

**SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT**

**XI'AN URBAN TRANSPORT PROJECT**

**IN THE**

**PEOPLE'S REPUBLIC OF CHINA**

**May 2003**

## CURRENCY EQUIVALENTS

(as of 30 April 2003)

Currency Unit	–	yuan (CNY)
CNY1.00	=	\$0.1208
\$1.00	=	CNY8.28

## ABBREVIATIONS

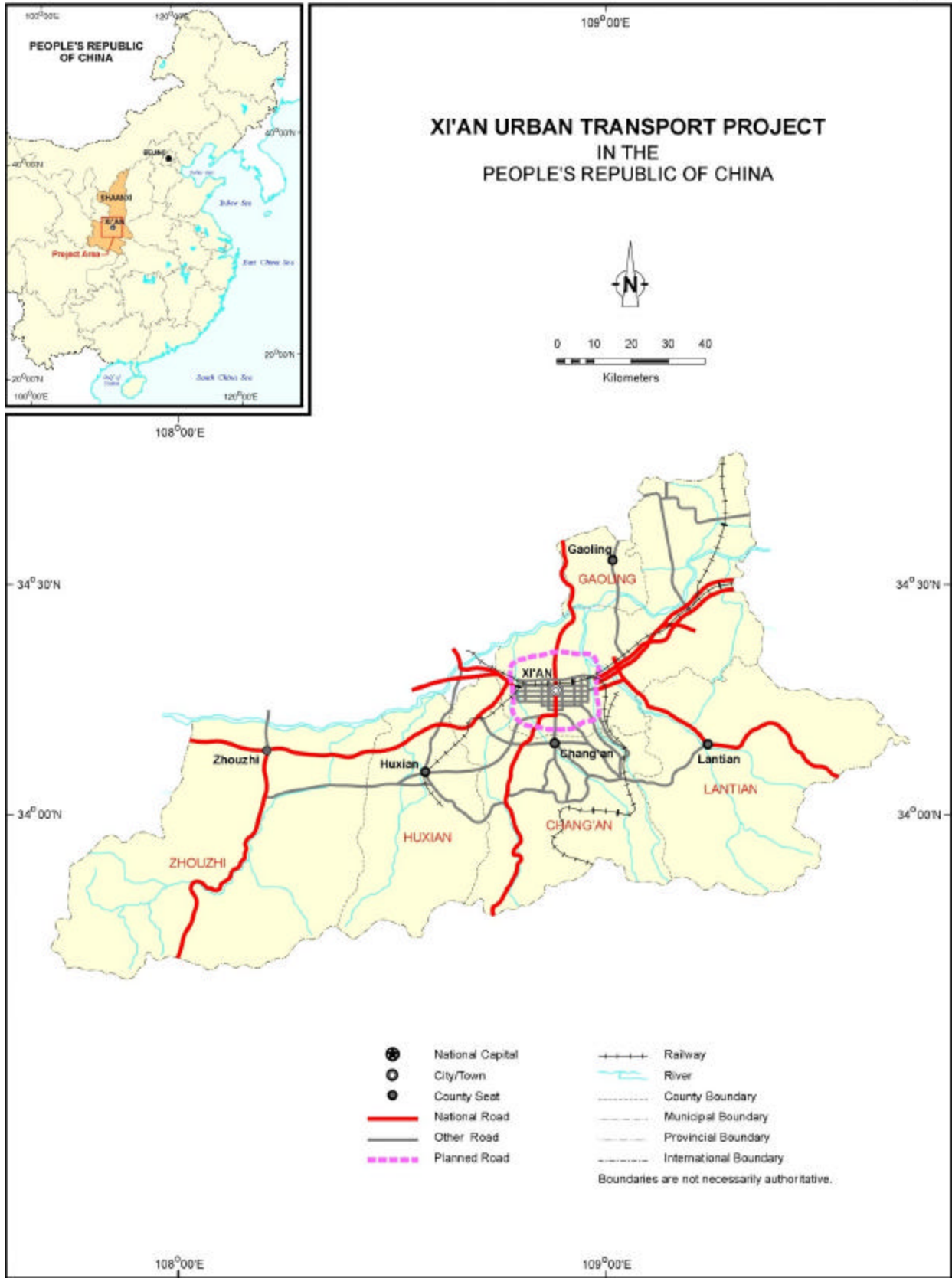
ADB	–	Asian Development Bank
AP	–	affected people
CNG	–	compressed natural gas
CO	–	carbon monoxide
dB(A)	–	decibel (acoustic)
EIA	–	environmental impact assessment
MOC	–	Ministry of Communications
NO <sub>x</sub>	–	nitrogen oxides
PRC	–	People's Republic of China
ROW	–	right-of-way
RP	–	resettlement plan
SEIA	–	summary environmental impact assessment
TA	–	technical assistance
THC	–	total hydrocarbons
TSP	–	total suspended particulates
XEPB	–	Xi'an Environmental Protection Bureau

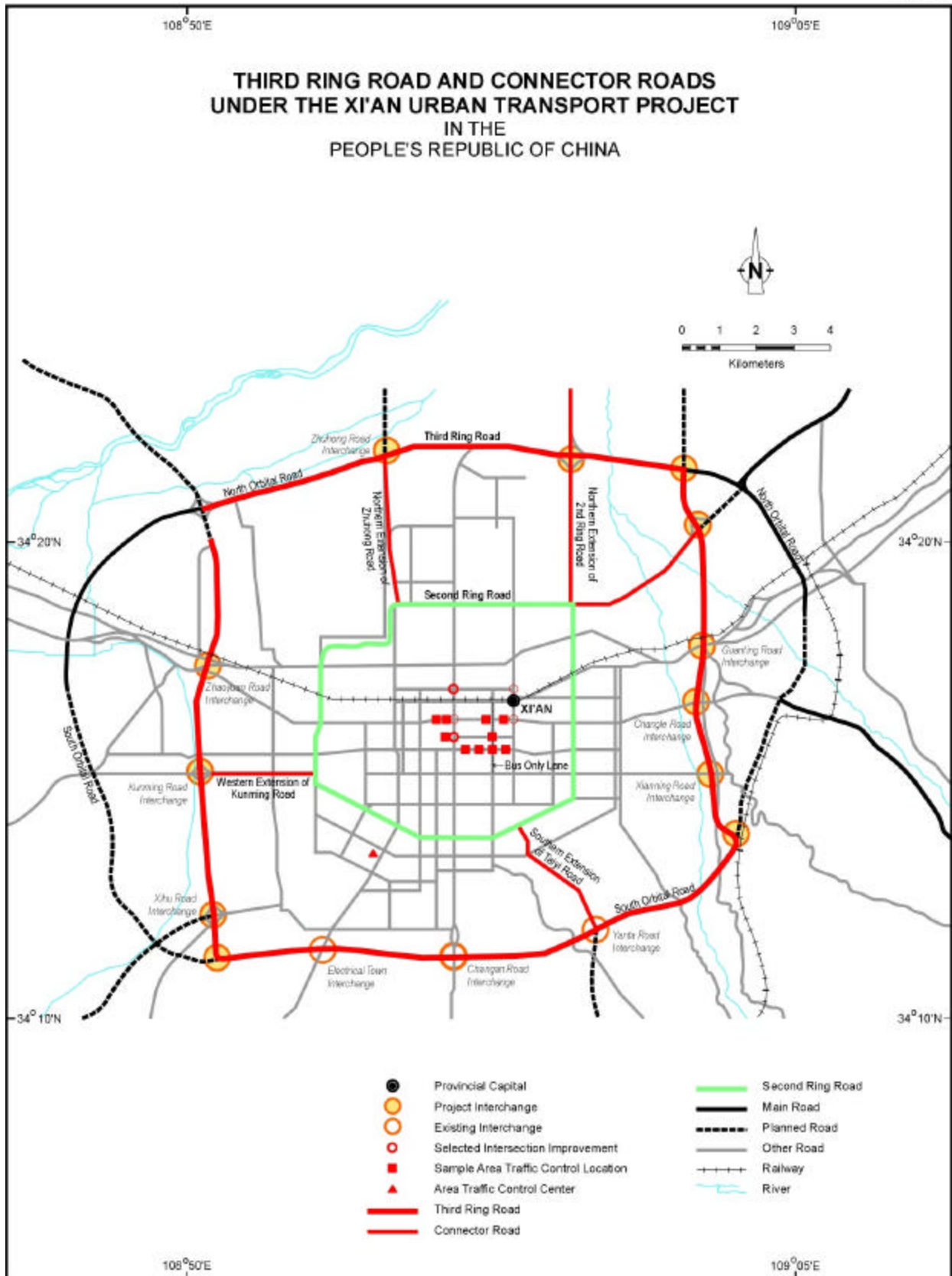
## NOTE

In this report, "\$" refers to US dollars.

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## I. INTRODUCTION

1. The environmental impact assessment (EIA) for the Xi'an Urban Transport Project was undertaken by Chang'an University in November 2002. The consultant engaged under the technical assistance (TA)<sup>1</sup> reviewed the report and visited locations that could experience environmental impacts. This summary environmental impact assessment (SEIA) was based on the EIA report, with some modifications, following Asian Development Bank (ADB) policy and guidelines as indicated in *Environment Policy of the Asian Development Bank*, November 2002, and *Environmental Assessment Requirements of the Asian Development Bank*, March 1998. The EIA and this SEIA are documents of the project proponent and have not been evaluated by ADB. ADB's assessment of these reports and evaluation of the environmental impacts will be included in the documentation presented to the Board of Directors separately. The EIA report is available at the project office on request.

2. The environmental assessment was conducted in accordance with relevant laws, regulations, and standards applicable in the People's Republic of China (PRC), including in particular (i) *Technical Guidelines on Environmental Impact Assessment and Environmental Protection Standards of the PRC*, September 1993, and (ii) *Standards for Environmental Impact Assessment of Highway Construction Projects*, Ministry of Communications (MOC), January 1996.

## II. DESCRIPTION OF THE PROJECT

3. The Project is located in Xi'an Municipality, the capital of Shaanxi Province in the relatively poorer western region of the PRC (Map 1). In 2001, the per capita gross domestic product of Xi'an Municipality was about 60% of the average of the provincial capitals.

4. The principal objective of the Project is to promote economic growth in Xi'an Municipality by relieving transport infrastructure bottlenecks. The Project will develop an efficient, safe, and environmentally sustainable urban transport system, thereby (i) strengthening institutional capacity through improved coordination among municipal government agencies concerned, (ii) improving traffic management and safety, (iii) enhancing vehicle emission control, and (iv) expanding the capacity of urban roads.

5. The Project comprises the following components: (i) construction of a 71 kilometer (km) ring road, including interchanges, toll stations, and bridges; (ii) upgrading and construction of 28 km of connector roads, linking the ring road with the overall urban road network; (iii) urban transport component, including four elements—traffic management and safety, vehicle emission control, urban transport planning, and road maintenance; (iv) procurement of equipment for road maintenance, transport planning model, traffic signals and area traffic control center, vehicle emission inspection, compressed natural gas (CNG) filling stations, toll collection, and surveillance and communications; (v) land acquisition and resettlement, and (vi) consulting services for construction supervision, urban transport component, monitoring and evaluation, and capacity building.

6. On the northern and southern sections of the ring road, six relief lanes (three on both sides) and eight relief lanes (four on both sides) will be constructed, respectively, to complement the existing North Orbital and South Orbital main lanes. On the eastern and western sections,

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<sup>1</sup> ADB. 2002. *Technical Assistance to the People's Republic of China for Preparing the Xi'an Urban Transport Project*. Manila.

eight main lanes plus six relief lanes (three lanes along both sides of the main lanes) will be constructed (Map 2).

