



Asia Pro Eco II project

“Policy Instruments for Chinese Sustainable Future: Environmental Policy Integration and Strategic Environmental Assessment for the Energy and Transport Sectors”

Transport Plan EA Report Review

China Academy of Transportation Sciences

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0. PURPOSE OF THIS REPORT

The report will be a Review Report (RR) at variance from the earlier planned SEA report due to the fact that no changes will be possible in the Transport Plan and that the assessment taking place is in the form of the review of existing EA report (ex-post SEA) and has to fill in the gaps of the assessment and elaborate the frameworks, which will be proposed for further SEA implementation in China's Transport sector.

The RR framework was coordinated with the Energy case SEA report framework, but has some specific features due to the process happening ex-post.

As it was pointed out in the Amsterdam closing seminar of November 2007, focus has to be on strengths and weaknesses as well as maximum utilization of European experience in the Transport case. Therefore, substantial part of the framework is coordinated not only with the existing information from the Transport Plan (via SWOT), but also with the European Council's Directive on the Assessment of the Effects of Certain Plans and Programmes on the Environment (EC SEA Directive 2001/42/EC).

1 INTRODUCTION

1.1 Origins of the Task

This report is one part of Asia Pro Eco II project-“Policy Instruments for Chinese Sustainable Future: Environmental Policy Integration and Strategic Environmental Assessment for the Energy and Transport Sectors”.

This report is the case study of transport.

1.2 Purpose of the Assessment

- 1). To analyze the impacts based on the sustainable development principle, making linkages with other planning, assessing the environmental impacts that may be caused by road network construction and proposing the measures for prevention, control and remedy as well as other suggestions;
- 2). Based on the Shaanxi province’s natural environment and social situation, according to the scientific development concept from the point of view of the environment feasibility, analyze the shortcomings of highway network planning, improve the layout of Shaanxi province’s highway network and put forward the replacement plan and controlling measures.
3. Recognize the environmentally sensitive spots (regions) of Shaanxi province’s natural reserve, forest parks and geological parks to offer reference for the planning and implementation of projects in the future;
- 4). Analyze the coordination between the planning on Shaanxi province’s highway network and the different national traffic planning on the earlier stage, to make highway network planning in accordance with the national traffic planning, as well as to complete, complement and perform it;
- 5). Analyze the coordination between the planning on Shaanxi province’s highway network and the planning of Shaanxi province’s other industries, to avoid the influence of highway network planning on other industries’ planning, as well as to offer convenient traffic environment for the successful performance of the other planning;
- 6). Analyze the stipulations on road construction by different relevant laws, rules and regulations to avoid the conflict with the working laws, rules and regulations during complementation of projects in the future;
- 7). Explore the method on evaluation of traffic industry’s environmental influence to offer reference for the succeeding similar research;
- 8). Offer reference for Shaanxi province to work out traffic development planning and have daily environmental administration.

1.3 Scope of the Assessment (including timeline and proposals to meet SEA requirements)

| Law name | Requirement | Comments |
|--|--|---|
| EIA Law | Carry out SEA | SEA after planning report finished |
| EIA Law Tentative Procedures of the Public Participation in EIA | Public | visit some departments and publish SEA report on website |
| SEA Guideline | consistency of plans related | Many plans were analyzed |
| Notice on Printing and Issuing “The Specific Scope of Plan for Compiling Environmental Impact Report (Probationary) and The Specific Scope of the Plan for Compiling Chapters or Explanation on Environmental Impact (Probationary)” | Before submitting for examination and approval their special draft plans, which the relevant departments under the State Council, local people's governments at or above the level of the city divided into districts and the relevant departments under them make arrangements for drawing up and which are related to the development of industry, agriculture, animal husbandry, forestry, energy, water conservancy, transportation, urban construction, tourism and natural resources (hereafter referred to as special plans, in short), they shall have the environmental effects evaluated and submit written reports on environmental effects to the authorities that examine such special plans before giving approval. | SEA of road network planning should be carried out |
| Highway Law of PRC | 1) Planning of land for road construction should be in accord with overall land use plans and the annual use of land for road construction should be brought within the annual construction land use plan 2) Design and construction of road construction projects should be in accordance with the legal requirements to protect the environment, protect cultural relics and prevent loss of water and soil. | 1) land use planning was analyzed in the SEA 2) some impact should be thought In single road section feasibility study and EIA |
| Law of the People's Republic of China on the Protection of Cultural Relics | Article 17 No construction of additional projects or such operations as blasting, drilling and digging may be conducted within the area of protection for a historical and cultural site. However, where under special circumstances it is necessary to conduct construction of additional projects or such operations as blasting, drilling and digging within the area of protection for such a site, its safety shall be guaranteed, and the matter shall be subject to approval by the peoples government which originally verified and announced the site and which, before giving approval, shall ask consent of the administrative department for cultural relics under the peoples government at the next higher level; and where construction of additional projects or such operations as blasting, drilling and digging are to be conducted within the area of protection for a major historical and cultural site protected at the national level, the matter shall be subject to approval by the peoples government of the relevant province, autonomous region, or municipality directly under the Central Government, which, before giving approval, shall ask consent of the administrative department for cultural relics under the State Council. Article 18 On the basis of the actual needs for the protection of cultural relics and with the approval of the peoples government of the relevant province, autonomous region, or municipality directly under the Central Government, a certain area for control of construction may be delimited around a site protected for its historical and cultural value, and such an area | Cultural Relics were identified in the SEA |

| Law name | Requirement | Comments |
|--|---|---|
| | <p>shall be announced.</p> <p>No construction of a project conducted in an area for control of construction may deform the historical features of the site protected for its historical and cultural value; and the design for the project shall, in correspondence with the protection level of the site protected for its historical and cultural value, be subject to consent by the appropriate administrative department for cultural relics before it is submitted to the department for urban and rural construction planning for approval.</p> <p>Article 19 No facilities that pollute the sites protected for their historical and cultural value or their environment may be put up within the area of protection for these sites or the area for control of construction, and no activities that may adversely affect the safety and environment of these sites may be conducted. Where there are already facilities that pollute the sites and their environment, they shall be brought under control within a specified time limit.</p> | |
| <p>Law of the People's Republic of China on Prevention and Control of Water Pollution</p> | <p>The people's governments at or above the provincial level may delineate surface sources protection zones for domestic and drinking water according to law.</p> <p>Such protection zones shall be divided into first-grade protection zones and protection zones of other grades.</p> <p>Certain water areas and land-based areas near the intakes of domestic and drinking surface water sources may be delineated as the first-grade protection zones.</p> <p>Certain water areas and land-based areas beyond the first-grade protection zones may be delineated as protection zones of other grades.</p> <p>Protection zones of all grades shall be indicated by clear geographic demarcations.</p> <p>It is forbidden to discharge sewage into water bodies within the first grade surface sources protection zones for domestic and drinking water.</p> <p>It is forbidden to travel, swim or carry out other activities within the first-grade surface sources protection zones for domestic and drinking water that may possibly cause pollution to the water body.</p> <p>It is forbidden to construct or expand within the first-grade surface sources protection zones for domestic and drinking water, any projects that have nothing to do with water supply facilities and protection of water sources</p> | <p>This is a keystone in SEA</p> |
| <p>Marine Environment Protection Law of the PRC</p> | <p>Article 20 The State Council and local People's Governments at the Provincial level shall adopt effective measures to protect such typical and representative marine ecosystems as mangroves, coral reefs, coastal wetlands, islands, bays, estuaries important fishery waters, etc, sea areas where rare and endangered marine organisms are naturally and densely distributed: marine organisms existence habitats with important economic value and marine natural historic relics and natural landscapes with great scientific and cultural significance. For marine ecosystems with important economic and social values that have been damaged, efforts shall be made to renovate and restore them</p> | <p>No sea in Shaanxi provincial</p> |
| <p>Law of The People's Republic of China on Water and Soil Conservation</p> | <p>Article 18 In the construction of a railway, highway or water project, the disturbance of vegetation shall be minimized; waste sand, rocks and earth thus created must be disposed of in an area specially designated for the purpose, and shall not be dumped out into any river, lake, reservoir or any ditch or canal other than the specially designated area</p> | <p>It's better to be thought in EIA, but the length in each different soil erosion area was calculated in the SEA</p> |
| <p>Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste</p> | <p>Article 13 The necessary supporting installations for the prevention and control of environmental pollution by solid waste specified in the statement of the effect of the construction project must be designed, built and put into operation simultaneously with the main part of the project. The construction project may be put into production or use, only after the installations for the prevention and control of environmental pollution by solid waste are examined and considered up to standards by the competent administrative department of environmental protection that examined and approved the statement of environmental effect. The installations for the prevention and control of environmental pollution by solid waste must be checked and</p> | <p>It's better to be thought in EIA, not SEA</p> |

