

## **11 Impact Assessment of Cultural Heritage**

### **11.1 Introduction**

This chapter is based on *Annex 10 Criteria for Evaluating Visual and Landscape Impact, and Impact on Cultural Heritage*, and *Annex 19 Guidelines for Assessment of Impact on Cultural Heritage and Other Impacts of Technical Memorandum on Environmental Impact Assessment Process*. The chapter will describe the existing condition of cultural heritage, assess the potential impact on cultural heritage caused by the Project, and propose the mitigation measures accordingly.

### **11.2 Laws, Regulations and Standards**

On the Shenzhen side, the assessment will be based on the state relevant laws and standards, while on the Hong Kong side, it will be referred to the relevant laws and standards of Hong Kong Special Administrative Region.

#### **11.2.1 National Laws and Standards**

- (1) *Cultural Relics Protection Laws of the People Republic of China*
- (2) *Notice about Protection of Cultural Relics, Historic Site and Famous Scenery in Construction (Jointly issued by Ministry of Urban and Rural Construction and Environmental Protection and Ministry of Culture in 1983)*

#### **11.2.2 Laws and Standards in Hong Kong**

*Technical Memorandum on Environmental Impact Assessment Process, Annex 10 Criteria for Evaluating Visual and Landscape Impact, and Impact on Cultural Heritage, and Annex 19 Guidelines for Assessment of Impact on Cultural Heritage and Other Impacts.*

### **11.3 Baseline Study**

Detailed baseline study is carried out on cultural heritage in the area of Stage III Project according to the requirements of Annex 19 of *Technological Memorandum of Environmental Impact Assessment Process*. The purpose of the baseline study is to find

out important cultural relics which might be affected by the Project, and identify its location, area, appearance character and value, and menace and destruction extent that might be caused by the Project.

The procedure and results of the study are described below:

**(1) On the Shenzhen side**

The consultant has conducted several field surveys on the area of Stage III Project. The results indicate that this area has been urbanized already, and some modern buildings are very close to the river dykes, while no cultural relics and site of historical heritage is found on the ground during the surveys.

The consultant has also carried out a special literature review in Shenzhen Museum and Shenzhen Library. The retrieved literature mainly includes:

*History of Relationship between Shenzhen and Hong Kong (Haitian Press)*

*History, Today and Future of Hong Kong (World Knowledge Press)*

*Research of Archaeology and Discovery in Shenzhen City (Historical Relics Press)*

*The Key Military Fort for Marine Defense in Qing and Ming Dynasty-Dapeng City (Historical Relics, No. 11, 1990)*

*On Culture in Pearl River Delta in Neolithic Age (Archaeology Board, No. 2, 1993)*

*On Three Basic Problems in Bronzy Age in Guangdong Province (Southeast Culture, No. 4, 1997)*

*Investigation on Bronzy Technology before Qing Dynasty in Shenzhen and Neighborhood (Archaeology, No. 6, 1993)*

*Comments on the Problems in Neolithic Age in South China Inshore (Southeast Culture, No. 4, 1997)*

The literature review indicates that no cultural relics, site of historical heritage and historical buildings is recorded in the Study Area.

Some historical relics found on the Shenzhen side are:

The Shoal Ruins in Dahuangsa: it is located at Kuiyong Town, Baoan County, Shen-

zhen City, which is remains of the Neolithic Age.

The Shoal Ruins Dapeng Xiantou ridge: It is sited at Xiantouling Village, Dapeng Town, Baoan County, Shenzhen City which is also remains of the Neolithic Age. Seven graves are unearthed which are remains of Bronzy Age, Song Dynasty and Han Dynasty.

Dieshishan Ruins: it is sited at the south part of Chaguang Village, Nantou District of Shenzhen City. Unearthed cultural relics include pottery fragment, stoneware, bronzes, and iron parts.

Xiaomeisha Ruins: it is located at the east end of Xiaomeisha dike in Lo Wu District of Shenzhen City, which is an old sand dike. The main unearthed cultural relics are china and stoneware.

Shoal Ruins in Shangdong: it is located in an old sand dyke in southeast Shangdong Village, Kuichong Town, Longgong District, Shenzhen City. The main unearthed cultural relics are china and stoneware.

Shoal Ruins in Chiwan Village: it is sited at Chiwan village, Shekou District, Shenzhen City, which has been built as a deep-water port. Cultural relics are abundant, mainly china and stoneware.

Shoal Ruins in Hedi Mountain: it is located on the mountainside northeast the Hedi Mountain and an old continent in mountain foot in Shekou industrial area. The main unearthed cultural relics are china and stoneware.

Shoal Ruins in Dameisha: it is sited in an old sand dyke in front of the Dameisha Village. The main unearthed cultural relics are china, stoneware and bronzes.

Hump Ruins in northwest Xili Reservoir: it is sited on the hump slope in northwest Xili Reservoir. The main materials unearthed are china, stonewares and bronzes.

Hump Ruins in Zuishuling: it is lied on north slope of Zuishuling Ridge, 800 m away from Dongan Village, Guanlan Town, Baoan District, Shenzhen City. The main relics are ruin left in Bronzy Age and Neolithic Age.

Hump Ruins in Jiuxiangling: it is located on the hump behind Xili Primary School in Nanshan District. The cultural relics are mainly china.

Houmeisha Ruins in Nantou: it is sited on the sand dyke connecting Nantou and Shekou Peninsula. The main unearthed cultural relics are china and stoneware.

Hump Ruins in Shizidui: it is lied in Shizidui hill, Zuitou Village, Longhua Town, Baoan District, Shenzhen City. The main cultural relics are china.

Besides these, there are other 38 historical sites such as Shangdong, Wanxialing and so on, which are beyond the Study Area.