### III. DESCRIPTION OF THE ENVIRONMENT

#### A. Physical Resources

##### 1. Assessment Boundaries

7. The project corridor for environmental baseline assessment is generally 200 meters (m) on either side of the centerline of the road (400 m total), but is expanded to include borrow and stockpile areas and water bodies receiving runoff from the Project. A broader study area consisting of the Beilin, Yanta, Weiyang, and Baqiao districts of Xi'an Municipality was defined for general demographic data and other regional characteristics. For regional impact analyses, other data sources with and without the Project were considered, especially for air quality, which is influenced by traffic in a broader regional network.

##### 2. Meteorology

8. The climate in the area is typical of continental semimoiest temperate zones. It is cool and dry in spring, wet in autumn, hot in summer, and very cold in winter. The average annual precipitation is 580 millimeters, of which 45–60% takes place between July and September. Average annual temperature is 13.3 degrees centigrade. Prevailing wind direction is northeast with average annual wind speed of 1.7 m/second. The maximum depth of ground freezing is 45 centimeters.

##### 3. Topography, Geology/Seismology, and Soils

9. Xi'an is located in the middle of the Guangzhong plain, bounded by Qin Mountain on the south, Li Mountain on the east, the Wei River to the north, and the Feng River to the west. The terrain is generally flat, with a natural slope rising from west to east forming terraced landforms. The ground elevation is about 400–450 m above mean sea level.

10. The geologic structure is a sedimentary basin with sub-base schist and granite overlain by up to 6,000 m of Neogenic-Quaternary deposits. There is 3–12 m thick loess layer on the surface, some of which has collapsible characteristics. There are 11 taphrogeny belts in the project area. The basic seismic intensity is Chinese degree 8.<sup>2</sup>

##### 4. Water Quality

11. The surface water drainage area consists of many tributaries emptying into the Wei River, which flows east to meet the Yellow River in Tongguan. The main tributaries in the project area are the Ba, Chan, and Zao rivers. Recent water quality monitoring results of these important water bodies are shown in Table 1. The water quality of the Chan River meets the class II standard. The Ba and Zao rivers are heavily polluted, mainly with organic materials from domestic and local industrial sources.

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<sup>2</sup> This represents the calculated damage risk according to Chinese standards over the next 100 years in a given area. Anything below 6 is not considered a high-damage intensity risk. The project area is considered to be at moderate risk.

**Table 1: Average Ambient Water Quality Conditions (2002)**

River and Sampling Location	PH	CODMn (mg/L)	Oil (mg/L)	SS (mg/L)	Standard
Chan River (Matengkong)	8.20	2.79	0.05	0.49	Class II
Ba River (Daminggong fishpond)	8.17	5.24	0.06	1.22	Class III
Zao River (residential area of Rail Equipment Factory)	8.30	114.36	5.49	273	Class V
Class II/III/IV/V <sup>a</sup>	6~9	= 4/6/10/15	= 0.05/0.05/0.5/1		

COD = chemical oxygen demand (manganese method), SS = suspended solids.

<sup>a</sup> Limits are from PRC Standard GB 3838-2002. According to the approved standards by the Shaanxi Environmental Protection Bureau, Class II and Class III are the standards for assessing the water quality of the Chan River and the Zao River, respectively. The two rivers are tributaries of the Wei River. The Chan River is the drinking water source of local inhabitants. It also is used for flood control and irrigation purposes. It is prohibited to discharge wastewater from any new project into the river, and it cannot be used for any purpose because of the high pollution.

Source: EIA Report.

## 5. Air Quality

12. The EIA documented ambient air quality conditions at six temporary sampling stations near the project (Table 2). Baseline measurements indicate that for ambient air quality, the concentrations of carbon monoxide (CO) and nitrogen oxides (NO<sub>x</sub>) at all sampling points are at the upper limits of the national air quality standards for urban residential, mixed-use, and rural areas. The daily average total suspended particulates (TSP) concentration exceeds the national standards at all sampling sites. TSP pollution is aggravated by the low precipitation rates during winter, dust generated in cultivated areas, and naturally occurring dust transported from the western provinces of the PRC.

**Table 2: Average Ambient Air Quality Conditions (2002)**

Sample Location	NO <sub>2</sub> (mg/Nm <sup>3</sup> )		CO (mg/Nm <sup>3</sup> )		TSP (mg/Nm <sup>3</sup> )
	Hourly avg.	Daily avg.	Hourly avg.	Daily avg.	Daily avg.
Liangjiajie village	0.006~0.012	0.009	0.875~1.750	1.427	0.791
Mujiangwang village	0.008~0.015	0.012	0.625~2.500	1.552	0.515
Waizicun village	0.006~0.012	0.009	0.125~2.000	1.188	0.461
Residential area of Rail Equipment Factory	0.008~0.014	0.009	1.250~2.375	1.886	0.461
Dongchaojiazhuang village	0.008~0.012	0.009	1.250~1.875	1.604	0.455
Liucunbu village	0.006~0.014	0.010	1.125~2.000	1.550	0.534
Class I/II/III <sup>a</sup>	0.15/0.15/0.30	0.10/0.10/0.15	4.0/4.0/6.0	10/10/20	0.12/0.30/0.50

<sup>a</sup> Limits are from PRC Standard GB3095-96: Class I is for the natural protection zones, scenery spots, and other special places. Class II is for residential areas; mixed areas of residential, commercial, and communication areas; culture areas; general industrial areas; and rural areas. Class III is for specific industrial areas. Class II is the standard approved by the Shaanxi Environmental Protection Bureau as the assessment standard for the Project.

Source: EIA Report.

13. Monitoring data from the past 5 years shows that air quality is worst during the winter due to heating, with peak pollution from December to February. This trend is expected to change due to the demolition of small boilers and vehicle conversion from gasoline to CNG and other cleaner fuels. Annual averages indicate overall reductions in NO<sub>x</sub>, sulfur dioxide, and TSP during the past several years (Appendix 1).

## **6. Noise**

14. Ambient noise level conditions around residential areas and schools near the proposed alignment were monitored at 13 temporary monitoring stations near the project alignment. The noise levels at villages range from 52 to 55 decibels acoustic (dB[A]) during daytime and 37 to 43 dB(A) at night, which is within the standards. Noise levels at schools range from 49 to 66 dB(A) during daytime and 42 to 49 dB(A) at night. This falls within the upper limits of the standards for most of the school locations. The exception of 66 dB(A) in the daytime is exceeded at the Rail Equipment Factory school.

## **B. Ecological Resources**

### **1. Flora and Fauna**

15. The project corridor contains large areas devoted to productive farmland, such as crops and fruit orchards. Some trees and landscaped greenbelts also exist in the project corridor. Animals are mainly domestic livestock, with wildlife limited due to intense human activity. There are no sensitive or endangered species (flora or fauna) in the alignment corridors.

### **2. Fisheries and Aquatic Biology**

16. Existing aquatic habitats in the Ba, Chan, and Zao rivers and their tributaries have been disturbed by decades of unmanaged aggregate mining and discharge of sewage, solid waste, and other effluents. The rivers support only a few native fish, primarily carp and minnows. Grass carp, silver carp, and other carp species are found in some artificial fishponds adjacent to the project alignment.

## **C. Human/Economic Development and Quality of Life Values**

### **1. Population**

17. The population of Xi'an in 2001 was 6.9 million people, with a density of 696 persons/square kilometer (km<sup>2</sup>). The population of the urban area was 4 million with a density of 2,037 persons/km<sup>2</sup>. In the project area, the populations of Yanta, Weiyang, Baqiao, and Beilin districts are 588,102, 385,731, 433,623, and 634,707, respectively. The population of non-agricultural persons accounted for 74.6%, 46.4%, 36.9%, and 98%, respectively, of these districts in 2001.

### **2. Land Use**

18. The project corridor is on the periphery of the Xi'an urban area, comprising mostly farmland with spots of intense human settlement activity around established villages. It is currently estimated that the Project will permanently acquire 971 hectares (ha) that is owned by village collectives; another 300 ha is already state-owned.

### **3. Economic Conditions and Quality of Life**

19. In 2001, the gross domestic product of Xi'an was CNY73,400 million. The average annual income of urban residents was CNY6,705, which was less than that the national average of CNY6,860. Annual agricultural income was estimated at CNY2,489, which was slightly higher than the national average of CNY2,366.

20. Xi'an is a major educational center and the largest urban center in the northwest PRC. There are 32 colleges and 47 junior colleges. The number of college students per thousand people is 36.6, higher than in most cities in the PRC.

21. There are 2,965 health institutions (clinics, hospitals, etc.) with 41,686 hospital beds in Xi'an. The number of health technicians per thousand persons is 7.6. As a consequence, health care services are fairly good.

22. The road network density in the Xi'an urban area was 3.0 km/km<sup>2</sup> in 2001, lower than the recommended 5.4-7.4 km/km<sup>2</sup>. The average road area per person was 5.12 square meters (m<sup>2</sup>), lower than the national average of 9.09 m<sup>2</sup>.

#### **4. Sites of Cultural and Historic Importance and Tourism Resources**

23. Xi'an City, the capital of Shaanxi province, is one of the oldest "birthplaces" of the PRC. It was an important station on the Silk Road, and the capital of 12 dynasties for over 3,000 years. This area is well known for its abundant historical and cultural resources. Major historical and tourism sites close to the alignment are the Erfanggong Palace Remains of the Qin Dynasty, Great Wall Remains, and Jianzhang Palace Remains of Han Dynasty. These sites are important elements of the character of Xi'an and are highly valued cultural/historical sites.

### **IV. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

#### **A. Topography, Geology, and Soils**

##### **1. Construction Period**

24. Some erosion during construction is unavoidable and will occur as a result of runoff in areas of excavation and other earthworks. Failure to properly clean up and replant borrow areas, fill areas, and spoils disposal areas would lead to erosion. Short- or long-term diversion of rivers for bridge construction could lead to future bank erosion unless properly designed and constructed.

##### **2. Operation Period**

25. Runoff from areas not properly resurfaced or revegetated would lead to erosion. Long-term diversion of major drainage courses or any significant alteration of surface water hydrology along the ring road would also lead to erosion.

##### **3. Mitigation**

26. The following soil erosion mitigation measures will be implemented:

- (i) Borrow and fill areas will be excavated and filled utilizing best practice rehabilitation measures. Slope stability at cut faces will be maintained by "benching" and by installing erosion protection devices during construction such as silt barriers and sedimentation ponds. No arbitrary borrowing will be allowed. Topsoil will be stockpiled for later rehabilitation activities.
- (ii) An erosion protection plan will be developed and approved prior to construction. Approved borrow pit locations will be defined in construction tender documents. All borrow materials, solid wastes, and temporary sewerage disposal sites will require prior approval of the Xi'an Environmental Protection Bureau (XEPB).

- (iii) Trees along borrow pit edges will be protected. Random movement of heavy machinery at excavation sites will be prevented. Large borrow areas will be replanted or transformed into ponds after consultation with local authorities.
- (iv) All cut slopes, embankments, and other erosion-prone working areas will be stabilized while work is going on to the extent feasible. All earth disturbance areas will be stabilized within 30 days after earthwork has ceased at the site.
- (v) Disposal of waste soil and rock, both the placement of the materials (not indiscriminate dumping) and rehabilitation methods will be carefully considered and planned as a part of the erosion protection plan. Placement areas will be selected with aesthetic considerations in mind as well as for economy and distance of transport.
- (vi) Spoil placements will be stabilized considering of the type of material to be placed. Rehabilitation will include surface compaction as well as planting with vegetation types that have root systems that hold the soil in early stages, then with trees and larger vegetation at later stages.
- (vii) Temporary earth settlement basins will be provided at locations where runoff may occur during construction. After construction, such drains will be refilled.
- (viii) Temporary construction camps and storage areas will be designed to minimize land area required and minimize impacts on soil erosion. Use of abandoned establishments for such activity will be encouraged.
- (ix) Maintenance of ring road slopes, cuts and embankments such as watering, fertilizing, pest control, and replanting when needed will be continued during operations. Maintenance of all such areas will be budgeted as a part of regular ring road maintenance.