| Law name | Requirement | Comments |
|---|--|---------------------------|
| | accepted at the same time as the main part of the project is checked and accepted | |
| Regulations of the PRC on Nature Reserves | <p>Article 18 Nature reserves may be divided into three parts: the core area, buffer zone and experimental zone.</p> <p>Article 32 No production installations shall be built in the core area and buffer zone of nature reserves. In the experimental zone, no production installations that cause environmental pollution or do damage to the natural resources or landscapes shall be built. Other installations to be built in these areas must not exceed the discharge of pollutants prescribed by national or local discharge standards. If the installations that have been built discharge more pollutants than are specified by the national or local discharge standards in the experimental zone of nature reserves, such pollution shall be eliminated or controlled within a prescribed period of time. Remedial measures shall be adopted to the damage caused.</p> <p>The projects constructed in the outer protection zone of nature reserves must not affect the environmental quality inside the nature reserves. If the damage has been done, the relevant units shall be ordered to eliminate and control the pollution within a prescribed period of time.</p> | This is a keystone in SEA |

2 THE OUTLINE OF THE PROPOSED TRANSPORT PLAN AND ITS OBJECTIVES

2.1 Layout of the Shaanxi Province Highway Plan

The layout integrating vertical-horizontal network and radiating routes is adopted for expressway network in Shaanxi Province. The plan can be summarized as “three vertical routes, four horizontal routes and five radiating routes”, that is “345” network for short. The expressway network is composed of 3 south-north vertical routes, 4 east-west horizontal routes and 5 radiating routes with Xi’an being the center, and the total length of the expressway network is about 5,002 km, including 369 km of 5 liaison routes. There is 3,541 km of state expressway and 1,461 km of provincial expressway in the total scale of the network. See the following form for details.

Table 2 – 1: The layout of Expressway Network in Shaanxi Province

| South-North Vertical Routes | | | East-West Horizontal Routes | | | Radiating Routes | | | Liaison Routes | | |
|-----------------------------|---------------|--------------|-----------------------------|---------------|--------------|------------------|---------------|--------------|----------------|-------------------------|--------------|
| No. | Title | Mileage (km) | No. | Title | Mileage (km) | No. | Title | Mileage (km) | No. | Title | Mileage (km) |
| 1 | Yushang Route | 736 | 1 | Wuding Route | 321 | 1 | Xiyu Route | 239 | 1 | Yujia Route | 88 |
| 2 | Yukang Route | 938 | 2 | Yifu Route | 190 | 2 | Xishang Route | 240 | 2 | Yanyan Route | 100 |
| 3 | Longhan Route | 356 | 3 | Tongbao Route | 375 | 3 | Ximan Route | 159 | 3 | Weipu Route | 52 |
| | | | 4 | Bailue Route | 484 | 4 | Xihan Route | 385 | 4 | New Airport Route | 20 |
| | | | | | | 5 | Xichang Route | 182 | 5 | Xi’xian North Ring Road | 109 |
| Sum | | 2030 | Sum | | 1370 | Sum | | 1233 | Sum | | 369 |

Note: The total length of the radiating routes include 28 km of the road section from Shangzhou to Machi.

2) Implementation Programme

The traffic mileage in 2007 has reached 2,018 km and 3 state highway arteries in the province have been connected. 59% of the counties (cities and districts) are connected with expressways. The traffic mileage in 2009 will reach 3,019 km, and 3 provincial highway passages for western development inside the province will be constructed ahead of schedule, and the original planned radial-type main highway network will be completely constructed. In addition, 10 urban areas in the province will be connected with expressways, and 71% of the counties (cities and districts) will be connected with expressways.

By 2010, the traffic mileage of expressway will reach 3,132 km, accounting for 62.7% of the planned mileage, and 72% of the counties (cities and districts) in the province will be linked with expressway and will be connected with expressways in adjacent provinces and regions, thus forming “one day traffic circle” with Xi’an being the centre leading to over 10 major surrounding cities.

By 2015, the traffic mileage of expressway will reach 4,115 km, accounting for 80.5% of the planned mileage. 82% of the counties (cities and districts) in the province will be connected with expressways, and the functions of expressway network will be further perfected. And the traffic mileage in 2012 will reach 3,807 km, and the state expressway inside the province will be basically constructed, and the expressway network will be basically formed. 80% of the counties (cities and districts) in the province will be connected with expressways.

3 ENVIRONMENTAL BASELINE

3.1 Shaanxi baseline

3.1.1 Topography

Shaanxi is narrow from east to west while long from south to north. It is divided into 3 typical natural regions from north to south: north region is Loess Plateau of temperate climate, accounting for 45% of total province area, 15% total province population, with rich coal, oil and gas resources, thrive stock raising; the middle region is of Guanzhong Plain of warm temperature zone, accounting for 19% of total province area, 60% total province population, with ready urban group, good traffic network, developed industrial and agricultural production and technology, 75% of whole province economy volume and 80% human resource; the south region is Qinling and Bashan mountainous area with subtropical climate, accounting for 36% of total province area, 25% total province population, with rich cement, mineral deposit and biotic resources.

With Qinling as threshold, the stream in south and stream in north belong to Yangtze water system and Yellow River water system respectively. The major rivers include Wei River, Jin River, Luo River, Wuding River, Han River, Dan River, Jialing River. Qinling is the boundary of south climate and north climate, as well as an important zoology safety screen in China, is also the important water source region for south Shaanxi and Guanzhong, and functions as climate mediation, soil conservation, self-restraint water source, retaining the variety of creature.

3.1.2 Population and social economy

The resident population of the whole province is 37.48 million as of the end of 2007. See Table 2-5 for specific information:

Table 3-1 Status of the population in Shaanxi as of year 2007

| Index | Year 2007 (10,000) | Proportion (%) |
|----------------------------------|--------------------|----------------|
| Total population in the province | 3748 | 100.0 |
| In which, urban | 1522.44 | 40.6 |
| Countryside | 2225.56 | 59.4 |
| In which: male | 1927.26 | 51.4 |
| Female | 1820.74 | 48.6 |
| In which, age 0-14 | 679.51 | 18.13 |
| Age 15~64 | 2732.67 | 72.91 |
| 65 or above | 335.82 | 8.96 |

In 2007 the total output value of Shaanxi is 536.985 billion RMB, 14.4% up from previous year. The increase in primary industry is 59.469 billion RMB, 6.7% up, accounting for 11.1% of total output value; that in secondary industry is 291.697 billion RMB, 17% up, accounting for 54.3% of total output value; and that in tertiary industry is 185.819 billion RMB, 13.1% up, accounting for 34.6% of total output value. Total production value per capita is 14350 RMB 14% up from previous year. The disposable income per capita among town dwellers is 10763 RMB, 10.5% up; and consumption expenditure per capita is 8427 RMB, 6.2% up. Net income per capita among rural population is 2645 RMB, 10% up.

3.1.3 Environmental protection

In 2007 the province boasts 51 natural reservation areas, with total area of 1,046,000 hectare, accounting for 5.2% of the total province territory. The number of natural reserves of national level amounts to 9, with total area of 295,000 hectare, accounting for 28.2% of the whole natural reserves in the province. The air quality of 2007 in 10 cities became better than that of 2006. The

number of days with air quality comply with grade II or above standard is 278-354 days, which is more than those in previous year. The comprehensive pollution index is 2.25 on average, almost the same with that in 2006. In 2007 the comprehensive pollution index mean in the 6 major rivers as Wei River, Yan River, Wuding River, Han River, Dan River and Jialing River is less than that in 2006. Among 40 monitoring sections, 27 sections satisfy the standard of water area function assessment, accounting for 67.5%, increasing by 2 sections than 2006. Among the 13 monitoring section in Wei River, 12 sections show decrease of COD mean concentration. The discharge amount of chemical oxygen demand at the Tongguan Bridge section decreases by 15.4% from 2006. The average equivalent level of traffic noise is almost the same with that in previous year. In the whole province, the discharge amount of chemical oxygen demand decrease by 3.96%, and discharge amount of sulfur dioxide decrease by 5.62%.

