDC = interest during construction and commitment charge.

Source: Asian Development Bank.

3. Cost Breakdown by Project Component (\$ million)

Component	Appraisal Estimate	Actual
A. Base Cost		
1. Civil works	405.0	573.2
2. Urban transport improvement	34.9	43.2
3. Equipment	20.8	23.2
4. Land acquisition and resettlement	180.5	438.7
5. Consulting services and training	6.5	35.4
Subtotal (A)	647.7	1,113.7
B. Contingencies		
1. Physical contingencies	35.2	0.0
2. Price contingencies	39.6	0.0
Subtotal (B)	74.8	0.0
C. Front-End Fee	1.4	1.4
D. Interest and commitment charges during Construction	38.1	217.9
Total (A+B+C+D)	762.0	1,333.0

Source: Asian Development Bank.

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants	February 2004	December 2004
Completion of Engineering Designs	June. 2003	May 2004
Civil Works Contract		
Date of award	March 2004	November 2004
Completion of work	December 2007	December 2008
Equipment and Supplies Dates		
First procurement	April 2004	May 2005
Last procurement	April 2004	August 2008
Completion of equipment installation	September 2007	February 2010
Start of Operations		
Completion of third ring road	November 2007	December 2008
Completion of all subprojects	December 2007	March 2010

Source: Asian Development Bank.

5. Project Performance Report Ratings

Implementation Period	Ratings	
	Development Objectives	Implementation Progress
From 30 Nov 2003 to 30 Sep 2004	Satisfactory	Satisfactory
From 1 Oct 2004 to 30 Nov 2004	Satisfactory	Unsatisfactory
From 1 Dec 2004 to 31 Dec 2005	Satisfactory	Satisfactory
From 1 Jan 2006 to 31 Dec 2006	Satisfactory	Satisfactory
From 1 Jan 2007 to 31 Dec 2007	Satisfactory	Satisfactory
From 1 Jan 2008 to 31 Dec 2008	Satisfactory	Satisfactory
From 1 Jan 2009 to 31 Dec 2009	Satisfactory	Satisfactory
From 1 Jan 2010 to 31 Aug 2010	Satisfactory	Satisfactory

Source: Asian Development Bank.

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members ^a
Fact-finding	31 March–10 April 2003	6	44	a, b, c, d, e, f
Appraisal	24 July–6 August 2003	7	66	a, b, c, d, e, f, g,
Inception	29 July–5 August 2004	2	16	e, h
Special review	4–7 February 2005	1	4	e
Special review	19–22 July 2005	1	4	e
Review 1 ^b	31 October–4 November 2005	5	17	e, h, i, j, k
Special review	4–7 April 2006	1	3	l
Midterm review	16–22 August 2006	4	25	j, k, m, o
Review 2	28 May–2 June 2007	2	10	j, k
Review 3	11–16 August 2008	3	12	j, k, l
Review 4	19–25 April 2009	2	14	j, k
Project completion review	7–11 April 2011	5	14	j, k, l, m, n

^a a = economist, b = financial analyst, c = programs officer, d = resettlement specialist, e = transport specialist, f = environment specialist, g = counsel, h = assistant project analyst, i = senior portfolio management specialist, j = national officer (transport), k = project analyst, l = resettlement officer, m = financial management officer, n = environment officer, and o = staff consultant.

^b Project administration was transferred to the People's Republic of China Resident Mission on 14 November 2005.
Source: Asian Development Bank.

I. PROJECT DESCRIPTION

1. Rapid economic development in the People's Republic of China (PRC) since the 1980s has been accompanied by a significant increase in urbanization. In 1980, the PRC had 51 cities with a population of more than half a million. By 2010, the number of such cities had increased dramatically to 235, of which nine had more than 5 million inhabitants and 79 had a population of 1 million–5 million.¹ Xi'an municipality is no exception to this unprecedented rapid urbanization process and its population increased from 7.41 million in 2000 to 8.47 million in 2010.² According to estimates by the World Urbanization Prospects, urbanization in the PRC—the urban population was 190 million (19.4% of total population) in 1980, 453 million (35.8% of total) in 2000, and 636 million (47.0% of total) in 2010—will steadily increase and its urban population will rise to 787 million (55.0% of total) by 2020 and 1,038 million (73.2% of total) by 2050.

2. Rapid economic growth and urbanization have brought more income and a decentralized auto industry, which has made vehicle ownership more affordable. Private vehicle ownership in the PRC was only a few thousand in 1980, but increased dramatically to 6.25 million in 2000 and further to 65.39 million by the end of 2010. In line with this trend, private vehicle ownership in Xi'an municipality increased almost threefold to 782,800 in 2010, from 264,100 in 2005. This put considerable stress on the existing, limited urban transport network and created the need for rapid development of infrastructure and related services. National road passenger traffic grew by 9.8% in 2010, reaching 1,502.1 billion passenger-kilometers (km), and road freight transport grew by 15.0%, reaching 4,339.0 billion ton-km. Because road transport was more flexible and responsive to the needs of a market economy than other transport modes, the road subsector has absorbed the brunt of passenger and freight movement in the context of the PRC's rapid economic growth over the past three decades.

3. The road network in Xi'an also developed significantly from 2001 to 2010 in both density and quality. Overall, it expanded from 3,298 km in 2001 to 12,378 km in 2010, equivalent to an annual increase of 908 km. Expressways increased from 159 km to 377 km during the same period. High-standard roads (i.e., above class II) accounted for only 13.3% of the total road network, and the remaining 86.7% of the road network (class III road and below) were medium- to low-grade paved roads and gravel roads in 2010. Road density grew from 32.7 km per hundred square kilometers in 2000 to 122.5 km per hundred square kilometers in 2010. Road density relative to the population increased from 5.12 square meters (m²) per capita to 15.40 m² per capita in the same period, which is higher than the national average of 6.60 m² per capita.

4. The major objective of the project was to promote economic growth in Xi'an by reducing transport costs and relieving transport infrastructure bottlenecks. The project was designed to assist in developing an efficient, safe and environmentally sustainable urban transport system by (i) strengthening institutional capacity through greater coordination between municipal government agencies, (ii) improving traffic management and safety, (iii) improving vehicle emissions control, and (iv) increasing the capacity of urban roads. Policy dialogue focused on key issues such as institutional strengthening, traffic management and safety, vehicle emissions control, road maintenance, and urban and public transport planning. The project framework is in Appendix 1.

¹ United Nations Population Division. 2010. *World Urbanization Prospects: The 2009 Revision Population Database*. Available at: http://esa.un.org/unpd/wup/unup/index_panel3.html.

² Xi'an Municipal Bureau of Statistics and Xi'an Survey Office of National Bureau of Statistics. 2011. *Xi'an Statistical Yearbook 2011*. Beijing: China Statistics Press.

5. A feasibility study for the project was prepared by the First Highway Survey and Design Institute and approved by the National Development and Reform Commission on 30 September 2003. The Asian Development Bank (ADB) approved project preparatory technical assistance (TA) on 27 August 2002 to review and assess the project's technical feasibility and economic viability, including environmental and resettlement impacts.³ The TA was completed on 14 May 2003 and its outcome confirmed the technical, financial, and economic viability, and the adequacy of environmental and social measures. Subsequently, the loan fact-finding and appraisal missions verified that the project was in line with ADB's country strategy and sector policy. ADB's Board of Directors approved a loan of \$270 million for the project on 27 November 2003. The loan became effective on 27 April 2004, with an original project completion date of 31 December 2007 and loan closing date of 30 June 2008. Two sections of the project's third ring road (TRR)—the west and east sections—were opened to traffic in 2006 and the entire ring road was in full operation by December 2008. However, delays in constructing the compressed natural gas (CNG) stations, in procuring several equipment packages, and in developing the requisite human resources resulted in two extensions of the loan closing date to 31 March 2010. Appendix 2 provides a chronology of major events.

6. At appraisal, the project comprised: (i) constructing a 71 km ring road, including interchanges and bridges; (ii) building 16 km of connector roads to integrate the ring road in the overall urban road network; (iii) improving five areas of urban transport—traffic management and safety, vehicle emissions control, public transport, urban transport planning, and road maintenance; (iv) procuring equipment for road maintenance, transport planning modeling, traffic signals and an area traffic control center, vehicle emissions inspection, a vehicle axle weighing system, CNG stations, and surveillance and communications; (v) land acquisition and resettlement; and (vi) providing consulting services for construction supervision, the urban transport component, monitoring and evaluation, and capacity building.

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

7. ADB's country strategy and program at the time of appraisal called for promoting pro-poor economic growth by giving the poor greater access to the opportunities and benefits of economic prosperity.⁴ The strategy was designed to (i) foster equitable and inclusive growth, (ii) make markets work more effectively, (iii) protect the environment, and (iv) promote cooperation with neighboring countries. An essential thrust of the strategy was to increase assistance to the poor central and western provinces, including Shaanxi province, by supporting projects that advance pro-poor economic growth. In the transport sector, the strategy would help to remove transport infrastructure constraints and improve the urban environment. An efficient, safe, and environmentally sustainable transport network was needed to promote economic growth and benefit the poor in urban and rural areas. Urban infrastructure, such as road transport systems and public utilities, would need to be improved to cope with the increasing burden imposed by rapid urbanization. The project, designed to remove transport bottlenecks and address environmental concerns in Xi'an, one of the major growth centers in the western region, was consistent with the PRC's development priorities and ADB's strategy. The project was also consistent with ADB's urban sector strategy, which supported investing in the urban sector because of the central role urban centers play in economic development.⁵ The project

³ ADB. 2002. *Technical Assistance to the People's Republic of China for Preparing the Xi'an Urban Transport Project*. Manila.

⁴ ADB. 2003. *Country Strategy and Program (2004–2006): People's Republic of China*. Manila.

⁵ ADB. 1999. *Urban Sector Strategy*. Manila.

also included a component to build institutional capacity for urban transport operations, road maintenance and asset management, road safety, transport planning, vehicle emissions control, project management, infrastructure development planning, monitoring and evaluation, environmental management, traffic management, quality control, bridge and road design, and commercial road development.

B. Project Outputs

8. **Third ring road and connector roads.** The Xi'an Third Ring Road Construction and Development Company (XTRRCDC) was responsible for implementing the TRR and connector roads. The TRR component consisted of western, eastern, northern, and southern sections. Construction began on 10 December 2004 for the western section and on 30 May 2005 for the eastern section. Construction of the other two sections started on 20 March 2006. The western section was completed on 30 May 2006, the eastern section on 30 December 2006, the southern section on 16 February 2008, and the northern section on 20 December 2008. To maximize network connectivity, the extended northern section of the Zhuhong road, extended northern line of the eastern section, and extended eastern line of the northern section, which form the project's connector roads, were completed simultaneously and, along with the TRR, integrated into the local urban road network. Interchanges, flyovers, and underpasses, lighting and safety measures, pedestrian paths, and traffic signage were adequately designed, built, and installed along the project roads. The pavement conditions were also satisfactory. To mitigate growing safety concerns over the sprawling urban expansion along the completed TRR, particularly in the western section, traffic lights and safety monitoring systems were installed at intersections, and speed limits were applied to the TRR, while landscaping separated the non-motorized traffic.

9. **Urban transport improvement.** This component comprised (i) traffic management and road safety, (ii) vehicle emissions control, (iii) road maintenance, (iv) urban transport planning, and (v) the public transport components. Five agencies of the Xi'an municipal government (XMG) were designated to implement the various sub-components.

10. **Traffic management and road safety.** This component entailed (i) an area traffic control system for traffic signals, main control center, traffic management scheme, and traffic enforcement communications and policing system; and (ii) a road safety strategy, including accident and enforcement data system and software, black-spot program, inter-agency mechanism, and road safety audit. The traffic management bureau of the Xi'an Public Security Bureau was responsible for this component. ADB provided financing for nine of the component's 10 packages, with the remaining package financed from domestic sources. Equipment procurement started in May 2006 and was completed in July 2007. All traffic management and safety equipment was installed, tested, and commissioned, and became operational by December 2009. The government conducted an acceptance mission for this part of the component on 18 December 2009. The road safety strategy was prepared and submitted to ADB in December 2007. Overall, the component improved the institutional capability of the Xi'an Public Security Bureau for traffic management and road safety, which in turn has enabled the government to provide broad services to the public and meet key requirements such as traffic administration, information collection and dissemination, traffic demand management, traffic accident processing, emergency response systems, vehicle parking management, traffic signal control, mobile-radar patrolling, automated traffic law enforcement, and traffic administration service extension to communities.

11. **Vehicle emissions control.** This comprised (i) provision of CNG stations, (ii) introduction of a mobile emissions inspection system, and (iii) formulation of an action plan for air quality management and vehicle emissions control. The Xi'an Municipal Environment Protection Bureau was responsible for the implementation of parts (ii) and (iii) and XTRRCDC was to implement part (i). For part (i), since CNG stations are administered by a special government agency given the hazardous nature of the products handled, the design and approval procedures were delayed and only completed in 2008, following which the bid evaluation report was approved by ADB in March 2009. The 10 CNG stations were completed before September 2009 and passed all safety and government quality acceptance reviews. For parts (ii) and (iii), procurement of equipment was completed in 2007. Installation and commissioning of the mobile emissions inspection system was completed in September 2008. With the support of consultants, a report on emissions standards and penalties for their infringement, and a plan for enforcing vehicle emissions control for the project roads was submitted to ADB in July 2009. The vehicle emissions control component was implemented in an effective and efficient manner. Once the equipment was available and while the project was still being implemented, the Municipal Environment Protection Bureau conducted a survey of vehicle emissions. Analysis was made and the findings were disseminated to government agencies and project entities.

12. **Road maintenance.** This included road improvement, maintenance equipment, and developing an asset management and maintenance strategy. The equipment was procured from 2005 to 2009 in accordance with the project implementation schedule and is operational. The urban road improvement component focused on the section including Dongwuxiwu Road and Lianhu Road totaling 4.1 km. Improvement works for these two roads were completed in 2005 and 2006, respectively. Pedestrian movement on non-motorized lanes has improved along these two roads. With the assistance of international consultants, an asset management and maintenance strategy was prepared and submitted to ADB in August 2008.

13. **Urban transport planning.** This component entailed the development of a comprehensive urban transport model. The implementing agency, Xi'an Municipal Planning Bureau, engaged Chang'an University in 2009 to develop the model, which was completed in March 2010, with a report to ADB. The model contains a comprehensive transport database with road network attributes, geographic information, and traffic characteristics for Xi'an's urban area. The database will be expanded to cover suburban areas of Xi'an in the future. The model structure has prevailing model applications incorporating base-year data required for model calibration.

14. **Public transport.** This component consisted of a bus priority scheme on a 5 km long east-west road with 13 bus lines, 40 buses, and seven bus stops on each side. The 30-meter-wide road features a 9.5-meter-wide bus priority lane. The Xi'an Public Transport Company was responsible for the implementation of this component. The bus priority corridor was implemented in October 2005 and such a practice was subsequently replicated in other bus lines in Xi'an. Bus services and traffic capacity have improved significantly.

15. **Equipment.** This component included procuring equipment for (i) a lighting system for the TRR, (ii) communications, and (iii) traffic surveillance and monitoring. The contract for the lighting system was approved in April 2007 and the system is operational. The equipment packages for communications and traffic surveillance and communications were procured in 2008 and 2009, respectively, and are operational.

