People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project

"Wuhan Urban Railway Construction Project"

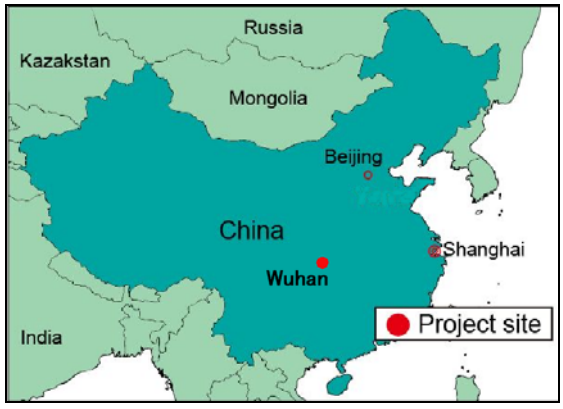
External Evaluator: Yasuhiro Kawabata, Sanshu Engineering Consultant

0. Summary

The objective of the project was to alleviate traffic congestion in the city center by constructing an urban railway with a total length of 10 km between Zongguan – Huangpulu in Wuhan, and thereby contribute to the improvement of air quality and promote social and economic development in Wuhan. The project has been highly relevant to the development plans and needs of China and Wuhan, as well as Japan's ODA policies, and therefore its relevance is high. Regarding the alleviation of traffic congestion, contributing to improvement of air quality and promotion of social and economic development, which is the project's objective, the project has somewhat achieved its objectives, and therefore its effectiveness is fair. Although the project cost was within the plan, the project period exceeded the plan slightly. Therefore, efficiency of the project is fair. No major problems have been observed in the operation and maintenance system (organizational setup, technical capacity and financial status), therefore the project's sustainability is considered high.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Location

Train (4 cars)

1.1 Background

Because of the economic development and enhancement of the living standards after the reform and the start of open door policies in 1978, the urban transport problems, including

traffic congestion due to increase in vehicles and underdeveloped urban infrastructure, were the main issues in major cities at appraisal stage. Cognizant of these issues, the Chinese government decided to introduce the mass transit system, including subways in cities which have more than one million urban population and more than 50 billion yuan of GDP, in order to alleviate traffic congestion, promote economic development and improve the urban environment. A strategic plan was developed to introduce the mass transit system in 15 cities, including Beijing, Shanghai, Ganzhou, Dalian, Chongqing and Wuhan among 35 cities.

The constant growth in traffic congestion in Wuhan caused by: 1) increase in passenger cars due to lack of urban mass transit system, and 2) concentration of vehicles to specific arterial roads (such as Jiefang Avenue along the project corridor) due to undeveloped road network. In accordance with the central government policies, the Wuhan Municipal Government established in 1998 the Urban Transport Development Strategic Targets to resolve the traffic problems in the city centre districts, and to make the mass public transport system, focusing on urban railways, as the basic mode of city transport, which can partly contribute to construction of modern urban city.

1.2 Project Outline

The objective of the project was to alleviate traffic congestion in the city center by constructing an urban railway with a total length of 10 km between Zongguan – Huangpulu (phase 1 section) in Wuhan, among the 27 km section between Gutianyilu and Fujiapo in Wuhan, and thereby contribute to the improvement of air quality and promote social and economic development in Wuhan. The location of the project site is shown in Figure 1.