Several old graves have been discovered in Shenzhen City. However none of them is in the involved area.

The results from field survey and literature review show that no historical relics or historical site are found on the Shenzhen side in the area involved.

## **(2) On the Hong Kong side**

The consultant has carried out field survey and collect information about whether there are any historical relics, historical site and buildings located in the Project Area.

From June 1998 to April 1999, the consultant conducted field surveys on the Hong Kong side. Pictures of the Study Area and some bridges in the area were taken. Meanwhile, the aerial photos were also obtained from the Lands Department of the HKSAR Government. The field survey in Study Area indicates that no historical relics or historical sites are found in this area. The historical building are Lo Wu Railway Bridge and Lo Wu Old Footbridge. Also, no historical relics or historical sites are found from the pictures that are taken on site or provided by relevant departments of Hong Kong SAR Government.

In 1998, Shenzhen Museum drilled five holes for investigation in Stage III Project Area. No historical relics and sites were found.

Moreover, large scale of literature retrieval was conducted in Hong Kong Kowloon Library, Hong Kong Historical Archive Office, journal stores and bookstores in Hong Kong to obtain information about whether there are historical relics and historical sites located in the involved area. The information referred is:

*The Locations for Archaeological Driling and Unearthing in North New Territories*

*(Archaeological Team from Shenzhen Museum, 1998)*

*Investigation Report for Archaeology in North New Territories (Archaeological Team from Shenzhen Museum, 1998)*

*Exhibition for Relics in 6000 Years in Hong Kong (Hong Kong Advisory Board, etc)*

*Lo Wu Railway Bridge (Antiquities and Monuments Office)*

*Sites of Archaeological Interest as at 1 September 1998*

*History of Lo Wu Railway Bridge*

*Loss of Hong Kong (Hong Kong Commercial Press)*

*Hong Kong's Border with China*

*History of Jiuguang Railway*

The result of literature review shows that the historical relics in Hong Kong are mainly located in the following areas:

Chun Hom Wan, Tai Wan, Sham Wan, Lo So Shing, Sai Wan, Hai Tei Wan, Tai Long Wan, Tung Wan, Fu Tei Wan, Kwo Lo Wan, Sham Wan Tsuen, Tung Ku Chau, Lung Kwu Tan, Yung Long, Shaluo Wan Cape, Lung Kwu Sheung Tan, So Kwun Wat, Shek Kok Tsui, Fa Peng Teng, Pau Tau Kwu, Kau Shat Wan, Sha Po Tsuen, Hung Shing Ye, Siu A Chau, Po Yue Wan, Tai Kwai Wan, Sha Lau Tong Wan, Tung Wan Tsai, Chuk Kok Wan, Man Kok Tsui, Sai Chau, Siu Lam, Yi Long, etc..

The result of the field survey, drilling investigation and literature retrieval on the Hong Kong side indicates that no historical relics and historical sites are found in the Study Area of EIA.

### **(3) Lo Wu Railway Bridge**

The plan layout of Lo Wu Railway Bridge is presented in Figure 11.1 (Scale 1:1000), and Figure 11.2 gives the existing condition.

The book named *History of Relationship between Hong Kong and Shenzhen* (Haitian Press) mentions the construction of Guangjiu Railway and Lo Wu Railway Bridge. It

records that the construction of Guangdong section of Guangjiu Railway began in August 1907, and finished four years later, which is from Dashatou to Lo Wu Bridge. The Hong Kong section began in 1909 and finished in 1911, which is from Lo Wu Bridge to Tsim Sha Tsui. The railway was put into operation after the opening ceremony on 14 August 1911. At that time, the railway was monorail and the steam engine and mechanical signal system were adopted. In 1962, the diesel engine was introduced. In 1976, the planning for improving the section in Hong Kong was discussed by Hong Kong government, which was carried out in 1978 and finished on 15 July 1983. In 1984, the Guangshen Railway Company was set up, and the renovation plan for double track was launched. It was started in January 1984 and finished in January 1987.

Information about Lo Wu Railway Bridge can be obtained from *History of Lo Wu Railway Bridge* and *History of Jiuguang Railway*. It is recorded that British army demolished the Lo Wu Railway Bridge and Jiuguang Railway in 1941 in order to prevent the intrusion of Japanese Army during the World War II. However, the damage did not stop the Japanese aggression. During the Japanese occupation, the Lo Wu Railway Bridge and Jiuguang Railway were reconstructed. When the Japanese army left, the railway and bridge were demolished again. The existing railway and bridge were reconstructed later. Hence, the history of the current bridge can only be dated back to 1945. Moreover, none of the State, Guangdong Province or Shenzhen City put it on the list of archaeological sites to be protected by the government.

Meanwhile, the consultant paid a visit to Jiuguang Railway Bureau to investigate the history of Lo Wu Railway Bridge. The Bureau could not provide any information, such as pictures or historical documents, etc., about the Lo Wu Railway Bridge.

#### **(4) On the Lo Wu Old Footbridge**

It is believed that the Lo Wu Old Footbridge was built in 1970s. The history of the bridge has reflected the diplomatic development between China and British Hong Kong government since the World War II and has witnessed frequently the coming and going of mainland residents and Hong Kong residents since China's reform and opening.

During the early period when Hong Kong was governed by Great Britain, there was

no enclosed boundary between Canton and Hong Kong and residents of both sides could cross the boundary freely. However, the Britain Hong Kong government changed this condition of near hundred year history and promulgated a series of regulations limiting Chinese residents in and out Hong Kong freely. Therefore, Lo Wu Border Crossing became the most important channel for the people crossing the boundary of Canton and Hong Kong. Examination and limitation were so strict that the number of people through the channel greatly decreased.