16. **Consulting services and human resources development.** International consultants were engaged to provide a total of 56.5 person-months of consulting services for the project. They comprised a team leader and 11 experts in the fields of engineering, construction supervision, road safety, traffic control, transport planning and modeling, vehicle emissions control, environmental monitoring, human resources development, and asset management and maintenance. By project completion, the international consultants had provided 81 person-months of consulting services, of which, 24.5 person-months were added to provide inputs on environment monitoring, social development, asset management, human resource development, capacity building and assisting the EA in preparing the project completion report.

17. A supervision unit headed by a chief engineer oversaw construction work under the project. Each contract package entailed a resident site engineer, who was assisted by a deputy and supported by technical and administrative personnel. In total, 4,940 person-months of inputs from 16 national supervision firms were engaged for oversight of 19 civil works contract packages comprising contract management, quality control, verification of measuring, material testing, review of technical drawings, engineering progress inspection, disbursement verification, and preparation of completion documents.

18. At appraisal, a program totaling 170 person-months of training was envisaged, covering the fields of urban transport operation, road maintenance and asset management, road safety and traffic management, project management, environmental protection, public transport, vehicle emissions control, and prioritized public transport. At project completion, 168 person-months of training had been conducted (46.5 person-months of overseas training and 121.5 person-months of domestic training). Staff who undertook this training gained valuable knowledge in their fields. XTRRCDC also organized several on-the-job training courses covering environmental protection, construction safety, traffic engineering and vehicle emissions control, and social and poverty impacts. A total of 115 staff participated in this training.

C. Project Costs and Financing Plan

19. **Project cost.** The total project cost at completion was CNY9.182 billion, 45.6% higher than the cost estimate of CNY6.307 billion at appraisal. About 92% of the cost over-run was attributed to the significant increase in land acquisition and resettlement costs (from the estimated at CNY1.494 billion at appraisal to CNY2.972 billion) and interest during construction (from CNY0.315 billion at estimated appraisal to CNY1.476 billion). The main reason for higher land acquisition and resettlement costs was an increase in compensation rates in accordance with new government policies issued after 2003, and variations from the rough estimates made in the preliminary design, which were the basis for the resettlement plan at appraisal. For physical works, there were minor cost increases caused by design changes, contract variations, or necessary technical measures that were adopted during construction. In general, the cost of physical works was well controlled during implementation and the project's outputs were completed at satisfactory quality. The cost of consulting services was \$6.5 million at appraisal and \$35.4 million at completion. The difference was mainly caused by some cost items at appraisal, such as the project feasibility study, preliminary and detailed design, and laboratory testing not being included in the project cost because the government had borne these preparation expenditures in advance while the project cost at completion retrofitted the costs incurred.

20. **Financing plan.** The updated project financing arrangements included funds from Xi'an municipal government (XMG) and local government, which increased from \$492.0 million (equivalent to CNY4.072 billion) at appraisal to \$1,068.9 million (equivalent to CNY7.239 billion),

of which XMG borrowed CNY4.102 billion from domestic banks with a term of 20 years, including a 4-year grace period. Actual loan proceeds utilized were \$264.1 million. The counterpart funds for the project were made available in a timely manner in line with the implementation schedule. Appendix 3 presents the project costs and financing plan.

D. Disbursements

21. All ADB-financed contract packages were procured through international competitive bidding (ICB) procedures. Out of the \$270 million loan proceeds, a cumulative \$264 million was disbursed from 2003 to 2010. Three types of disbursement procedures were followed: reimbursement procedure for civil works, direct payment for consulting services, and commitment procedure for equipment. The disbursement control was satisfactory. Out of the disbursed ADB loan proceeds, \$240.8 million was utilized for project civil works, urban transport improvement, and procurement of equipment and consulting services; \$1.35 million for front-end fees; and \$21.99 million for capitalized interest during construction and commitment charges. The loan account was closed on 5 August 2010 and loan savings of \$5.85 million was cancelled at the same time. The projected and actual contract awards and disbursements are shown in Appendix 4.

E. Project Schedule

22. On 22 July 2003, ADB approved advance action for procurement of civil works contracts to enable XTRRCDC to start site preparation. The loan was approved on 27 November 2003 and the loan agreement was signed on 27 April 2004, five months after Board approval. The loan became effective on 8 December 2004. Civil works construction began in December 2004 after ADB approved contract awards for the first batch of five packages. The remaining 13 civil works packages were approved and commenced construction in 2005. Land acquisition and resettlement activities started in April 2004 and most were completed by 2006. International and national consultants were fielded in December 2004. The components of traffic management and safety, vehicle emissions control, road maintenance, urban transport planning, and public transport were procured and implemented from 2005 to 2010. The TRR was completed and opened to traffic by the end of 2008. Procurement of equipment started in 2006 and ended in late 2009. The whole project was completed by the end of March 2010. The appraisal and actual project implementation schedules are in Appendix 5.

F. Implementation Arrangements

23. The Xi'an Municipal Urban and Rural Construction Commission (XMURCC) was the executing agency for overall management and implementation of the project. XTRRCDC, a wholly state-owned company, was established on 2 April 2003 for the purpose of implementing the project road. It has a board of directors, management staff, and sufficient and qualified technical, financial, and administrative staff. As stipulated in the loan and project agreements, XTRRCDC was responsible for the implementation and operation and maintenance (O&M) of the project road. Various government agencies were designated for regular O&M, while any medium or major rehabilitation works would be undertaken following public bidding procedures.

24. The urban transport improvement component comprised five subcomponents and was delegated to five agencies affiliated with XMG, including the (i) traffic management bureau of the Xi'an Public Security Bureau, (ii) Xi'an Environment Protection Bureau, (iii) Xi'an Public Transport Company, (iv) Xi'an Urban Public Facility Bureau, and (v) Xi'an Municipal Planning Bureau. A project committee was established within XMG, chaired by a vice-mayor and included

senior officials from concerned government agencies, and XMURCC and XTRRCDC. The committee coordinated and facilitated project implementation and subsequent operations. The organizational charts are in Appendix 6.

G. Conditions and Covenants

25. The condition for loan effectiveness stipulated that an onlending agreement between XMG and XTRRCDC needed to be executed on the same terms and conditions as those of the ADB loan. The loan was declared effective 5 months after the loan agreement was signed, 2 months later than the targeted 90 days after loan signing. No covenants were modified, suspended, or waived during implementation. Covenants were generally complied with, particularly those related to implementation arrangements, environmental protection, and monitoring and evaluation. All audited accounts and financial statements were submitted as required in a timely manner. The quality of audits was good. There were no qualified audit opinions. Compliance with major loan covenants is set out in Appendix 7.

H. Related Technical Assistance

26. ADB provided project preparatory TA with the aim to (i) assist the government in refining the feasibility study, including the environmental impact assessment (EIA) and resettlement plan, for the proposed project in conformity with ADB's requirements; and (ii) review urban transport sector issues and provide assistance on policy dialogue with the government. The TA included (i) developing an efficient, safe, and environmentally sustainable urban transport system; (ii) increasing the efficiency and safety of the urban road network; (iii) developing effective public transport services; and (iv) strengthening institutional capacity through greater coordination between municipal agencies. The TA used 41 person-months of consulting services (18 person-months of international consultants and 23 person-months of national consultants). It was conducted on schedule and produced the required outputs. Subsequent loan processing was based on the TA's findings and recommendations.

I. Consultant Recruitment and Procurement

27. International consultants financed under the loan were recruited in accordance with ADB's Guidelines on the Use of Consultants. ADB approved contract awards in February 2004. The international consultants were fielded in February 2004 and their services were completed in March 2010. National consultants for design, construction supervision, and procurement were recruited following national procedures acceptable to ADB.

28. All ADB-financed packages and sections followed ADB's Procurement Guidelines. The relevant details are in the preceding paragraphs on project outputs. Two national procurement agents were engaged to assist XTRRCDC in civil works and equipment procurement. In the bidding documents and contracts, relevant sections of ADB's anticorruption policy were incorporated and implemented. In addition, through a separate integrity and anticorruption contract, prevailing domestic anticorruption practices were widely applied in civil works construction during implementation. Advance action was undertaken in accordance with ADB guidelines. XTRRCDC undertook preparatory work for advance procurement, which gave it an opportunity to become familiar with such procurement procedures during the subsequent loan processing. No major issues were encountered in the bidding and execution of the contracts. Contracts for equipment financed by ADB were tendered following ICB procedures except for one package financed by local funds, which followed national procedures. The details of civil works and equipment packages are in Appendix 8.

J. Performance of Consultants, Contractors, and Suppliers

29. The international and national consulting firms engaged to assist in project implementation performed satisfactorily and established good working relationships with XTRRCDC. The international consultants organized the overseas training program in an efficient and effective manner. Training materials and site visits familiarized representatives from XMURCC and XTRRCDC with international practices on urban road design, construction, and management. The international consultants also provided expertise on environmental protection and road safety measures, and helped integrate these measures into project implementation. National consultants, working jointly with international consultants, provided satisfactory services to project implementation.

30. The civil works contractors performed well and completed construction according to schedule and as stipulated in their contracts. The civil works for the TRR and connector roads, including bridges and pavement, were implemented well and of satisfactory quality. From 2007 to 2010, the project was awarded nine quality or showcase certificates, including three from state agencies and five from provincial agencies. These credits confirmed the project's major accomplishments. Equipment for components was supplied, installed, and commissioned according to schedule. Resettlement and environmental monitoring during construction by national consultants was also satisfactory. The overall performance of consultants, contractors, and suppliers was evaluated as satisfactory.

K. Performance of the Borrower and the Executing Agency

31. XMURCC and XTRRCDC implemented the project in an effective and efficient manner. Project management during preparation and construction was evaluated as efficient and effective. Construction standards for the TRR and connector roads were evaluated as meeting international best practice. XTRRCDC built sufficient capacity to manage contracts based on Fédération Internationale des Ingénieurs-Conseils (FIDIC) standards. Internal project controls were put in place to ensure effective use of funds, and project costs were under effective control except for resettlement expenses, which were affected by the government's newly issued policies. An internal auditing unit was established at XTRRCDC. Domestic funds were mobilized on time. Withdrawal applications were submitted in a timely manner and contractors were paid on time. Land acquisition and resettlement activities were completed on time to the satisfaction of the affected persons. The performance of the borrower, XMURCC, and XTRRCDC was satisfactory.

L. Performance of the Asian Development Bank

32. ADB conducted regular loan review missions during project implementation and provided effective advice to XMURCC and XTRRCDC on project implementation, monitoring, and procurement matters. ADB reviewed and processed procurement documents efficiently, and processed requests from the borrower and XMURCC promptly and efficiently. Withdrawal applications were processed and disbursed on time. XMURCC and XTRRCDC expressed satisfaction that responsibility for project administration had been delegated to the PRC Resident Mission, which made for closer and more efficient communications. ADB's performance during project implementation was satisfactory.

III. EVALUATION OF PERFORMANCE

A. Relevance

33. The project was assessed as relevant given its location in Xi'an municipality, the capital of Shaanxi province and a key growth center in the poor western region of the PRC. In Xi'an, the urban population increased from 6.88 million in 2000 to 7.83 million in 2010. This steady urbanization put pressure on the urban transport system, resulting in traffic congestion and increasing motor vehicle emissions. The project supported the government's development strategy by (i) constructing an urban ring road; (ii) building connector roads; (iii) establishing urban transport facilities and services; and (iv) providing consulting services and training to boost construction quality, road safety, vehicle emissions control, and project monitoring and evaluation. Consistent with the Xi'an urban development master plan, large investments had been programmed for road construction, a subway system, and public transport operations. Policy and institutional reforms were included in the urban transport policy and regulations to foster development of public transport, traffic management and safety, road maintenance, vehicle emissions control, driver education, urban poverty reduction, and private sector development. The master plan gave priority to the construction of the TRR, which formed the main physical component of the project. Construction of a ring road and connector roads provided efficient and safe access in and out of the city for inbound and outbound traffic, and through traffic.

34. The project thus eased growing congestion arising from the rapid increase in traffic, inadequate road infrastructure, and poor traffic management. It was designed as a public service since urban residents benefit from the project directly or indirectly due to less congestion in the overall urban road network. Xi'an municipality identified the project as a priority investment that was consistent with ADB's urban sector strategy, which supported investing in the urban sector because of the key role of urban centers in economic growth. Gross domestic product (GDP) for the Xi'an urban area grew at an annual rate of 13.3% during 2001–2005 and by 14.5% annually during 2006–2010, higher than the national average in the same period. The annual increase in per-capita income in Xi'an in 2006–2010 was 18.2% for urban areas and 17.5% for rural areas. The per-capita income in 2010 was CNY22,244, higher than the national average of CNY19,109.

B. Effectiveness in Achieving Outcome

35. The project is evaluated as effective because it (i) developed efficient, safe, and environmentally sustainable urban transport infrastructure; and (ii) strengthened institutional capacity through greater coordination between municipal agencies. Moreover, the project developed urban transport infrastructure and services in Xi'an to meet increasing traffic demand by building the TRR and connector roads; upgrading road technical standards; improving road traffic flows along major intersections and main roads; and increasing vehicle speeds while reducing traffic congestion, traffic accidents, and vehicle emissions. The TRR, particularly the eastern and western sections, facilitated significant traffic increases—growth in 2011 was 268% for the western section and 384% for eastern section, above traffic forecasts at appraisal

36. The road infrastructure in Xi'an increased from 7.96 m² per person in 2004 to 15.40 m² per person in 2010, along with the growing population. The public transport services expanded from 4,288 buses in 2004 to 7,107 buses in 2010, and there were 235 bus lines in 2010 compared with 182 bus lines in 2004. The average cross-town speed increased from 12 km per hour in 2002 to 15-20 km per hour in 2010. Traffic accidents in Xi'an declined from 4,114

accidents with 3,214 injuries in 2002 to 2,323 accidents with 2,520 injuries in 2010. The project assisted the establishment of the Xi'an Vehicle Emissions Monitoring and Inspection Center in 2008, which was designated as the permanent agency to administer and monitor vehicle emissions in Xi'an. Meanwhile, a complete vehicle emissions management system is being set up with domestic and external assistance. Based on surveys, air pollution emissions in 2008 were 324,900 tons per year for carbon monoxide, 52,100 tons per year for hydrocarbon, and 42,800 tons per year for nitrogen monoxide. To cope with these challenges, the Shaanxi provincial government approved the Xi'an Vehicle Emissions Pollution Prevention Regulation on 27 May 2009. Vehicle emissions inspections have been conducted regularly since 2008, covering carbon monoxide, nitrogen monoxide, and nitrogen dioxide.

C. Efficiency in Achieving Outcome and Outputs

37. The reevaluated economic internal rate of return (EIRR) for the project is 16.3%, as compared with the 15.4% estimated at appraisal. The higher EIRR was mainly due to substantially higher traffic on the TRR despite a higher project cost. The reevaluated EIRR is higher than the cut-off rate of 12.0% and the project is considered economically viable. Based on an economic reevaluation, the project is rated efficient. Xi'an municipality implemented urban road construction projects continuously from 2004 to 2010. The length of urban roads increased from 1,332 km in 2004 to 2,662 km in 2010. The per-capita area of roads in the urban area also increased from 7.96 m² per person in 2004 to 15.40 m² per person in 2010, an increase of 93.5%. Although road length increased significantly in recent years, traffic congestion, especially during the rush hours and in the southern area of Xi'an, is still a major issue. The average speed in non-project urban areas remains at 10–20 km per hour. One of the reasons is the rapid increase in the number of vehicles—from 512,804 in 2004 to 844,904 in 2008, and further to 1.28 million in 2010. Among the vehicle types, passenger vehicles including buses, cars and vans increased by 21.8% annually on average during the same period. Private cars had the largest and fastest increase in numbers and still pose a tremendous challenge for the urban road network. Two subway lines are under construction. Subway Line 2 commenced construction in 2007 and started operation on 16 September 2011. Subway Line 1 was begun in 2008 and is expected to open in 2013. Xi'an is the first northwestern city in the PRC to have a subway, and urban transport is expected to improve with its operation.