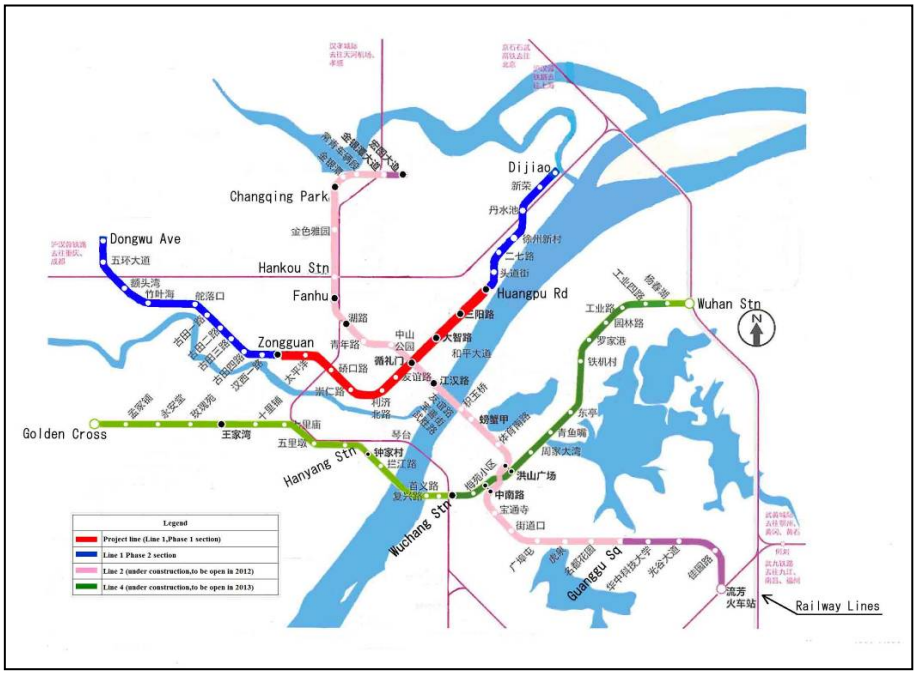


Figure 1 Location of Project Site

Loan Approved Amount/ Disbursed Amount	2,894 million yen / 2,340 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2001 / March 2001
Terms and Conditions	Interest Rate: 0.75% Repayment Period: 40 years (Grace Period: 10years) Conditions for Procurement: Bilateral tied
Borrower / Executing Agency(ies)	Government of People's Republic of China/Wuhan Municipal Government
Final Disbursement Date	July 2006
Main Contractor (Over 1 billion yen)	Nissho-Iwai
Main Consultant (Over 100 million yen)	-
Feasibility Studies, etc.	F/S by Beijing City Planning and Design Research Institute (1999)
Related Projects (if any)	Project Identification/Promotion Study by Ministry of Transport (1994)

2. Outline of the Evaluation Study

2.1 External Evaluator

Yasuhiro Kawabata, Sanshu Engineering

2.2 Duration of Evaluation Study

Duration of the Study: July 2011 –September 2012

Duration of the Field Study: October 9 - October 22, 2011 and February 14 - February 24, 2012

2.3 Constraints during the Evaluation Study (if any)

Since the alignment of phase 2 section was largely changed after the commencement of the project, it became difficult to compare the actual number of passengers per day and number of peak hour passengers with the numbers projected at appraisal, which are the basis for evaluation of project effectiveness.

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of China

The China's 10th Five-Year Plan (2001 – 2005) states that the government would develop a comprehensive transport infrastructure. The Wuhan's Urban General Plan (developed in 1998) indicated the development targets for the urban development in each region, by dividing Wuhan city into three regions. The Wuhan Municipal Government developed the

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[2] ③: High, ② Fair, ① Low

Urban Transport Development Strategic Targets aimed at having a complete urban development and urban functions. Hence, the following objectives have been established for the transport sector: 1) improve the functions of each transport mode, including railways, waterways, roads and aviation, and enhance the synergistic effect among modes in order to develop a safe, comfortable, economical and convenient comprehensive transport system; and 2) give priority to the development of urban railway transport, mainly consisting of surface and public transport among the transport modes in the city area, in order to resolve the traffic problems in the city's central district. The urban railway transport network plan in Wuhan involved 6 lines with a total length of 142 km, including Line 1 under the project.

The China's 11th Five-Year Plan (2006-2010) states that priority shall be given to the development of public transport infrastructure, particularly the development of the urban railway in major cities and in urban areas. Moreover, it states that the development plans shall be developed as soon as possible and projects shall be implemented per the implementation schedule. The 12th Five-Year Plan (2011- 2015) states that the previous Five-Year Plan shall be sustained and that development of urban railways (subway, light rail and urban railway) shall be promoted.

The development of the urban railway is a priority agenda in the national and municipal development plans during appraisal and post evaluation of the project, thus making it consistent with both development plans.

3.1.2 Relevance with the Development Needs of China

The state of transport sector in Wuhan at appraisal was as follows:

- the operating speed of public transport has been decreasing year after year because the road/highway network in the city center was underdeveloped and traffic was concentrated into some arterial roads;
- traffic congestion in the city was a serious concern because of heavy traffic volume during the morning and afternoon peak hours;
- traffic congestion has been continually growing because of the combination of cars, bicycles and pedestrians. Thus, it was difficult to cope with the increasing traffic volume only with improvement and construction of roads and bridges; and
- the city environment has deteriorated because of traffic noise and exhaust gas.

Based on the above, development of public surface transport system focusing on railway transport was needed.

Under the Wuhan Urban General Plan (2010 - 2020), Wuhan is classified as a core city

in central China and an important industrial base. Wuhan's traffic congestion identified at appraisal has been improving. However, as the economy improved, the number of registered vehicles, including passenger cars, has also been increasing. Consequently, further development of public transport infrastructure is needed. For that reason, Wuhan city is constructing Lines 2-4 (to be completed by 2012, 2014 and 2013, respectively) under the Metro Network Development Plan, in which 12 lines with a total length of about 230 km are to be completed by 2020.

The urban environment has been deteriorating as well due to traffic noise and air pollution caused by traffic congestion. Thus, the need for the development of railway network targeting alleviation of traffic congestion in the project affected area was high during appraisal and post evaluation.

3.1.3 Relevance with Japan's ODA Policy

In the Annual Report on the Implementation of Japan's ODA (1999), the aid policy towards China was to resolve the lagging infrastructure development, including transport, communications and power sectors. This was an obstacle in China's economic development, thus making transport as one of the priority sectors. It was proposed to provide aid to projects that would increase transporting capacity by constructing transportation facilities and enhancing the maintenance and management technology that would raise transportation efficiency.