3.1.4 Land Resources

According to the alteration survey of current land utilization of Shaanxi Province in 2004, the total land area of the province is 205795 km² (20,579,500 ha), including: agricultural land of 18,476,100 ha (277,141,800 mu), building land of 795,100 ha (11,926,000 mu), and uncultivated land of 1,308,300 ha (19,624,100 mu). The utilization of different types of lands is shown in Table 3-2.

Table 3-2 Land utilization of Shaanxi province

| Province controlled | Agricultural land | | | | | Building land | | | Uncultivated land |
|-----------------------|-------------------|-------------|----------|-----------|-------------------------|-----------------------------------|----------------------|---------------------------------|-------------------|
| | Cultivated Land | Garden plot | Woodland | Grassland | Other agricultural land | Residential sites and mining land | Land used by traffic | Water conservancy facility land | Uncultivated land |
| 10,000 ha | 415.41 | 68.12 | 1020.32 | 313.41 | 30.35 | 69.44 | 6.11 | 3.96 | 130.83 |
| 10,000 mu | 6231.14 | 1021.86 | 1530.47 | 4701.21 | 455.24 | 1041.56 | 91.65 | 59.39 | 1962.41 |
| Provincial proportion | 20.19% | 3.31% | 49.58% | 15.23% | 1.47% | 3.37% | 0.30% | 0.19% | 6.36% |

3.1.5 Mineral Resources

Shaanxi, as one of the largest resource-abundant provinces, is rich in mineral resources, and occupies important position of the country. As of the end of 2003, 137 different minerals (including sub-minerals) have been found in the province, with 92 known mineral reserves and 783 diggings. Shaanxi province has many of the 45 major mineral resources ranking at the top, for example, salt, limestone cement (1st place), mercury, kaolin (2nd), coal, natural gas, molybdenum, rare earth ore, vanadium, asbestos, glass with quartzite (3rd), titanium, graphite aphanitic (4th), oil, barite (5th), gold, antimony, crystalline graphite (6th), phosphorus (7th), lead, nickel (8th), manganese (9th), Zinc (10th). Among the 15 kinds of pillar minerals essential to the development of national economy, the salt, cement limestone of the province ranks first of the country. Among the 12 western provinces and autonomous regions, Shaanxi's oil and natural gas ranks the 2nd place; coal, the 3rd; phosphorus, the 4th; lead, zinc, aluminum, the 6th; iron, the 7th; and copper and iron sulfur, the 8th.

Although Shaanxi is rich in mineral resources, most of them are located along the dust-bowl in the north and Qinling-Bashan mountains in the south of the province, where the ecological environment is sensitive. The major environmental problems during the development are: a large number of solid waste are piled up unreasonably, and as a result, with land and river been occupied and vegetation destroyed, serious soil erosion and other disasters have been caused; due to simple exploitation techniques and outdated environmental facilities, waster and air are easily polluted.

3.1.6 Tourism Resources

Shaanxi Province is the birthplace of the Chinese nation, 13 dynasties including Zhou, Qin, Han and Tang etc have built capital here, lasting 1,100 years.

There 35750 above-and-underground cultural relics in Shaanxi, including 140 key state protection units, and 415 provincial ones. There are 103 museums and memorial halls across the province, containing more than 600,000 pieces of cultural relics, including 121 pieces (sets) of national treasure, ranking No.1 of the country.

Based on the natural tourism resources of Qinling, Shaanxi province has huge developing potential in tourism industry. At present, the province has 1 world heritage site; 5 view spots, 5 nature reserves, 23 forest parks, 5 geo-parks, 6 historical and cultural cities at national level; and 29 view spots, 17 nature reserves, 45 forest parks, and 11 historical and cultural cities at provincial level.

The province has primarily formed its worldwide well-known tourism product system represented by the Museum of Terracotta Warriors and Horses. The advantages of tourism resources are transferring to industrial advantage and economic advantage. Shaanxi Province follows the principle of protection and reasonable utilization, and puts efforts to develop its unique and distinctive image of tourism products. So far, the province has developed over 200 tourism areas (spots) with certain scale, including 17 at national AAAA level, 28 ones at AAA, 36 at AA, and 3 at A.

3.1.7 Biodiversity

The ecological system of Shaanxi province has various types, including forest ecosystem, agricultural ecosystem, grassland ecosystem, wetland ecosystem, urban ecosystem, and meadow ecosystem and so on. □

The province has 206 families of vascular plants, 1182 genera, and 4177 species, including 29 families, 72 genera and 270 species of ferns; 9 families, 24 genera and 46 species of gymnosperms; 168 families, 1086 genera and 3861 species of angiosperms. Compared with the whole country, the proportions of the family, genus and species of seed plants account respectively for 59%, 37.19% and 15.87% of the total. Plants of single family and genus or rare family and genus are relatively more, with ancient origin. The Qinling-Bashan mountains have the riches plant species. There are 159 families, 995 genera and 1550 species of seed plants in Qinling, accounting for 89.83%,

89.64%, 39.67% of the total provincial number. There are 104 families, 291 genera and 1057 species of woody plants in the north slope of Bashan mountain, accounting for 58.76%, 26.21%, 27.05% of the province. Guanzhong Plain in the Loess Plateau in northern Shaanxi are relatively barren. The province has 45 kinds of state protection plants, mainly located in Qinling-Bashan Mountains. The rare and endangered plants of Shaanxi province are shown in Figure 3-9.

According to incomplete statistics, Shaanxi has 29 orders, 97 families, 315 genera and 609 species of terrestrial vertebrates, including 2 orders, 8 families, 26 species (subspecies) of amphibians; 3 orders, 9 families, 27 genera, 51 species and 9 subspecies of reptiles; 17 orders, 53 families, 189 genera, 390 species and 20 subspecies of birds; 7 orders, 29 families, 87 genera, and 142 species of mammals. The fish resource of Shaanxi is also abundant, boasting 6 orders, 14 families, 74 genera, and 144 species (subspecies). The province has 69 species of vertebrate animals listed into the directory of state protection animals, accounting for more than 20% of the total, including 12 species of animals at protection grade 1, as shown in Figure 3-10, and 65 species at protection grade 2, as shown in Figure 3-11. Among these key protection animals, there are 22 species of mammals, 44 species of birds, 1 kind of amphibians, and 2 kinds of fish. The giant panda, golden monkey, takin and crested ibis are crowned as the Four Treasures of Qinling.

3.1.8 Soil erosion

Shaanxi suffers from the most serious soil erosion in the country. The soil erosion area of the province covers 138,000 km², accounting for 66.8% of the total provincial area. The seriously eroded soil area reaches 42,000 km². The soil and water conservation distribution of the province is shown in Figure 3-9. Viewing from the regional distribution, the soil erosion is most serious in the gully regions of the Loess Plateau in north Shaanxi and in Weibei Plateau, and then in the hilly area in the south of Shaanxi, which is one of the most eroded areas along the Yangtze River.

3.1.9 Desertification

The desertification mainly goes along the Great Wall in the north of Shaanxi province; at the interchange of Guanzhongweihe River and Beiluohe River there is also a small plot of sandlot. According to the Macro Monitoring Report on Land Desertification of Shaanxi Province, from 1994 to 1999, area desertification was 1,455,000 ha, expanding from the original 7 counties to 13 counties (districts), the flowing sandlot (sand hill) area increased by 13.6%, reflecting the overall spreading trend. The desertification grows especially quickly along the loess hills, passing across the Great Wall by 10-30 km. Analyzing from the intensity of wind erosion desertification, from southeast to the northwest, there are potentially deserting strip, slightly deserting strip, and intermediately and seriously deserting strip.