## **B. Groundwater and Surface Water Quality**

### **1. Construction Period**

27. Alteration of natural drainage can result in erosion as well as flooding and absorption of pollutants from areas not previously subject to flooding. Irrigation flows of paddy fields are a critical element in crop production. Any interruption of these flows during construction or any permanent alteration of these flows would have a direct impact during the construction period. Local flooding could be caused by excessive watering or flushing of construction sites. Contamination can be caused by sewage from construction camps. Sand and gravel removal from river beds is not expected to have any adverse impact but will be monitored, and sites for such materials approved prior to construction. There is a possibility of groundwater contamination and surface water contamination from bridge construction. Surface water or groundwater may be contaminated by improper utilization or storage of construction materials, such as chemicals or petroleum products.

### **2. Operation Period**

28. The principal impact during operation is expected to be surface water and groundwater contamination from rainfall runoff from the Project.

### **3. Mitigation**

29. The following water quality mitigation measures will be employed:

- (i) All toxic, hazardous, or harmful construction materials including petroleum products will be managed to prevent entry to surface water or groundwater systems. Construction area drainage will be controlled through the preparation of settling basins and planted runoff areas.
- (ii) To maintain adequate flow in the irrigation system, drainage installations and piping (culverts, side drains, bridges) will be planned and designed based on hydrological studies and evaluations of irrigation flows. Contaminated road runoff will be separated from irrigation and drinking water by proper design of piping and drainage facilities wherever feasible.
- (iii) Toilet facilities for construction workers will, at the minimum, be pit privies that are regularly serviced and maintained.
- (iv) Solid waste disposal will be handled in consultation with local authorities to protect surface water and groundwater resources.
- (v) Roadway runoff will be directed to detention and sedimentation basins or allowed to flow over grassed areas as long as such areas have adequate erosion protection.

## **C. Flora and Fauna**

### **1. Construction Period**

30. Loss of vegetation and natural habitat will occur. The EIA estimated the loss of various land types including orchards and other productive crops. Land acquisition impacts are concentrated mainly in Weiyang District, which accounts for half of the total land area to be acquired. Agricultural land acquisition was estimated to be 776 ha, accounting for 80% of the collective land required for the project. Land area taken from orchards was estimated at 111 ha, accounting for 11% of land taken for the Project. There is expected to be no impact on rare or endangered plants and animal species.

### **2. Operation Period**

31. No plant or animal impacts are expected during operation other than the effects from vehicle exhaust emissions.

### **3. Mitigation**

32. The following are mitigation measures for minimizing impacts on flora and fauna:
- (i) Since soil erosion will occur in areas left without vegetation, stabilization by revegetation will be necessary. The use of fast-growing local grasses, shrubs, and trees is recommended.
  - (ii) Trees reduce erosion and noise, and they improve air quality by producing oxygen. There is consequently a large budget for green space landscaping. The revegetated roadside areas may also eventually provide a habitat for common species of small animals and birds. Replanting along the road will consist of a mix of local vegetation species similar to the mix and composition found locally. Consultation with the Xi'an Forest Bureau will be undertaken to confirm appropriate species for project landscaping. This will be made a part of the contractor's responsibility, to be estimated and budgeted as a construction cost. Plantings will be placed in the median strip, on embankments and slopes, on the inner areas of interchanges, and along the sides of the road.
  - (iii) Most of the naturally occurring animal species have long since been lost to the

immediate area, other than some common species of birds, small mammals, and amphibians. However, every effort will be made to stop and reverse the steady decline in available habitat by avoiding established natural areas and providing an extensive landscaping budget to enhance buffer landscaping along the project corridor. Trees and other vegetation will not arbitrarily be felled outside of the right-of-way (ROW).

33. All lost vegetated and natural habitat will be offset by replanting an equivalent or larger area. The Xi'an Forest Bureau and XEPB will be consulted during preliminary design to ensure that this requirement is met.

## **D. Air Quality**

### **1. Construction Period**

34. Dust from aggregate production, concrete mixing, and construction traffic, and emissions from asphalt plants and heavy diesel equipment will affect air quality during the construction phase. Impacts will be confined to areas downwind from construction and materials processing sites.

### **2. Operation Period**

35. The principal air quality impacts during operation will come from vehicle emission pollutants. Pollutants monitored will include CO, NO<sub>x</sub>, TSP, and total hydrocarbons (THC). The air quality projection model used in the EIA considered several factors to predict impacts during operation, including diffusion patterns, mass and concentrations of the pollutant source (i.e., vehicle emissions based on traffic forecasts), wind velocity patterns, and project lifetime. Baseline monitoring indicates that NO<sub>x</sub> and CO concentrations in the ambient air along the proposed alignment meets national standards, while TSP is above the standard. Modeling results showed that CO and THC will be less "with" the project, but TSP will increase with the project (Appendix 2).

### **3. Mitigation**

36. The following air quality mitigation measures will be utilized:

- (i) Asphalt plants and mixers will be sited as far away as possible (preferably a minimum of 200 m downwind) from the nearest human settlement areas and other sensitive land use sites.
- (ii) Emissions control equipment will be installed on batch plants; trucks carrying material that may generate dust will be covered.
- (iii) Exposed construction access roads and exposed construction sites will be watered on a set schedule depending upon weather conditions.
- (iv) Proper maintenance of diesel equipment and curtailment of unnecessary idling will be practiced to help control emissions.
- (v) New residential, hospitals, health clinics, schools, and other sensitive land use construction will be prohibited within 60 m of the edge of the ROW of the new road facilities.
- (vi) Cleaner fuel supplies (e.g., CNG) are being expanded, and various vehicle emission reduction strategies will be implemented to mitigate NO<sub>x</sub>. National and local policies already emphasize reduction of vehicle emission pollutants through a mix of cleaner fuels, improved vehicle emissions controls, traffic demand

management, and improved public transportation options.

## **E. Noise Impacts**

### **1. Construction Period**

37. Noise impacts during construction will result mainly from operation of heavy machinery, including concrete mixing plants and stone crushing and screening plants. In addition, there is expected to be a small amount of blasting in areas of rock excavation. Noise intensities from these activities and equipment will range from 80 to 100 dB(A) at the source. Sustained noise levels during construction are expected to exceed 70 dB(A) at a distance of 200 m from the source.

### **2. Operation Period**

38. A predictive model was used to forecast noise impacts, which considered several factors including noise levels generated by various types of vehicles; operating speeds; period of assessment (the peak hour); traffic volume forecasts; distance from point source to noise receptor location; distance from baseline monitoring location; and attenuation factors regarding noise absorption, including other noise obstructions such as buildings and land forms. Within 200 m of the Project, 47 villages and 13 schools were identified as sensitive receptors. Based on traffic forecasts, 5 villages will be affected by 2015, increasing to 8 by 2025. The maximum exceedance level was projected to be 2.0 dB(A) at night. At 8 of the 13 schools, the standard will be exceeded by 7.0 dB(A) at night by 2025. The noise impact projections presented in the EIA are considered a "worst case" scenario.

### **3. Mitigation**

39. The following noise mitigation measures have been identified:

- (i) To reduce nighttime disturbance from construction noise, construction activities within 500 m of residences will be prohibited between the hours of 2200 and 0600.
- (ii) To help avoid the adverse impacts from noise during operations, new sensitive receptor construction (i.e., schools, hospitals, residential uses, etc.) will be prohibited within 60 m of the edge of the highway or ROW.
- (iii) Additional surveys will be undertaken prior to or during preliminary design to refine noise impacts and develop appropriate abatement measures in consultation with those affected. Preliminary engineering design and projections of noise impacts based on adjusted traffic forecasts will be reviewed to determine whether any other noise-sensitive areas will be affected in addition to the areas listed in the EIA.
- (iv) Noise-sensitive locations identified in a subsequent survey will be the subject of design analyses to incorporate appropriate mitigation measures if needed. Solid masonry walls, earth berms, cuts in the natural terrain, other types of noise barriers, and depression of the road below the surrounding surface are considered effective noise attenuation methods. Planting of vegetation screens should not be considered, by itself, as an effective method for alleviating serious impacts. The cost of these measures will be included as part of the final design cost estimate if needed.

## **F. Land Acquisition and Resettlement Impacts**

40. The Project will result in significant land acquisition and resettlement. A draft resettlement plan (RP) includes a detailed description of land acquisition needs, resettlement procedure policies, compensation, institutional requirements, and monitoring and evaluation measures (Appendix 3). It is estimated that the Project will permanently acquire 971 ha of collectively owned land. Residential land area to be taken will be 84 ha, 8.6% of total land acquisition. Agricultural land acquisition was estimated to be 776 ha, 80% of the land required. Land area taken from orchards was estimated at 111 ha, 11.4% of land to be taken. The Project will also require another 300 ha of state-owned land, which includes residential dwellings and enterprises.

41. According to initial impact assessments, the Project will affect some 90 villages and 17 subdistricts/townships with varying degrees of impact. Ongoing surveys are covering all categories of affected people – rural/urban, agricultural/commercial, and other institutions. The project proponent has taken efforts to minimize the land acquisition and resettlement impacts by (i) acquiring the absolute minimum farmland, (ii) demolishing as few homes as possible, and (iii) placing the alignment close to villages without going through them. When aligning the route, the objective has been to avoid densely populated residential areas.

42. Based on impact data and field surveys, it is estimated that (i) 1,735 rural households with 7,361 persons will be affected only by loss of land, (ii) 4,277 households (rural and urban) with 18,047 persons will be affected by residential/commercial area relocation, (iii) 2,823 rural households with 11,852 persons will be affected by both land loss and building/house relocation, and (iv) 48 enterprises with 4,100 persons will also be affected. It is estimated that 41,360 persons (8,835 households) will be affected in total. Detailed measurement surveys to account for a full census of project-affected persons will be undertaken when the detailed design is available. As a consequence, final adjustments in total population to be relocated are expected.

43. The RP sets out the compensation and mitigation entitlements for affected people in order to comply with Government's regulations and ADB's policy on involuntary resettlement. Rehabilitation plans are currently being formulated for the seriously affected villages based on consultation with local officials and village representatives. Resettlement information booklets are being prepared for distribution to affected villages, which explain the project impacts, entitlements, compensation standards, and procedures for resolving grievances. When the final road alignments are approved, the detailed measurement survey of affected land, housing and people will be carried out and an updated RP will be submitted to ADB.

## **G. Socioeconomic Impacts**

44. The regional economy is expected to improve due to improved transport access and efficiency, with benefits accruing to the local population. Access will be improved for local residents for necessities, consumer goods, health care, and transportation overall. Response times for emergency services will be improved. Income levels of local residents are expected to rise as a result of improved transport efficiency and reduced vehicle operating costs.

45. More diversified employment opportunities are expected to result, and some resettled persons will acquire improved skill levels via training for new employment. There will be temporary benefits to local residents as they provide food, goods, and services to construction workers, and as civil works contractors make incidental purchases in the local economies. It is estimated that some 22,000 to 23,000 workers will be employed during construction, mostly as

unskilled and semiskilled laborers. It is anticipated that persons residing within the corridor as well as the urban poor will benefit from these job opportunities. There will be opportunities for the urban poor users of the Project to benefit during operations and also through available employment opportunities during construction.