According to the former JBIC's Overseas Economic Cooperation Implementation Policy, the railway sector in China was a priority sector in the Japanese aid policy for alleviation of economic disparity between coastal and inland regions. At appraisal stage, it was determined that the subject project was in accordance with the Japanese aid policies.

Accordingly, the project has been highly relevant with the Chinese and Wuhan's development plan and needs, as well as Japan's ODA policies. Its relevance is therefore considered high.

3.2 Effectiveness[3] (Rating: ②)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Passenger transport

1) Average number of passengers per day

Actual numbers of passengers during the period from the opening of phase 1 in July 2004 to last year are shown in Table 1.

[3] Sub-rating for Effectiveness is to be put with consideration of Impact

Table 1 Number of Passengers

Unit: Whole line average: 0,000/day, peak hour: 0,000/hour

	2004 1st year	2005	2006	2007	2008 5th year	2009	2010 Before completion of phase 2	2010 After completion of phase 2	2011
Whole line average	0.77	1.19	2.05	2.53	3.04	3.6	4.1	15.64	20.77
	(22.1)	(25.4)	(29.2)	(30.4)	(61.6)	(63.5)	(65.6)	(65.6)	(67.7)
Peak hour	0.13	0.21	0.34	0.27	0.27	1.31	-	1.45	2.07
	(0.8)	(0.9)	(1.1)	(1.2)	(1.4)	(1)	(1.6)	(1.6)	(1.8)

Source: Appraisal documents, Responses to Questionnarire

Note1: Completion of phase 2 of Line 1 was scheduled for 2007 at the appraisal stage. However, it was actually opened to the public on July 28, 2010.

Note 2: Numbers in ( ) are project numbers at the planning stage.

Note 3: The feasibility study report for the current Line 1 route was prepared in November 2005, in which the average number of whole line passengers was estimated at about 450,000 passengers per day. However, the estimate was made assuming that phase 2 would be completed by end 2012.

As shown in Table 1, the average number of passengers per day is much lower than planned at appraisal. The reasons are: i) route change[4] of phase 2 section of Line 1, ii) impacts to number of passengers due to delay in the completion of phase 2 section (delayed from 2007 to July 2010), and iii) over estimation of the projected number of passengers.

i) The alignment of the completed phase 1 section (Zongguan - Huangpulu) is exactly the same as proposed in the feasibility study. However, the actual alignment of phase 2 section is completely different from the originally proposed. As shown in Figure 2, in the original plan, phase 2 section was a key arterial route connecting between Hankou District, where the Wuhan Municipal Government is located with Fujiapo (currently Zhongnan) in Wuchang District, which is a political and cultural center of Wuhan, crossing the Changjiang river. Many public agencies and educational institutes are located in Wuchang District, including the Provincial Committee of the Communist Party, Hubei Provincial Government, Provincial People's Congress, Wuhan University, and Wuhan University of Technology. Thus, more metro users (passengers) than those on the current route (Line 1) were anticipated. The completed phase 2 section is extended to the north along the Changjiang river from Huangpulu and does not function as an arterial route crossing the river.

[4] In 2003, the new Metro Network Development Plan in Wuhan was established, and routes including sections in the subject project (phase 2 section) were also changed.

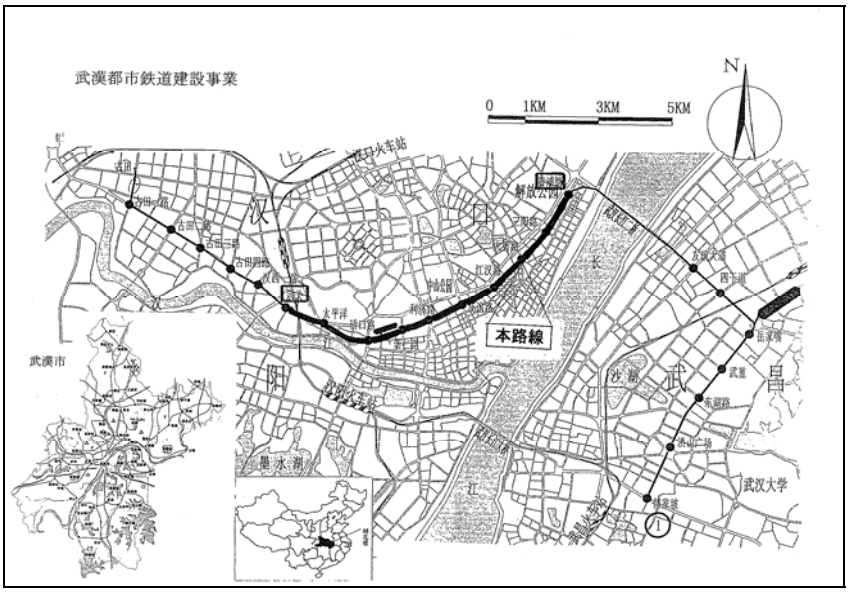


Figure 2 Route Alignment at the Planning Stage

ii) In the original feasibility study, the passenger projection was made assuming that the Zongguan - Huangpulu section would be completed by 2006, and phase 2 section (the extended section up to Fujiapo) by 2008. However, the realigned phase 2 section of Line 1 (Dongwudadao - Zongguan, and Huangpulu - Dijia) was completed on July 28, 2010. Consequently, realization of increase of passengers was delayed.