3.1.10 Soil Salinization

There are 4 major types of soil salinization in Shaanxi province, the first is the salinization of high-salt strata, mainly happening in the Dali county and Pucheng county in the north of Weihe River; the second is the salinization of modern salt lake, mainly happening in Dingjing Plateau along the Great Wall; the third is the soil salinization caused by strong evaporation, mainly happening along the marsh area along the east of Great Wall; the fourth is the salt salinization caused by rising water level, mainly happening in Sanmenxia Reservoir and irrigation area in Guanzhong and north Shaanxi area. The salinity degree in Guanzhong and north Shaanxi irrigation area is mainly mild to moderate, with part of the area where the intensity is serious. The salinity of Wudinghe River along the Great Wall is moderate to serious. The soil on Dingjing Plateau is mainly sheet-based saline soil.

The total salinization area of Shaanxi province is showing a rising tendency, due to the beach reclamation in Yulin Region. Although the salinization of other area does not expand, the potential salinity problems should not be neglected, especially in the Guanzhong irrigation area.

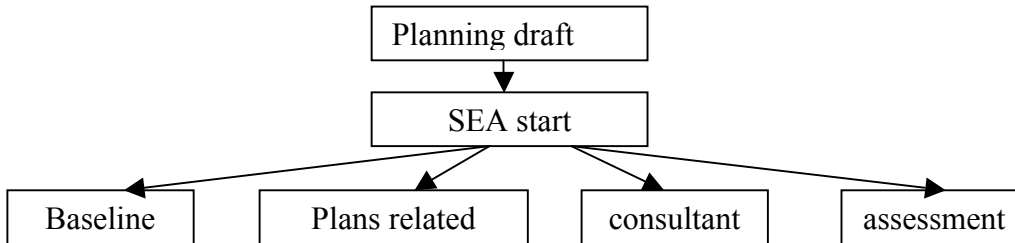
3.1.11 Major Natural Disasters

The major natural disasters in Shaanxi province are drought, floods and geological disasters and so on. Drought is the most important natural disaster of the province, affecting 587,000 ha each year on average, most serious in north Shaanxi, north Weihe River and east Guanzhong areas. The average flood affecting area of the province is 193,000 ha, mainly happening in summer, most serious along river areas in south Shaanxi. Geological disasters mainly include landslide, debris flows, ground fissures and subsidence and so on. Across the province there are 1786 key landslide sites and 2000 non-key ones. The debris flow area covers 2/3 of the total provincial area, most serious in Qinling-Bashan mountains and the Loess Plateau in north Shaanxi. Ground subsidence and ground fissures mainly happen in urban and suburb of Xi'an city. It is related to the over-exploitation of underground water. The ground subsidence may directly damage the foundation of urban buildings, block the road drainage system. Ground fissures may split and damage the buildings and road surface, causing serious direct or indirect economic loss and social impact.

4 SWOT

4.1 Process

The process of Shaanxi provincial road network:



4.2 Methods

- **Checklist Method**

Checklist method is to put the elements that may be influenced by traffic planning and the influence that may happen together in a list and make qualitative or quantitative evaluation on the checked environmental influence.

Checklist method is convenient and easy to be accepted by the professionals and the public. It can guarantee that severe environmental influence won't be neglected if used at the early stage of the evaluation on traffic planning's environmental influence. However, it's a tedious and time-requiring job to establish a systematic and comprehensive checklist; meanwhile as the checklist doesn't integrate the "receptor" with "source" as well as fails to clearly show the influential process, degree and comprehensive effects of traffic planning on environment, economy and society.

- **Analogy Method**

On the insufficiency of data, partial investigation can be adopted, and then take it as basis to analogize the different situations in the province. Its disadvantage is its requirement on a lot of detailed investigation data.

- **Experts Consultation Method**

On the process of information collection, the relevant departments and authorities such as Shaanxi Environmental Protection Bureau, Communication Department, Construction Department, Forestry Department, Water Resources Department, Land Resources Department and Tourism Bureau etc have been consulted to put forward environmental protection measures suitable to the local actuality based on the existing local environmental problems and during the process of report making, senior experts on environmental protection and planning have been consulted for many times to complete the making of the report. Its defects are work load is too much, and the cost is too high; the advantage is that some accidental discovery can be acquired.

- **Map Overlay Method**

Map Overlay Method is to overlay the specific maps concerning natural conditions, social background and economic conditions etc that evaluate regional characteristics to form a map that can reflect comprehensively the space characteristics of environmental influence.

Map Overlay Method is suitable for the comprehensive analysis, environmental influence recognition (to judge influential scope, nature and degree) and accumulated influence evaluation. Map Overlay Method can directly, vividly and briefly show the space distribution of different single influence and compound influence. But it can't reflect the casual relationship between source

and receptor directly on map, so it can't comprehensively evaluate the degree of environmental influence or the importance of environmental factor.

The disadvantage is its requirement on enough electronic maps, professional geographical information system software, which will inevitably increase the project cost; its advantage is the quantitative analysis can be made to some extent.

Mathematics Model Method

Environmental mathematics model means to show spatial temporal change process and change rules of environmental system or environmental factors with mathematics form quantization.

Environmental mathematics model has the following features:

- it can quantitatively describe the interactive effects and casual relationship between the multiple environmental factors and environmental influence;
- it has great flexibility.

Its defects mainly include:

- high requirement on basic data;
- application limited to environmental system that has been known well by people;
- high cost and influence analysis limited to single environmental factor.

• Space Analyzing Technology Symbolized with GIS (Geographic Information System)

Space analyzing technology symbolized with GIS (Geographic Information System) mainly means 3G technologies, namely GIS (Geographic Information System), GPS (Global Positioning System) and RS (Remote Sensing). Currently the research and application on "3G" technology in the world develop at the direction of integration.

In traffic planning's environmental influence evaluation, as the traffic planning's environmental influence evaluation is regional, and what it is to analysis and evaluate is the environmental influence of traffic infrastructure construction in a larger region scope, it must be closely connected with the space distribution of environmental factors and their interactive relationship. Therefore geographic information system technology will be an important technical tool and measure for traffic planning's environmental influence evaluation and traffic planning, environmental background and status quo can all be visualized in GIS and be checked and inquired; GIS's space analyzing function and its combination with model technology (environmental forecast model or decision analyzing model) can play important roles in the environment influence forecast of different plans.

• Analytic Hierarchy Process

Analytic hierarchy process (AHP) is to analyze the factors contained in complicated problems and their mutual relationship to decompose the problem to different factors and classify the factors to different levels to form a multi-level structure and on every level make paired-comparison on the factors of this level and establish judgment matrix according to certain stipulated rule. It can get the weight of the factors of this level on the rule by calculating the maximum eigenvalue of the judgment matrix and its corresponding orthogonalizational eigenvector.

AHP applies to the determination of the weights of different environmental factors of the evaluation on road network planning's comprehensive environmental influence.

4.3 Conclusion

- 1) SEA started later
- 2) Some sustainable index not covered
- 3) Few of public participation

5 CONSULTATION AND PARTICIPATION

5.1 Implementation of Public participation investigation

1) Investigation time

From May, 2006 to June, 2006.

2) Investigation area and object

Highway network planning covers the whole Shaanxi Province. Due to comprehensibility and complication of highway network planning, it is quite difficult to have the general public get to know such complicated information and master related professional knowledge to put forward significant opinions and suggestions. Therefore, they can refer to the public participation section in the past road construction projects so as to put forward specific opinions for road construction, and they can also get further understanding in the specific project construction stage. Hereby, this investigation object is the concerned governmental departments and experts that understand the road network planning and have direct relation with the planning.

5.2 Investigation method

This public participation investigation mainly adopts the visit of governmental bodies and the consultation of multidisciplinary experts, which shall complete each other.

1) Visit of governmental bodies

The visit of governmental bodies mainly consists of all-level governmental function bodies, incl. the departments of environmental protection, planning, land resources, water resources, agriculture and animal husbandry, forestry, urban construction, tourism and cultural heritage, etc, which are the main supervisors of road network construction and have direct relation with highway network planning. What they concern most is whether the road network planning has conflict with the planning of development of industries and fields they are engaged in, and how to plan the development of their industry depending on the road network planning. The investigation shall be conducted via directly issuing the public participation questionnaire or symposium.