38. The TRR connects four districts and two commercial and industrial development zones of Xi'an municipality. It also connects with several main urban roads, three national highways, and eight expressways. Since it started operation in 2008, traffic volumes have been growing rapidly. The western section was opened to traffic in 2006, more than 1 year earlier than the TRR's full operation, and it has the highest traffic volume because it connects with the airport expressway and several urban trunk roads. The northern section of the TRR, opened in December 2008, has lower traffic volumes than other sections because it mainly serves local traffic.

39. Without the project, the urban road network would have experienced worsening traffic congestion resulting in lower average travel speeds, higher vehicle operating costs (VOC), more accidents, and higher road maintenance costs. The TRR and its connector roads ease inbound and outbound traffic, alleviate congestion in the urban area, and improve road capacity for through traffic. Higher traffic speeds on the TRR resulted in lower VOCs. The urban traffic benefits from the project because of fewer accidents and better road conditions.

40. Passenger time savings are the major economic benefit of the project. The TRR provides a faster route for urban transport in Xi'an municipality. The average traffic speed in the

eastern and western section of the TRR is 60 km per hour, with average speeds of 40 km per hour for the northern section and 30 km per hour for the southern section. These speeds are much higher than the average of 10–20 km per hour in the other districts of Xi'an. Passenger time savings are valued based on the average per-capita income in Xi'an, for which a growth rate consistent with recent GDP growth has been applied. Better road conditions and higher speeds also generated savings in VOC. To calculate traffic benefits, VOC computations at different speeds, based on representative traffic composition according to traffic survey results from April 2011, were used.

41. The project eased the congestion of urban roads, and traffic accidents declined dramatically during 2004–2010, from 5,226 in 2004 to 2,323 in 2010. The number of fatalities from traffic accidents fell by 32.3% in the same period, as did direct property loss. Traffic safety has improved, resulting in net cost savings from incident prevention. The economic reevaluation is in Appendix 9.

D. Preliminary Assessment of Sustainability

42. The project is likely to be sustainable. The TRR and other project components have also contributed to robust economic growth in Xi'an by encouraging investments, boosting incomes, and creating employment opportunities. XMG's fiscal income in 2010 was CNY24.18 billion, up 331% from CNY7.29 billion in 2005. Continued and stable economic growth in Xi'an will encourage XMG to mobilize adequate resources and provide adequate funds for O&M for the TRR and the other components, thus ensuring positive and sustained economic and social development in the project area.

43. The physical sustainability of the TRR and other components is probable given the sound engineering technology used in its construction and the well-developed technical capacity of XTRRCDC. Given adequate budget support from Xi'an municipality and the efficiency-improvement measures, XTRRCDC and the XMG agencies concerned are expected to continue operating and maintaining the TRR and related components well into the future.

E. Impact

44. The completion of the TRR, connector roads, and urban transport improvement components has relieved transport infrastructure bottlenecks and congestion in the project area and reduced transport costs. For example, the intersection traffic signal cycle was reduced to 90 seconds in 2010 from 172 seconds in 2008 and the corresponding service level at intersections has improved to a D in 2010 (from a lower-level E). The project has also provided a shorter route for through traffic. Since the opening of the TRR, a significant amount of traffic, both local and transit, has been induced and diverted from the urban road network to the TRR. Unit air pollutant emissions were reduced even though vehicle numbers in Xi'an increased by 151%, from 0.51 million in 2004 to 1.28 million in 2010, while carbon monoxide merely increased by 29% and nitrogen oxide by 71% in the same period.

45. **Socioeconomic impacts.** A project performance management system was established to monitor and assess the socioeconomic and poverty reduction impacts. The Xi'an Academy of Social Science was engaged for monitoring and evaluation during project implementation. It collected baseline data in 2004 and conducted four monitoring activities. Based on its findings, the GDP of Xi'an grew at an average annual rate of 13.3% from 2001–2005 and 14.5% from 2006–2010. The per-capita urban income for Xi'an in 2010 was CNY22,244, an increase of CNY12,616 on 2005 and higher than the 2010 national average of CNY19,109. The per-capita

rural income for Xi'an in 2010 was CNY7,750, an increase of CNY4,290 in 2005. Total passenger transport volume was tripled to 311.2 million persons between 2005 and 2010. Freight transport increased by 280% to 343.32 million tons in the same period. The number of public transportation vehicles per 10,000 people increased by 108.1% from 2004 to 2010. The project had created 3,450 construction employment opportunities in 2006 and 4,384 construction employment opportunities in 2008.

46. **Land acquisition and resettlement impacts.** Land acquisition and house demolition for the project began in April 2004 and most relocation activities were completed by December 2006, but resettlement of some households was not completed until 2009. According to the resettlement completion report prepared by XTRRCDC, 14,105 *mu* (940.3 ha) of land was permanently acquired by the project, an increase of 12% on the estimate in the resettlement plan. A total of 1,892,300 m² of buildings were demolished, which was 45% above the estimate in the resettlement plan. Land acquisition and resettlement under the project directly affected 35,500 persons and meant relocating 3,025 households (about 12,000 people), 11% more than estimated. Land acquisition and resettlement were implemented based on the resettlement plan, the 1998 Land Administration Law, and a specific land acquisition and resettlement policy for the project issued by XMG in July 2003. During implementation, all collective land to be permanently acquired in Weiyang district and Baqiao district was compensated at the rate of CNY30,000/*mu*, which is equal to the maximum compensation standard for land acquisition in the resettlement plan. In Yanta district, an even higher compensation rate of CNY46,000/*mu* was paid. The compensation rates for house demolition, including the assessment value and incremental subsidy, ranged from CNY400/m² to CNY700/m² (brick and concrete structure), which was also higher than the amount in the resettlement plan after negotiations.

47. XTRRCDC, local governments, street management offices, and village committees have taken various measures to assist affected people in income and livelihood restoration, including: (i) developing new businesses with collective ownership by using the compensation for land acquisition as equity investment; (ii) improving community facilities such as roads, channels, or wells for production and business; (iii) offering technical and capacity building training to help villagers find jobs in urban areas; and (iv) combining resettlement with the reconstruction program of "Village in Urban".⁶ In addition to the measures supported by local governments, affected villagers took their own measures to restore production and income, such as reconstructing houses in a way that allowed more space to rent out, operating roadside businesses in houses along the project roads, and obtaining income from transport businesses and urban employment. The external resettlement monitoring report concluded that income restoration of the project-affected households had been achieved.

48. The actual cost of land acquisition and resettlement was CNY2.971 billion, a 99% increase on the CNY1.494 billion estimate in the resettlement plan, owing mainly to (i) higher compensation standards for land acquisition and resettlement, (ii) the absence in the original budget of various taxes and fees required by local regulations on land acquisition and resettlement, and (iii) an increase in the land acquisition and building demolition area. Further details on the land acquisition and resettlement are in Appendix 10.

⁶ The "village in urban" refers to a residential area, which is surrounded by urban communities due to rapid urbanization but still retains rural features and rural inhabitants are its permanent residents. Major activities of the reconstruction program include building new residential houses/apartments for the rural inhabitants, improvement of infrastructure, and building up of social amenities such as education and health services.

49. **Environmental impact.** The environmental management plan (EMP) and the monitoring program were implemented well during construction, in line with the EIA, and adverse environmental impacts were mitigated effectively. The project did not produce significant damage to the environment. The project alignment ran parallel to but did not traverse the cultural and historic sites pinpointed by the government and any cultural or historic sites close to the alignment were restored and preserved under its guidance and supervision. During construction, the Xi'an Environment Monitoring Station conducted environmental monitoring. Four environmental monitoring reports were prepared and submitted to ADB, including one summary report in January 2011.

50. The vehicle emissions control component was implemented successfully. Under the project, two vehicles and associated measuring facilities were purchased for emissions inspection. In 2008, XMG established the Xi'an Vehicle Emission Monitoring and Inspection Center, which is affiliated with the Xi'an Environment Protection Bureau and responsible for administering and monitoring vehicle emissions control. The center has been carrying out vehicle emissions inspections since 2008. Monitoring was first done on a bimonthly basis in 2008 and on a monthly basis since 2009. All monitoring data are collected and documented to serve the needs of the government and the general public. The environmental impact analysis is in Appendix 11.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

51. The project is rated successful. It is deemed (i) highly relevant to the government's and ADB's development strategy, (ii) effective in achieving outcomes, (iii) efficient in achieving outcomes and outputs, and (iv) likely to be sustainable. The project was successfully implemented and achieved its main objective of promoting economic growth in Xi'an by reducing transport costs and relieving transport infrastructure bottlenecks. The project has assisted in developing an efficient, safe and environmentally sustainable urban transport system by (i) strengthening institutional capacity through greater coordination between municipal government agencies, (ii) improving traffic management and safety, (iii) improving vehicle emissions control, and (iv) increasing the capacity of urban roads. The completed TRR, connector roads, and other project components eased urban traffic congestion and helped meet increasing traffic demands in the urban area of Xi'an with specific features such as (i) a TRR capable of diverting the through traffic, (ii) significant improvement of technical standards for urban transport infrastructure, (iii) increased road traffic capacity in critical bottleneck sections, (iv) higher average vehicle speeds in urban areas, (v) fewer traffic accidents, and (vi) reduced vehicle emissions levels.

52. The overall project implementation was carried out effectively. The TRR, connector roads, and most other components were generally completed on time and with satisfactory quality, but a few components, including the CNG stations and urban transport planning, were not completed until 2010. From 2007 to 2010, the project was awarded nine quality or showcase certificates, including three certificates issued by state agencies and five certificates issued by provincial agencies. These credits and certificates acknowledged the major accomplishments of the project. Besides the TRR, the latest-technology equipment for traffic management, road safety, and vehicle emissions control enabled the local authorities to tackle the growing urban traffic congestion and air pollution. The improvements to the public transportation system, various items of maintenance equipment, and the newly built CNG stations contributed to the sustainability of transport development in Xi'an. The vehicle emissions control component

helped the government to obtain a more accurate assessment of the environmental situation, followed by sound technical solutions and mitigation measures. The government continued its efforts on vehicle emissions control by allocating more funds through the ongoing World Bank-financed Xi'an Sustainable Urban Transport Project and ADB-financed Xi'an Urban Road Network Improvement Project to strengthen the capacity of the environmental protection agency with more equipment and broader coverage. The institutional capacity of XTRRCDC and government agencies involved was strengthened through the human resource development plan.

B. Lessons

53. For the TRR, there were several variations caused by design changes or differences between the engineering designs and actual field conditions, which included (i) addition of a pump station to the subgrade package due to an exceptional design change, (ii) rapid expansion of the urban areas, (iii) inaccurate preliminary design and engineering designs, (iv) emerging urban infrastructure demands during project construction. A more accurate detailed design based on a well-coordinated inter-agency strategy would have helped to avoid unexpected variations as well as increased resettlement costs. Better preparation and coordination would have been of great value to the design of interchanges, grade separations, pedestrian bridges, and traffic safety measures along the TRR and its connector roads.

54. The project consisted of several components implemented or administered by various agencies. XMURCC, XTRRCDC, and the government offices concerned made enormous efforts in coordinating and harmonizing project implementation activities, particularly in obtaining necessary government clearances during procurement and operation. A streamlined institutional arrangement will ensure a solid foundation for smooth project implementation. Further, complicated domestic processing requirements related to equipment procurement—it took a long time to obtain domestic clearances from the agencies involved before submission to ADB for review and approval—caused delays. The government needs to simplify cumbersome domestic procedures to speed up project implementation.

C. Recommendations

1. Project Related

55. XMG should continue to monitor the key socioeconomic and urban traffic indicators established during project preparation and implementation so as to evaluate the long-term benefit and impact from the construction of the project. The results of the evaluation and the lessons learned from the project should be referenced and applied to future urban transport development projects.

56. The project performance evaluation report could be prepared in 2014 or later. By that time, the TRR, connector roads, and subcomponents will have been fully operational for more than 5 years and traffic flows, maintenance status, physical condition of the infrastructure, attainment of benefits, and socio-economic development impacts can be properly assessed.

57. The coverage of the public transport component is limited. The government may consider replicating and expanding the component in both urban and suburban areas.

2. General

58. The implementation agencies for the TRR and the other project components had familiarized themselves with procedures and requirements for ICB and contract management. It is suggested that their experience and accumulated knowledge be used again in other projects financed by both domestic and external funds.

59. Construction of urban transport infrastructure is only the first step of the planning–construction–maintenance cycle. Management and maintenance of urban infrastructures are very important to modern urban development. During project implementation, advanced international road asset management and road maintenance practices were introduced. Given the limited resources, the government may consider utilizing that experience to prioritize and meet the growing maintenance demands that urban transport infrastructure imposes.

60. Knowledge introduction and knowledge sharing are crucial to maximizing the development impacts of major urban infrastructure projects. More knowledge-oriented components, such as zoning, urban planning, and efficient public transport services can be considered in both domestically and externally financed urban infrastructure projects in the future.