iii) On the basis of the projected number of passengers made at appraisal, the peak hour factor of passengers (number of passengers during the peak hour/average number of passengers per day for the whole route) was calculated. The average peak hour factor was 3.0%, ranging between 3.6% (2004) and 2.7% (2011). For reference, the peak hour factor of Line 13 of Beijing Metro at the planning stage was 7.25%, ranging between 7.4% (2006) and 7.1% (2010). Thus, the peak hour factor assumed for the Wuhan Urban Railway was less than half of that assumed for Beijing Metro. Since about 20,000 passengers during the peak hour was considered reasonable taking into account the capacity when 12 trains with four cars in each train were operated during peak hour, the planned average number of passengers per day, which was more than 30 times of the peak hour passengers was likely over estimated.

2) Number of passengers during peak hour

The fundamental operational effectiveness indicator for the railway projects was the number of passengers transported. The project's objective was to alleviate traffic congestion in the city central area. The actual number of passengers during peak hours

was reviewed as follows. The number of passengers during the peak hour at the first operational year 2004 was 1,300/hour, 16% of the planned. By 2008, the number increased to 2,700/hour, 19% of the planned. Since four high schools and a few shopping malls were completed along the project corridor by 2009, the number of passengers during the peak hour increased to 13,000/hour in 2009, 87% of the planned. Furthermore, in 2010 phase 2 section was completed, and the number of passengers increased to 20,700, 115% of the planned. The reason is likely that people acknowledge superiority of the urban railway, which can secure punctuality, and avoiding traffic jam.

3) Number of train operations

The actual number of train operations during the period from the opening of phase 1 in July 2004 to last year is shown in Table 2.

Table 2 Number of Train Operations

Unit: trains/hour

	Planned after completion	2004-2009	2010 Before completion of phase 2	2010 After completion of phase 2	2011
Peak hour	12	7	7	10	12
Off-peak hour	6 - 10	7	7	9	11

Source: Responses to Questionnaire

The planned number of train operations (a train consisting of 4 cars) was 6 to 10 trains during regular hours, and 12 trains during peak hours. The actual number of train operations in 2011 was more than planned during regular hours and as planned during peak hours.

4) Travel time required for the section completed (reduction of travel time)

The current travel time required for the section between Zongguan and Huangpulu by each mode is shown in Table 3.

Table 3 Current Travel Time required

Unit: minutes

Period	Mode	Planned	Actual
Peak hour	Bus	45	45
	Taxi	-	40
	Urban railway	17	17
Off-peak hour	Bus	45	35
	Taxi	-	20
	Urban railway	17	17

Source: Responses to Questionnaire

Note: Travel time by bus is the average time travelling 10 km section including boarding and alighting time.

The travel time by urban railway during off-peak hours is about half of that by bus, and slightly less than that by taxi. The travel time during the most congested peak hours is about 1/3 of that by bus and less than half of that by taxi. It was confirmed that the urban railway has more advantage than other existing public transport modes during both peak and off-peak hours.

5) Number of registered vehicles (Wuhan City)

The number of registered vehicles and growth rates for the past seven years in Wuhan city are shown in Table 4.

Table 4 Number of Registered Vehicles and its Growth Rates in Wuhan city

Unit: 000 vehicles

	2003	2004	2005	2006	2007	2008	2009	2010
Number of registered vehicles	271	334	370	418	484	556	669	808
Growth rates (%)	-	23.2	10.8	13.0	15.8	14.9	20.3	20.8

Source: Wuhan Annual Statistics 2004-2011

Note: Vehicles include only passenger cars, buses and trucks.

The traffic volume in Wuhan has been increasing because the number of registered vehicles is also increasing due to economic development with a growth rate of 17% per annum for the past five years. Although the number of urban railway passengers has been increasing as well, it is difficult to verify quantitatively how much the project has contributed to reduction of traffic volume (impact to the alleviation of traffic congestion).

However, it is possible to estimate how much more the traffic volume would have increased if the project has not been implemented. The transporting capacity of a train is about 1,000 passengers. If all the passengers used cars (assuming the average occupancy is 2.5 passengers per car), the number of cars would have been 8,280 (20,700 passengers/2.5 passengers). It is likely that the traffic volume would be reduced at most by 8,300 vehicles per hour during peak hours.