After being entrusted to conduct SEA of the planning, we have visited Shaanxi Environmental Protection Bureau, Forestry Bureau, Communication Department, Construction Department, Land Resources Department, Water Resources Department, Cultural Heritage Bureau, Tourism Bureau and Water and Soil Conservation Bureau to make the investigation. The main consultation contents with the concerned departments are as follows:

Table 5-1: The Main Contents of consultations with the concerned Departments

| No. | Department | Consultations' Content |
|-----|---------------------------------|---|
| 1 | Communication Department | <ul style="list-style-type: none"> - the traffic planning of other levels, - the experiences on environmental protection gained from the past road construction |
| 2 | Environmental Protection Bureau | <ul style="list-style-type: none"> - Water environmental function regionalization, - natural reserve regionalization, - wet land situation, |

| No. | Department | Consultations' Content |
|-----|-----------------------------------|---|
| | | <ul style="list-style-type: none"> - desertification, - ecological exemplary region planning, environmental protection planning |
| 3 | Forestry Bureau | <ul style="list-style-type: none"> - Name list of wild fauna and flora, - forest park, - threatened animals and plants habitats distribution, - forest planning, - natural forest protection |
| 4 | Construction Department | <ul style="list-style-type: none"> - Scenic and historic areas, - urban system planning |
| 5 | Land Resources Department | <ul style="list-style-type: none"> - General planning on land utilization, - basic farmland protection planning, - general planning on mineral resources, - general planning on geological environment - prevention and control on geological disasters such as landslide, landslip, debris flow, land subsidence etc, - planning on geological remains protection, - geological park distribution |
| 6 | Water Resources Department | <ul style="list-style-type: none"> - Water and soil conservation planning, - water and soil loss status quo, - information concerning flood |
| 7 | Agriculture Department | Agricultural planning |
| 8 | Cultural Heritage Bureau | Distribution of Cultural Heritage |
| 9 | Tourism Bureau | <ul style="list-style-type: none"> - Distribution of Scenic spots, - tourist planning |
| 10 | Development and Reform Commission | <ul style="list-style-type: none"> - Regional economy development planning, - comprehensive traffic system planning, - railway planning |

2) Consultation of Multidisciplinary experts

The expert consultation mainly contains experts in various fields, covering the fields of environment, ecology, conservation of soil and water, geology, regional development, etc, and it mainly analyzes the rationality of the whole highway network from the prospective of multiple disciplines. The expert consultation is a higher level in public participation and is an important link of perfecting the whole planning environmental assessment.

5.3 Statistical analysis for result of public participation

1) Visit of governmental bodies

(1) Questionnaire investigation

This investigation issues 52 copies of questionnaire, 31 copies are replied, and the response rate is 59.6%. Because most people do not understand the whole road network planning well and are not clear of environmental problems concerned with the road network planning, the response rate is low. See table 5-2 for statistical results.

Table 5-2 Statistics of visit of governmental bodies

| Problem | Answer | Quantity | Percentage |
|--|------------------------|----------|------------|
| Whether this road network planning is favourable for local economic development? | Favourable | 31 | 100% |
| | Unfavourable | - | - |
| | I don't know | - | - |
| Whether the current transport capacity can satisfy the demand of the industry you are engaged in? | Satisfactory | 9 | 29.0% |
| | Unsatisfactory | 22 | 71.0% |
| | I don't know | - | - |
| Whether the road network construction is favourable for the industry development at your place? | Favourable | 26 | 83.9% |
| | Unfavourable | 5 | 16.1% |
| | I don't know | - | - |
| Whether the road network layout has conflict with the planning of the industry you are engaged in? | No conflict | 24 | 77.4% |
| | Conflict | 6 | 19.4% |
| | I don't know | 1 | 3.2% |
| Do you agree with this road network planning? | Agree | 28 | 90.3% |
| | Agree after adjustment | 3 | 9.7% |
| | Not agree | - | - |

The above table shows that, governmental function departments agree with the implementation of this highway network planning in principle; 9.7% of departments think that partial lines should be adjusted properly in specific layout, 16.1% of departments think the road network construction is unfavourable for the development of industry they are engaged

in, and 29.0% think that the current road transport capacity can satisfy the demand of industry development, but, considering that the road network construction can improve local social and economic development, they agree with the road network construction

(2) Investigation results

Combining the investigation results of questionnaire and symposium, the governmental departments put forward the following problems and suggestions for road network planning:

- Special natural geographical and geologic environment of Shaanxi Province determine the sensitivity and the vulnerability of ecological environment of the province, therefore, the layout of road network planning in the ecologically sensitive area and key ecological protected areas shall be considered seriously, and it is required to take preventive measures in the drinking water source area;
- Strengthen the protection and compensation for cultivated land, forest and grassland during the highway network construction and ensure the interests of residents;
- Highway network planning should attach much importance to the expansion and reconstruction of existing roads and minimize the impact on ecological environment;
- Keep good communication and coordination with planning departments of all areas and do a good job in the connection with related industry planning.

2) Consultation of multi-disciplinary experts

(1) Investigation object

In this expert consultation, six experts (three of Shaanxi, and three of Beijing) are visited, including three experts in ecology, one expert in geology and mineral resource, one expert in protection of cultural heritage. They are consulted on the impact of highway network construction in all industries and fields, the rationality of road network planning and the issues in the implementation of road network planning.

(2) Consultation results

The consulted experts hold positive attitude toward the highway network planning of Shaanxi Province. They think that the implementation of road network planning can promote the social and economic development, and its resource advantage can be transformed to economic advantage. But the natural environment and ecological environment of Shaanxi Province are special to certain extent and there are many sensitive problems, and several experts put forward suggestions and requirements for the environmental evaluation of highway road network planning for these sensitive problems. The key points are as follows:

- Generally speaking, they are positive for the development goal of highway road network planning. Many experts think that the highway network planning will have a decisive influence on the development of whole Shaanxi Province, and the road development will drive the development of a series of related industries, attract the investment and facilitate the economy of Shaanxi Province to realize leaping development.
- When analyzing the ecological compatibility of road network planning, put forward guidance and suggestions for the ecological function and biodiversity protection of Shaanxi Province from the macroscopic view;

- Because the environmentally sensitive area of Shaanxi covers a large area like the nature reserve, famous scenery and forest park, while developing the road network, try to avoid irrecoverable disturbance, impact or destroy on them, and comply with the fundamental principle of development under the protection and respect the natural law;
- Sensitivity and vulnerability of ecological environment in Shaanxi Province requires that the road network planning and construction must pay high attention to the prevention of geologic hazard;
- The planning environmental evaluation and the project environmental evaluation shall make clear of emphasis and division. The planning environmental evaluation shall emphasize the road network structure, the general environmental characteristics of Shaanxi, the compatibility and adaptability of distribution of key sensitive areas, demonstrate the environmental rationality of all corridor belts, but not discuss the detailed trend and control point of all roads;
- The environmental evaluation of highway road network planning shall be blended with environmental evaluation of other planning, refer to the planning document and evaluation data like Shaanxi ecological construction planning, nature reserve planning, cultural heritage planning, planning of mineral resource development and utilization, planning of cities and towns layout, tourism planning, land use planning, general planning of social and economic development, and also provide scientific basis and reference opinions for further perfecting these planning;
- Seek public opinions from all walks of life and coordinate the relationship with related departments.

6 ALTERNATIVES

In China, the transportation planning of different transportation models are supervised by different departments. Shaanxi province communication department only takes charge of the road and water transportation planning while the railway transportation planning is charged by The National Ministry of Railway and the aviation planning by General Administration of the Civil Aviation of China, so the comparison selection can not be done among different transportation models.

During the highway network planning, it needs to consult with several departments and experience demonstration many times. The planning process itself is a selection process and compares the proposed traffic corridor strips. There is only one road network in the draft of planning scheme, which was reviewed by the project team. It has no alternative schemes to be compared with. Because the works of environmental impact assessment was carried out later than the planning works, and EIA has not been started until the planning draft had been issued, the project team found out that the *Environmental Impact Assessment of Highway Network Planning of Shaanxi Province* does not include the comparing selection section of planning.