PROJECT FRAMEWORK

Design Summary	Performance Indicators and/or Targets		Monitoring Mechanism	Assumptions and Risks
	At Appraisal	At Completion		
<p>Goal</p> <p>Economic growth promoted by relieving transport infrastructure bottlenecks in Xi'an municipality.</p>	<p>GDP for Xi'an urban area expected to grow at 12.6% per annum during 2002–2008 and 10.2% per annum during 2008–2013.</p>	<p>GDP for Xi'an urban area has achieved an average growth rate of 13.3% during 2001–2005 and 14.5% during 2006–2010, respectively. According to Xi'an's 12th Five-Year Development Plan, it will achieve an average GDP growth of 13% per annum during 2011–2015.</p>	<p>Municipal statistics.</p> <p>Project performance management system applied by the executing agency at inception, completion, and 3 years thereafter.</p>	<p>Rapid economic growth continues in the People's Republic of China and in Xi'an municipality.</p> <p>Planned development of commerce, tourism, industries, and agriculture takes place.</p>
<p>Purpose</p> <p>Develop an efficient, safe, and environmentally sustainable urban transport system.</p>	<p>Increase in per-capita urban incomes of 15% per annum during 2002–2008.</p>	<p>The increase in per-capita incomes was 18.2% per annum for urban area and 17.5% for rural area during 2006–2010. The per-capita income in 2010 for Xi'an was CNY22,244 which was higher than the national average of CNY19,109.</p>		
	<p>Average cross-town speeds to increase from 14 km per hour in 2002 to 19 km per hour in 2008.</p>	<p>Average cross-town speed is 15–20 km per hour in 2010.</p>	<p>Traffic surveys before and after the project.</p>	<p>Xi'an adopts policy measures, the urban transport improvement initiatives, and institutional reforms.</p>
	<p>Traffic accidents in Xi'an municipality reduced by 10% in 2010 from the following 2002 baseline figures: 4,114 accidents, 3,214 injuries.</p>	<p>By 2010, traffic accidents in Xi'an municipality reduced to 2,323 (down from 4,114) with 2,520 injuries (down from 3,214).</p>	<p>Accident statistics reported by the Public Security Bureau.</p>	<p>Traffic regulations are effectively enforced.</p>
	<p>Intersection delay reduced by 20% in 2008.</p>	<p>The intersection traffic signal cycle optimized to 90 seconds in 2010 (from 172 seconds in 2008). Intersection service improved to higher-level D in 2010 (from lower-level E in 2008).</p>	<p>Midterm review and PCR.</p>	<p>A road safety audit program is implemented.</p>
	<p>Air pollutant emissions reduced (or increased) as a result of the project: carbon monoxide—less 15,000 tons/year by 2008 and less 85,900 tons/year by 2028; hydrocarbon—</p>	<p>Vehicle numbers in Xi'an increased from 0.51 million in 2004 to 1.28 million in 2010. Total air pollutants increased from 2004 to 2010 as follows: carbon monoxide from 272,000 tons to 350,000 tons; hydrocarbon from 37,700 tons to</p>	<p>Traffic survey before and after the Project.</p> <p>PCR and environmental monitoring reports.</p> <p>Municipal</p>	<p>Xi'an uses the available road space efficiently by implementing appropriate traffic management measures and policies as well as institutional measures. Xi'an strictly enforces traffic law for all transport modes.</p>

Design Summary	Performance Indicators and/or Targets		Monitoring Mechanism	Assumptions and Risks
	At Appraisal	At Completion		
Strengthen institutional capacity through greater coordination between municipal agencies.	less 1,200 tons/year (2008) and less 7,400 tons/year (2028); NO ₂ —plus 300 tons/year (2008) and plus 800 tons/year (2028). Adoption of agreed policies, plans, and institutional reforms.	40,000 tons; and nitrogen dioxides from 29,200 tons to 50,000 tons. A project committee provided effective project coordination. The Xi'an Vehicle Emission Pollution Prevention Regulation was issued on 27 May 2009. The Xi'an Vehicle Emission Monitoring and Inspection Center was established in 2008.	environmental statistics. Midterm review and PCR.	There is a general consensus on the policy and institutional reforms. The project committee, chaired by the vice-mayor and comprising 20 senior officials of municipal and district agencies concerned, effectively coordinates urban transport activities in Xi'an.
Output TRR and connector roads constructed.	Construct 71 km of the TRR, 16 km of connector roads, 436,400 m ² of bridges, and 155 pedestrian underpasses by the end of 2007.	The completed TRR included (i) 32.22 km main lines of eastern and western sections; (ii) 69.66 km trunk roads including the northern and southern sections; (iii) 14.87 km connector roads; (iv) 10 interchanges and 16 grade separations, three large bridges, 12 overpasses, and 12 flyover bridges over the loop expressway, (v) underground facilities including 249 km drainage pipe, 146 km wastewater pipe, 76 km communications trench, 34 km gas pipe, 78 km drinking water lines, and 12.5 km heating lines; and (vi) 4.1 million m ² landscape works and 5,003 street lights.	Loan review missions, progress reports and midterm review, and PCR.	Contractors perform well and strict construction supervision and quality control are carried out.
Four urban transport components implemented.	Traffic flow volumes, vehicle delays, speed, number of accidents, and air quality measurements.	Traffic growth on eastern and western sections of TRR exceeded traffic forecasts at appraisal by 268% and 384% in 2011, respectively. Average urban vehicle speed increased from 14km/h to 15–20 km/h. Traffic accidents reduced. Air quality measurement	Carry out “before” and “after” measurements on the performance indicators.	Government staff carries out the survey and analysis appropriately.

Design Summary	Performance Indicators and/or Targets		Monitoring Mechanism	Assumptions and Risks
	At Appraisal	At Completion		
Preliminary design, prequalification documents, topographic survey of project alignment.	<p>Executing agency employs competent local design company for the preliminary design by mid-April 2003.</p> <p>Preliminary design competed and approved by November 2003.</p>	<p>equipment procured for the government agency and widely used.</p> <p>A local design institute was engaged in 2003.</p> <p>Preliminary design was completed in December 2003.</p>	Review design and prequalification documents.	<p>There is full cooperation between the municipal and provincial designers and engineers.</p> <p>Design works are closely monitored to ensure quality and timing of products.</p>
Bidding documents for the civil works and urban transport components prepared.	Competent local design company employed to perform the detailed design and prepare the required bidding documents by November 2003.	Detailed design was completed in May 2004 and the bidding documents prepared in June 2004.	Review design and bidding documents.	
Construction and installation supervised and on-the-job training.	International consultants (51 person-months) assisted by national consultants (3,000 person-months) for construction supervision, road safety, urban transport management, environmental, resettlement monitoring, evaluation and training.	<p>International consultants provided 81 person-months of services for the project in the fields of engineering, construction supervision, road safety, traffic control, transport planning and modeling, vehicle emissions control, environmental monitoring, human resources development, and asset management and maintenance.</p> <p>National consultants from 16 firms provided 4,940 person-months of consulting services on contract management, quality control, verification of measuring, material testing, review of technical drawings, engineering progress inspection, disbursement verification, and preparation of completion documents.</p>	Progress reports, loan review missions, midterm review, and PCR.	Performance of contractors and consultants is effective.
Capacity building and human resources development provided.	International training (170 person-months) in urban transport operations, road asset management, road safety, vehicle emissions control, monitoring and evaluation.	<p>168 person-months of trainings conducted, (46.5 person-months overseas training and 121.5 person-months domestic training).</p> <p>On-the-job training courses were organized for 115 staff.</p>	Loan review missions and training reports.	Training is effective.

Design Summary	Performance Indicators and/or Targets		Monitoring Mechanism	Assumptions and Risks
	At Appraisal	At Completion		
Resettlement plan carried out as planned.	29,043 people to be affected by acquisition of 839 hectares of land.	14,105 <i>mu</i> of land permanently acquired. 1,892,300 m ² of buildings demolished 35,500 persons directly affected by land acquisition and resettlement. 3,025 households were relocated due to house demolition.	Progress reports, executing agency's and consultants' reports. Independent consultants to monitor entitlements and make periodic reports during resettlement implementation, and evaluate achievement of objectives at completion.	Good monitoring and review take place. Independent national consultants are appointed. Agreed upon compensation rates are implemented.
Environmental mitigation measures taken as planned.	No major adverse impacts provided that mitigation measures are implemented through engineering designs, contract documents, and budgetary allocations.	Environmental management plan and monitoring program generally implemented well during construction, in line with the environmental impact assessment, and adverse environmental impacts were mitigated effectively.	Environmental monitoring reports prepared by contractor and approved by the EA. Quarterly progress reports including findings of environmental monitoring.	There may be unexpected environmental impacts related to construction practices and unexplored archeological sites.
Project performance monitoring and evaluation system established.	Economic development and socioeconomic indicators for Xi'an, transport costs and time, transport services and charges, accident rates, income levels, and employment generation.	GDP of Xi'an increased steadily with an average annual growth rate of 13.3% from 2001 to 2005, and 14.5% from 2006 to 2010; total GDP value in 2010 was CNY324.1 billion. The number of public transportation vehicles per 10,000 people increased by 108.1% from 2004 to 2010. The project also created 3,450 employment opportunities in 2006 and 4,384 employment opportunities in 2008.	Survey results, and monitoring and evaluation reports.	Adequate skills are available within the executing agency, supported by the consultants.

CNY = yuan, GDP = gross domestic product, km = kilometer, km/h = kilometers per hour, m² = square meter, mu = Chinese unit of measurement (1 mu = 666.67 square meters or 0.07 hectares), PCR = project completion report, and TRR = third ring road.

Sources: Asian Development Bank, Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

CHRONOLOGY OF MAJOR EVENTS

Date	Events
27 August 2002	Approval of project preparatory technical assistance
31 March–10 April 2003	Fact-finding mission fielded
22 July 2003	Management review meeting held
24 July–6 August 2003	Appraisal mission fielded
23 September 2003	Staff review committee meeting held
21–24 October 2003	Loan negotiations held
6 November 2003	Board circulation
27 November 2003	Loan approval
27 April 2004	Loan agreement signed
29 July–5 August 2004	Inception mission fielded
22 November 2004	First civil works contracts approved
2 December 2004	Contract for consulting services approved
8 December 2004	Loan effectiveness
8 December 2004	First disbursement
10 December 2004	Commencement of civil works construction
4–7 February 2005	Special review mission fielded
19–22 July 2005	Special review mission fielded
19 September 2005	First contract for equipment approved
31 October–4 November 2005	First loan review mission fielded
14 November 2005	Transfer of the project administration to the People's Republic of China Resident Mission
6 December 2005	Project internal audit established
4–7 April 2006	Special review mission fielded
30 May 2006	Western section of the third ring road completed
16–22 August 2006	Midterm review mission fielded
30 December 2006	Eastern section of third ring road completed
28 May–2 June 2007	Third loan review mission fielded
26 October 2007	Extension of loan closing date from 30 June 2008 to 31 March 2009
16 February 2008	Southern section of third ring road completed
15 May 2008	First repayment of loan principal
30 June 2008	Original loan closing date
11–16 August 2008	Fourth loan review mission fielded
4 September 2008	First loan reallocation approved
20 December 2008	Northern section of third ring road completed
28 February 2009	Extension of loan closing date from 31 March 2009 to 31 March 2010
19–25 April 2009	Fifth loan review mission fielded
15 March 2010	Second loan reallocation approved
25 June 2010	Final disbursement
5 August 2010	Final reallocation, loan balance cancellation, and actual loan closing date
7–11 April 2011	Project completion review mission fielded

Sources: Asian Development Bank, Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

PROJECT COSTS AND FINANCING PLAN

Table A3.1: Project Costs
(\$ million)

Item	At Appraisal			At Completion		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
A. Base Cost						
1. Civil works	197.5	207.5	405.0	201.8	371.4	573.2
2. Urban transport improvement	24.0	10.9	34.9	16.9	26.3	43.2
3. Equipment	18.7	2.1	20.8	20.1	3.1	23.2
4. Land acquisition and resettlement	0.0	180.5	180.5	0.0	438.7	438.7
5. Consulting services and training	2.7	3.8	6.5	2.1	33.4	35.4
Subtotal (A)	242.9	404.8	647.7	240.8	872.9	1,113.7
B. Contingencies						
1. Physical contingencies	14.6	20.6	35.2	0.0	0.0	0.0
2. Price contingencies	18.5	21.1	39.6	0.0	0.0	0.0
Subtotal (B)	33.1	41.7	74.8	0.0	0.0	0.0
C. Front-end Fee	1.4	0.0	1.4	1.4	0.0	1.4
D. Interest during Construction and Commitment Charge	18.6	19.5	38.1	21.9	196.1	217.9
Total (A+B+C+D)	296.0	466.0	762.0	264.1	1,068.9	1,333.0

Note: Numbers may not add up precisely because of rounding.

Sources: Asian Development Bank, Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

Table A3.2: Financing Plan
(\$ million)

Sources	At Appraisal			At Completion		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
Asian Development Bank	270.0	0.0	270.0	264.1	0.0	264.1
Xi'an municipal government	26.0	466.0	492.0	0.0	1,068.9	1,068.9
Total	296.0	466.0	762.0	264.1	1,068.9	1,333.0

Sources: Asian Development Bank, Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

PROJECTED AND ACTUAL CONTRACT AWARDS AND DISBURSEMENTS

Table A4: Projected and Actual Contract Awards and Disbursements
(\$ million)

Year	Contract Awards			Disbursement		
	Projected	Actual	Actual/Projected (%)	Projected	Actual	Actual/Projected (%)
2004	80.00	0	0.00	11.00	1.35	12.27%
2005	66.10	116.39	176.09	9.50	14.97	157.58%
2006	44.00	95.73	217.56	65.00	60.50	93.08%
2007	10.00	21.22	212.20	70.00	64.39	91.99%
2008	0	0	0.00	50.00	72.17	144.34%
2009	0	7.46	0.00	30.00	28.26	94.20%
2010	0	0	0.00	25.00	22.51	90.04%
Total	200.10	240.80	120.34%	260.50	264.15	101.40%

Source: Asian Development Bank.

APPRAISAL AND ACTUAL IMPLEMENTATION SCHEDULE

Item	2003				2004				2005				2006				2007				2008				2009				2010			
	I	II	III	VI	I	II	III	VI	I	II	III	VI	I	II	III	VI	I	II	III	VI	I	II	III	VI	I	II	III	VI	I	II	III	VI
A. Loan Processing																																
1. Fact-finding	X																															
2. Management review meeting and approval of advance action		X																														
3. Appraisal			X																													
4. Board consideration				X																												
5. Loan effectiveness							X																									
B. Land Acquisition and Resettlement																																
C. Civil Works																																
1. Third ring road and connector roads																																
a. Prequalification, bidding, and mobilization																																
b. Construction																																
D. Equipment																																
1. Bidding and contract award																																
2. Supply, delivery, and installation																																
E. Consulting Services and Training																																
1. Shortlisting, recruitment, and mobilization																																
2. Services and training																																

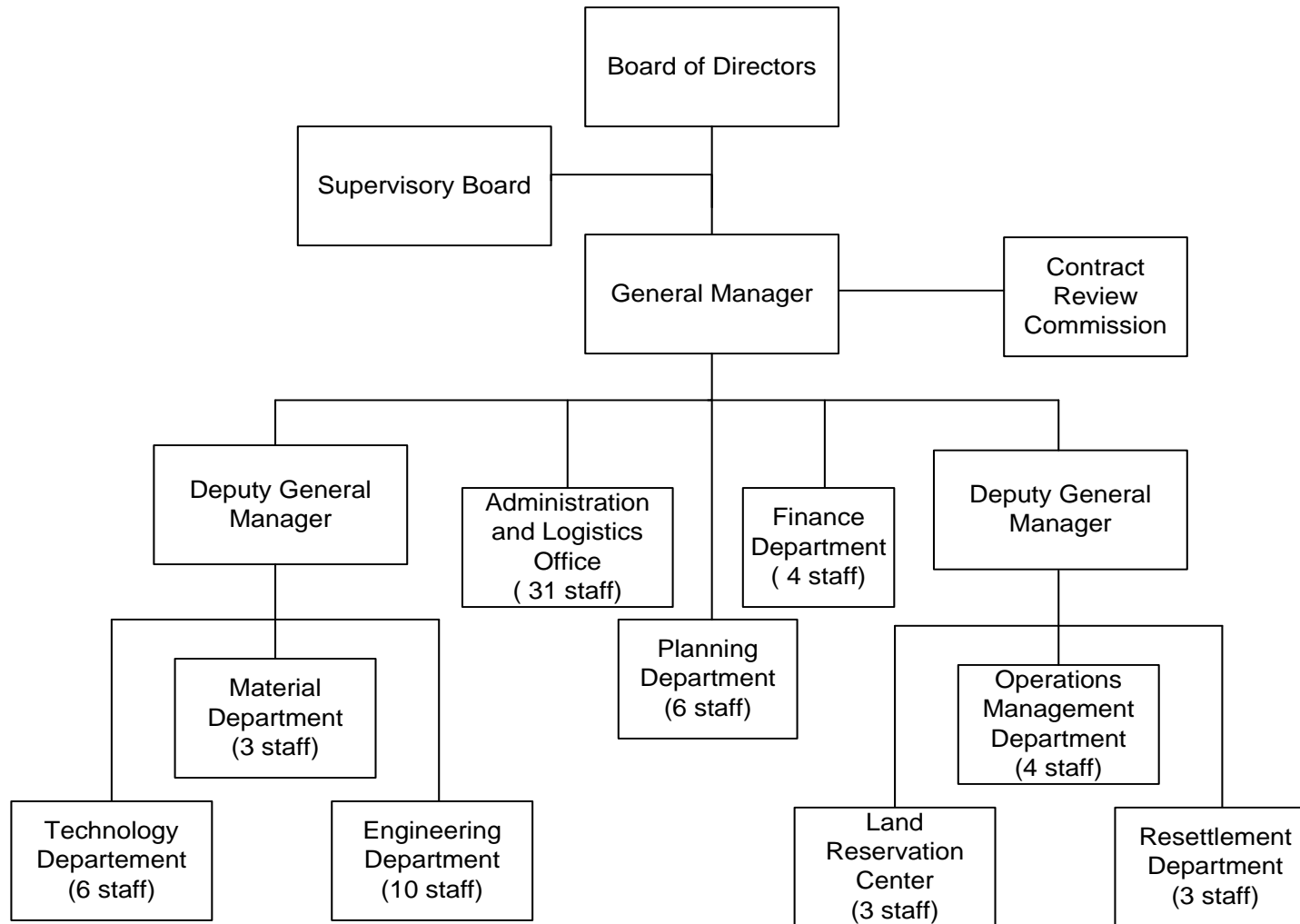
Appraisal

Actual

Sources: Xi'an Municipal Urban and Rural Construction Commission and Xi'an Third Ring Road Construction and Development Company.