3.2.2 Qualitative Effects

(1) Alleviation of traffic congestion by shift of automobile users to the urban railway

According to the PR officer of Wuhan Metro, the completion of urban railway has raised people's awareness of urban environment, reduced the use of private cars, and instead promoted the use of public transport modes (urban railway and buses). Ultimately, they have been trying to achieve the low carbon economy by alleviating traffic congestion. Upon completion of the phase 2 section, the bus terminals in the downtown were relocated to both ends of the Line 1, and entering of large buses to downtown was prohibited.

Consequently, automobile passengers were guided to the urban railway, which have contributed to the reduction of traffic passing through downtown.

In the post evaluation work, beneficiary surveys through interviews with users were conducted in the project affected area (at 10 stations completed). The total number of respondents (railway users) was 100. The classification of respondents by sex was 31% female and 69% male. The main results of the beneficiary surveys are as follows. About 70% of respondents answered that they could shorten the travel time by using Line 1 and that they were satisfied with the achievement of the project. Thus, it is likely that the project has contributed to enhancing the convenience for the people who live along the project corridor. Although it is difficult to resolve the traffic congestion by the accomplishment of this project alone, 70% of respondents recognize that the level of traffic congestion has improved. It was also confirmed that people who used to take taxis or private cars before opening of Line 1 (about 10% of respondents) have shifted to the urban railway. If the project has not been implemented, the traffic congestion would have been worst. Thus, it seems that the project has contributed to alleviation of traffic congestion to some extent. On the other hand, only one third of respondents are currently satisfied with the bus service connection. Therefore, further improvement is needed.

3.3 Impact

3.3.1 Intended Impacts

(1) Promotion of economic development along the project corridor

The growth rates of the Gross Domestic Product (GDP) of the project area are shown in Table 5.

Table 5 GDP of the Project Area

Unit: million yuan

District	2003	2004	2005	2006	2007	2008	2009	2010
Jiangan	8,562	9,909 (15.7)	14,020 (41.5)	16,297 (16.2)	19,116 (17.3)	23,897 (25.0)	36,362 (52.2)	43,335 (19.2)
Jianghan	8,824	10,144 (15.0)	18,046 (77.9)	21,641 (19.9)	25,263 (16.7)	31,001 (22.7)	43,008 (38.7)	48,001 (11.6)
Qiaokou	6,956	8,007 (15.1)	15,011 (87.5)	17,295 (15.2)	19,768 (14.3)	24,557 (24.2)	27,893 (13.6)	30,772 (10.3)
National average (%)	10.0	10.1	10.4	11.1	11.4	9.6	9.1	10.3

Source: Wuhan Annual Statistics, China National Statistic Bureau

Not: Numbers in ( ) are the growth rates against the previous year (%)

Since phase 1 section (the project) was completed in 2004 and phase 2 section in 2010, the project corridor along the line has become popular because of their proximity between the working place and residence. The high-rise apartments, as well as schools, hospitals,

and shopping centres have been constructed, and as a result the commercial and economic activities along the corridor have been stimulated. As the population along the corridor has grown and the bus service connecting to the metro stations has commenced, the number of passengers using the urban railway has rapidly increased, particularly upon completion of the phase 2 section. The growth rate of GDP of the project affected area is much higher than the Chinese national average.

Changes of the land price in the project area are shown in Table 6.

Table 6 Changes of the Land Price

Unit: yuan/m^2

	2004	2005	2006	2007	2008	2009	2010
Qiaokou District	903	1,115	920	1,895	1,659	4,220	2,654

Source: Responses to Questionnaire

Although the real estate value has been affected by the change of policies of the Chinese Government, the current land value in the Qiaokou District has risen to about three times of that when the project (phase 1) was completed in 2004. The average inflation rate of commodities during the same period was 2.8%.

(2) Improvement of Environment (improvement of air pollution)

Changes of air pollution during the period from the opening of phase 1 in July 2004 to last year are shown in Table 7.

Table 7 Change of Air Pollution in Wuhan (monthly average)

	2005 March	2006 February	2007 June	2008 October	2009 September	2010 September	2011 September
SO_2 (mg/m^3)	0.058	0.049	0.035	0.033	0.037	0.034	0.031
NO_2 (mg/m^3)	0.058	0.040	0.035	0.055	0.049	0.039	0.049
PM10 (mg/m^3)	0.120	0.083	0.089	0.102	0.088	0.064	0.077

Source: Website of Environmental Protection Bureau of Wuhan City (www.whepd.gov.cn)
Note 1: PM10 (Particulate Matter less than 10 micron)
Note 2: Numbers are concentration in the air.

The emission amount of air pollutants specific to the project affected area was not available. The Environmental Protection Bureau of Wuhan City publishes partly the data on emission amount for the entire city. Since the environmental improvement countermeasures and efforts by Wuhan City are dominant, it is not clear how much the project has directly contributed to reduction of air pollutants. Since the opening of phase 1 section to the public in 2004, SO_2 has been declining and the SO_2 amount has been reduced by about half right after the opening. Regarding the NO_2, there is variability by year, and no substantial

improvement was observed. Improvement was observed in terms of PM10. Generally speaking, the air pollution level in Wuhan has been improving.