7 IMPACT ASSESSMENT of the Draft Transport Plan

7.1 Introduction

Due to the stage of the road network planning, the planning scheme fails to provide enough detailed parameters, such as the ratio of various vehicle models, and the parameters between the sensitive point and all road sections, so the emission concentration of pollutants can't be forecasted.

7.2 Main findings of the assessment

Analysis and Conclusion of Land Impact

If the high-value indicator of land use is adopted to realize the goal of Shaanxi highway network, it shall increase 17748.62ha of land; if the medium-value indicator of land use is adopted, it shall increase 16698.05ha of land, if the low-value indicator of land use is adopted, it shall increase 15607.69ha of land. In contrast, the high-value indicator of land use is 1090.36ha of land more than the medium-value indicator of land use and 2140.93ha of land more than the low-value indicator of land use.

Analysis and Conclusion of Ecological Environment Impact

In the nature reserve of Shaanxi Province, in the road section awaiting construction of highway network, there may be nine nature reserves within 2km of the corridor, 12 nature reserves within 5km traffic corridor and passage, and 16 nature reserves within 10km of traffic corridor and passage. Besides, eight nature reserves with a larger area may be intersected with the road awaiting construction and the intersecting length is totally 121.33km.

The implementation of road network planning has small impact on the protected area of geological relics, and there are two protected area of geological relics within the traffic corridor and passage with a width of 10km in the road section awaiting construction.

Within 2km of traffic corridor, two forest parks may be affected including Sandaomen Forest Park; within 5km of traffic corridor and passage, eight forest parks may be affected, and within 10km of traffic corridor and passage, 19 forest parks may be affected.

(2) Impact on loss of soil and water

In 42 road sections through various preventive areas, the total length of road sections through the preventive area of water and soil conservation is 957.51km, the length of road sections through protective area of water and soil conservation is 461.17km, the length of road sections through the supervised area of water and soil conservation is 123.15km, which occupies 42%, 20% and 5% of total length of 42 road sections respectively.

Analysis and Conclusion of Water Environment Impact

In the road sections awaiting construction, the construction of 33 road sections may affect the surface water system of Shaanxi Province, among which, Binxian-Qishan road section goes through the source water of Qishui River, Fugu-Shenmu road section goes through the source water of Majiata gutter, Fuxian -Shaanxi-Gansu juncture road section goes through the drinking water area of Hulu River, Pingmu-Fengxian road section goes through the drinking water area of Jialing River, and Yangjiapo-Pantang road section goes through the source water of Majiata gutter.

It is estimated in the method of analogy analysis that, after the road section awaiting construction in the whole road network is open to the traffic, the daily emission of COD is 249kg-574kg, the emission of SS is 4979kg-11480kg, and the emission of petroleum type is 37kg-87kg.

Analysis and Conclusion of Mineral Resources Impact

19 road sections in the highway network planning may have impact on the development of 16 mining areas, among which, the length of road section within the mining areas of coal, metal and natural gas is 338.12km, 186.72km and 63.24km respectively.

Analysis and Conclusion of Water Resource Facilities

In the highway network of Shaanxi Province, the construction of 14 road section may affect 17 hydraulic projects including Erlongshan Reservoir, Jiepaiguan Reservoir, Jiezihe River Reservoir, etc.

Analysis and conclusion of acoustic environment impact

ArcGIS software is adopted to recognize the sensitive point of acoustic environment within 200m of both sides of 34 road sections, which may have large deviation with the actual condition due to the problem with the data precision.

Analysis and Conclusion of Tourism Resources Impact

Within 2km of traffic corridor belt, three famous sceneries may be affected including Wuzhang Plateau, within 5km of traffic corridor and passage, nine famous sceneries may be affected, and within 10km of traffic corridor and passage, 21 famous sceneries may be affected. Because there are many cultural relics and historic sites in Shaanxi Province, 18 road sections among the road sections awaiting construction may have conflict with the cultural relics and historic sites in several places.

Analysis and Conclusion of Social Environment Impact

- (1) 2880 thousand of jobs can be provided during the construction of the road of the whole road network construction.
- (2) The implementation and operation of road network will bring active change to the industrial distribution of Shaanxi Province.
- (3) The implementation of road network planning will improve the traffic condition of Shaanxi Province and have great significance for improving the life quality of people of Shaanxi Province.

7.3 Cumulative impacts and proposed mitigation measures

In Environmental Impact Assessment of Highway Network Planning of Shaanxi Province, cumulative impacts assessment has been tried initially, including impact analysis on reserve land, water environment, water resource facilities and mineral resources.

- (1) Analysis of cumulative impacts on reserve land

If the layout of highway network was improper, it would be the case that several highway routes would pass through reserve land as natural reserve area. When such reserve land has a large area, impact would be more liable to cause.

Cumulative impacts will be caused to the same reserve area by more than one highway as shown in the Highway Planning of Shaanxi Province. For example, Chengcheng-Huayin Highway and Huayin-Shangluo with about 10km interval will impact jointly Huashan Forest Park, as per Table 7-1 and Table 7-2.

Table 7-1 Analysis of cumulative impacts on natural reserve area caused by highway network of Shaanxi Province

| No. | Name natural reserve area | Highway section |
|-----|------------------------------|---|
| 1 | Ying Lake Swamp Reserve Zone | Langao-Ankang, Ziyang-Boundary of Shaanxi Province and Sichuan Province with 2km interval, and Ankang-Pingli with 5km interval. |

Table7-2 Analysis of cumulative impacts on forest park caused by highway network of Shaanxi Province

| No. | Name of forest park | Highway section |
|-----|---------------------|--|
| 1 | Huashan Forest Park | 10km buffer area of Chengcheng-Huayin and Huayin-Shangluo |
| 2 | Yan'an Forest Park | 10km buffer area of Yanshuiguan-Yan'an and Yan'an-Baibao (boundary of Shaanxi Province and Gansu Province) |

(2) Analysis of cumulative impacts on water environment

The cumulative impacts of highway network planning on high-function water region mainly exist in 5 rivers including Jiaru River as per Table 7-3

Table7-3 Analysis of cumulative impacts on high-function water region by highway network of Shaanxi Province

| No. | River | Highway section | Water quality category |
|-----|----------------|--|---|
| 1 | Majiata gutter | Yangjiapo-Pantang, Fugu-Shenmu | <input type="checkbox"/> |
| 2 | Beluo River | Fuxian-Boundary of Shaanxi Province and Gansu Province, Yan'an-Baibao (Boundary of Shaanxi Province and Gansu Province), Chengcheng-Huayin, Heyang-Yaoxian | <input type="checkbox"/> |
| 3 | Han River | Chadian-Hujiaba, Pingmu-Hanzhong | <input type="checkbox"/> , <input type="checkbox"/> |
| 4 | Dayu River | Chengcheng-Huayin, Heyang-Yaoxian | <input type="checkbox"/> |
| 5 | Jing River | Yaoxian-Binxian, Weinan-Jingyang | <input type="checkbox"/> |
| 6 | Kuye River | Yangjiapo-Pantang, Fugu-Shenmu | <input type="checkbox"/> |
| 7 | Shiwang River | Yanchang-Yichuan, Boundary of Shaanxi Province and Shanxi Province--Fuxian | <input type="checkbox"/> |
| 8 | Wei River | Pucheng-Weinan, Chengcheng-Huayin, Jinyang-Huxian, Tangyu-Qishan | <input type="checkbox"/> |

(3) Analysis of other cumulative impacts

Water resource facilities and mineral resources likely to be subject to cumulative impacts are shown in Tables7-4 and 7-5.