46. Induced development will result from the proposed Project at key interchange and access ramp locations near existing urban areas unless controlled by local government intervention. This development should occur proportionally to the induced traffic forecast. More intense industrial or commercial development and associated employment opportunities will likely occur around the 12 urban interchange locations.

### **1. Construction Period**

47. The construction work force will be housed temporarily at various sites. The presence of a large number of workers from outside of the local villages is expected to have temporary and minor impacts from social and economic interaction with the local population.

48. The amounts and types of productive lands to be taken by the Project are indicated in the RP. Some cultivated fields and other production areas will be separated from the farmers' houses by the Project.

49. During construction, there will be temporary diversions of traffic along the existing road network where the new road crosses existing roads, as well as temporary blockage of access to structures and roadside areas.

50. Overall housing quality will be improved as older houses are demolished and replaced by new houses built to higher standards. New houses will be served by water, electricity, and other urban amenities. Residents generally approve of the removal of the old structures and resultant upgrading actions. A positive benefit will occur from provision of additional housing to allow younger members of extended families to establish separate households in new housing, which is seen as a desirable result by the families involved.

51. Some negative impact will result from separation of communities by the road, with respect to access to schools, health facilities, and other community facilities. Similar social impacts will result from separation from neighbors and families and disruption in patterns of social interaction. Some temporary disruption will occur to schools and other community facilities near the proposed alignment during construction. The EIA indicated that three schools and one university will be affected by the Project. Of these, the Rail Equipment Factory Primary School will be relocated.

### **2. Operation Period**

52. Existing roads near the Project will likely experience initial traffic congestion after the completion of the limited-access ring road and prior to completion of the connector roads. Improved operating conditions on the existing road and high design standards on the new road will improve road safety and decrease the accident rate on the existing roads. Separation of slow- from high-speed traffic will enhance safety conditions. Reduction of congestion on the existing roads will facilitate the operation of buses and other public transport used for short and medium distance travel on those roads, decreasing travel time and improving the comfort level of passengers.

### **3. Mitigation**

53. The following socioeconomic and community mitigation measures will be implemented:
- (i) Removal of houses, relocation of population, and loss of productive land will be minimized by careful final route selection and sensitive design.
  - (ii) Compensating and minimizing the adverse impacts from resettlement will be achieved through active consultation and agreements with affected people. The RP will be followed with respect to compensation, relocation, reallocation of land, training, and monitoring.
  - (iii) To minimize the impact of separation of communities, and separation from fields and other urban development activity centers, 155 pedestrian crossings (overpasses/underpasses) are planned, allowing crossings at an average of every 500 m along the project roads.
  - (iv) Health clinics will be provided in construction camps to avoid overloading local community health facilities. In addition, civil works contractors will coordinate with local health authorities in each construction area to facilitate the screening of construction workers for specified communicable diseases and to coordinate emergency response actions for large accidents.
  - (v) Child labor will not be permitted. Local authorities will enforce all applicable PRC labor standards.

## **H. Historic and Cultural Impacts**

### **1. Construction Period**

54. Two designated historic or cultural protection construction buffer areas are within the project area: Erfang Palace Remains of the Qin Dynasty, and the Chang'an City remains of the Han Dynasty. Both are protected areas with clearly demarcated boundaries. The proposed alignment will run parallel to but not traverse these two zones. The possibility exists for discovery of unexplored archaeological sites during excavation for site clearance. The need for baseline surveys before beginning of construction will be further evaluated during preliminary design. A contingency budget for preliminary surveys has been included in the environmental mitigation costs.

### **2. Operation Period**

55. No impacts on historic or cultural resources will occur during operation, except for possible increases in vehicle emissions.

### **3. Mitigation**

56. Prior to construction, cultural relic authorities will conduct additional surveys to determine if any potential for sites may exist. The Xi'an Cultural Bureau will monitor site clearance, excavations, and other soil disturbance areas and report any finds to authorities for further investigation before construction work continues in the immediate area of the site. If any cultural relics sites are found, work will stop immediately until authorities have a chance to evaluate the significance and nature of such findings. No borrow sites or construction access roads will be permitted in the two protected areas. In the unlikely event of a new archeological discovery, the project proponent will consult with other government agencies to determine if changes in alignment are needed.

## I. Hazardous Materials Spills

### 1. Construction Period

57. The EIA analyzed risks of hazardous materials spills on the Ba and Chan rivers. During construction, there is potential for spills in construction areas, including material storage and staging areas.

### 2. Operation Period

58. The predicted frequency of severe traffic accidents leading to water pollution of the Ba and Chan rivers or other sensitive land is low. The risk of spills causing significant contamination will be decreased due to improved operating conditions with the Project.

### 3. Mitigation

59. The following hazardous spills prevention and mitigation measures have been included:

- (i) The Project design includes comprehensive pipeline systems for utilities, paved side ditches, and retention/settling basins. While the primary function of these structures will be to control rainfall runoff, they will be designed to allow containment of hazardous materials spills.
- (ii) During construction, monitoring will be carried out to observe whether hazardous materials, including petroleum products, are being transported, handled, and stored properly.
- (iii) A spill contingency plan will be prepared and implemented by the project proponent. The plan will specify authority, responsibility, and appropriate response actions; equipment, tools, and material to be maintained and used to control various types of spills; and training requirements for maintenance, operations, management, supervisory, and administrative personnel. The plan will also include provisions for driver training and certification, transport company licensing, cargo placarding, and strict liability for vehicle and cargo owners, in accordance with PRC laws, regulations, and standards.

## V. ALTERNATIVES

60. **“No-Build” Alternative.** The “no-build” alternative would be inconsistent with the long-term urban transport development plan for Xi’an. The continued exclusive use of existing roads provides a possible, but not more feasible or environmentally sustainable alternative. Congestion would increase until existing roads are overloaded, resulting in increased air pollution, noise, and water pollution. A comparison of potential impacts of the “with” and “without” Project scenarios is shown in Appendix 4.

61. **Other Transport Improvements and Traffic Management Alternatives.** Improvement of alternate modes of transport by themselves would not accomplish the primary objective of the Project, which is to facilitate high-speed periphery movement of high-value goods and passengers through a significant component of the regional land surface transport network around Xi’an. Traffic demand management is the least-cost alternative, but by itself would not meet the objectives of the Project; it is considered an important element in the urban transport master plan. Mass transit options would not provide the through-traffic and freight transit capacity needed in the area. Construction of new passenger systems would extend beyond the implementation scheduling of the proposed Project, and might not be least-cost, depending on

technology employed.

62. **Alternative Project Alignments.** Various alignments have been considered. The proposed design optimizes interconnection with the existing orbital roads; and minimizes land acquisition, demolition, earthwork, large bridge structures, and total cost. Minor alignment adjustments within a defined project corridor may be required during preliminary and final design.

## **VI. ECONOMIC ASSESSMENT**

### **A. Environmental Management and Mitigation Costs**

63. Total environmental protection costs are estimated to be CNY424 million, approximately 6% of total project costs (Table 3). Environmental monitoring, evaluation, and capacity building costs total CNY12 million, of which CNY5 million is required during construction, and CNY7 million during operations. Resettlement and land acquisition costs are estimated to be CNY1.4 billion.

### **B. Benefits of Environmental Mitigation**

64. The main benefits of the environmental mitigation plan are (i) ensuring that environmental standards are met during design, construction, and operation of the Project; (ii) providing offsets to negate project impacts, e.g., in the form of landscaping and greenbelts; and (iii) construction of amenities such as pedestrian crossings, which are expected to prevent serious injury and death of pedestrians.

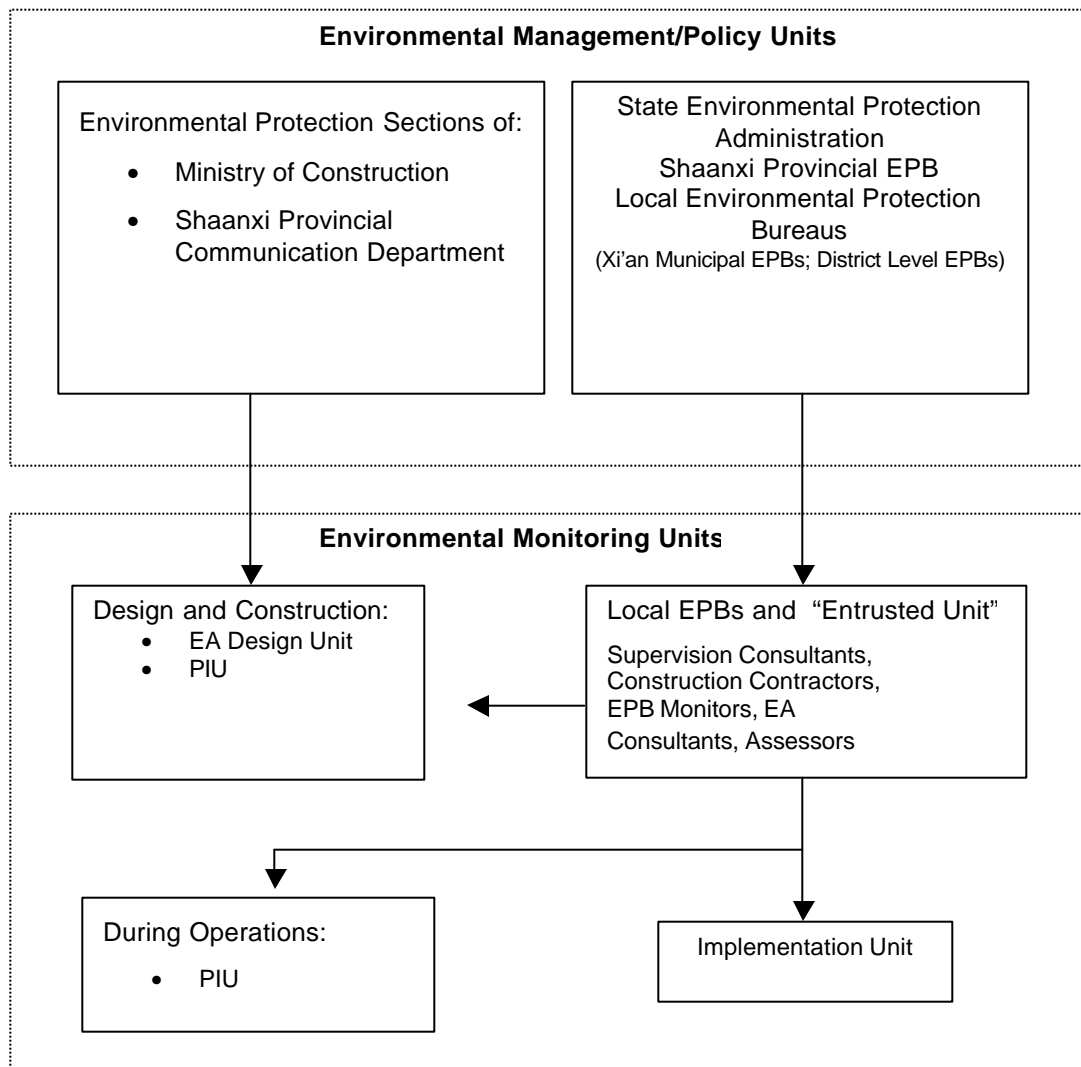
**Table 3: Environmental Management and Mitigation Costs  
(CNY '000)**

<b>Component</b>	<b>Cost</b>
<b>Monitoring, Evaluation, and Capacity Building</b>	
Monitoring by outside agencies (Construction)	384
Monitoring by outside agencies (Operations)	3,850
Implementing agency capacity building (Construction)	480
Implementing agency capacity building (Operations)	300
Consultant technical assistance (Construction and Operations)	6,887
<b>Subtotal</b>	<b>11,901</b>
<b>Environmental Engineering Components</b>	
Drainage, preventing of soil erosion and air and water pollution, utilities relocation	<b>3,418</b>
<b>Environmental Amenities</b>	
Pedestrian overpasses/underpasses	186,000
Planning and lands capping	218,770
Relics protection	3,600
Noise insulation windows	540
<b>Subtotal</b>	<b>408,910</b>
<b>Total (for all environmental related components)</b>	<b>424,229</b>
<b>Additional Costs</b>	
<b>Social Impact Mitigation</b>	
Land acquisition, resettlement, and compensation restoration of livelihoods	<b>1,372,000</b>
<b>Urban Transport Component</b>	
CNG filling stations	40,000
Mobile emission test vehicles	5,100
Emission control action plan	5,550
<b>Subtotal</b>	<b>50,650</b>
<b>Total of Environment and Social Mitigation Costs</b>	<b>1,846,879</b>
<b>Total Project Cost</b>	<b>6,698,520</b>

## **VII. INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING**

### **A. Institutional Requirement**

65. Two types of organizations implement various environmental functions: environmental management agencies, responsible for formulating policies and implementing regulations, and environmental monitoring units, which gather and analyze data to evaluate project impacts and the effectiveness of environmental mitigation programs. The organizational structure for implementing the environmental management program is presented in Figure 1.