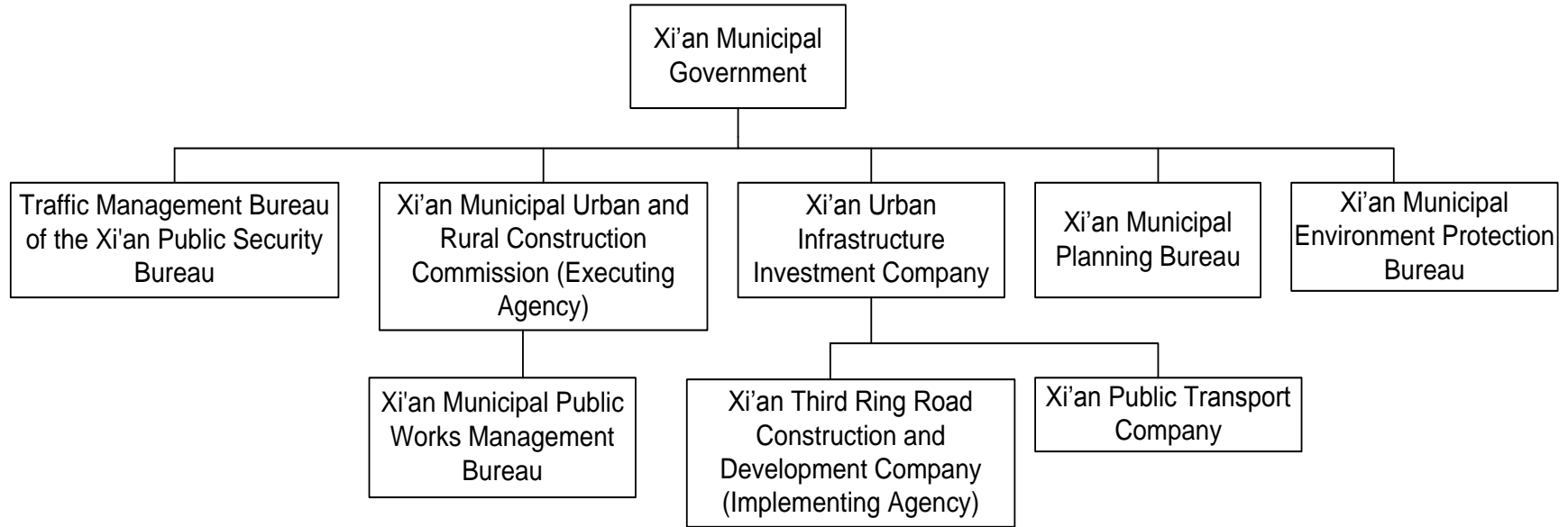
ORGANIZATIONAL CHARTS

Figure A6.1: Organizational Chart for the Xi'an Third Ring Road Construction and Development Company



Source: Xi'an Third Ring Road Construction and Development Company.

Figure A6.2: Organizational Chart for the Operation and Maintenance Period



Source: Xi'an Third Ring Road Construction and Development Company.

COMPLIANCE WITH LOAN COVENANTS

Covenants	Reference	Status of Compliance
1. Project Executing Agency. XMURCC shall be the Project Executing Agency, responsible for the overall management and implementation of the Project.	PA, Schedule, para. 2	Complied with.
2. Project Implementing Agency. The Project Company shall be the implementing agency responsible for the day-to-day implementation of the Project, including construction, operation and maintenance of the Project facilities. The general manager of the Project Company shall be responsible for overall Project management, including approval of contracts and payments. The deputy general managers of the Project Company will be responsible for physical implementation activities on a day-to-day basis and preparation of progress reports.	PA, Schedule para. 3	Complied with. XTRRCDC was established in 2003 and was responsible for implementation, operation and maintenance of the project ring road.
3. Construction Quality. XMURCC and the Project Company shall ensure that all construction works under the Project are carried out in accordance with the Borrower's technical standards, and construction supervision, quality control, and control management comply with national standards and internationally accepted practices. The Project Company shall appoint the team leader of the international consultants engaged under the Project as the assistant chief supervision engineer, who will assist the chief supervision engineer (CSE) in Project. The assistant CSE shall review and help certify contractor's monthly payments and contract variations prior to their approval by the CSE.	PA, Schedule para. 4	Complied with. The project ring road has achieved 9 technical awards.
4. Road Safety. XMURCC and the Project Company shall implement a road safety signage, communication, hazard barriers, traffic monitoring, and vehicle weighing program (road safety measures). To ensure compliance with the national safety standards, the Project Company shall conduct road safety audit twice during Project implementation, i.e., before beginning of the construction works, and before opening of the ring road. In implementing the road safety measures, XMURCC and the Project Company will closely cooperate with the Xi'an Municipal Public Safety Bureau (XMPSB).	PA, Schedule Para. 7	Complied with. Traffic accidents were reduced after completion of the project.
5. XMG shall cause XMPSB to prepare and start implementing the municipal road safety guidelines and action plans in line with the recently approved National Road Transport Safety Law by 30 June 2006. Before opening of the Project road, XMURCC in consultation with the XMPSB shall prepare and submit a report on the emergency response plan for the Project road to ADB for review.	PA, Schedule Para. 7	Complied with.

Covenants	Reference	Status of Compliance
<p>6. Axle Loads. XMURCC and the Project Company shall take appropriate measures following government regulation to prevent overloading on the Project Road by installing vehicle axle weighing equipment at selected entry points. XMURCC and the Project Company shall make suitable arrangements for operation of such equipment. Before opening the Project Road, the Project Company will submit to ADB a plan for operation of the vehicle weighing stations, including the prescribed axle load limits and penalties for infringement.</p>	PA, Schedule Para. 8	Complied with. Vehicle axle load control has been widely applied on a road network basis in Shaanxi since 2007.
<p>7. Land Acquisition and Resettlement. SPG, XMG through XMURCC, and the Project Company 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 of the Borrower, and ADB's Policy on Involuntary Resettlement and Social Protection Strategy.</p>	PA, Schedule Para. 9	Complied with.
<p>8. SPG, XMG, through XMURCC, and the Project Company 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. XMG shall ensure that counterpart funds for compensation and entitles 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 as well off as they would have been in the absence of the Project.</p>	PA, Schedule Para. 10	Complied with. The external resettlement monitoring report concluded that income restoration of the project-affected households had been achieved.
<p>9. SPG, XMG, through XMURCC, and the Project Company 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; (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' and (iii) a summary of internal XMG audits of resettlement disbursement and expenditure relevant to the Project will be provided to ADB annually, until all payments are completed.</p>	PA, Schedule Para. 11	Complied with. XTRRCDC committed resources to supervise and implement the RP and the Xi'an Academy of Social Science was engaged as the external monitor and monitoring reports were regularly submitted.

Covenants	Reference	Status of Compliance
10. SPG, XMG, through XMURCC, and the Project Company 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. XMG shall cause local resettlement offices to, and the Project Company shall keep records of consultation.	PA, Schedule Para. 12	Complied with.
11. SPG, XMG, through XMURCC, and the Project Company shall update the RP as necessary to reflect any significant changes in Project scope and other causes, and submit such changes to ADB for approval.	PA, Schedule Para. 13	Complied with.
12. SPG, XMG, through XMURCC, and the Project Company shall 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. 14	Complied with.
13. SPG, XMG, through XMURCC, and the Project Company 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. The Project Company shall supervise the contractors to ensure compliance with requirements of RP, law and ADB policy.	PA, Schedule Para. 15	Complied with.
14. Environment. XMG and the Project Company shall ensure that (i) implementation of the Project is carried out in accordance with all existing environmental laws, regulations, and standards of the Borrower and ADB's guidelines and procedures, in particular, the ADB's Environmental Assessment Guidelines, 2003; (ii) any adverse environmental impacts arising from the Project are minimized by implementing environmental monitoring program and the mitigation measures identified in EIA; such mitigation measures are incorporated into Project design, civil works and other contracts and are followed during operation and maintenance of the Project facilities; (iii) the implementation of the environmental monitoring program, including mitigation measures, as well as copies of permits, licenses and clearances, will be regularly reported to ADB as specified in EIA; (iv) impact on the archeological sites, if any, will be minimized by taking appropriate measures, following relevant laws and regulations of the Borrower.	PA, Schedule Para. 16	Complied with. Report on emissions standards and penalties for their infringement, and a plan for enforcing vehicle emissions control for the project roads was submitted.

Covenants	Reference	Status of Compliance
<p>15. Vehicle Emissions. Prior to opening of the Project Company in consultation with XMEPB will submit to ADB the emission regulations limits prescribed by the Government, penalties for their infringement, and the plan for enforcing vehicle emission control for the Project road. XMG shall cause XMEPB to prepare and implement the action plan for vehicle emissions reduction in Xi'an Municipality, by 30 June 2006.</p>	PA, Schedule Para. 13	Complied with. The Municipal Environment Protection Bureau conducted a survey of vehicle emissions and findings were disseminated.
<p>16. Poverty Reduction. The Project Company shall cause contractors under the Project to (i) maximize the employment of local poor persons who meet the job and efficiency requirements for construction of the Project Road, and (ii) provided on-the-job training to such local workers. XMG shall ensure that XMURCC will take necessary measures to extend the coverage and improve the quality of basic urban infrastructure services in the Project Area to enhance the poverty reduction impacts.</p>	PA, Schedule Para. 18	Complied with. The project created 3,450 and 4,384 construction employment opportunities in 2006 and 2008, respectively.
<p>17. Gender and Development. XMURCC and the Project Company shall ensure that ADB's policy on gender and development will be followed during project implementation, all necessary actions will be taken to encourage women living in the Project area to participate in planning and implementing the Project, and civil works contractors will not differentiate payment between men and women for work of equal value.</p>	PA, Schedule Para. 19	Complied with. Men and women were paid equally for equivalent work.
<p>18. Health Risks. XMURCC and the Project Company shall ensure, with the assistance from Xi'an Municipal Health Bureau and other relevant municipal authorities, that information on the risks of socially transmitted diseases is disseminated to those employed during Project implementation and to transport operators involved in the operation of the Project facilities thereafter.</p>	PA, Schedule Para. 20	Complied with. Health care information was disseminated during construction and operation.
<p>19. Change in Ownership. If (i) any change in ownership of the Project Company or the Project facilities, or (ii) sale, transfer, or assignment of the Project Company's interest in the Project facilities is anticipated, XMG and the Project Company shall consult ADB at least six months in advance. No change, sale, transfer, or assignment will be approved or implemented without the prior ADB's concurrence, if such changes would affect SPG, XMG, including XMURCC, or the Project Company's ability to perform their obligations under the Project Agreement and/or the Onlending Agreement. XMG and the Project Company shall ensure that any proposed change be carried out in a legal and transparent manner.</p>	PA, Schedule Para. 21	Complied with. No change in ownership.

Covenants	Reference	Status of Compliance
20. Cost Recovery. XMG shall ensure that the Project Company will have budgetary resources available for operation and maintenance of the Project facilities. During midterm review, XMG and ADB shall discuss availability of alternative revenue sources for financing operation and maintenance of the Project facilities.	PA, Schedule Para. 22	Complied with. XMG will allocate adequate budget for operation and maintenance.
21. Internal Audit. The Project Company shall maintain the internal audit unit throughout Project implementation and operation.	PA, Schedule Para. 23	Complied with. Internal audit unit was established in 2005.
22. Capacity Building. XMURCC shall (i) by 32 December 2004, prepare a human resource development plan; (ii) before undertaking international training, prepare and submit to ADB for approval (a) a training plan and a list of nominated candidates, (b) a program of workshops to be delivered by those trained internationally; and (c) a list of training equipment and assistance required to strengthen domestic training programs, and (iii) upon completion of each workshop, will submit to ADB an evaluation of the international training and workshop.	PA, Schedule Para. 24	Complied with. 168 person-months of training were conducted. On-the-job training courses were provided for 115 staff.
23. Project Monitoring and Evaluation. XMG and the Project Company shall monitor and evaluate impacts, including those on poverty and women, through the project performance management system to ensure that the Project facilities are managed effectively and benefits are maximized. XMURCC and the Project Company will collect data agreed upon with ADB before implementation, at the completion of the Project, and three years thereafter.	PA, Schedule Para. 25	Complied with.

ADB = Asian Development Bank, CSE = chief supervision engineer, EIA = environment impact assessment, LA = Loan Agreement, PA = Project Agreement, Para = paragraph, PRC = People's Republic of China, RP = resettlement plan, SPG = Shaanxi Provincial Government, TA = technical assistance, XMEPB = Xi'an Municipal Environment Protection Bureau, XMG = Xi'an Municipal Government, XMPSB = Xi'an Municipal Public Safety Bureau, XMURCC = Xi'an Municipal Urban and Rural Construction Commission, and XTRRCDC = Xi'an Third Ring Road Construction and Development Company.

Source: Asian Development Bank.