Table 7-4 Analysis of cumulative impacts on water resource facilities caused by highway network of Shaanxi Province

| No. | Reservoir name | Highway section | Reservoir nature |
|-----|----------------------|--|---------------------|
| 1 | Jiezihe Reservoir | Fuxian-Boundary of Shaanxi Province and Gansu Province, Boundary of Shaanxi Province and Shanxi Province--Fuxian | Planned reservoir |
| 2 | Longjiamao Reservoir | Jiaxian-Yulin, Shenmu-Yulin, Yulin--Mizhi | Completed reservoir |

Table 7-5 Analysis of cumulative impacts on coal resource caused by highway network of Shaanxi Province

| No. | Name of mine field | Mine field type | Highway section |
|-----|-----------------------------------|-----------------|--|
| 1 | Fengtailongbao metallogenic field | Metal | Pingmu-Fengxian, Pingmu-Hanzhong, Tangyu--Qishan |
| 2 | Shanzhenzhaxun metallogenic field | Metal | Ziyang-Boundary between Shaanxi Province and Sichuan Province, Huayin-Shangluo |
| 3 | Binchang Mine Field | Coal mine | Yaoxian-Binxian, Binxian-Qishan |
| 4 | Chenghe Mine field | Coal mine | Yichuan-Chengcheng, Chengcheng-Huayin, Heyang--Yaoxian |
| 5 | Shenfu Mine Field | Coal mine | Yangjiapo-Pantang, Fugu--Shenmu |
| 6 | Tongchuan Mine Field | Coal mine | Heyang-Yaoxian, Yaoxian-Binxian |
| 7 | Yuheng Mine Field | Coal mine | Jiaxian-Yulin, Shenmu-Yulin, Yulin-Mizhi |
| 8 | Yushen Mine Field | Coal mine | Yangjiapo-Pantang, Fugu-Shenmu, Shenmu-Yulin |
| 9 | Zizhouzhenchuan Gas Field | Natural gas | Yulin-Mizhi, Mizhi--Qingjian |

7.4 Trans-boundary impacts

Trans-boundary impact is usually caused by flowing environment elements, such as air and water course. Nevertheless, it is impossible to forecast at highway network planning stage due to absence of forecast parameter.

7.5 Difficulties and uncertainties

1) Analysis of difficulties in highway network plan EA

(1) Highway network plan EIA method is immature.

Since SEA was required by Environmental Impact Assessment Law of People's Republic of China on Sep. 1, 2003, highway network plan SEA has been conducted by some relevant parties. Nevertheless, the assessment methods adopted by different assessing parties are different, mostly based on the experience or reference of project EIA. In general, the assessment methods currently being adopted by the assessing parties are immature. There is no commonly accepted method system for highway network plan SEA yet. The fact that existing assessment methods are immature will inevitably affect the development of highway network plan SEA.

(2) Difficulties in collecting data

Due to a variety of reasons, there are certain difficulties in collecting environment background data. As mentioned above, highway network plan SEA involves a variety of environmental issues, and requires a lot of detailed data to describe environmental background.

Since the assessment object is provincial-level road network, the data to be collected by the assessing party shall include environmental background outline information of the province and planning information of all sectors of the province. Most of the parties are willing to disclose to public the information on sector planning prepared and existing nature & environment mastered, and EIA party is easy to get the same. Nevertheless, the possessors are reluctant to disclose free of charge the results gained at great cost and through years of research, observation and test, which are very helpful in describing the environment history and trend, or are must in EIA, and is difficult for the EIA party to get because of fund restraint. Furthermore, some plan or scientific research is in the course of preparation or research, and the interim results usually will not be disclosed to EIA party due some sensitive issues as confidentiality or copyright. Besides, due to some objective reasons as past fault, management fault or fund shortage, some sectors have never conducted any planning for their own sectors, nor survey into relevant background. Therefore, it is impossible for EIA party to obtain information on such aspects.

(4) Multiple Difficulties in Public Participation:

It is definitely provided for in “Law on Environment Impact Assessment Law of the People’s Republic of China” that the organ compiling special plans shall conduct discussion and hearing or adopt other manners to seek the opinions of relevant units, experts and the public on the draft of the environment impact assessment report for the plans that may cause undesirable environmental impact and directly involves the environmental interests of the public before such draft plan is submitted for examination and report. However, at present, there are multiple difficulties confronting public participation in practice.

(1) Choice of Public Participants

As for the general public, on the one hand, many people have shown little interest to environment assessment and plans of the government departments due to lack of awareness of environmental protection and democracy. On the other hand, due to the comprehensive and complex factors of highway network planning, which is different from construction projects, it is rather difficult for general public to learn about so complex information and grasp relevant professional knowledge to put forth meaningful opinions and suggestions, and sometimes it is even impossible. And such factors have restricted and checked their role in environment assessment.

Therefore, we shall mainly turn to relevant government departments and experts when selecting public participants. Firstly, government departments and experts occupy more relevant information on the draft plan. Secondly, government departments and experts have grasped professional knowledge, and their opinions are generally of specific aim and are constructive during consultancy, which are quite important for promoting coordination between the draft plan and the relevant plans of various departments.

(2) Means of Public Participation

The means of public participation in current environment assessment of plans include calling together local residents that may be influenced, relevant units and experts to hold discussion, or designing questionnaire for the public.

The merit of discussion lies in the convenient two-way exchanges between the assessors or decision-makers and the public, in which it is easy for them to reach consensus. However, the its

shortcomings are the difficulties in organizing it and guaranteeing the representativeness of the participants, and the high cost.

The problems with questionnaire lie in that, compared with construction projects, environment assessment of plan involves more complex and pluralistic environmental issues, and more comprehensive aspects. Therefore the questionnaire is more complex and it is hard to render it concise and clear, which has increased the difficulty of questionnaire. And another outstanding and key problem is low rate of information feedback, and inconvenience in two-way exchanges.

In addition, public participation may be conducted by means of consensus participation launched by the media and public decision made by all the citizens. However, it is difficult to carry out such work now, and the defects lie in the systematic features and volume of the feedback information.

Therefore, even though suitable public participants are determined during environmental assessment of plan, the effectiveness of public participation have been restricted in practice due to lack of means of public participation now.

2) Analysis of Uncertainty of Environment Assessment of Highway Network Plan

Many uncertain factors lie in environmental impact assessment of highway network plan, including uncertainty in plan program and the environment background information.

(1) Uncertainty in Highway Network Plan and Program

The uncertainty of highway network plan and program mainly lie in uncertainties in route layout, construction levels and construction programs etc..

- Uncertainty in Route Layout

Expressway network plan has only preliminarily determined the network nodes and laid out the rough passages. However, the specific location of the routes is not clear and has a great swing.

- Uncertainty in Construction Level

In case of long span of time in the plan, the highway levels may be adjusted according to social economic development level.

- Uncertainty in Construction Program

The construction program herein refers to whether the highway is newly-built, upgraded or expanded. The uncertainty in construction program of highway network plan mainly lie in the uncertain length of the original highway to be used in upgrading or expansion.

(2) Uncertainty in Extent of Environment Impact

The uncertainty in highway network plan and program has led to the uncertainty in extent of environment impact caused by the highway network construction. Firstly, the uncertainty in extent of environment impact caused by swing of highway routes; Due to the large scope of environment impact assessment in highway network plan, it is quite hard to express the environment information in the drawings clearly, especially for some important environment sensitive regions. For example, nature reserves, scenic areas, cultural relics and ancient sites etc.. Such environment sensitive areas may be only indicated with a point in the drawings, and the actual scope thereof cannot be accurately indicated, and it is impossible to judge the division of the core area, buffer area and experiment area of the natural reserve, or determine the scope of protection and zone for

construction control for the cultural relics under protection. However, such facts usually directly determine the extent of environment impact of highway network.

Secondly, adjustment of highway levels and change of construction modes may change the extent of environment impact of highway construction. The extent of environment impact caused by highway of various levels and different construction modes may vary greatly from each other due to the occupied area and means of construction. For example, the number of the lanes of the highways, and the difference in the occupied area of 6 lanes and 4 lanes during project implementation; For another example, the 6-lane expressway in the plan is adjusted to level-3 highway in the plain area, which will reduce the occupied area by about 5hm² per kilometre, and it will naturally reduce destruction to the ground vegetation, lower the water and soil erosion. Similarly, the extent of impact on land resources and ecological environment etc. caused by upgrading and expansion of the old highway may vary greatly from that caused by a newly-built highway.

(3) Uncertainty in Environment Information

The uncertainty in environment information mainly lies in the following aspects:

- Lack of Synchronization in Data

The data collected by various departments, especially plan data, generally are not synchronous in time, which has lowered the comparativeness of the data. For example, the indexes for 2015 have been put forth in highway network plan, while those for 2010 are adopted in land-use plan. So the indexes of arable land convertible to construction land in 2010 determined in land-use plan cannot be used to assess land occupation of highway network during assessment of occupation of arable land by highway network.