The result of the beneficiary surveys confirms that only 30% of respondents admit the impact by the project with respect to improvement of air pollution along the corridor, since the traffic volume has been increasing due to increase in number registered vehicles.

3.3.2 Other Impacts

(1) Impacts on the natural environment

During implementation, a folded noise barrier was installed along the route as a noise protection measure. For sites and sections needing special treatment, including Wuhan Second High School and Jinghan Garden, the higher noise barriers were installed. Furthermore, sections (close to schools, hospitals, and public buildings with about 1.6km both sides), which need special consideration for noise protection, elastic short sleepers and shock absorption ballast bed were adopted in order to reduce noise. During the operation stage, monitoring has been made according to the Environmental Impact Assessment (EIA). Based on the results of the monitoring report, in 2006 the noise protection work was undertaken at three locations where the noise level exceeded the standard. Upon completion of the work, the noise level was reduced by 2.0 - 7.6 dB(A), and the noise level became lower than the standard.

The business and domestic sewage discharged from stations is treated in the anaerobic tank within the station area and then discharged to the public sewage network. The industrial sewage, including oil-stained waste water and waste water from car wash in the depot, is treated in the special treatment plant located in the depot. The treated water is checked if the water meets the national standard for the treated water, and discharged to the public sewage network. However, part of the treated water is reused for cleaning cars.

(2) Land Acquisition and Resettlement

The acquired land area was about 3 ha and the number of households resettled was 623 with a total number of 1,980 people. The total amount of compensation paid was 197 million yuan. Since all the resettled people requested the compensation in cash, it was paid in cash. Even though it took longer time than expected to negotiate the compensation amount, there was no major issue in the resettlement.

As discussed above, although the average number of passengers per day is lower than the planned, the current number of passengers during peak hours, which is more relevant to traffic congestion, is higher than the planned. If the project has not been implemented, and

train riders used automobiles, it is estimated that the traffic volume would have increased by 8,300 vehicles per hour during a peak hour. Thus, it is considered that the project has contributed to the alleviation of traffic congestion. The results of beneficiary surveys confirm that seventy percent of respondents acknowledge the project's contribution to alleviation of traffic congestion upon completion of the project. Regarding the improvement of air pollution, although it is difficult to measure the direct impact of the project, the level of air pollution in Wuhan has been generally improving.

Based on the above, the project has somewhat achieved its objectives, and therefore its effectiveness is fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The original and actual output of the project is shown in Table 8.

Table 8 Output (original and actual)

Item	Original	Actual
Civil work/tracks	Zongguan - Huangpulu with a total length of 10 km (viaduct) 10 stations (viaduct)	as planned
Signals/telecommunication facilities	ATC and ATO by signals in cars Telecommunication between stations: optical cable, Between cars: wireless communication, communication with ground maintenance staff: wireless communication	as planned
Power supply/disaster prevention facilities	Substation: 13 locations	as planned
Management facilities	Control center, toll collection system	as planned
Trains	12 trains (48 cars)	as planned
Environmental protection	Sewage/drain water treatment, Noise protection wall	as planned
Depot/Yard	One Unit (Qiaokoulu - Lijibeilu with a total area of about 26,000 m^2)	32,700 m^2, about 25% increase

Source: Appraisal documents, Responses to Questionnaire

There were no major changes in the scope of works. Civil works and procurement of equipment have been implemented as planned. However, the precise location of the depot is between Qiaokoulu and Chongrenlu, and the area was increased to 32,700 m^2. The reason for the increase is that the area estimated at appraisal was based on the concept plan in the feasibility study, while the actual area is based on the detailed designs. Stores and shops were built under the depot, and the space has been leased/sublet to a private entity.

Train Operation Control Center

Tracks on viaduct section
(Jinghan Avenue)

3.4.2 Project Inputs

3.4.2.1 Project Cost

The estimated project cost at appraisal was 26.981 billion yen, of which the Japanese ODA loan with a total amount of 2.894 billion yen for the foreign currency portion alone and the rest to be funded by the Wuhan Municipality. The actual project cost was 24.388 billion yen, of which the Japanese ODA loan used was 2.34 billion yen and the rest was funded by the Municipality. The actual cost is equivalent to 91% of the planned cost. In Chinese yuan currency, the actual project cost was equivalent to 83% of the planned cost.