In 1951, Canton also started to control the residents through the boundary. Resident who passed the border must applied passport at first. It resulted in dramatically decrease of number of people through the border. In 1955, the British Hong Kong government declared to implement so that the number decreased further, about 50 persons per day on September 13, 1956. With Great Britain participating UN force during the Korean War and existing embargo in China, the relation of China and Britain was further tense. At the same time, the "cultural revolution" since 1966 also resulted in high decrease of number coming back mainland.

During 1949 and 1979, the train between Guangzhou and Hong Kong travelled intermittently and the travelers had to go through the Lo Wu Railway Bridge on foot. It was considered not necessary to build a pedestrian bridge for few travelers.

With the end of the cold war, China started to increase its communication to outside since 1972 and the number of travelers entering Canton from Hong Kong increased gradually over one million, creating a peak record. After 1973, China loosened the policies on China's residents entering Hong Kong. The number of residents who held passports increased year by year. In 1978, China implemented the opening policy and resumed its normal diplomatic relations with western countries. Canton and Hong Kong discussed to have the train service travelling between Guangzhou and Hong Kong again.

As a result of relaxing the relation between China and Britain since 1970s, communication between mainland and Hong Kong increased. Significant increase of the number of residents in and out the Lo Wu Border Crossing made it necessary to build a new crossing. The old Lo Wu Foot Bridge is believed to be built under this situation.

With the improvement projects by the Lo Wu and Shenzhen customs during 1980s and

1990s, the Lo Wu Old Footbridge was replaced by new bridge and ended its historical mission for serving the travelers.

Shortly, the history of the Lo Wu Old Footbridge reflected the devious diplomatic development between China and Britain and profile of the customs. Despite its short history, the bridge contributed to the increasing civilian communication between Canton and Hong Kong.

The Lo Wu New Footbridge, Man Kam To Old Bridge, and Man Kam To New Bridge have little archaeological values.

For the distribution of the Lo Wu Railway Bridge, Lo Wu Old Footbridge, Lo Wu New Footbridge, Man Kam To Old Bridge, and Man Kam To New Bridge, refer to Figure 11.3. For their pictures see Figure 11.2, 11.4, 11.5, 11.6, and 11.7 respectively.

During the EIA, the Lands Department of the HKSAR Government of the north area reported to the Hong Kong Antiquities and Monuments Office that an ancient kiln site was found. After field investigation taken, the office thought it has 150 years history and reflects the manufacture history, with historical value.

To sum up, the baseline study shows that the historical site found in the study area is the ancient kiln site and ancient structure is the Lo Wu Old Footbridge. The Old Lo Wu Foot Bridge has some historical value as well.

#### **(5) Assessment of existing condition**

Shenzhen Museum carried out several archaeological surveys and investigations in Shenzhen City since its establishment in June 1981. From February to May in 1998, they conducted surveys on historical buildings and underground historical relics in New Territories at invitation of Hong Kong Antiquities and Monuments Office. According to the published information provided by the office, no sites with special architectural value is found in the area involved in Stage III Project. Also no historical relics or sites are found during the construction period of Stage I and Stage II Project which share the same area as Stage III.



控制点坐标  
CONTROL POINT COORDINATE

POINT	X	Y
A	56065.535	11110.542
B	56070.087	11080.073
C	56078.054	11073.544
D	56085.610	11074.650
E	56071.341	11118.383
F	56078.929	11119.471

说明

1. 图中高程为黄海高程, 单位以米计, 余均以厘米为单位。
2. 图中坐标为深圳河独立坐标, 单位为米。
3. 图中地形、高程, 坐标均为本阶段地形实测。
4. 现有桥台及基础均为砖砌体。
5. 现有轨道里程约5.90m。

NOTES:

1. ELEVATION REFERS TO YSD, IN METERS, OTHERS ARE IN CENTIMETERS.
2. ALL COORDINATES IN THE TABLE ARE THE SHEN ZHEN RIVER INDEPENDENT COORDINATE SYSTEM.
3. FORM, ELEVATION AND COORDINATE IS THIS STAGE LANDFORM SO
4. PRESENT PIER AND ABUTMENT IS MASONRY STRUCTURE
5. ELEVATION OF PRESENT TOP-RAIL IS 6.90 METRES