**Figure 1: Environmental Management Organization**

EA = Executing Agency, EPBs = Environmental Protection Bureaus, PIU = Project Implementation Unit.  
Source: EIA Report

66. The principal environmental policy and management agency in the PRC is the State Environmental Protection Administration (SEPA), which is responsible for policy formulation, legislation, promulgation of national standards, oversight of provincial and municipal EPBs, and—in some cases—direct enforcement action. The Shaanxi Provincial EPB and XEPB have primary responsibility for ensuring that the Project complies with all applicable environmental standards. The project proponent is responsible for incorporating government environmental policy into their activities, including administrative coordination of EIAs and monitoring. The project proponent and contractors have primary responsibility for compliance with EIA conditions, implementing the environmental management and monitoring plans, and performing routine compliance monitoring. The Xi'an and district EPBs will have primary responsibility for oversight, and will conduct supplemental monitoring as necessary to ensure compliance. Additional staff trained in resettlement and environmental disciplines will be part of a project implementation unit during construction and operations.

## **B. Environmental Monitoring**

67. The EA will be responsible for finalizing a detailed monitoring plan in advance of project implementation following the EIA recommendations. The monitoring plan will include the following elements:

- (i) a description of the sampling design (location of sampling station, frequency of monitoring, number of samples to be taken each time at a given station, etc.),
- (ii) methods to be used in sample collection and sample handling from the field to the laboratory,
- (iii) nature of output expected in the monitoring reports, and
- (iv) reporting schedule.

68. The environmental monitoring action plan is presented in Appendix 5.

## **VIII. PUBLIC INVOLVEMENT**

69. The Project has been widely publicized by local media, particularly in newspapers in Xi'an municipality and affected districts. Between July 2002 and February 2003, 33 focused group discussions were conducted, 1,550 households were surveyed in 22 affected villages, and 20 affected enterprises were interviewed. Public consultations were also carried out during the development of the EIA. A random sample of 80 people potentially affected by the proposed Project was interviewed during August 2002. The results of this consultation process indicated that most respondents

- (i) favored the Project as defined;
- (ii) supported the preferred alignment and acknowledged the poor existing traffic conditions;
- (iii) perceived that traffic noise and vehicular emissions would be potentially significant environmental problems;
- (iv) favored resettlement actions, if terms were agreeable, clearly defined, and administered on an equitable basis; and
- (v) indicated that they had no problems regarding the land uses of the Project or proposed future land uses of areas surrounding the Project.

70. The EIA document will be available upon approval by the Government and the summary EIA will be made available for wider distribution to the public. The Chinese version of the EIA will be available in the Project's office for reference to enhance the disclosure and review process by the public and other interested stakeholders during project preparation.

## **IX. CONCLUSIONS**

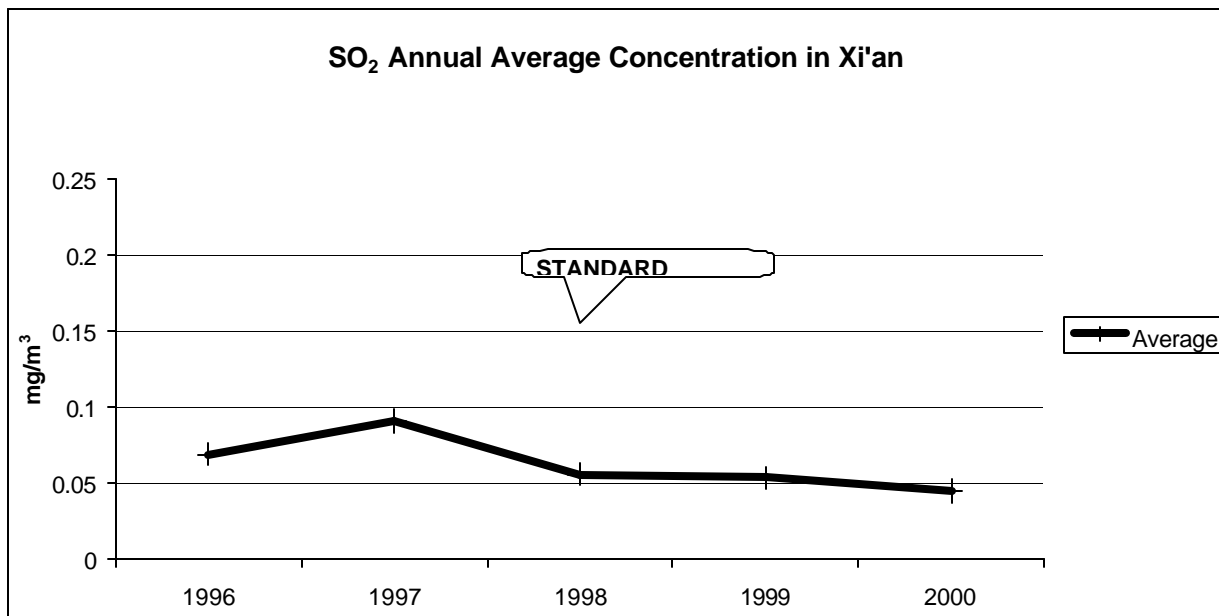
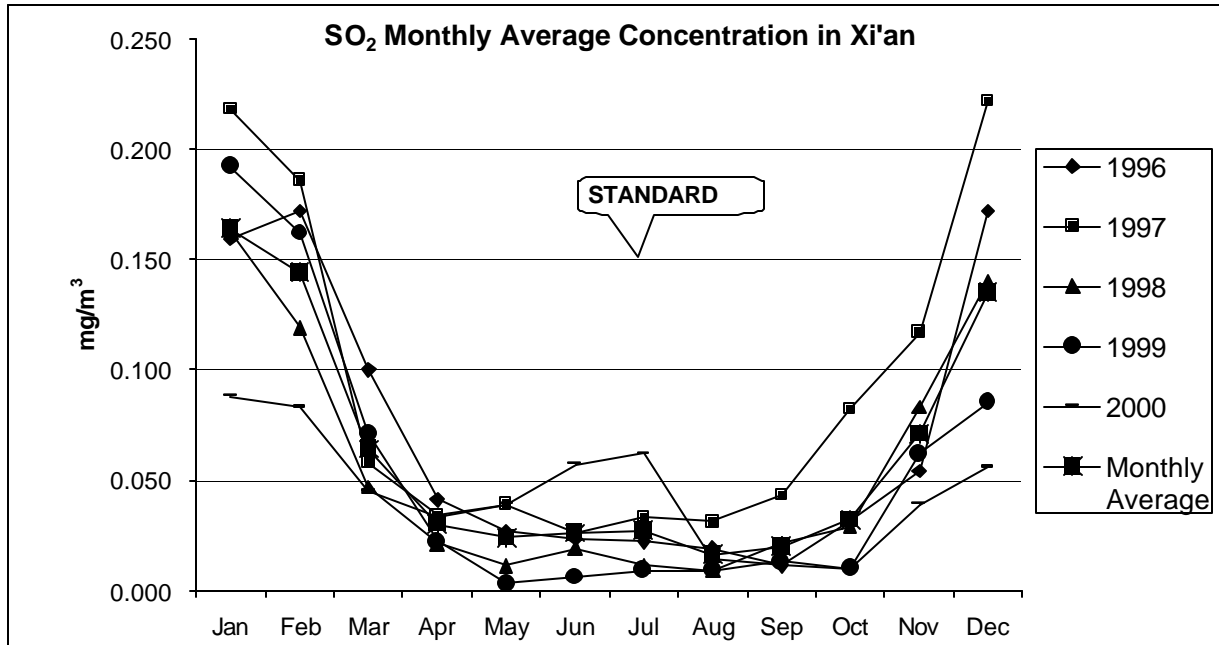
71. The EIA concluded that the Project's environmental impacts would be minimized provided that mitigation measures and monitoring actions as defined in it are fully implemented. The likely positive benefits are expected to offset the unavoidable negative affects. Any residual negative impacts will be offset by economic and social gains accruing to the affected communities. A net reduction in adverse impacts on air quality and noise is anticipated due to the rerouting of traffic from the existing roads in densely populated areas to the project road. The design standards and operating characteristics of the new ring road and connector roads will improve safety and reduce the frequency of accidents. Conversion of land from existing uses to road uses represents an exchange of productive agricultural value for the productive value of enhanced mobile transport efficiency.

72. Environmental mitigation measures will be incorporated in the civil works contracts. Monitoring will be undertaken to ensure that environmental impacts will be minimized to acceptable levels, and that all PRC environmental standards and ADB environmental requirements are met. Domestic and international environmental/social consultants will be recruited under the construction supervision consulting services to prepare and supervise the implementation of the environmental management plan, monitor the environmental and social/resettlement impacts, and prepare related reports.