CONTRACT DETAILS UNDER THE PROJECT

Table A8.1: Civil Works Packages

No.	Contractor	Mode of Procurement	Contract Date	Country	Original Contract Amount (CNY)	Final Contract Amount	
						Total (CNY)	ADB financed portion (\$)
C01	The Third Engineering Company Limited under China Railway Wuju Group	ICB	30-Dec-05	PRC	196,893,189.00	220,335,004.00	14,632,527.00
C02	The Fourth Engineering Department of the Second Highway Bureau (Luoyang)	ICB	10-Dec-04	PRC	96,184,521.00	103,579,807.00	6,695,806.00
C03	Panjin Municipal Engineering Construction Company	ICB	10-Dec-04	PRC	107,144,790.00	107,144,790.00	6,732,583.00
C04	The First Engineering Company Limited. under China Railway Wuju (Group) Corporation	ICB	10-Dec-04	PRC	77,883,693.00	77,883,693.00	4,995,366.00
C05	China Railway 17 Bureau Group Corporation	ICB	29-Apr-05	PRC	153,691,756.00	153,691,756.00	10,069,537.00
C07	Xi'an Railway Engineering (Group) Company Limited	ICB	29-Apr-05	PRC	86,668,068.00	114,313,086.00	7,211,147.00
C08	RBG The Second Highway Engineering Bureau	ICB	30-Dec-05	PRC	241,950,910.33	241,950,910.33	16,644,817.00
C09	China Railway 20 Bureau Group Company Limited	ICB	30-Dec-05	PRC	235,257,751.00	329,116,320.12	22,677,984.00
C10	China Railway Shisiju Group Corporation	ICB	20-Mar-06	PRC	158,595,209.30	161,637,189.00	10,816,940.00
C11	The Third Engineering Company Limited. under China Railway Wuju Group	ICB	30-May-05	PRC	219,682,888.00	226,766,916.00	14,569,788.00
C12	China Railway Shisiju Corporation	ICB	30-May-05	PRC	231,163,274.10	266,018,456.00	17,716,762.00
C13	China Railway 11th Bureau Group Corporation	ICB	20-Aug-05	PRC	335,234,411.00	335,234,411.00	22,055,488.00
C14	Qingdao No.1 Municipal Engineering Company Limited.	ICB	30-Dec-05	PRC	95,871,124.79	95,871,124.79	6,366,853.00
C15	The Fourth Engineering Department of the Second Highway Bureau (Luoyang)	ICB	20-Mar-06	PRC	66,136,555.00	66,136,555.00	4,494,861.00
C16	Joint Venture of Xi'an First Municipal Engineering Company and Xi'an Municipal and Bridge Construction Company Limited.	ICB	20-Mar-06	PRC	128,260,035.97	128,260,035.97	8,315,126.00
C17	The Sixth Engineering Department of Second Highway Engineering Bureau Road and Bridge	ICB	10-Dec-04	PRC	97,687,763.00	106,951,344.99	6,714,887.00
C18	Guangdong Construction Engineering Group Corporation	ICB	30-May-05	PRC	79,343,446.00	110,050,731.00	7,199,588.00
C19	Joint Venture of Xi'an First Municipal Engineering Company and Xi'an Municipal and Bridge Construction Company Limited	ICB	10-Dec-04	PRC	107,196,001.00	107,196,001.00	6,817,897.00
C20	Shanxi Hongye Garden Artdesign & Construction Company Limited	ICB	16-Nov-06	PRC	7,693,847.63	7,693,847.63	499,470.00
C21	Jiangsu Bada Gardening Construction Company Limited	ICB	11-Nov-06	PRC	5,289,442.26	5,289,442.26	362,935.00
C22	Shaanxi Royal City Traditional Building Landscaping design Project Company Limited	ICB	11-Nov-06	PRC	4,759,525.00	4,759,525.00	330,892.00
C23	Xi'an Wenyuan Flowers and Seedling Project Company Limited	ICB	11-Nov-06	PRC	3,454,977.61	3,454,977.61	236,226.00
C24	Beijing Golden Five Landscape Architecture Engineering Company Limited	ICB	11-Nov-06	PRC	6,487,005.00	6,487,005.00	467,170.00

No.	Contractor	Mode of Procurement	Contract Date	Country	Original Contract Amount (CNY)	Final Contract Amount	
						Total (CNY)	ADB financed portion (\$)
C25	Xi'an Huaxin Gardening & Greening Engineering Company Limited	ICB	11-Nov-06	PRC	3,988,831.62	3,988,831.62	275,563.00
C26	Chengdu Shuhan Gardening Company Limited	ICB	11-Nov-06	PRC	11,236,197.63	11,236,197.63	525,162.00
C27	Beijing Golden Five Landscape Architecture Engineering Company Limited	ICB	11-Nov-06	PRC	5,328,231.00	5,328,231.00	386,894.00
C28	Changzhou No.2 Gardening Construction Company Limited.	ICB	11-Nov-06	PRC	3,949,305.80	3,949,305.80	258,692.00
C29	Chengdu Shuhan Gardening Company Limited	ICB	11-Nov-06	PRC	8,990,431.87	8,990,431.87	610,840.00
C30	Xiamen Xiasheng Garden Landscaping Engineering Company Limited.	ICB	11-Nov-06	PRC	9,902,265.47	9,902,265.47	696,823.00
C31	Shaanxi Haojing Garden Engineering Company Limited	ICB	11-Nov-06	PRC	11,091,918.25	11,091,918.25	786,083.00
C32	Changzhou Jiaze Garden/Park Construction and Landscaping Engineering Company Limited	ICB	11-Nov-06	PRC	4,479,573.67	4,479,573.67	316,555.00
C33	Xi'an Landscape Architecture Company Limited	ICB	11-Nov-06	PRC	2,627,741.07	2,627,741.07	189,119.00
C34	Henan Zhongyuan Landscaping Engineering Company Limited	ICB	11-Nov-06	PRC	3,936,990.27	3,936,990.27	284,715.00
C35	Hongxiang Classical Garden Construction Company Limited	ICB	11-Nov-06	PRC	6,087,411.50	6,087,411.50	424,212.00
C36	Jiangsu Bada Gardening Construction Company Limited	ICB	11-Nov-06	PRC	5,508,011.63	5,508,011.63	398,045.00
C30	Xiamen Xiasheng Garden Landscaping Engineering Company Limited	ICB	11-Nov-06	PRC	196,893,189.00	220,335,004.00	14,632,527.00
C31	Shaanxi Haojing Garden Engineering Company Limited	ICB	11-Nov-06	PRC	96,184,521.00	103,579,807.00	6,695,806.00
C32	Changzhou Jiaze Garden/Park Construction and Landscaping Engineering Company Limited	ICB	11-Nov-06	PRC	107,144,790.00	107,144,790.00	6,732,583.00
C33	Xi'an Landscape Architecture Company Limited	ICB	11-Nov-06	PRC	77,883,693.00	77,883,693.00	4,995,366.00
C34	Henan Zhongyuan Landscaping Engineering Company Limited	ICB	11-Nov-06	PRC	153,691,756.00	153,691,756.00	10,069,537.00
C35	Hongxiang Classical Garden Construction Company Limited	ICB	11-Nov-06	PRC	86,668,068.00	114,313,086.00	7,211,147.00
C36	Jiangsu Bada Gardening Construction Company Limited	ICB	11-Nov-06	PRC	241,950,910.33	241,950,910.33	16,644,817.00
FJ01	Xi'an Municipal Road and Bridge Construction Company Limited	ICB	27-Nov-06	PRC	100,222,253.00	100,222,253.00	3,679,314.00

ADB = Asian Development Bank, CNY = yuan, ICB = international competitive bidding, No. = number, and PRC = People's Republic of China.

Sources: Xi'an Municipal Urban and Rural Construction Commission and Xi'an Third Ring Road Construction and Development Company.

Table A8.2: Details of Equipment Packages

Item	Contractor	Mode of Procurement	Contract Date	Country	Original Contract Amount	\$ equivalent
Compelling intermittent & asphalt mixing plant	Bernardi Impianti International	ICB	12-Oct-05	Italy	\$1,300,000	1,300,000 .00
Crawler paver	Changsha Zoomlion Heavy Industry Science Technology Development Company Limited	ICB	12-Oct-05	PRC	CNY5,540,000	692,933.00
Roller	Dynapac GmbH	ICB	12-Oct-05	Germany	\$453,790 and CNY520,000	520,230.00
Cold milling machine	Wirtgen Hong Kong Limited	ICB	12-Oct-05	Germany	\$879,000	879,000.00
Truck crane and backhoe loader	Shaanxi Prospect Company Limited	ICB	12-Oct-05	PRC	\$507,926.18	507,926.18
Thin Slurry Seal Coating Truck, Bitumen Equipment	Xi'an International Trade Economic Cooperation Company Limited	ICB	12-Oct-05	PRC	CNY5,280,773	662,319.00
Asphalt pavement hot recycling & patching machine	Shengyang North Traffic Engineering Company	ICB	10-Jun-06	PRC	CNY4,037,600	530,713.00
Lighting facility section 1	Jiangsu Jingcan Steel Pole Company Limited	ICB	18-May-07	PRC	CNY8,302,000	1,184,620.00
Lighting facility section 2	Beijing Lian Yuan Municipal Electric Equipment Installation Company Limited	ICB	18-May-07	PRC	CNY6,263,805.93	893,788.00
Lighting facility section 3	Xi'an Dingjie Industrial Company Limited	ICB	18-May-07	PRC	CNY4,933,795	642,100.00
Lighting facility section 4	JV of Holyland Mechanical & Electrical Equipment (Beijing) Company Limited and Zhongji Tianjian Construction Engineering (Beijing) Company Limited	ICB	18-May-07	PRC	CNY3,533,677.06	491,163.68
Lighting facility section 5	Xi'an Hanson Electrical Engineering Project Company Limited	ICB	18-May-07	PRC	CNY6,300,882.39	899,423.00
Lighting facility section 6	Joint Venture of Xi'an Oshirmapple Industrial Company Limited and Xi'an Frank Times Systems Engineering Company Limited	ICB	18-May-07	PRC	CNY11,226,007	1,643,259.00
Lighting facility section 7	Shaanxi Liujin Digital Photoelectric Science & Technology Company Limited	ICB	18-May-07	PRC	CNY10,127,467.40	1,465,027.00
Lighting facility section 8	Joint Venture of Xi'an Oshirmapple Industrial Company Limited and Xi'an Frank Times Systems Engineering Company Limited	ICB	18-May-07	PRC	CNY6,398,371	913,407.00
Lighting facility section 9	Xi'an Hengtai City Lighting Engineering Company Limited	ICB	18-May-07	PRC	CNY7,592,484.85	1,083,875.00
Lighting facility section 10	Joint Venture of Holyland Mechanical & Electrical Equipment(Beijing) Company Limited and Zhongji Tianjian Construction Limited	ICB	18-May-07	PRC	CNY6,208,752.30	898,137.00
Lighting facility section 11	Nanjing Sanle Lighting Company Limited	ICB	18-May-07	PRC	CNY10,485,790	1,496,867.00
Lighting facility section 12	Xi'an Hengtai City Lighting Engineering Company Limited	ICB	18-May-07	PRC	CNY18,303,754.28	2,612,976.00

Item	Contractor	Mode of Procurement	Contract Date	Country	Original Contract Amount	\$ equivalent
Lighting facility section 13	Shannxi Guangda Lighting Electric Appliance Company Limited	ICB	18-May-07	PRC	CNY7,094,280	1,012,791.00
Lighting facility section 14	The Third Engineering Company Limited Of China Railway Electrification Bureau (Group)	ICB	19-May-07	PRC	CNY4,959,453.73	722,494.00
Communication system for traffic enforcement	Beijing Sonicom Network System Company Limited	ICB	06-Jul-07	PRC	CNY6,378,000	933,128.00
Traffic monitoring system	Shenzhen Bocom System Engineering Company Limited	ICB	06-Jul-07	US	CNY7,778,111	1,137,972.00
Transport information center	Neusoft Corporation	ICB	06-Jul-07	US	CNY5,720,000	836,762.00
122 emergency call and dispatch system	Shenzhen Telewane Communication Company Limited	ICB	06-Jul-07	US	CNY1,688,800	247,192.00
GPS patrol car mounted mobile electronic police system	Shaanxi Tianhe Guoan Electronic Technology Company Limited	ICB	06-Jul-07	US	CNY805,400	117,963.00
Led traffic video screen	Xi'an Qingsong Technology Company Limited	ICB	06-Jul-07	PRC	CNY3,392,300	496,733.00
GIS system for traffic control	China Hualu Information Industry Company Limited	ICB	06-Jul-07	US, Germany	CNY1,984,686	290,496.00
Automatic traffic check system	Xi'an Xiangxun Technical Company Limited	ICB	06-Jul-07	UK, Japan	CNY2,524,950	369,810.00
Dlp large screen projection display system	Ningbo Gqy Video & Telecom Stock-Joint Company Limited	ICB	30-Jul-07	US	CNY6,861,507	1,004,755.00
Gasoline and Gas Filling Station Part 1	Xi'an Oshirnmaple Industrial Company Limited	ICB	31-Mar-09	PRC	\$2,730,135	2,266,012.00
Gasoline and Gas Filling Station Part 2	Imw Industries Limited	ICB	31-Mar-09	Canada	\$800,902.90	664,749.00
Gasoline and Gas Filling Station Part 3	Chongqing Silian Oil & Gas Equipment Manufacturing Company Limited	ICB	31-Mar-09	PRC	CNY6,338,000	770,425.00
Gasoline and Gas Filling Station Part 4	Shaanxi King Flying Trade Company Limited	ICB	31-Mar-09	PRC	CNY3,260,070	396,282.00
Motor vehicle emission pollution monitoring system	China National Chemical Construction Shaanxi Import & Export Company	ICB	06-Jul-07	US, Finland	CNY2,154,222	315,576.00
Small Road Miller and Intelligent Asphalt Distributor	Xi'an Dagang Road Machinery Company Limited	ICB	11-Nov-08	Germany	CNY1,080,000 and €152,732	391,964.00
Road cleaner truck	Changsha Zoomlion Heavy Industry Science And Technology Development Company Limited	ICB	06-Nov-08	PRC	CNY2,430,000	355,924.00
Aloft work truck	Joint Venture of Xi'an St. Gain Trade Corporation Limited and Xuzhou Handler Special Vehicle Company Limited	ICB	18-Nov-08	PRC	CNY3,412,276	499,367.00
Excavator and Loader	Xi'an Oshirnmaple Industrial Company Limited	ICB	20-Nov-08	PRC	CNY6,110,228	894,969.00
Cold recycling equipment	Wirtgen Hong Kong Limited	ICB	16-Jul-09	PRC	€673,579.76	973,228.00

CNY = yuan, € = euro, ICB = international competitive bidding, PRC = People's Republic of China, UK = United Kingdom, and US = United States.
Sources: Xi'an Municipal Urban and Rural Construction Commission and Xi'an Third Ring Road Construction and Development Company.

Table A8.3: Consulting Service Packages

Item	Contractor	Mode of Procurement	Contract Date	Country of Procurement	Original Contract Amount	Final Contract Amount
Consulting Services for Construction Supervision and Training	H&J Inc.	QCBS	05-Feb-05	United States	\$2,699,880	\$2,080,852
Transport Modeling	Chang'an University	QBS	10-Aug-09	PRC	\$250,000	\$250,000

CNY = yuan, QCBS = quality- and cost-based selection, QBS= quality-based selection, and PRC = People's Republic of China.
 Sources: Xi'an Municipal Urban and Rural Construction Commission and Xi'an Third Ring Road Construction and Development Company.

ECONOMIC REEVALUATION

A. General

1. The project comprised a 71 kilometer (km) ring road—third ring road (TRR)—and 16 km of connector roads in the urban area of Xi'an municipality, as well as an urban transport improvement component for traffic management and safety, vehicle emissions control, public transport, and road maintenance. The economic reevaluation was undertaken using with-project and without-project scenarios in accordance with the Guidelines for the Economic Analysis of Projects of the Asian Development Bank (ADB).⁷ Without the project, traffic would have used the existing urban road network, resulting in greater traffic congestion, lower average travel speeds, increased vehicle operating costs (VOC), higher incidence of accidents, and higher road maintenance costs. The TRR and the connector roads provide alternative, fast urban road access in Xi'an, release congestion in the urban area, and improve the road capacity for through traffic. Travel speeds increase and VOCs are lower. Further, the urban transport improvement component benefits traffic on both the TRR and the existing road network because of fewer accidents and better transport conditions. The evaluation period covers the implementation period from 2004 to 2010 and the operation period from 2009 to 2027.