- Dynamic Changes of Environment Information

The data collected by environment assessment units are mostly introduction to current environmental conditions, and some are analysis of the course of environmental development, which are generally adopted as basis for prediction and assessment of environment impact of highway network. However, the environment background changes with the time, and the uncertainty caused by the change of environment information will necessarily increase the uncertainty of the assessment results.

- Uncertainty in Potential Environment Sensitive Areas

Potential environment sensitive areas refer to the places that may be determined to be nature reserve, scenic areas or sources of drinking water etc.. According to the outlook of sustainable development, environment impact assessment of highway network plan shall not only assess the impact of highway network construction on the current environment sensitive areas, but also the impact on the potential environment sensitive areas. The environment sensitive areas have a greater uncertainty, being indefinite in exact location, area and division of function sections. And it is still to be discussed whether such areas will be determined to be environment sensitive areas.

7.6 Conclusions and recommendations

Road sections such as Tangyu-Qishan and Yaoxian-Binxian among all the road section to be built are highly sensitive road sections. And 6 road sections such as Heyang-Yaoxian, Huayin-Shangluo, Langao-Ankang, Weinan-Jingyang, Weinan-Yushan and Ziyang- Boundary of Shaanxi Province and Sichuan Province etc. belong to medium sensitive road sections, and 14 road sections such as

Ankang-Pingli etc. are slight sensitive road section. In addition, 12 road sections such as Chadian-Hujiaba etc. belong to ordinary sensitive road sections.

The comprehensive environment impact index (E)of the expressway network in Shaanxi Province is 2.156, which shows that the environmental sensitiveness of highway network is slight sensitive, and most of the road sections in highway network has minor environmental impact. In addition, highway network plan has shown a good environmental coordination, and some road sections are to be adjusted.

8 MONITORING ENVIRONMENTAL EFFECTS

8.1 Indicators used in the EA

Monitoring Indicators

The monitoring indicators of environment impact assessment of plan include compatibility indicator and environment indicator. Compatibility indicator refers to the assessment indicator on whether the expressway network plan is compatible with other plans. Environment indicator refers to the assessment indicator on ecological environment and social environment.

Compatibility Indicators

The compatibility indicators in the report mainly include the assessment indicators on the compatibility between the expressway network plan and tourism plan, other traffic plan, land-use plan and urban system plan etc..

Environment Indicators

The indicator of ecological environment in the environment indicators mainly include the quantity of the nature reserve, forest parks, scenic areas and geological remains etc. and the quantity of the water bodies of various levels spanned over or accompanied thereby, and the fuel oil consumption, increase of noise and emission of atmosphere pollutants of the whole expressway network.

Indicators of social environment include the number of posts increased due to expressway network, the number of scenic spots increased or influenced thereby, resources developed promoted thereby and the quantity of cultural relics and ancient sites interfered thereby etc..

8.2 Additional indicators

Other indicators of pollutant density such as COD and TSP etc. can only be predicted during environment impact assessment of construction projects of various road sections.

8.3 Plan to collect information on the impacts of the plan based on the indicators

At present, a 5-year short-term development plan will be compiled every five years for various industries in China. And three 5-year plans will be compiled during implementation of the expressway network, and other plans are being constantly updated during the period. Compatibility analysis shall be conducted based on the plan in case of change of other plans to analyse whether other plans contradict with the highway network plan. In case of any contradiction, the department of communications may put forth opinions on rectification; In case of changes in state highway network plan, the plan shall be amended based on the latest state highway network plan to rectify the improper items. The plan shall be taken as basis in case of change of the highway network plan below provincial level.

The monitoring time is the first phase of implementation of each 5-year plan, that is 2006, 2011 and 2016, which may be organized by the provincial development and reform committee.

9 NEXT STEPS

9.1 Commenting on this report and documentation of the decisions

The expressway network plan of Shaanxi Province is required for constructing a well-to-do society and realizing the objectives of modernization construction, which has been widely supported and approved by the social public. Though negative impact will be inevitably occur on surrounding environment during implementation of highway network, the social benefits, economic benefits and environmental benefits thereof can be guaranteed so long as we consciously take corresponding preventive measures, and do well in environmental protection in specific project implementation. Therefore, the expressway network plan and layout are rational and are coordinated with other relevant plans. Assessed from the perspective of environment, the highway network plan is feasible after being amended according to the proposal on adjustment put forth in the assessment report.

9.2 Monitoring and follow-up measures envisaged

- 9 It is necessary to conduct inspection of the plan implementation during various phases of plan such as recent plan, intermediate plan and future plan, and analyse the quantity of the nature reserves, forest parks, scenic areas, geological remains and cultural relics and ancient sites actually interfered thereby, and the quantity of the water bodies spanned over or accompanied thereby, and sum up the fuel oil consumption of the whole highway network, analyse the emission of pollutants of the highway network, the scenic spots and tourism scenic spots newly increased due to the highway network etc..

10 NON-TECHNICAL SUMMARY

According to the current technical situation of EIA of road network planning in China and the data that road network planning has, the road network planning has the following weaknesses:

- 1) Unable to predict the density of polluted emissions;
- 2) Unable to carry out multi-solution....
- 3) Lack of public participation

There are many uncertain factors during the construction of road network planning. The emphasis of road network EIA is just to identify the environment-sensitive point in the corridor and provide them to the planner and designer in the next phase.

Annex: Information used to prepare the Framework

This report is based on two useful inputs from documents by the Chinese partners and additionally, the proposed content of the Environmental (SEA) Report as of EC SEA Directive (2001/42/EC) was used.

A) Contents for the Transport EA report

Chapter 1 Introduction

Chapter 2 Survey of Planning for Expressway Network and Analysis of Coordination

Chapter 3 Survey of Current Environmental Situation in Shaanxi Province

Chapter 4 Environmental Impact Analysis and Assessment

Chapter 5 Alleviating Measures and Suggestions

Chapter 6 Environmental Management, Monitoring and Follow-UP Assessment

Chapter 7 Public Participation

Chapter 8 Difficulties and Analysis of Uncertainty

Chapter 9 Summary of Implementation

B) The main stages in planning and assessment of the ShaanXi Province Highway Plan

| Date | Planning tasks | Lead organisation | Inputs required | Analysis proposed | Outputs expected |
|-------------|--------------------------------------|---|--|---------------------------------|--|
| Aug. 2005 | | Shaanxi Provincial People's Government | Planning for State Expressway Network | Investigation and research | Require further accelerating the construction of expressway |
| Aug. 2005 | | Shaanxi Provincial Department of Communications | | | Scale of highway network |
| Nov. 2005 | Highway network planning scheme | ShaanXi Highway Survey and Design Institute | | | Highway network planning scheme |
| Jan 2006 | Solicit opinions | Shaanxi Provincial Department of Communications | Highway network planning scheme | Consult relevant departments | Adjustment opinions of highway network planning by all departments |
| June 2006 | Final draft | Shaanxi Provincial Department of Communications | Opinions put forward by all departments; planning protocol | Adjustment of planning scheme | Plan report |
| Sep 2006 | Environmental Impact Assessment | CATS | Demand models; Routes, Etc. | Indicators based evaluation.... | Constraint maps SEA Report |
| Nov. 2006 | Analysis of results from assessments | ShaanXi Environmental Protection Agency | SEA Report | Revision of the report by ??? | Memo explaining how the results were considered ??? |
| Feb 2007 | Plan Approval | Provincial Gov (with DRC) | Final Draft Plan | Council Debate?? | Final Plan |

C) Proposed content of the SEA Report based on the EC SEA Directive (2001/42/EC), Annex I

- (a) an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes;
- (b) the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme;
- (c) the environmental characteristics of areas likely to be significantly affected;
- (d) any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;
- (e) the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation;
- (f) the likely significant effects (1) on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors;
- (g) the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme;
- (h) an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;
- (i) a description of the measures envisaged concerning monitoring in accordance with Article 10;
- (j) a non-technical summary of the information provided under the above headings.