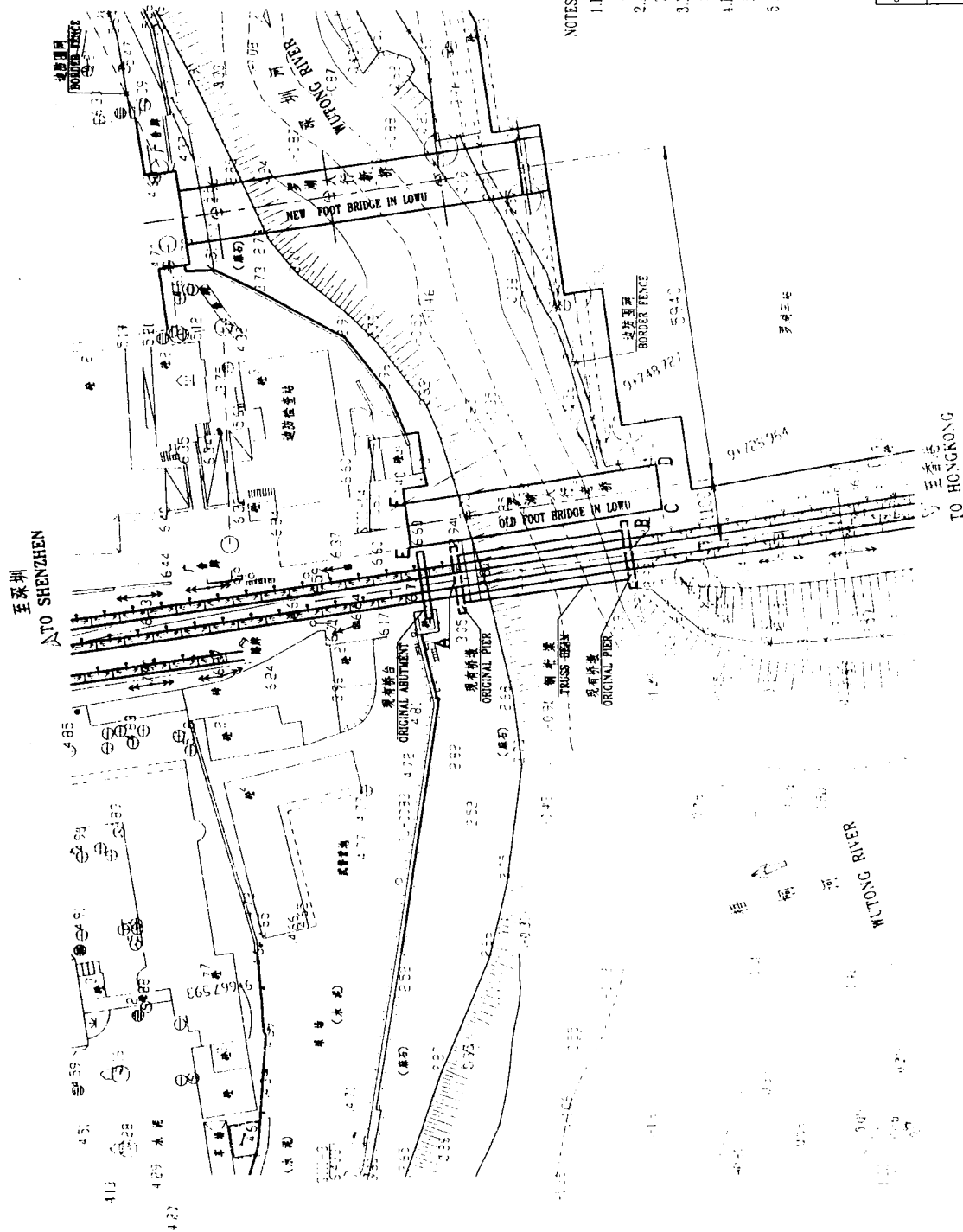


图 11-1 现有罗湖铁路桥平面西面图

FIG.11-1 PLAN OF PRESENT RAILWAY BRIDGE LO HU

设计单位: 广东省水利电力勘测设计研究院  
 设计日期: 1995.3  
 设计阶段: 初步设计  
 设计人: 高洪达  
 审核人: 李静  
 批准人: 李静  
 日期: 1995.3  
 图号: SP111-Q1-1-02

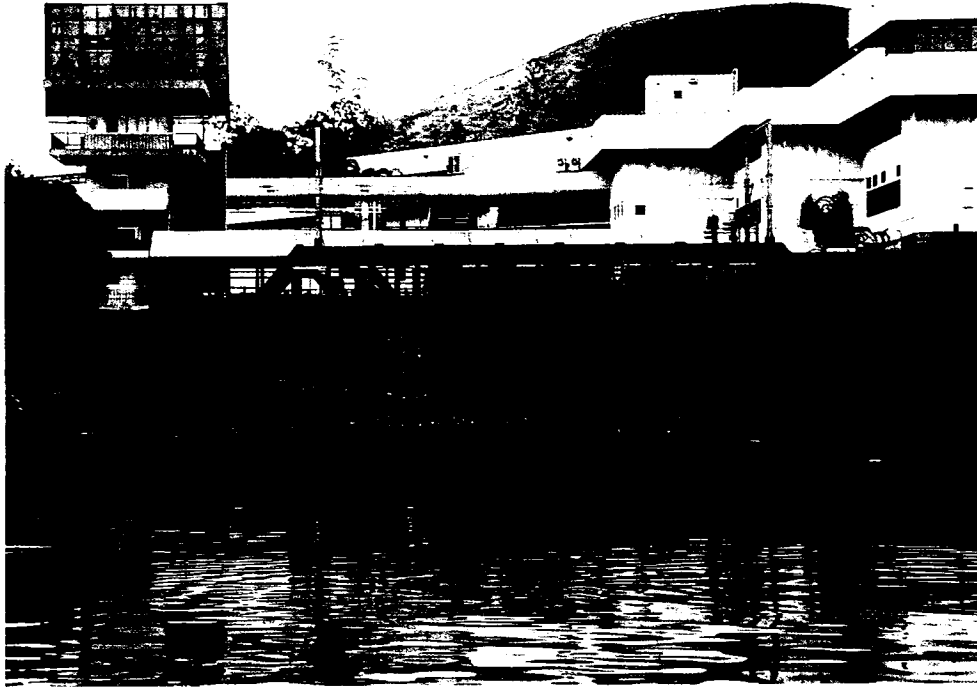


Figure 11.2 Lo Wu Railway Bridge





Figure 11. 4 Lo Wu New Footbridge



Figure 11. 5 Lo Wu Old Footbridge



Figure 11. 6 Man Kam To New Bridge



Figure 11. 7 Man Kam To Old Bridge

The consultant found no historical relics or sites during the field survey except the ancient architecture of Lo Wu Railway Bridge.

The consultant found no record about cultural relics and site of historical heritage in the Study Area in the literature search.