B. Xi'an Municipality Urban Transportation

2. Xi'an municipality has implemented urban road construction projects continuously from 2004 to 2010, increasing the urban road network from 1,332 km in 2004 to 2,662 km in 2010. The per-capita area of roads in the urban area increased from 7.96 square meters (m²) per person in 2004 to 15.40 m² per person in 2010, a rise of 93.5%. Although road length increased significantly in recent years, traffic congestion, especially during rush hours and in the southern area of Xi'an, remains an issue. The average speed in the urban area is still only 15–20 km per hour after a rapid increase in the number of vehicles in recent years, from 512,804 in 2004 to 844,904 in 2008 and further to 1.28 million vehicles in 2010. The number of passenger vehicles including buses, cars and vans increased by 21.8% annually on average during the same period. Private cars accounted for the majority of vehicle ownership. Two subway lines are under construction. Subway Line 2, begun in 2007, opened in September 2011. Subway Line 1, begun in 2008, is expected to open in 2013. By then, Xi'an will be the first provincial capital in the northwestern region to have mass transit services. It is expected that the subways will further improve urban transportation services and reduce transport congestion in Xi'an.

3. Public transportation services in Xi'an have improved in recent years. Public transport vehicles increased from 4,288 in 2004 to 7,107 in 2010. The number of public transport vehicles per 10,000 persons reached 23.77 in 2010, up 108.1% from the 11.42 in 2004. The public traffic routes increased from 182 in 2004 to 236 in 2010, and the total length of the public traffic routes increased from 830 km in 2004 to 940 km in 2009. The average coverage radius of bus stations in the urban area is 150–200 meters; in suburban areas it is 250–300 meters. Besides bus, minibus, and trolley bus services, the number of taxis increased from 10,463 in 2004 to 12,786 in 2010. Table A9.1 provides information on urban public transportation service and infrastructure development from 2004 to 2010.

⁷ ADB. 1997. *Guidelines for the Economic Analysis of Projects*, February. Manila.

Table A9.1: Xi'an Urban Transportation Service

Items	Unit	2004	2005	2006	2007	2008	2009	2010
Per capita area of roads	m ² /person	7.96	8.11	9.86	12.65	14.04	14.80	15.40
Per capita public transport vehicles	vehicles per 10,000 people	11.42	12.38	16.15	18.02	19.07	22.92	23.77
Public transport vehicles	bus	4288	4762	5489	5836	6123	7039	7107
Public traffic routes	line	182	190	195	206	206	210	235
Length of public transport routes	km	830	873	571	734	856	940	...
Average speed (urban areas)	km/h	...	15	10–18	10–18	10–20	10–20	15–20
Average speed (suburban areas)	km/h	...	18	10–20	10–20	10–20	15–25	15–25
Average coverage radius of bus station (urban areas)	meter	...	200	200	200	200	200	150–200
Average coverage radius of bus station (suburban areas)	meter	...	250–300	250–300	250–300	250–300	250–300	250–300
Number of taxis	vehicle	10,463	11,236	11,177	11,879	11,879	12,786	12,786
Traffic accidents								
Number of traffic accidents	incident	5,226	4,903	3,709	3,643	2,576	2,702	2,323
Fatalities	person	784	617	617	597	551	531	531
Injuries	person	2,936	3,081	3,075	3,002	2,464	2,247	2,520
Direct losses	CNY10,000	1,966	2,024	1,328	1,038	523	852	737

... = data not available, CNY = yuan, km = kilometer, km/h = kilometer per hour, and m² = square meter.

Sources: Xi'an Municipal Bureau of Statistics and Xi'an Survey Office of National Bureau of Statistics. *Xi'an Statistical Yearbook 2011*. Beijing: China Statistics Press. Xi'an Municipal Urban and Rural Construction Commission and Xi'an Third Ring Road Construction and Development Company.

C. Revised Traffic Forecast

4. The TRR connects four districts and two commercial and industrial development zones of Xi'an municipality. It also connects with several main roads of the urban area, three national highways, and eight expressways. Since it started operation in 2008, traffic volumes have been growing rapidly. Traffic surveys were conducted in 2009 and in early 2011, and Table A9.2 lists the results versus the appraisal estimates. All sections of the TRR have had significant traffic growth between 2009 and 2011. The western section was opened to traffic in 2007, 1 year earlier than other sections, and it reports the highest traffic mainly because it connects with the airport expressway and offers access to many urban roads. The northern section of the TRR was opened in December 2008. Being far from the downtown area, it has the lowest traffic volume. The southern and northern sections of the TRR were constructed as low-speed roads parallel to the Xi'an Loop Expressway, which diverts a large proportion of the transit traffic.

Table A9.2: Traffic of Third Ring Road
(daily vehicles in passenger car units)

Third Ring Road	At Appraisal	Actual		Growth ^a
	2008	2009	2011	(%)
Western Section	24,569	39,651	90,364	268
Southern Section	48,494	29,164	57,610	19
Eastern Section	14,480	29,598	70,038	384
Northern Section	37,348	14,554	42,024	13

^a the growth refers to change between actual in 2011 and the appraisal estimates.

Sources: Asian Development Bank, Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

D. Costs

5. The economic costs include (i) the capital cost of the project; (ii) the cost of operation and maintenance (O&M) for the TRR at CNY3 million per year with an annual real increase of 5%; and (iii) the cost at CNY2.4 per km for anticipated re-pavement and major repairs of these roads which will be conducted at an interval of 10 years and each time in phases over 4 years. The economic costs are derived from financial costs by applying a standard conversion factor of 0.97.

E. Benefits

6. VOC and passenger time savings are the major economic benefits of the project. The TRR provides an express route for urban transport in Xi'an, particularly for through traffic. The average speed of traffic on the eastern and western sections of the TRR is 60 km per hour; it is 40 km per hour on the northern section, and 30 km per hour on the southern section. These speeds are much higher than the average speed of 10–20 km per hour in other urban areas of Xi'an. Passenger time savings are valued on the average income of Xi'an, for which a growth rate consistent with gross domestic product growth is applied. Better road conditions and higher speeds also generate savings in VOC. To calculate this benefit, the VOC computations at different speeds that were used at appraisal are applied based on the traffic composition established in a traffic survey in April 2011 (para 4). The connector roads are not included in the benefit calculation.

7. The project eased traffic congestion of urban roads and, with the urban transport improvement component, lowered the incidence of traffic accidents. Traffic accidents in Xi'an decreased from 5,226 in 2004 to 2,323 in 2010. Fatalities fell by 55.5% in the same period (Table A9.1). Both the number of injured people and direct property losses declined significantly. Due to limited urban statistics and difficulty in obtaining transport statistics in Xi'an, such as the transportation measurement in vehicle-km during the project's operation period, the reevaluation could not accurately capture the cost savings derived from the reduction in traffic accidents, but the positive impact is obvious considering the improvement in traffic safety.

F Economic Internal Rate of Return Reevaluation

8. The reevaluated economic internal rate of return (EIRR) for the project is 16.3%, as compared with the 15.4% estimated at appraisal. The higher EIRR is mainly due to substantially higher traffic on the TRR despite the higher project costs. The reevaluated EIRR is higher than the cut-off rate of 12.0% and the project is considered economically viable. The economic reevaluation results are in Table A9.3.

9. Sensitivity analysis was carried out to test the impacts of (i) an increase in O&M costs, (ii) a decrease in benefits, and (iii) a combination of these two scenarios. Based on this analysis, the project would continue to be economically viable even if O&M costs increased 20% and benefits decreased 20%. The result of the sensitivity analysis is in Table A9.4.

G. Operational Sustainability of Project Facilities

10. Upon completion of road construction, all road assets of the TRR and connector roads were transferred to the Municipal Infrastructure Facility Management Bureau for O&M. The bureau is currently in charge of 1,100 km roads, including all roads within the second ring road and partial roads of the eastern suburban area. It has nine specialized branches for

maintenance of roads, bridges, storm-water pipelines, and pump stations, with an annual maintenance budget of CNY110 million–120 million provided by Xi'an municipality. Major repairs and specific maintenance assignments were outsourced to specialized companies, which reduces costs by 5%. The bureau is taking other measures to further improve the efficiency of road maintenance work, including acquisition of construction equipment required for road construction and maintenance, introduction of road performance monitoring and evaluation methods applicable to the Xi'an urban road network, and implementation of a road maintenance programming and investment plan based on the principle of road asset management. Given adequate budget support from Xi'an municipality and the efficiency improvement measures, the long-term sustainability of project-related O&M is ensured and considered very likely.

Table A9.3: Economic Reevaluation
(CNY million)

Years	Costs			Benefits			Net Benefits
	Capital	O&M	Total	VOC Savings	Time Savings	Total	
2004	558.30		558.30				(558.30)
2005	1,122.58		1,122.58				(1,122.58)
2006	2,178.14		2,178.14				(2,178.14)
2007	1,224.39		1,224.39				(1,224.39)
2008	983.20	3.00	986.20				(986.20)
2009	714.13	3.15	717.28	318.00	130.23	448.23	(269.05)
2010	849.75	3.31	853.06	567.86	232.55	800.41	(52.65)
2011		3.47	3.47	1,135.72	465.09	1,600.81	1,597.34
2012		3.65	3.65	1,158.43	512.35	1,670.78	1,667.13
2013		3.83	3.83	1,181.60	564.40	1,746.00	1,742.17
2014		4.02	4.02	1,205.23	621.74	1,826.98	1,822.96
2015		4.22	4.22	1,229.34	684.91	1,914.25	1,910.03
2016		4.43	4.43	1,253.92	740.53	1,994.45	1,990.02
2017	42.60	4.65	47.25	1,279.00	800.66	2,079.66	2,032.41
2018	42.60	4.89	47.49	1,304.58	865.67	2,170.25	2,122.77
2019	42.60	5.13	47.73	1,330.67	935.97	2,266.64	2,218.91
2020	42.60	5.39	47.99	1,357.29	1,011.97	2,369.25	2,321.27
2021		5.66	5.66	1,384.43	1,094.14	2,478.57	2,472.91
2022		5.94	5.94	1,412.12	1,182.98	2,595.10	2,589.16
2023		6.24	6.24	1,440.36	1,279.04	2,719.40	2,713.17
2024		6.55	6.55	1,469.17	1,382.90	2,852.07	2,845.52
2025		6.88	6.88	1,498.55	1,495.19	2,993.74	2,986.87
2026		7.22	7.22	1,528.53	1,616.60	3,145.12	3,137.90
2027	(1,526.09)	7.58	(1,518.51)	1,559.10	1,747.87	3,306.96	4,825.48

EIRR:16.3%

() = negative, CNY = yuan, EIRR = economic internal rate of return, O&M = operation and maintenance, and VOC = vehicle operating cost.

Source: Asian Development Bank.

Table A9.4: Sensitivity Analysis
(%)

Item	Changes		EIRR	NPV (CNY million)
	O&M Cost	Benefits		
Base Case	0	0	16.3	2,303
	20		16.3	2,300
Changes		(20)	15.1	1,575
	20	(20)	13.7	844

() = negative, CNY = yuan, EIRR = economic internal rate of return, NPV = net present value, and O&M = operation and maintenance.

Source: Asian Development Bank.

LAND ACQUISITION AND RESETTLEMENT

A. Scope of Project Impact

1. According to the resettlement plan, which was prepared by the Xi'an Third Ring Road Construction and Development Company (XTRRCDC) with the assistance of the project preparatory technical assistance consultant in September 2003, construction work under the Xi'an Urban Transport Project— for the third ring road (TRR) and connector roads—would result in the loss of land, houses, enterprises, shops, and other assets. The project would permanently acquire about 12,588 mu (839.2 ha) of land, demolish a total of 1,301,277 m² of buildings, and cause the relocation of 2,736 households. It would also affect 151 enterprises. The number of affected persons was estimated at 29,044. The resettlement budget was estimated at CNY1.62 billion, which accounted for 24% of the estimated project cost.

2. Land acquisition and house demolition for the project commenced in April 2004 and most land acquisition and house demolition activities were completed by December 2006 but the resettlement of affected households in some concentrated sites was delayed to 2008 and even 2009. According to the project completion report prepared by XTRRCDC, the project permanently acquired 14,105 mu (940.3 ha) of land, an increase of 12% on the resettlement plan estimate. A total of 1,892,300 m² of buildings were demolished, 45% more than estimated. A total of 35,500 persons were directly affected, including 3,025 households (11% more than estimated) that were relocated due to house demolition. Table A10.1 presents the actual project impacts versus those estimated in the resettlement plan.

Table A10.1: Project Land Acquisition and Resettlement Impacts

Items	Unit	Impacts		Variation	
		Resettlement Plan	Actual	Quantity	%
A. Permanent Land Acquisition	mu	12,588	14,105	1,517	12
B. Building Demolition	m ²	1,301,277	1,892,300	591,023	45
C. Population Affected	Person	29,044	35,500	6,456	22
of which households relocated	Household	2,736	3,025	289	11
D. Enterprises and Shops		151	1,761 ^a	na	na

m² = square meter, mu = 0.07 hectares or 666.67 m², and na = not applicable

^a The large discrepancy in the number of affected enterprises and shops was mainly due to the different methodology used during preparation of the resettlement plan, when a commercial market was treated as a single unit. For instance, Hongqi market had 472 small shops, Banpo market 322 small shops, and Zhuhonglu commercial street 268 small shops, but these three markets were consolidated and recorded as 3 units in the plan.

Sources: Resettlement Plan (2003), Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

3. The increase in permanent land acquisition was mainly due to (i) the increased amount of land acquisition for inaccessible plots of land left between the alignments of the northern and southern Ring Road segments and the alignments of the adjacent orbital expressway, as requested by local communities, and (ii) an additional 4 km in the east segment and 6 km in the north segment due to design changes. The increase in building demolition and relocated households was mainly due to (i) the increase in land acquisition, (ii) the increase in the area covered by buildings from 2003 to 2006, and (iii) underestimation of project resettlement impacts in the feasibility study and rough preliminary design.

B. Resettlement Policy and Compensation Rates

4. Land acquisition and resettlement were implemented based on the resettlement plan, the 1998 Land Administration Law, and a specific land acquisition and resettlement policy for the project issued by Xi'an municipal government in July 2003. According to this policy: (i) the compensation rates of permanent land acquisition should be CNY30,000/*mu* for vegetable land, and CNY25,000/*mu* for other land; (ii) compensation for demolition should be based on an individual assessment of a house or building; (iii) affected rural households should be given housing plots to rebuild new houses in rural areas; and (iv) affected urban houses should be compensated on the basis of the *Xi'an Urban House Demolition Regulation*.