**AIR QUALITY DATA**

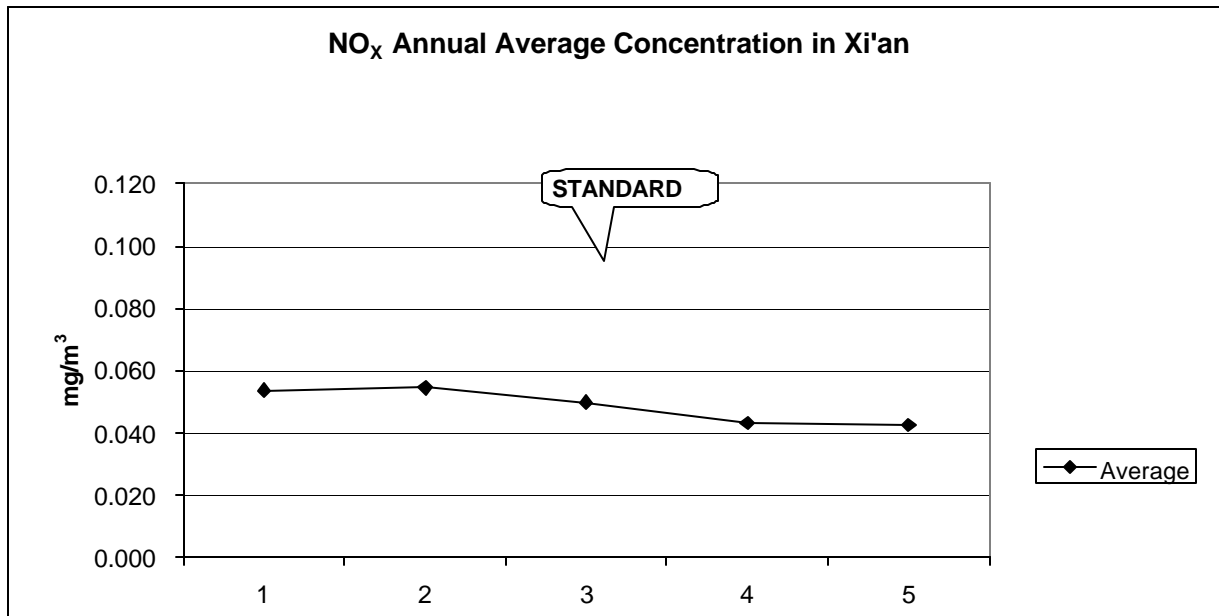
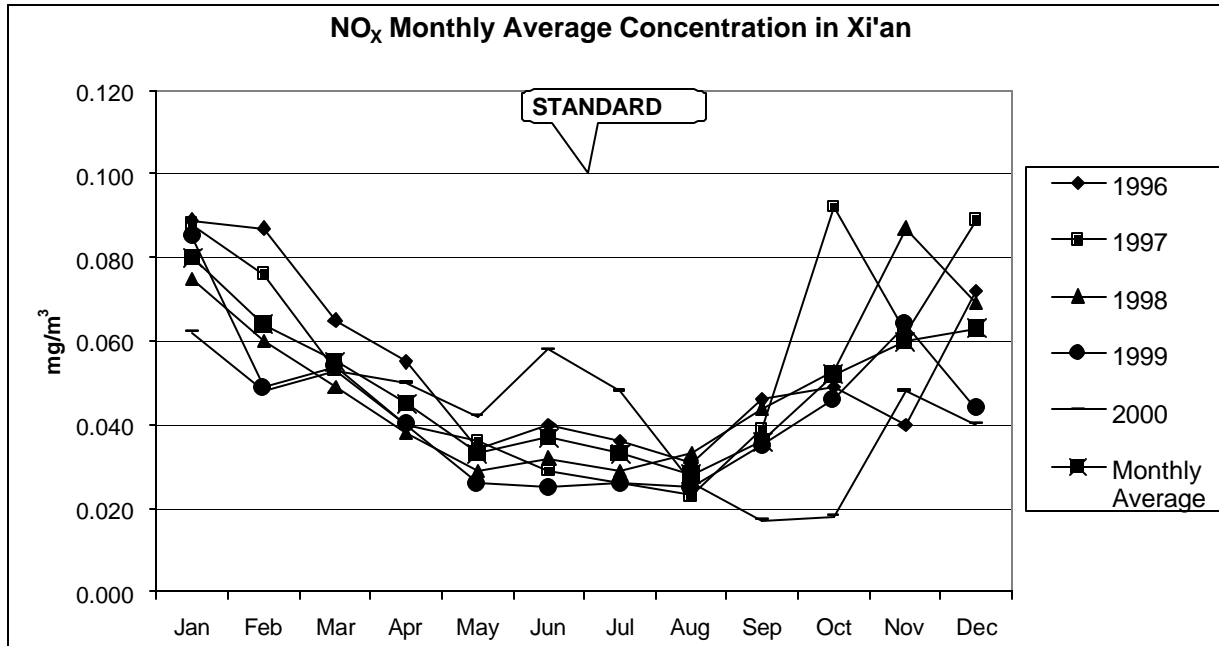
**Table A1.1: SO<sub>2</sub> Concentration in Xi'an**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	0.159	0.172	0.100	0.041	0.027	0.023	0.022	0.019	0.011	0.031	0.054	0.172
1997	0.218	0.186	0.058	0.034	0.039	0.026	0.033	0.031	0.043	0.082	0.117	0.222
1998	0.163	0.119	0.047	0.021	0.011	0.019	0.011	0.009	0.021	0.029	0.083	0.140
1999	0.192	0.162	0.071	0.022	0.003	0.006	0.009	0.009	0.013	0.010	0.062	0.085
2000	0.088	0.083	0.045	0.033	0.039	0.057	0.062	0.014	0.011	0.010	0.039	0.056
Monthly Average	0.164	0.144	0.064	0.030	0.024	0.026	0.027	0.016	0.020	0.032	0.071	0.135
Standard	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150



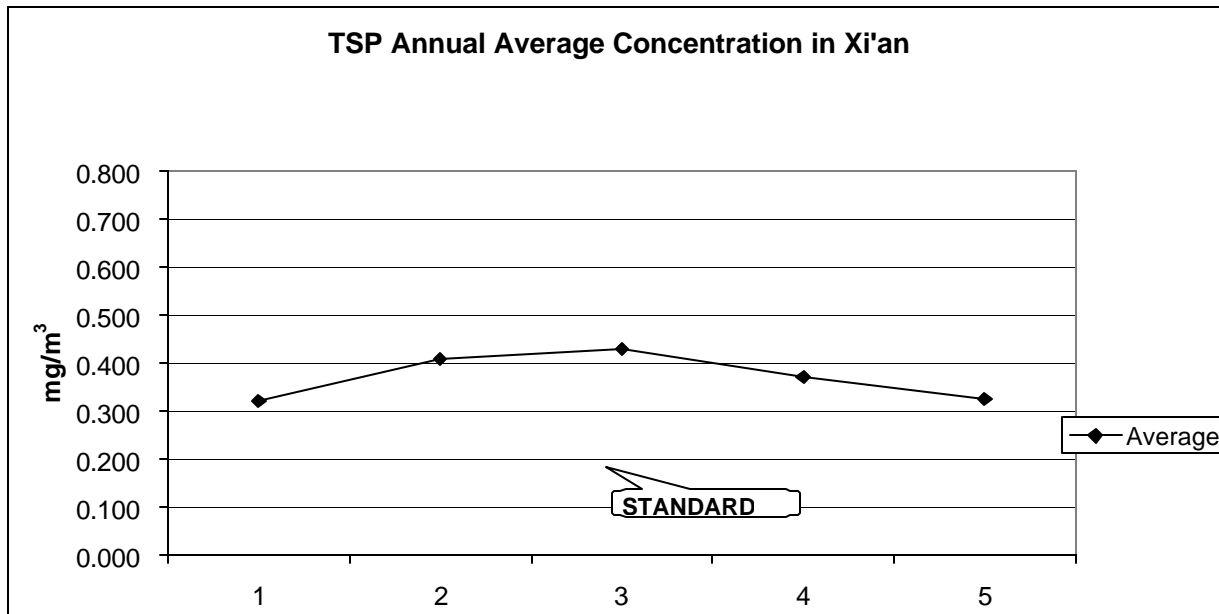
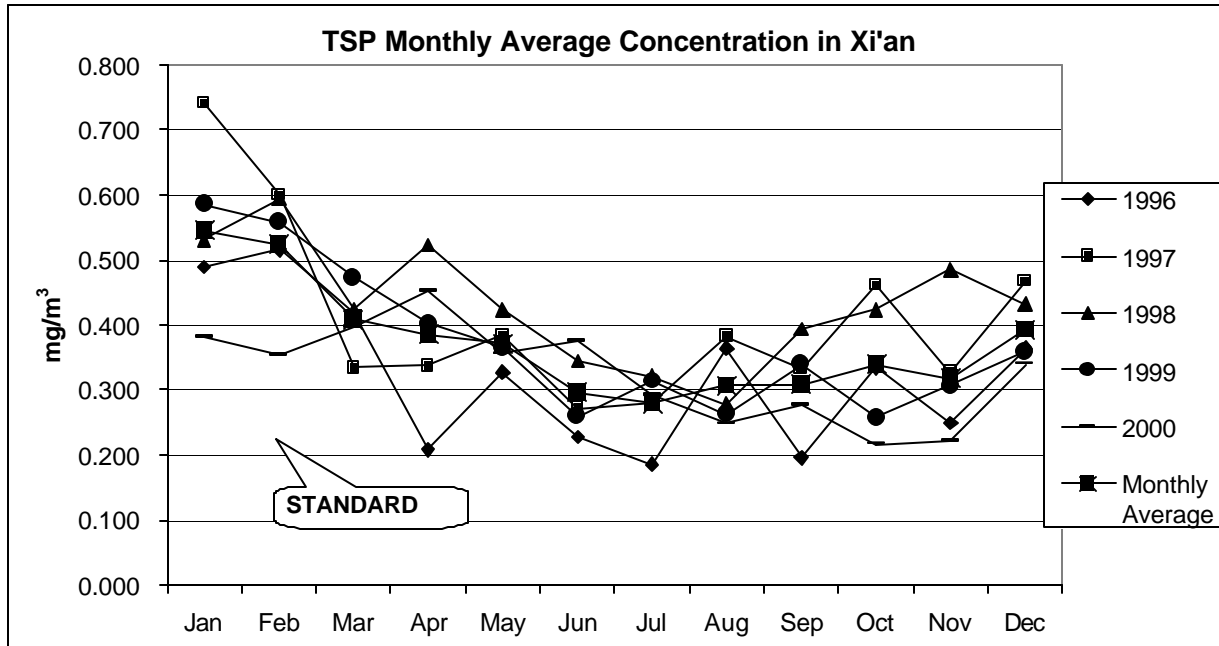
**Table A1.2: NO<sub>x</sub> Concentration in Xi'an**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	0.089	0.087	0.065	0.055	0.034	0.040	0.040	0.036	0.031	0.046	0.040	0.072
1997	0.088	0.076	0.053	0.040	0.036	0.029	0.026	0.023	0.039	0.092	0.062	0.089
1998	0.075	0.060	0.049	0.038	0.029	0.032	0.029	0.033	0.044	0.053	0.087	0.069
1999	0.085	0.049	0.054	0.040	0.026	0.025	0.026	0.025	0.035	0.046	0.064	0.044
2000	0.062	0.048	0.053	0.050	0.042	0.058	0.048	0.026	0.017	0.018	0.048	0.040
Monthly Average												
Average	0.080	0.064	0.055	0.045	0.033	0.037	0.033	0.028	0.036	0.052	0.060	0.063
Standard	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100



**Table A1.3: TSP Concentration in Xi'an**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	0.489	0.516	0.419	0.208	0.327	0.228	0.186	0.364	0.196	0.334	0.250	0.364
1997	0.741	0.600	0.334	0.337	0.385	0.272	0.280	0.383	0.332	0.462	0.327	0.468
1998	0.531	0.593	0.424	0.523	0.423	0.344	0.321	0.278	0.394	0.423	0.485	0.432
1999	0.586	0.557	0.473	0.402	0.366	0.259	0.314	0.262	0.339	0.258	0.307	0.360
2000	0.382	0.354	0.396	0.453	0.356	0.375	0.292	0.248	0.277	0.217	0.222	0.340
Monthly Average	0.546	0.524	0.409	0.385	0.371	0.296	0.279	0.307	0.308	0.339	0.318	0.393
Standard	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200



**URBAN AREA AIR QUALITY ANALYSIS  
'WITH' AND 'WITHOUT' PROJECT SCENARIOS AND RESULTS**

Assumptions: Traffic Forecast (Daily whole network in passenger car units [PCUs])  
Unit: PCU km (million)

Year	Project	PCU	Average speed (km/h)	PCUs/vehicle
2008	Without	36.52	43.1	1.17
	With	36.58	44.1	
2028	Without	133.65	28.0	1.34
	With	134.98	29.7	

Assumptions: Percentage Breakdown Assumed by Vehicle Type (%)

Year	Light	Medium	Heavy
2008	75.0	17.7	7.3
2028	78.9	16.3	4.8

Assumptions: Yearly Traffic Forecast by Vehicle Type  
Unit: vehicle-km/year (million)

Time	Project	Kilometers of different type of vehicles		
		Light	Medium	Heavy
2008	Without	8,540.2	2,017.7	835.1
	With	8,554.2	2,021.0	836.5
2028	Without	28,726.9	5,948.5	1,729.2
	With	29,012.8	6,007.7	1,746.4

Assumptions: Per Vehicle Kilometer Emission Factor by Average Speed Eij (v)  
Unit: gram/vehicle-km

Type	Speed (km/h)	CO (j=1)	THC (j=2)	NO <sub>x</sub> (j=3)
Light Vehicle (i=1)	43.1	45.38	3.96	2.84
	44.1	44.08	3.88	2.85
	28.0	70.07	5.40	2.89
	29.7	65.87	5.22	2.88
Medium Vehicle (i=2)	43.1	42.40	5.98	4.29
	44.1	41.69	5.79	4.35
	28.0	54.28	9.48	3.61
	29.7	52.84	9.03	3.67
Heavy Vehicle (i=3)	43.1	19.76	3.78	12.65
	44.1	19.43	3.66	12.82
	28.0	25.30	6.00	10.64
	29.7	24.63	5.71	10.81

Eij (v) = Sum [vehicle (i) x emission factor (j)] @ speed (km/h).