## **11.4 Impact Assessment**

Among the five bridges for reconstruction, Lo Wu Railway Bridge, as the key component of Jiuguang railway, which connects Shenzhen and Hong Kong, has certain historical value. Though it is not ascertained as the cultural relics by relevant authority, it should be properly protected for its special historical status. The Lo Wu Old Footbridge, linking mainland and Hong Kong at the customs building, has significant value in the histories of the communication and customs of Hong Kong and therefore should be protected suitably.

From the result of baseline study, ancient relics and sites are ancient kiln site, Lo Wu Railway Bridge and Lo Wu Old Footbridge, which may be affected by the Stage III project.

Due to broadening and deepening of the river, the buried depths of the piers and abutments of the bridge will be reduced. If the bases are shallow, the piers and abutment will be undermined, which make the foundation of Lo Wu Railway Bridge unstable. In order to meet the requirements of both the Project and safe operation of the Bridge, Lo Wu Railway Bridge will be reconstructed. However, the existing Lo Wu Railway Bridge will not be kept in its original location and its appearance and historical value would be changed after reconstruction.

The Lo Wu Old Footbridge will be removed for the project, which may have some historical impact on if no mitigation measures taken.

The Nga Yiu Ancient Kiln site is located outside the construction area of Stage III Project, which may be affected by the construction activities.

### **11.4.1 Alternative Schemes for Lo Wu Railway Bridge**

#### **(1) Alternative Schemes for Lo Wu Railway Bridge Reconstruction**

The consultant has proposed three schemes for Lo Wu Railway Bridge reconstruction. Scheme 1 is strengthening the piers and the abutments, Scheme 2 is lifting the ridge and modifying the piers and Scheme 3 is rebuilding. Details are given below:

#### **Scheme for strengthening the piers and the abutments**

Reinforced concrete piles with diameter of 1200 mm and minipiles with diameter of 200 mm are used to enclose and strengthen the pier base and the foundation on the Shenzhen side. Meanwhile, the piers on the Hong Kong side and abutments on the Shenzhen side are strengthened by the dyke vertical walls on both sides of the new river course.

#### **Scheme for lifting the ridge and modifying the piers**

On the Shenzhen side, reinforced concrete piers are used to replace the stone pier by lifting the ridges twice. Also the abutment on the Shenzhen side and piers on the Hong Kong side are strengthened by the dyke vertical walls on both sides of the new river course.

#### **Scheme for rebuilding**

A new bridge is to be rebuilt at the location of the existing Lo Wu Railway Bridge, and the Old Lo Wu Railway Bridge would be demolished.

With respect to environmental consideration, the consultant proposes the following four alternatives:

- No-build option: the existing bridge remained without any reconstruction;
- Widening option: widening the spans on both sides of the Lo Wu Railway Bridge and keeping other parts unchanged;
- Lengthening option: demolishing the existing Lo Wu Railway Bridge, building a new bridge to replace the old one. The upper part of the new bridge uses the material from the old one as much as possible;
- No protection option: building a new bridge to replace the old one without any protection measures on the old bridge.

Therefore, there are seven alternatives for the Lo Wu Bridge reconstruction works

(No-build option is also a scheme) which include:

- ① No-build option;
- ② Strengthening the piers and abutments option;
- ③ Lifting the ridge and modifying the piers option;
- ④ Widening option;
- ⑤ Lengthening option;
- ⑥ Rebuilding a new bridge and protecting the old bridge in other place;
- ⑦ No protection measure option.

Evaluations on these seven options are given in Table 11.1.

From Table 11.1, each alternative cannot keep the Lo Wu Bridge its existing appearance. Among them, due to the widening and deepening of the river, in Scheme I, bridge abutment will be damaged. Its original appearance will be changed and the bridge will even be destroyed, although no bridge modification work is carried out. Hence the Lo Wu Railway Bridge cannot keep its original appearance unless no work on the river at the bridge location. However, the objectives of the Project will not be fulfilled without regulation of the river at the bridge location.

From Table 11.1, options ①, ②, ③, ④ and ⑤ are unacceptable to railway agency due to unfavorable safe operation of the railway. Among them, Option ① might completely destroy the bridge, while option ② and option ③ will decrease the safety of the bridge during construction, in which safety cannot be guaranteed even after being strengthened. Besides, the train velocity needs to be limited during construction. Option ④ and option ⑤ will suspend the communication for a long time during construction. Besides, option ①, option ② and option ③ will affect flood control, and option ①, ②, ③, ④ pose difficulty in spoil outside dumping and maintenance dredging of the Project. Option ②, ③, ④ and ⑤ have problems about technological reliability and construction difficulties. A lot of border crossing buildings must be removed if option ④ is adopted, which is not accepted by related departments. Therefore the above 5 options should be excluded. For option ⑦, as the historical value of the Lo Wu Railway Bridge is not considered, which is unacceptable from the view of protecting cul-



tural relics.

Option ⑥ is recommended because it has little impact on flood control and border crossing buildings. It is beneficial to spoil outside dumping and maintenance dredging. It has advantages of adopting the advance and reliable technology, easily controlling the construction quality, and safely operation during the construction period. It has been approved and recommended by the relevant department.

## **(2) The alternative schemes of the reconstruction of the Lo Wu Old Footbridge**

The schemes include four alternatives as follow:

- ① Remain the old bridge and take no reconstruction;
- ② Remove the old bridge and build a new one in other site;
- ③ Remove the old bridge, build a new one and remain achieves on the old bridge; and
- ④ Remove the old bridge; build a new one and take no protective measures to the old one.