5. During implementation, all types of collective land to be permanently acquired in Weiyang and Baqiao districts were compensated at the rate of CNY30,000/*mu*, which was equal to the maximum compensation standard of land acquisition in the resettlement plan. In Yanta district, a higher land compensation rate of CNY46,000/*mu* was applied. The compensation rates for house demolition, including assessment value and incremental subsidy, ranged from CNY400–500/m² for brick-concrete structures, higher than in the resettlement plan.⁸ Each affected household received a house relocation allowance of CNY1,000, a government bonus/subsidy of CNY2,000, and a transitional housing subsidy of CNY4–6/m²/month. In addition, many affected households built additional floor space after endorsement of the detailed survey and assessment from 2003 to 2006; this non-titled floor space was compensated at around CNY220/m², which is equivalent to construction cost. Table A10.2 presents the actual compensation rates versus those in the resettlement plan.

Table A10.2: Compensation Rates of Land Acquisition and Building Demolition

Land Type	Unit	Resettlement Plan	Actual
A. Permanent Land Acquisition			
Vegetable land	CNY/ <i>mu</i>	30,000	30,000–46,000
Irrigated land	CNY/ <i>mu</i>	25,000	30,000–46,000
Dry land/residential	CNY/ <i>mu</i>	20,000	30,000–46,000
B. Building Types			
Brick-concrete	CNY/m ²	375	400–500
Brick-wood	CNY/m ²	291	300–350
Earth-wood	CNY/m ²	54	na
Simple structure	CNY/m ²	10	70

CNY = yuan, m² = square meter, *mu* = 0.07 hectares or 666.67 m², and na = not applicable.

Sources: Resettlement Plan (2003), Xi'an Municipal Urban and Rural Construction Commission, and Xi'an Third Ring Road Construction and Development Company.

C. Resettlement Measures and Income Restoration

6. All affected villages received land compensation for permanent land acquisition. The use of the land compensation fund was different in different villages. According to XTRCDC, affected people received replacement land through land readjustment within the village or group where adequate land was available; the land compensation fund was either distributed among all villagers in the village, or a portion was used to improve the village public facilities. For slightly affected villages, the compensation fund was given to affected families but there was no

⁸ The incremental subsidy ranged from 20% to 60% of the assessment value.

land readjustment as the affected families still had sufficient farmland left after land acquisition by the project. In addition, the acquired land had been used for grape production, the affected households also received compensation for grapevines at the rate of CNY13,000/*mu*, and were given 10 days to transplant their grapevines. In most villages, the use of the land compensation fund was decided in village representative meetings, whereupon a formal report with village representatives' endorsement was submitted to the local district management office. The funds were disbursed directly by the local financial agency subsequent to approval by the district management office.

7. XTRRCDC, local governments, district management offices, and village committees took various measures to restore the incomes and livelihoods of the affected people. Some developed new businesses under collective ownership by using the compensation for land acquisition as equity investment—Yongfeng village, for instance, established the 20,000 m² Banpo Construction Material Market. Many villagers were hired by the market and received a salary. In addition, all villagers receive annual dividends from operating the market. Others improved community facilities such as roads, channels, or wells for production and business. There was also technical and capacity training to help villagers find jobs in the urban areas, e.g., Liuchunpu village established a technical school to train villagers who lost land due to the project, which resulted in 200 villagers being employed by the Hangang chemical plant and many others by the local industrial park. In some cases, resettlement was combined with the “Village in Urban” reconstruction program. The villages constructed standard, solid, and beautiful buildings for all villagers. For example, Mujiangwang village resettled villagers on 39 m² per capita for living and 26 m² for business operations. However, the “Village in Urban” reconstruction program has been a time-consuming process, which delayed resettlement progress and prolonged the transitional periods, particularly in Mujiangwang Village, Huangdeng Village, and Liangjiajie Village.

8. In addition to the measures supported by local governments, affected villagers took their own measures to restore production and incomes; many rebuilt larger houses to gain rooms for renting out. For example, Guanting village built standard houses with three floors for its villagers, who would generally use one floor for themselves and rent out the other two. The village reached an agreement with the Zhejiang Commercial Association, which rented the extra floor space for 12 years and thus provides the villagers with a long-term rental income. Another option was to operate small businesses along the TRR. Affected villagers would rebuild houses along or near the project roads and use the spare rooms to operate a business or rent them out to small business owners; this was the case in Mujiangwang, Yongfeng, and Sandian villages in Baqiao district, and Tuanjie, Xinjiamiao, Nanhe, Wuyi, and Sanqiao villages in Weiyang district. Other villagers began operating transport services for sand, soil, and construction waste and earned good incomes. The external resettlement monitoring report concluded that income restoration of the project-affected households had been achieved.

9. Compensation for each affected enterprise or shop was negotiated on the basis of loss assessment. Most large enterprises were not relocated if the project affected only a small part of their operations or did not affect regular production. In the case of the Haihong bearing factory in Weiyang district, for example, 3.233 *mu* of state-owned land was acquired and part of a building demolished, but the factory's production activities were not affected. For enterprises that did relocate, adequate compensation ensured fast rehabilitation. For example, Datang Thermal Power Plant in Baqiao district was demolished in July 2006 and rebuilt in another location in September 2006, which meant a three-month transition period. The enterprise obtained CNY11 million in compensation funds, which was higher than the original value of its fixed assets. Thanks to the newly purchased production equipment and an environment that

was better than the previous location, the resettlement benefitted business development. Small private shops and businesses were assisted in finding new venues, in addition to receiving adequate cash compensation. Construction of the TRR and connector roads has largely improved conditions for many local enterprises, leading to better business development. The sales of Huifeng Dairy Plant, for instance, which was relocated along the TRR, improved because of the convenient transport conditions.

D. Land Acquisition and Resettlement Cost

10. The actual total cost of land acquisition and resettlement was CNY2.972 billion, 99% more than the CNY1.494 billion estimate in the resettlement plan. This was mainly due to (i) the original budget not including various taxes and fees required by local regulations related to land acquisition and resettlement; (ii) the government increasing compensation standards for land acquisition and resettlement; and (iii) land acquisition and building demolition activities covering a larger area than foreseen as described above.

E. Institutional Arrangements

11. XTRRCDC, the implementing agency for the project, was responsible for land acquisition and resettlement, road construction, and cooperation with relevant government agencies. The company set up a resettlement department that was in charge of daily procedures and held consultations with local governments that were to establish their own resettlement offices. The resettlement department consisted of five staff who were responsible for resettlement implementation in Yanta, Baqiao, and Weiyang districts.

12. Weiyang district government established its resettlement office in early 2003, and Yanta and Baqiao districts later set up similar offices. The resettlement offices, usually led by senior district leaders, were responsible for land acquisition, relocation, compensation disbursement, and settling resettlement accounts; their members were from local government departments, e.g., land administration, municipal construction, environmental protection, and urban transportation. Resettlement work groups were established in affected towns or street management offices. The groups consisted of town leaders or street management offices and members of affected village committees. The street management office and the village committee collaborated in resettlement, relocation, and economic and production restoration. In general, the institutional arrangements for land acquisition and resettlement were well organized and efficient.

F. Monitoring and Evaluation

13. The Xi'an Academy of Social Science was engaged as the external resettlement M&E agency to conduct independent resettlement monitoring and evaluation (M&E) for the project. ADB received four annual external resettlement monitoring and evaluation (M&E) reports from 2005 and 2008. As requested by ADB, the Xi'an Academy of Social Science prepared a final M&E report to evaluate the income restoration of affected people, and submitted it in May 2011. According to the final resettlement M&E report, of the affected households with average annual income below CNY20,000 declined by 25% as compared with that before land acquisition, those with annual income in between CNY20,000-CNY30,000, CNY30,000-CNY50,000, and CNY50,000-CNY100,000 increased by 5.3%, 7.9%, and 11.7%, respectively, as compared with those before land acquisition.

G. Participation and Information Disclosure

14. During project preparation and implementation, XTRRCDC and local governments conducted extensive and effective consultation with affected people, villages, and enterprises regarding the issues of land acquisition and resettlement. All received information and documents related to the resettlement caused by the project. The compensation standards were prepared on the basis of participation and consultation, and were adjusted in time to meet the economic development of the affected area. The final compensation standards were also disclosed to the affected people and implemented in a timely manner. The land compensation allocation between affected village groups and individual villagers were fully discussed in village representative meetings. The house structures and attachments were assessed by professional assessment companies, and the assessment results were confirmed by the affected people. In addition, XTRRCDC and local governments established effective complaint and appeal procedures and opened complaint channels for affected people. During project implementation, XTRRCDC resolved complaints from affected people with the assistance of local governments in a timely manner.

H. Conclusions and Lessons

15. XTRRCDC and local governments conducted extensive consultation with affected communities, enterprises, and persons throughout the process of land acquisition and resettlement implementation. At all levels, those responsible for resettlement issues worked proactively to solve the issues raised by the affected people. XTRRCDC and local governments also made efforts to improve incomes of affected people by providing a higher land compensation rate, farmland adjustment, skills training, as well as job opportunities. The fifth M&E report concluded that the income restoration of affected people had been achieved.

16. The project was implemented along with urbanization process in the suburbs of Xi'an City. The resettlement policy and plan was formulated in 2004 before the "Village in Urban" urbanization program was finalized. The RP assumed the affected rural households were provided housing plots to construct new houses, and the affected villages still have remaining farmlands after land acquisition by the project. However, such resettlement approaches were no longer possible when the "Village in Urban" urbanization program officially commenced in 2007. Instead, the local villages are entirely converted to urban communities, the title of farmers are being changed to urban residents, and new apartments in large compounds are being constructed and allocated to affected households. Given such a rapid transition rather than natural urbanization, the viability of livelihoods of urbanized farmers is experiencing high risks, although the local government has been making great efforts to address this challenge. Therefore, for projects with large scale resettlement on the urban fringe, ADB should not only assess the project direct impacts on local communities but also evaluate the mid-term and long-term influences induced by the project and related urban development.

17. Considering the large land acquisition and resettlement impacts, the project resettlement supervision and monitoring were initially quite weak. Firstly, ADB's supervision on resettlement implementation was not fully adequate during the peak time from 2004 to 2006 prior to handover of project administration to PRCM. Secondly, the external monitor recruited by the EA was not very experienced in resettlement monitoring and evaluation. Subsequently, PRCM provided closer supervision and substantial training to the Xi'an Academy of Social Science, and the quality of monitoring reports was improved. The lesson learned is that an experienced monitor should have been engaged by ADB with financing under the loan; this experienced monitor could have worked with a local institute to build capacity if required by the EA.

ENVIRONMENTAL IMPACT ANALYSIS

A. Introduction

1. The project constructed 71 kilometers (km) of the third ring road (TRR) including interchanges and bridges. The project also constructed 16 km of connector roads. The project was classified as Asian Development Bank (ADB) environmental category A. The summary environmental impact assessment was prepared in May 2003 based on the domestic environment impact assessment (EIA). The summary EIA concluded that the project's adverse impacts could be offset by positive benefits from greening and landscaping, and less air pollution and noise, than in a without-project scenario. Potentially adverse environmental impacts would be minimized if mitigation measures and monitoring were fully implemented and conducted.

2. The State Environmental Protection Administration approved the domestic EIA report in September 2003. The Xi'an Environment Monitoring Station carried out the completion technical review for environment protection in June 2011. The government approval on environmental protection completion acceptance is expected in early 2012.

B. Environmental Protection and Management

3. The implementing agency, Xi'an Third Ring Road Construction and Development Company, oversaw and coordinated implementation of the project environment management plan (EMP). Adequate staff resources were allocated to deal with specific environment matters, including contract management, monitoring, reporting, public communication, and technical review.

4. During construction, environment monitoring was conducted by the Xi'an Environment Monitoring Station. Based on the monitoring results, four environment monitoring reports were submitted to ADB, including one summary report in January 2011.

5. At appraisal, the total cost of environmental protection and mitigation measures was estimated to be CNY424 million. According to the project completion report prepared by the executing agency, the actual total investment for environmental protection was CNY420 million for landscaping, greening, soil erosion control, and cultural relic preservation.

C. Environmental Impacts and Mitigation Measures

a. Topography, Geology, and Soils

6. During construction, limited soil erosion occurred at temporary sites, such as cut slopes, embankments, and other erosion-prone earthwork sites. The six borrow pits and spoil sites were not employed permanently. Most of the earth, gravel, and construction material were transported from outside sources and spoils were transferred to designated landfill sites approved by local authorities. Erosion-control measures were applied effectively. The construction activities took place mostly in urban areas, which were in flat terrain and thus caused no significant erosion. During operation, soil erosion is very minor and can be avoided through regular road maintenance of ring road slopes, cuts, and embankments.

b. Water Quality

7. During construction of the TRR and connector roads, major adverse impacts on water quality were limited, coming mainly from siltation and wastes from construction sites and workers' camps. All proposed mitigation measures were undertaken adequately. The monitoring results showed that the water quality of the Ba and Chan rivers was well maintained within the target standards of Grade III under GB3838-2002.

8. During operation, potential water pollution may occur due to rainfall runoff from the pavement surface. To solve this, runoff drainage and pipe systems were constructed and installed to collect runoff. The collected runoff will be discharged to the municipal sewerage system according to national and local wastewater regulations.

c. Noise

9. Noise during construction arose mainly from construction machinery and transportation vehicles. Mitigation measures were strictly applied to minimize and avoid noise impacts, as described in the EMP. The monitoring results showed that noise levels during construction were under control, following the national noise standards for construction sites (GB12523-90). Given the potential noise impacts during operation, noise mitigation measures such as more greening and planting were added along the right-of-way areas.

d. Air Quality

10. The major air pollution during construction was from dust due to cement mixing, asphalt plants, and construction traffic. Mitigation measures were fully implemented as required in the EMP, which included water spraying, covering of transported materials, and good machinery maintenance. However, the monitoring results showed that total suspended particles exceeded the designated level in terms of the national ambient air quality standard (GB3095-1996, Grade II) because of the high baseline level of total suspended particles in the project areas.

D. Preservation of Cultural Relics

11. Five tombs of the Tang Dynasty and one port relic of the Han Dynasty were found in the TRR alignment while excavating earth during construction. The Xi'an Cultural Bureau was engaged to investigate, document, and supervise protective excavation of the sites. All identified sites close to the alignment were carefully investigated and documented according to national and local regulations for cultural relic preservation. After investigation and excavation, all sites were restored and preserved accordingly.

E. Vehicle Emissions Control

12. The vehicle emissions control subcomponent was implemented successfully. Under the project, two vehicles and associated measuring facilities were purchased for emissions inspection. The Xi'an municipal government in 2008 established the Xi'an Vehicle Emission Monitoring and Inspection Center staffed with 40 people, which implemented the subcomponent. The center, which is affiliated with the Xi'an Environment Protection Bureau, is now a permanent government agency to supervise and monitor vehicle emissions in Xi'an. This proactive measure has created a very important basis for future institutional development of vehicle emissions management.

13. The center began inspecting vehicle emissions in 2008. The monitored vehicle gases include carbon monoxide, nitrogen monoxide, and nitrogen dioxide. The monitoring took place bimonthly in 2008 and has been undertaken monthly thereafter. The center has documented all monitoring data effectively and produced timely monitoring reports. Three annual reports were provided to ADB for information. The monitoring shows that vehicle emissions have increasingly become the major air pollution source in the Xi'an urban area.

F. Conclusions

14. During construction, all contractors fulfilled their obligation to protect the environment and to implement mitigation measures in their construction schemes. The adverse effects of project construction on the surrounding environment were thus minimized. The cultural relics have been well preserved. During operation, the impacts on the ambient environment come mainly from the increasing number of vehicles. The project has reduced motor vehicle emissions as a result of better motor vehicle engine efficiency through the vehicle emissions management system.