Note: Above calculations are based on the result of Pollution Emission Factor Study by Chang'an University.

## Results

## Total Air Pollutant Emissions

Unit: ton/year

Year	Scenario	Total emission		
		CO	THC	NO <sub>x</sub>
2008	With	477,536.0	47,974.8	43,859.9
	Without	491,593.7	49,081.7	43,513.1
	Benefit	-14,057.7	-1,106.9	+346.8
2028	With	2,271,464.7	215,694.1	124,487.4
	Without	2,379,383.3	221,951.3	122,984.7
	Benefit	-107,918.6	-6,257.2	+1,502.7

Note: Above calculations were based on application of air pollution emission factors by Chang'an University.

**With:** Total Xi'an transport network with all future improvements including the Project

**Without:** Total Xi'an transport network without the Project

PCUs: Passenger car units. PCUs are used to equalize the impact on a road's capacity of vehicles of different types. Each type is expressed as a multiple of the number of cars, the factor for cars being set at 1.0. The factors themselves vary with terrain type, with factors for trucks and buses increasing in hilly or mountainous terrain. Motorcycles or similar small motorized vehicles are not included.

Based on the above analysis, it is concluded that carbon monoxide and total hydrocarbons pollutants are less "with" the Project. However, an increase in nitrogen oxide pollutant levels results with the Project. This implies a need for continuous air quality/vehicle emission control and demand management, from the urban transport sector users of the Project in addition to the vehicle users of the other urban area road networks.

## SUMMARY RESETTLEMENT PLAN

### A. Description of the Project

1. The Project involves construction of a 71-kilometer (km) ring road around Xi'an City and five inter-connectors between the Second and the Third Ring roads. The total length of the inter-connectors is 28 km. Table A3.1 presents various components of the Project. The Xi'an Municipal Urban and Rural Construction Commission (the Commission) is the Executing Agency (EA) of the Project. Under this Commission, the Xi'an Municipal Third Ring Road Construction and Development Company Limited (the Company) was established in April 2003 to manage project construction and operation as the Implementing Agency (IA).

**Table A3.1: Project Roads and Inter-connectors**

Road	Section	Number of Interchanges	Length (km)
Third Ring Road	Northern Section	2	14.8
	Southern Section	0	21.6
	Eastern Section	6	18.3
	Western Section	4	16.3
	Subtotal	12	71.0
Connector Road	North Extension of Zhu Hong Road		5.7
	North Extension of East 2 <sup>nd</sup> Road		6.7
	East Extension of the North Sector of 2nd Ring Road		5.7
	South Extension of Taiyi Road		5.2
	Kunming Road/West Extension		4.5
	Subtotal		27.8
Total		12	98.8

Source: Feasibility Study, 2002.

2. The northern and southern sections of the ring road will be side roads to the existing Orbital Expressway, whereas the eastern and western sections are entirely new alignments. The five interconnectors will be largely widening and improvement of existing roads, with only 10 km of new alignments. The right-of-way (ROW) width for the ring road is 100 meters (m), and the width for interconnectors varies from 80 to 100 m. The ring road will have four lanes on either side of the median and three-lane relief/service roads on each side for slower traffic. There will be 12 new interchanges in the ring road system.

### B. Land Acquisition and Resettlement Impacts

3. The Project will pass through 3 districts, 13 urban wards, 4 rural townships, 90 villages, and 17 streets/urban communities. The project will permanently occupy 1,200 hectares (ha) of land, of which 972 ha is collectively owned and needs to be compensated. Efforts have been made to reduce resettlement impacts by occupying as little farmland as possible and demolishing as few houses as possible by placing the alignment close to villages without going through built-up areas. Also, the general alignment of the ring road has been included in the master plans for many years, so in many places the local government has restricted new construction along the proposed alignment. The decision to combine the northern and southern sections with the Orbital Expressway has also reduced the amount of land acquisition by 170 ha and avoided 475,059 square meters (m<sup>2</sup>) of buildings/houses, thereby reducing the number of people affected. During construction, it is estimated that an additional 330 ha will be used temporarily for 1–3 years. Table A3.2 summarizes the amount of collective land to be acquired for the Project.

**Table A3.2: Land Acquisition Impacts (Collectively Owned Land)**

District	Area to be Acquired (ha)				%
	3rd Ring Road	Interchanges	Interconnectors	Subtotal	
Weiyang	201	129	159	488	50.2%
Yanta	153	30	55	238	24.5%
Baqiao	86	161	0	246	25.3%
Total	440	320	214	972	100.0%

Source: Resettlement Plan.

4. The total structures lost will include the losses of buildings/houses and enclosure walls. The floor space of total buildings/houses lost is 1.72 million m<sup>2</sup>, of which, around 76% is village residential/commercial area and around 24% institutional/enterprise premises.

5. Based on impact data and field surveys, it is estimated that (i) 1,735 rural households with 7,361 persons will be affected only by land acquisition, (ii) 2,823 rural households with 11,852 persons will be affected by both land acquisition and building/house relocation, (iii) 4,277 rural and urban households with 18,047 persons will be affected only by residential/commercial area relocation, and (iv) 48 enterprises with 4,100 staff will also be affected either directly or indirectly. Therefore, a total of 45,100 persons will be affected, making up 3.2% of the total population in the three districts immediately affected by the Project (see Table A3.3).

**Table A3.3: Population Affected by Project**

Districts	Ward/Township		Village		Household		Population		Affected Enterprises	
	Total	Affected	Total	Affected	Total	Affected	Total	Affected	Units	Persons
Yanta	8	5	201	29	147,275	1,859	588,102	8,217	11	370
Weiyang	12	7	252	41	116,614	3,743	385,731	18,858	31	3,007
Baqiao	11	4	259	20	121,944	3,143	433,623	13,911	6	723
Total	31	16	712	90	385,833	8,745	1,407,456	40,986	48	4,100

Source: Resettlement plan.

## C Resettlement Principles and Compensation

6. For this Project, land acquisition is governed by the Land Administration Law of the People's Republic of China of 1998, the Methods of Execution of the Land Administration Law in Shaanxi of 1999, and Management Regulations of Xi'an Urban Building Removal of 2003. Resettlement will also follow ADB's Policy on Involuntary Resettlement and local resettlement policies and practices for similar projects in Xi'an City. The resettlement plan (RP) addresses all kinds of losses and impacts of the Project on different target groups, businesses and structures. Based on the inventory of losses, an entitlement matrix has been developed, which recognizes all types of affected persons (APs) and their losses irrespective of ownership or registration (see Table A3.4). Losses suffered by APs have been broadly categorized as land loss, structure loss, land attachment loss business/salary loss, and crop loss.

**Table A3.4: Entitlement Matrix**

Type of loss	Application	Entitled person/group	Compensation policy	Implementation issues
Permanent loss of arable land	Arable land located in the right of way (ROW) of the 3 <sup>rd</sup> Ring Road and interconnector roads  Land adjacent to ROW for construction purposes	a) Land-owning groups  b) Farmers who use the land	Land compensation and resettlement subsidies, respectively <sup>a</sup>  Replacement land and/or cash payments and/or income restoration measures sufficient to ensure maintenance of existing economic and social conditions  Cash compensation for any trees (based on type, age, and diameter) and standing crops (average production value of last 3 years)	Village meetings to be responsible for deciding on the allocation of funds, the redistribution of land and investment in income-generating activities such as improved cultivation techniques/ irrigation/ small business development/ training, and recommendations for transfer to urban status  Higher level authorities to approve and monitor village level proposals and, if required, to facilitate urban transfers and training programs
Temporary loss of arable land		Farmers who use the land	Cash compensation based on average annual output value (AAOV) for each year land is not available + reinstatement to preconstruction condition	Village committee/farm owners must be notified in advance and paid accordingly
Forest land	Forest land within ROW	Local forest bureau	Cash compensation to forest bureau according to standards and regulation of Shaanxi provincial laws	Construction of greenbelt by the forest bureau
Loss of residential land/ property	Residential land located in or affected by ROW	a) Land-owning groups  b) Owner of the building or houses	Cash compensation for land if affected people (AP) requires new plot Cash compensation for land (if rebuilding on existing site possible) or replacement plot or same size apartment in urban area Cash compensation at replacement rates for all buildings Transition and moving allowances, transportation/shifting cost	Land-owning groups and APs to decide on location of new residential plots. Wards/townships and districts to allocate new apartments for urban transfers  Construction of new apartments for urban transfer must be ready prior to relocation.
Noncultivated land loss	Noncultivated land within ROW	Land-owning groups	Cash compensation	The rate must be negotiated with the landowners/groups
Loss of nonresidential establishments (e.g., shops, commercial units, enterprises, common property units, etc.)	Establishments sited in or affected by ROW	a) Legal owner of the establishment b) Employees c) Residents d) Beneficiaries of the common property units	Cash compensation for land (unless replacement site provided) Cash compensation for buildings Transitional allowances for lost income	Assistance with finding new site if relocation of establishment is unavoidable.

AAOV = average annual output value, AP = affected people, ROW = right of way.

<sup>a</sup> Arable land reclamation fee is also payable, but this does not affect affected people. Likewise, compensation for public utilities is not shown on this matrix.

Type of loss	Application	Entitled person/ group	Compensation policy	Implementation issues
			Moving allowance for transport of building materials to new families who are relocated (not payable in cash) Transitional allowances for lost income for up to 6 months (if owner is not responsible for paying wages during the transitional period) Construction of common property units by local government in consultation with beneficiary groups	
Business/salary losses		APs	Business/salary losses will be compensated through specific allowances to be paid on a monthly basis for up to 6 months after relocation. The business losses allowance will be based on the total post-tax profit during the 6 months prior to relocation as declared in the tax receipts.	
Crop losses		APs	Crops losses will be compensated at a rate equal to the AAOV.	

AAOV = average annual output value, AP = affected people, ROW = right of way.

<sup>a</sup> Arable land reclamation fee is also payable, but this does not affect affected people. Likewise, compensation for public utilities is not shown on this matrix.

Source: Resettlement plan.

7. The main objective of the RP is to restore and improve the economic condition of the APs, particularly vulnerable groups. A series of measures such as transitional allowance for lost livelihood, business/economic rehabilitation support, and alternative training for livelihood have been adopted, and details are provided in the RP. Economic rehabilitation will be partly supported by employment and income generation opportunities related to project construction works. Also, some of the seriously affected villages will be incorporated into the urban village reconstruction program of Xi'an City.