For the alternative ①, due to broaden and deepen of the existing river, the buried depths of the piers and abutments of the bridge will decrease. The bases will be lowered and the piers and the abutment will be undermined, resulting in the Lo Wu Footbridge being unstable and not to be retained. The piers of the old bridge in the channel blocks the river flow greatly, and the design water surface will be and heightened flood protective standard of the river channel will be reduced. Meanwhile, the bridge affects navigation of ships on the river, which is unfavorable to transporting spoils outside the construction site and navigation after the project completion. Therefore, the old bridge should not be remained for realizing the planned objectives of the project. That is why the alternative ① cannot be accepted.

For the alternative②, the bridge surface and piers are concrete structures, which will be broken up and not be remained as a whole according to the experts' views. Therefore, it is impossible for the alternative of reconstructing a new bridge in other site.

For the alternative③, removing the old bridge and reconstructing a new one can avoid piers blocking flow and favor transporting spoils out, dredging and navigation after the project completed. In addition, remaining the archives on the old bridge favors

the general public's understanding on the history of the bridge and special historical period it represented.

For the alternative④, though requirement of the project is met, it ignores historical value of the old bridge completely. Therefore it cannot be accepted if no any projective measures taken.

To Sum up, among above four alternatives, the one of removing old bridge, reconstructing a new one and filed the archives on old bridge can ensure the project conducted smoothly and remain the historical archives on the old bridge as well. This alteration is feasible while others are not.

#### **11.4.2 Impact Assessment**

The existing Lo Wu Railway Bridge could not be retained in its original location. Its appearance and historical value will be affected after reconstruction.

In fact, the Kowloon Canton Railway was reconstructed several times since it was put into operation according to the relevant information. Especially during the period from 1978 to 1983, when the railway is electrified and modernized, and the period from 1984 to 1987 when the Double Track Reconstruction Project was carried out in Guangdong section of the railway. The Lo Wu Railway Bridge was also modified several times to be in line with the reconstruction of the railway. After the reconstruction, the Kowloon Canton Railway (Including the Lo Wu Railway Bridge) is more convenient and comfortable and vehicle volume are significantly increased. The reconstruction on Lo Wu Railway Bridge of Stage III Project will increase the safety standard. Moreover, it will improve the connection between Shenzhen and Hong Kong, fully satisfy the need of all kinds of communication and future development in Shenzhen and Hong Kong, and make great contribution to economic perspective and sustainable development on both sides.

It should be pointed out that Lo Wu Railway Bridge is still in its original location and basically keeps its original appearance and structure after several times of reconstruction. However, according to the plan of Stage III Project, the bridge will be removed and replaced by a new bridge, which will greatly affect the Bridge's special historical significance.

The project needs removing the Lo Wu Old Footbridge, which cannot be reconstructed for the reason of construction material. Thus, this bridge with historical value cannot be preserved in physical form.

The Nga Yiu Ancient Kiln site is near the boundary of the scope of the project area, though outside the scope of the area of Stage III Project, and may be affected by the construction of the project if no measures taken.

## **11.5 Mitigation Measures**

### **11.5.1 Protection on Lo Wu Railway Bridge**

There are four alternative schemes protecting the Lo Wu Railway Bridge, include:

Alternative (1): Relocate the bridge on the upper reach of the Shenzhen River and prohibit navigation after the completion of the project;

Alternative (2): Use the bridge as a pedestrian bridge somewhere other than the Shenzhen River;

Alternative (3): Preserve the bridge in the museum;

If the above alternatives are not feasible,

Alternative (4): dismantle the bridge, store its parts by the project department in charge and rehabilitate bridge when suitable site is selected. Dismantling and storing method and finding a site for rehabilitating must be addressed to Hong Kong Antiquities and Monuments Office, Shenzhen Relics Management Committee and other relating departments to get their agreement before implement.

For the alternative (1), both Shenzhen Relics Management Committee and Hong Kong Antiquities and Monuments Office can accept, but the site for relocation and rehabilitating alternative need further discussion. The demerit of the alternative is that it gives a good passage for illegal immigrants. Therefore, it must acquire the agreement of the both police authorities before implementation.

For the alternative (2), the bridge is used as a pedestrian bridge in other place out of the Shenzhen River. As the bridge is owned by both sides, no matter where it will be relocated, agreement has to be get by other party. Therefore, it needs discussion of

both sides before implementation.

For the alternative (3), in theory, it is a good option that museum, as a special department of historical heritages, preserves the bridge. The space are limited for the museums of both sides for preserving the bridge. Enlargement of the museum can accommodate the bridge. For the reason of the bridge owned by both sides, the others' agreement must be acquired no matter where the bridge will be preserved. Therefore, it needs discussion of both sides before implementation.

Except the alternative (1), others are feasible and the outstanding issue is that the historical heritage protection authorities of both sides needs discussion and determine the alternative to be implemented before the bridge is disassembled. Before it is determined, the alternative (4) can be implemented temporarily. Upon approved by the historical heritage protection authorities of both sides and selection of site accepted by both sides, the bridge can be disassembled by the project proponent. After the bridge has been dismantled, the project proponent should preserve and store the parts of the bridge according to the Guidelines for preserving components of structures of the "Dismantle of Lo Wu Railway Bridge" until formal hand over procedures finished. When consensus arrived by both sides, the bridge will be reconstructed or preserved in the site accepted by both sides.

If the alternative (4) implemented, the project proponent (Shenzhen River Regulation Office and Hong Kong Drainage Services Department) have to invite historical heritage experts whose qualification has to be identified by the Hong Kong Antiquities and Monuments Office and Shenzhen Relics Management Committee. The experts have to conduct study of the "Dismantle of Lo Wu Railway Bridge" within at least 6 months before commencement of the project. The content of the "Dismantle of Lo Wu Railway Bridge" shall include detailed rules on information recording and dismantle procedures; dismantle programme, guidelines for preserving the dismantled materials, location of re-erection, restoration programme and detailed rules for restoration. The bridge shall only be demolished after the dismantle proposal has been approved by the Hong Kong Antiquities and Monuments Office and other relevant offices.