Table 9 Comparison of Project Cost (Planned and Actual)

Item	Planned					Actual				
	Foreign	Local		Total		Foreign	Local		Total	
	million yen	million yuan	million yen	million yuan	million yen	million yen	million yuan	million yen	million yuan	million yen
Civil work/tracks	0	454	5,902	454	5,902	0	412	5,760	412	5,760
Signal/Telecom.	674	167	2,171	219	2,845	598	128	1,790	170	2,388
Power supply/disaster prevention	254	231	3,003	250	3,257	442	189	2,642	221	3,084
Management	0	7	91	7	91	0	7	98	7	98
Trains	1,550	254	3,302	373	4,852	1,330	238	3,328	331	4,658
Environmental protections	0	42	546	42	546	0	45	629	45	629
Depot/yard	243	121	1,573	140	1,816	0	137	1,915	137	1,915
Others	0	446	5,798	446	5,798	0	421	5,886	421	5,886
Price escalation	35	48	624	51	659	-	-	-	-	-
Contingency	138	79	1,027	90	1,165	-	-	-	-	-
Total	2,894	1,849	24,037	2,072	26,931	2,340	1,577	22,048	1,744	24,388

Source: Appraisal documents, Responses to Questionnaire

Note: Exchange rate at appraisal : 1 yuan = 13 yen, Exchange rate at post evaluation: 1 yuan = 13.981 yen (average rate during the period of January 2000 - December 2004)

Main reasons for the lowered project cost are as follows.

1) During the implementation stage, designs were reviewed in detail, and construction methodologies, which led to elimination of ineffectual items and reduction of costs, were adapted.
2) Since the procurement of equipment (signals and telecommunication system, power supply and disaster prevention, and trains) was made through international competitive bidding (ICB) procedures, the competition produced lower bid prices resulting in the lower contract prices than the estimated costs.

3.4.2.2 Project Period

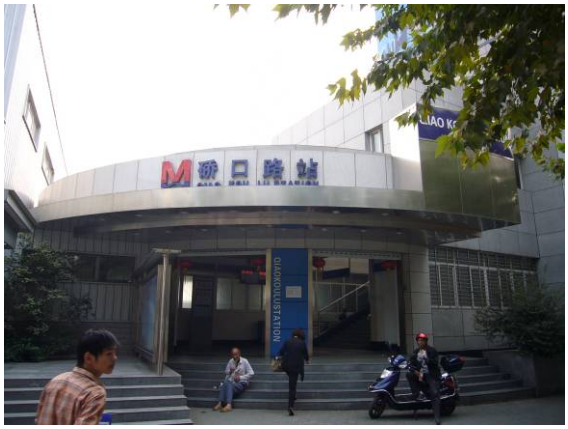
The project period was slightly longer than planned. The project period planned at appraisal was from March 2001 (signing of the Loan Agreement) to March 2003 (open to public) with a total period of 34 months. The actual project period was from March 2001 (signing of the Loan Agreement) to July 2004 (open to public) with a total period of 41 months, or equivalent to 121% of the planned period. The whole line with a total length of 29 km including the phase 1 section was open to public on July 28, 2010.

The main reasons for extension of the project period were: i) completion of civil works were delayed by a few months; but ii) with regards to the supply and installation of equipment, the ICB procedures process took longer than planned hence delaying the construction period. It was further delayed because of the final inspection and the test run lasted for a few months after the completion of all the project components. Eventually, the project period was delayed by 7 months, which was slightly longer than planned.

3.4.3 Results of Calculations of Internal Rates of Return (IRR)

The Financial Internal Rate of Return (FIRR) calculated at appraisal was 4.9% and the Economic Internal Rate of Return (EIRR) at appraisal was 14.9%. It is difficult to calculate the FIRR and EIRR at the post evaluation stage because of the following reasons: i) the construction cost of phase 2 and the operation and maintenance cost by phase are not available; and ii) the assumptions made for calculation (including change of the route, the total plan of metro network and the implementation schedule) have completely changed.

Depot



Qiaokoulu Station

Although the project cost was within the plan, the project period slightly exceeded the plan. Therefore, efficiency of the project is fair.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

Upon completion of the project, Wuhan Metro Operation Company (100% owned by Wuhan Metro Group), which is the subsidiary of Wuhan Metro Group (formerly called Wuhan Light Rail Transport Company) is undertaking operation and maintenance. The company has 12 divisions and offices with a total number of 1,600 employees at present (as of November 2010). Among 1,600 employees, about 500 staff are under the Maintenance and Management Division. The number of staff responsible for operations is about 50 for the Supervision and Dispatching Center, about 500 for Trains Division and about 500 for Passenger Transport Division.

3.5.2 Technical Aspects of Operation and Maintenance

Among the total 1,600 employees, 301 staff are college graduates and 1,262 staff graduated from vocational schools. Among the technical staff, four are senior engineers, 25 are engineers, and 37 are assistant engineers. The number of training modules implemented in 2011 is 14, including those on operating manuals, safety control, and countermeasures at emergency when the signals are not functioning. These training were undertaken internally and at the companies' supplied equipments. The training of each module lasted between 3 and 10 hours and the number of training recipients for each module was between 35 and 195. The training on safety and service enhancement was offered to all the employees once a year. Manuals prepared by the company include Management, Control and Procedures for Passenger Transport Service, Management, Control and Procedures for Operations and Safety Enforcement, Regulations for Train Dispatching Management, and Regulations for

Train Inspection and Repair Management. These manuals were developed for each job assignment.