#### **D. Stakeholder Participation, Disclosure of RP, and Grievances**

8. Since the Project will have significant impacts, due attention has been given to community views through a series of consultation meetings. Between July 2002 and February 2003, 33 focused group discussions were conducted, 1,550 households were surveyed in 22 affected villages, and 20 affected enterprises were interviewed. At various stages of project planning, APs have been informed of and consulted about the likely impacts of the Project. Various stakeholders consulted include (i) heads of households/business units to be affected; (ii) village heads and villagers' representatives; (iii) local government agencies and departments; and (iv) women, the poor, and other vulnerable groups. The consultation will continue throughout project implementation.

9. The resettlement framework prepared by the Company has been sent to local government agencies and stakeholders for review and comments on the policy in general and on the adequacy of the compensation standards and resettlement strategy. Public consultation meetings were held in each affected district, which verified strong local support for the Project. Regarding land acquisition and resettlement, there were concerns about adjusting the road alignment, improved compensation standards, resettlement options, and entitlements. A resettlement information booklet is being prepared for distribution to affected households.

#### **E. Resettlement Site Development and Rehabilitation Assistance**

10. Resettlement site selection will be planned comprehensively with the income restoration plans and, where applicable, with Xi'an's urban village reconstruction program. Generally there are three options for residential resettlement site selection: (i) for areas where only several households are involved in house relocation (light impact), the new housing sites will be selected in the same village/community; (ii) for a village with more households involved in relocation, but with enough land for their livelihood (intermediate impact), a site suitable for apartment buildings will be selected considering farmers' production and operational convenience; or (iii) for a village with a serious relocation impact, either the affected households/entire village will be included in the urban village reconstruction program or a separate village rehabilitation plan will be formulated. The interconnector roads will affect 48 enterprises. For the enterprises needing relocation, new sites will be planned by the Xi'an Municipal Planning Department. Each enterprise will be responsible for redeployment of staff and contract workers.

11. The urban village reconstruction program is a pilot program that will be important for supporting farmers transition to the urban economy. Proposed income rehabilitation measures include the following: (i) provide employment opportunities in new commercial and industrial enterprises, (ii) establish collective enterprises, and (iii) establish a social security system with policy support in the affected villages. Under the above categories, detailed needs for farmers to promote their working skills will be identified, and relevant training will be planned. For

vulnerable groups, a special social assistance fund will be provided by the Project to secure their livelihood.

## **F. Implementation Framework and Budget**

12. The Commission will be responsible on behalf of the Xi'an Municipal Government for general administration and coordination of the Project. The Leading Group and a Working Office have been established to coordinate interagency responsibilities. The Company has been entrusted to construct and operate the Third Ring Road. A Land Acquisition and Resettlement Division within the Company has been established, and experienced staff are being recruited. This Division will supervise the local government offices that are responsible for land acquisition, compensation, and resettlement, and for resolving grievances. Resettlement coordination offices will be established in each affected district, ward, and township. Each affected street/urban community and village will appoint one person as a member of the ward/township offices to assist with the preparation and implementation of relocation and economic rehabilitation plans.

13. Since the compensation rates and related rehabilitation policies for different types of losses are still under discussion, the budget for land acquisition and resettlement is still tentatively estimated at \$152 million equivalent. The budget will be refined when the preliminary design is completed.

14. The Company will establish a system to carry out internal monitoring of land acquisition and resettlement to guarantee timely and adequate land acquisition and resettlement works in accordance with the RP and to ensure the entitlements of the APs are fully met. The Company will provide summaries of resettlement progress in the quarterly reports it submits to the Asian Development Bank (ADB). At midterm and at project completion, the Company will submit resettlement evaluation reports to ADB that summarize achievements, outstanding issues, and remedial measures. Each year, the Commission will provide to ADB a summary of the annual resettlement audit of disbursements and expenditures, conducted by the Xi'an Municipal Audit Bureau.

15. An independent institute or firm will be contracted by the Company to carry out the external monitoring and evaluation of resettlement. The tasks include the following: (i) prepare the baseline data, (ii) verify the adequacy and timeliness of compensation payments, (iii) assess economic rehabilitation measures and the adequacy of the budget, (iv) assess the quality of new house construction and timely transfer, (v) appraise the effectiveness of the grievance procedure, (vi) collect APs' reactions and level of satisfaction, (vii) assess the efficiency and effectiveness of agencies responsible for resettlement, (viii) survey households to assess whether they have restored or improved their living conditions and income levels, and (ix) assess the rehabilitation of enterprises and redeployment of staff and contract workers. The external monitoring will be carried out every 6 months in the first 2 years, and then annually for 3 years. Monitoring and evaluation reports will be submitted to the Company and ADB.

### COMPARATIVE “NO BUILD” AND “BUILD” EVALUATION MATRIX

Parameter	“No Build”	“ Build”
1. Noise vibration	●	◎
2. Air quality	●	◎
3. Highway spills of hazardous materials	●	◎
4. Environmental aesthetics	●	◉
5. Erosion and silt runoff	◎	◎
6. Impairment of fisheries/aquatic ecology and other beneficial uses	◎	◉
7. Encroachment on historical/culture/monument/areas	●	◎
8. Encroachment on precious ecology	●	◉
9. Highway runoff pollution	◎	◉
10. Construction stage problems a) Erosion / silt runoff b) Other construction hazards c) Monitoring	N.A.	◉
11. Postconstruction monitoring	●	◉
12. Dislocation and involuntary resettlement	N.A.	●
13. Consistency with long range urban/ regional plans	No	Yes

Source: Environmental impact assessment report and Technical Assistance consultant.

- Significant adverse regional or local impact if no action taken; contingency planning or mitigation measures not implemented.
- ◎ Moderate adverse impact from existing roads or proposed project. Usually can be minimized through contingency planning or mitigation measures.
- ◉ Insignificant or no major impacts provided mitigation measures implemented.
- N.A. Not applicable.

## ENVIRONMENTAL MONITORING ACTION PLAN

Item	Monitoring Action	Timing	Supervision
<b>A. Prior to Construction</b>			
Implementation of resettlement plan	Monitoring of the resettlement plan should be in accordance with the monitoring program set forth in it.	Prior to groundbreaking	Leading Group, Implementing Agency (IA), and district governments
<b>B. During Construction Period</b>			
<b>1. Compliance Monitoring</b>			
Location of asphalt plants	Review siting of asphalt plants upon setup of each plant to determine that it is downwind from residential areas.	During the road pavement	Supervision consultant
Dust control	Inspect batch plants upon setup to determine if dust suppression equipment is installed.	Weekly during construction	Supervision consultant, IA
Dust suppression	Observe watering of construction roads and other construction works to determine if contract requirements are followed.	Inspect daily as part of construction monitoring	IA, supervision consultant with input from environmental protection bureaus (EPBs)
Maintenance of construction access and haul roads	Confirm maintenance schedule for all haul/access roads and verification that road has been rehabilitated and left in as good condition as when work started, when not needed.	Monthly during construction	Supervision consultant with input from EPBs
Equipment emission	Observe operation to determine if equipment is being properly maintained to control emissions.	Monthly during construction	Supervision consultant with input from EPBs
Construction noise	Monitor to determine that construction activities are not occurring between 22:00 and 06:00 hours within 500 meters (m) of residences.	Daily during construction	IA, supervision consultant with input from EPBs
Erosion protection	Monitor to determine if erosion protection devices such as silt traps have been installed in accordance with contract requirements.	Inspect monthly	IA, supervision consultant, EPBs, Water Resource Bureau
Spoil site rehabilitation	Monitor to ensure that proper selection has been made for spoil placement areas and that these areas are being properly rehabilitated.	Inspect monthly	IA, supervision consultant with input from EPBs
Drainage water	Observe construction activities to determine that construction drainage water is controlled so as not to contaminate surface water or groundwater.	Inspect monthly	Supervision consultant with input from EPBs
Toilet facilities	Inspect to ensure that adequate toilet facilities are provided for construction workers and that wastes are properly removed and treated.	During construction	IA, supervision consultant, EPBs
Cultural relics	Monitor site clearance and excavation for evidence of previously unidentified historic or cultural sites or artifacts and order that construction in the immediate area of any such finds be discontinued until proper investigation can take place.	During construction	Xi'an/Shaanxi Cultural Bureau
Disposal of dredge spoils	Monitor to determine that dredge spoils and pile boring spoils from bridge construction are disposed of in upland areas.	During bridge construction	IA, supervision consultant with input from EPBs
Harmful and toxic material	Observe construction activities to determine that harmful, toxic, or hazardous material including petroleum products are being handled properly.	Inspect monthly	IA, supervision consultant

Item	Monitoring Action	Timing	Supervision
Revegetation	Monitor to determine that revegetation planting is being carried out.	Twice a year	Xi'an Forest Bureau, IA, supervision consultant
Check and accept the environmental facility	Check to determine that all the environmental facilities are installed properly and the environmental management action plan is followed strictly.	Once after the completion of the Project	State Environmental Protection Administration and its designated specialist
<b>2. Impact Monitoring</b>			
Air quality monitoring	Undertake sampling of total suspended particulates (TSP) at the construction sites in a random schedule during the working days, as well as at the residential area of Xi'an Rail Equipment Factory, Liangjiajie, and Liucunbu	Frequency: once a month; Duration: 2 days	Xi'an/Shaanxi environmental monitoring station (EMS)
Construction noise	Undertake noise monitoring at the construction sites in a random schedule during working days, as well as at Xijing University, Aoli Primary School, Xi'an 16th High School.	Once a month Duration: 1 day	Supervision consultant and Xi'an EPB
Water quality	Monitor the water quality of Ba and Chan rivers: acidity (pH), chemical oxygen demand (COD), oil and suspended solid (SS).	Twice a year Duration: 2 days	Xi'an/Shaanxi EMS
<b>C. During Operation Period</b>			
<b>1. Compliance Monitoring</b>			
Maintenance	Monitor to ensure that appropriate continuing maintenance is being carried out on highway slops, cuts, and embankments.	Twice a year	Xi'an EPBs
Noise and air pollution buffer zone	Monitor enforcement of setback of 100 m from the highway in which new schools and hospitals are to be prohibited, 60 m from the highway in which new residential buildings are to be prohibited.	Once a year	Xi'an Planning Bureau, Xi'an EPB
Protection of vegetables from pollution	Monitor enforcement of setback of 30 m from the highway in which vegetables are prohibited.	Twice a year	Xi'an EPB, Xi'an Agricultural Bureau
Vehicle emission	Monitor vehicle emissions.	Randomly	PSB and Xi'an EPB, Xi'an EMS
<b>2. Impact Monitoring</b>			
Noise	Monitor the noise levels at Xijing University, Aoli Primary School, Xi'an 16th High School, and the residential area of Xi'an Rail Equipment Factory.	4 times a year Duration: 2 days Twice a day (daytime and night)	Xi'an/Shaanxi EMS
Air quality	Undertake sampling of TSP and nitrogen dioxide at Liangjiajie, residential area of Xi'an Rail Equipment Factory, East Chaojiazhuang, and Liucunbu	Twice a year (in January and July) Duration: 5 days	Xi'an/Shaanxi EMS
Water quality	Monitor the water quality of Ba and Chan rivers: pH, COD, oil, and SS	Twice a year (dry/wet seasons) Duration: 2 days	Xi'an/Shaanxi EMS

AAOV = average annual output value, AP = affected people, COD = chemical oxygen demand, EA = executing agency, EMS = environmental monitoring station, EPB = Environmental Protection Bureau, IA = implementing agency, m = meter, pH = acidity, ROW = right of way, SS = suspended solid.

Source: Environmental impact assessment report and Technical Assistance consultant.