### **11.5.2 Protection of the Lo Wu Old Footbridge**

As mentioned above, the Lo Wu Old Footbridge cannot be reconstructed after dismantled. A comprehensive record of the bridge will be kept.

The experts of the project proponent, before dismantling the bridge, should produce drawings and photography of the Lo Wu Old Footbridge. The project proponent must determine a detailed content of the map and photography with consultation of Hong Kong Antiquities and Monuments Office and Shenzhen Relics Management Committee within at least 6 months before the bridge to be dismantled. The project proponent starts to disassemble only after the map and photography are taken and the records are submitted to and approved by the Hong Kong Antiquities and Monuments Office and Shenzhen Relics Management Committee.

### **11.5.3 Protection of the Nga Yiu Ancient Kiln Site**

In order to protect the Nga Yiu Ancient Kiln Site effectively and avoid it being affected by the project construction, it is recommended that site limit is set 5 m at least away from the kiln and the area is fenced off.

### **11.5.4 Archeological Study**

It is known that the Shenzhen River basin is suitable for ancient people to live. Thus the possibility of historic sites and antique buried underneath in the Study Area cannot be excluded. Therefore, it is suggested that a detailed archeological investigation should be conducted in the Study Area. The responsible departments shall employ competent archeological professionals, who possess the license of archeological excavation issued by Hong Kong Antiquities and Monuments Office to conduct the archeological investigation. If any archeological ruins are found in the Project Area, the archeological excavation should be proceeded and finished before Project commencement. It is suggested that the archeological study should be started 12 months before the Project commencement (April 2000), and completed before March 2001.

The investigation methodology the archeological professional applied shall be approved by Hong Kong Antiquities and Monuments Office in advance.

The archeological professionals who carry out the work shall submit a detailed time

schedule to Hong Kong Antiquities and Monuments Office.

If any archaeological site found in the investigation, archaeologist must report to the Hong Kong Antiquities and Monuments Office and propose further mitigation measures such as relocation of ancient site or archaeological excavation after investigation. The Hong Kong Antiquities and Monuments Office must approve these mitigation measures in advance. It is recommended to start the archeological study 12 months before the Project commencement (April 2000), and completed before March 2001 for enough time of the works.

#### **11.5.5 Cultural Relics Protection in Construction Period**

If any cultural relic is found in Hong Kong, Hong Kong Antiquities and Monuments Office should be informed immediately. If it is found in Shenzhen, Shenzhen City Cultural Relic Management Commission should be notified. In this case, construction activity must be stopped to protect the site, where is handled by the personnel of the cultural relic department. The construction restarts after the cultural relics department has approved it.

### **11.6 Residual Impact**

After having been adopted the recommended mitigation measures, the original Lo Wu Railway Bridge can be preserved. Its cultural relic value will be reduced, as it is not preserved in original location and appearance.

The Lo Wu Old Footbridge, with some historical value, will be removed, but its relating archives will be preserved in detailed.

The Nga Yiu Ancient Kiln Site is outside the construction area so that the construction activities will not affect on it.

There is no other residual impact on cultural heritage for the Project as no other historical relics and heritage have been found in the Project Area.

### **11.7 Conclusion**

Among the five bridges to be reconstructed, Lo Wu Railway Bridge has certain significance for its special historical value. Project proponent shall preserve the dismantled

parts of the Bridge temporarily. The Bridge will be reconstructed or exhibited at a proper place and its cultural relic value will decrease. The Lo Wu Old Foodbridge is a part of customs building linking mainland and Hong Kong, with significant value in the histories of the communication and customs of Hong Kong. The Lo Wu Old Footbridge cannot be reconstructed after dismantled. The bridge cannot be reassembled and only the relating archives can be filed. Other three bridges to be reconstructed in the Stage III project have no historical value. The modification works have no impact on cultural heritage.

The project area is highly unlikely to be of archaeological potential as desk-top search does not yield any archaeological sites. However, a detailed archaeological investigation is still recommended to ensure it.

According to the Annex 10 Criteria for the Technical Memorandum on EIA process, the impacts of the project on the historical heritage site are acceptable after mitigation measures taken.

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**Table 11.1 Alternatives for Reconstruction and Reinforcement of Lo Wu Railway Bridge**

Scheme	Impact on Original Bridge	Impact on Flood Control	Impact on Border Crossing Buildings	Impact on the Project	Technical Reliability	Difficulty of Construction Technique	Impact on Safe Operation of the Bridge	Construction Period and Fabrication Cost	Opinion of the Departments Involved
(1) No reconstruction	Due to widening and deepening of river course, the bridge foundation is damaged, the bridge could not keep the original appearance, and even be destructed.	Piers of the original bridge hinder flood discharge, having significant impact.	No impact	It affect the benefits of the Project for remarkable impact on flood control; impact on spoil outside dumping as bridge piers affect the navigation; it is unfavorable for maintenance dredging of the Project.	No	No	Because of broadening and deepening of river course and damaging the foundation of bridge, the original bridge can not be safely operated.	No	The railway department does not approve it as the bridge could not safely be operated
(2) Strengthening pier and abutment	It has a little impact on original bridge for only changing bridge pier and keeping the upper structure of the bridge; the option designs two spans, the diameter of main span is 30 m, that of side span is 50 m, spatial proportion is unbalance.	Backwater will increase by 0.56 m due to the bridge pier effect, which raise the surface water level in upper reach, thus increasing the dyke height and working quantities.	It has no impact on existing border crossing buildings.	Increasing working quantities; affecting spoils outside dumping; unfavorable to maintenance dredging of the Project	The option is based on comprehensively examining of 100-year-old bridge, quantity assessment, and having data about the design, operation, and maintenance of the original bridge. But above requirements can not be met up to now. Technique in other aspects is feasible.	Construction technique is difficult. If construction is improperly organized, it may affect the safety of the bridge.	Safety of the railway bridge is reduced during reinforcement period; safety of the bridge after reinforcement depends on the structure of the old bridge; trains need to limit speed during construction period.	Total construction period is 12.5 months; fabrication cost is 7,850,000 RMB yuan except the fee for bridge examination, temporary maintenance and brittle break reinforcing	Railway department strongly disapproved.
(3) Lifting ridge and changing pier	It has a little impact on original bridge for only changing bridge pier and keep the upper structure of the bridge; lifting ridge and changing pier are conducted on the Shenzhen side, principle layout is unreasonable, spatial proportion is unbalance.	Backwater height of the bridge pier is 0.46 m, which raise the surface water level in upper reach and increase dyke height in upper reach and quantities.	It has no impact on existing border crossing buildings.	Increasing working quantities; affecting spoils outside dumping; unfavorable to maintenance dredging of the Project.	The option is based on comprehensively examining of 100-year-old bridge, quantity assessment, and having data about the design, operation, and maintenance of the original bridge. But above requirements can not be met up to now. Technique in other aspects is feasible.	Construction technique is complex and difficult. If construction is improperly organized is improper, it may affect the safety of the bridge.	Safety of the railway bridge is reduced during reinforcement period; safety of the bridge after reinforcement depends on the structure of the old bridge; train speed should be limited during construction period.	Total construction period is 14 months; fabrication cost is 9,600,000 RMB yuan except the cost for bridge examination, temporary maintenance and brittle break reinforcing	Railway department strongly disapproves.

Scheme	Impact on Original Bridge	Impact on Flood Control	Impact on Border Crossing Buildings	Impact on the Project	Technical Reliability	Difficulty of Construction Technique	Impact on Safe Operation of the Bridge	Construction Period and Fabrication Cost	Opinion of the Departments Involved
(4) Side enlargement option	The most part of the bridge will be preserved only changing the parts in south and north bank.	The impact on flood control depends on whether enlarged parts on both sides are enough.	The border buildings on Shenzhen and Hongkong need to be demolished.	Increasing working quantities and prolonging construction period; affecting spoils outside dumping; unfavorable to maintenance dredging of the Project.	Technique is feasible.	A large number of border buildings need to be demolished to ensure having enough construction sites (see Figure 11.5); the problem that the railway facility meets in old bridge and enlarged parts will occur.	The operation of the train will be suspended for a long time during construction.	It has not estimated but a large number of demolition a large amount of money.	Railway department will not accept this option for intermitting operation of the train for a long time; as well as the border department in Shenzhen and Hongkong for demolishing a large number of border buildings.
(5) Lengthening	Keeping the upper structure of the bridge and changing the other parts.	Backwater caused by the bridge pier is 0.35 m, which has a little impact on flood control.	Sentry box of Border Crossing on the Shenzhen side and passage on ends of the old footbridge on the Hong Kong side need to be demolished.	Benefit for spoil outside dumping and maintenance dredging of the Project.	Lengthening after the old bridge demolition. The technical feasibility is under study.	Construction is rather difficult.	The operation of the train will be suspended for a long time during construction.	It has not estimated.	Railway department will not accept this option for intermitting operation of the train for a long time.
(6) Rebuilding a new bridge and protecting the old bridge in other place	The original bridge will be protected after demolition.	Backwater caused by the bridge pier is 0.35 m, which has a little impact on flood control.	Sentry box of Border Crossing on the Shenzhen side and passage on ends of the old footbridge on the Hong Kong side need to be demolished.	Benefit for spoil outside dumping and maintenance dredging of the Project.	It is reliable even if lacking of data about design, operation, and maintenance and without examination and quantity assessment. Moreover, it is not restricted by old bridge and implementation technique is advanced.	Less construction procedure, and not restricted by the old bridge, easy implementation and control of construction quality; the technique to be used is advanced, which have certain difficulty to implement. It could be completed on time and quality can be ensured.	The railway bridge can safely be operated during construction period; the accident prone of the old bridge will be entirely solved after reconstruction.	Total construction period is 15 months, fabrication cost is 17,150,000 RMB yuan, which is more exact than that of the option 2 and 3.	Railway department and border authority have approved this option.
(7) No protection	Original Lo Wu Railway Bridge will entirely disappear.	Backwater is 0.35 m due to bridge pier, which has a little impact on flood control.	Sentry box of Border Crossing on the Shenzhen side and passage on ends of the old footbridge on the Hong Kong side need to be demolished.	Benefiting for spoil outside dumping and maintenance dredging of the Project.	It is reliable even if lacking of data about design, operation, and maintenance and without examination and quantity assessment. Moreover, it is not restricted by old bridge and its implementation technique is advanced.	Less construction procedure, and not restricted by the old bridge, easy implementation and control of construction quality; the technique to be used is advanced, which have certain difficulty to implement. It could be completed on time and quality can be ensured.	The railway bridge can be safely operated during construction period; the accident prone of the old bridge will be entirely solved after reconstruction.	Total construction period is 15 months, fabrication cost is 17,150,000 RMB yuan, which is more exact than that of the option 2 and 3.	Railway department and border management authority have approved this option.

Notes: The backwater level caused by the bridge pier, construction period, fabrication cost and other technical data in Table 11.1 are quoted from Project design report.