3.5.3 Financial Aspects of Operation and Maintenance

At the planning stage, the flat fare (2 yuan/passenger during 2004-2012) was originally proposed for phase 1 section between Zongguan - Huangpulu section with a total length of about 10 km.

However, since the number of passengers was lower than expected upon commencement of operation, the charges were set low. Since then, fares have been raised and the current rate is 1.5 yuan for the first 6-station section and increased by 0.5 yuan for each of the following 3-station section. The revenue and expenditure status for the past four years is shown in Table 10.

Table 10 Revenue and Expenditure Status for the past Four Years

Unit: 000 yuan

Year	2008	2009	2010	2011
Fare revenue	16,513	19,515	56,546	95,980
Advertisement revenue	2,667	4,956	18,171	19,110
Revenue from lease of fixed assets	14,420	15,779	19,393	19,610
Subsidy from city government	18,000	18,000	18,000	18,000
Revenue total	51,600	58,250	112,110	152,700
Operation and maintenance costs	50,760	57,380	99,060	122,550
Balance	840	870	13,050	30,150

Source: Response to Questionnaire

Note: The revenue from lease of fixed assets includes revenues by leasing the space under the depot to the commercial entities.

Since the number of passengers was lower than expected, and the fare was set low, the fare revenue was not sufficient to the operation and maintenance costs. For the past 4 years, the Wuhan Municipal Government has provided subsidies amounting 18 million yuan every year. After opening the phase 1 section to the public in July 2004, the number of passengers was low and the business revenue was also quite low. However, on July 28, 2010 the whole alignment was opened to the public and the fare revenue has increased resulting in substantial surplus both in 2010 and 2011[5]. The parent company, Wuhan Metro Group is a state-owned company (100% owned by Wuhan Municipal Government), and it is also likely that the Municipal Government would continuously provide financial assistance. The budget needed for operation and maintenance of the equipment and facilities procured under the project is secure, and thus, no major financial issue is observed.

[5] The balance in 2011 ended in the black even excluding subsidies from the municipal government.

3.5.4 Current Status of Operation and Maintenance

Cleaning the inside cars and washing the train is regularly implemented. Train exteriors are inspected every 20,000 km of operation, and overhaul (dismantling bodies, detailed inspection and changes of worn out parts are implemented.) is implemented every 400,000-600,000 km. In addition, the tracks and power transmission lines are inspected every day. From the ocular inspection when riding the train, it was confirmed that trains and stations/platform have been cleanly maintained. Particularly, no difference was observed to the appearance between the trains procured under the project in 2004 and those procured under the phase 2 in 2010. This proves that the maintenance quality is high. The customer service of station staff is satisfactory and all the guide signs in the stations are quite visible.

No major problems have been observed in the operation and maintenance system, and therefore sustainability of the project effectiveness is rated high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project was to alleviate traffic congestion in the city center by constructing an urban railway with a total length of 10 km between Zongguan – Huangpulu in Wuhan, and thereby contribute to the improvement of air quality and promote social and economic development in Wuhan. The project has been highly relevant to the development plans and needs of China and Wuhan, as well as Japan’s ODA policies, and therefore its relevance is high. Regarding the alleviation of traffic congestion, contributing to improvement of air quality and promotion of social and economic development, which is the project's objective, the project has somewhat achieved its objectives, and therefore its effectiveness is fair. Although the project cost was within the plan, the project period exceeded the plan slightly. Therefore, efficiency of the project is fair. No major problems have been observed in the operation and maintenance system(organizational setup, technical capacity and financial status), therefore the project's sustainability is considered high.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

At present, the number of passengers during peak hours has reached the planned. However, since the passengers during the off-peak hours are less than expected, the average number of passengers per day is quite low. In order to alleviate the congestion in

train cars during peak hours and traffic congestion in the city's road network during the day, it is suggested to implement the policy of limiting the use of private cars during the day, as implemented in Beijing.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(1) The project completion date (opening Line 1 to public) was July 2004, and the loan closing date was July 2006. The reason why the ex-post evaluation of the project is only undertaken now is because the completion of the whole project components, including phase 2 section, which was funded by own resources, not by the ODA loans, was July 2010, when the phase 2 section was officially open to traffic. When preparing ex-post evaluation seven years after the project was completed, it is difficult to collect the relevant data and information and meet the officials who were involved in the project. Thus, it might affect the accuracy and preciseness in the assessment and evaluation process. In order to make an accurate ex-post evaluation, it is essential to keep all the records and data properly.

(2) From around 2003 after the project commenced, there was a change in alignment of the project route (phase 2 section), and the metro network development plan in Wuhan was formulated. Thus, it required a review of the demand forecast (number of passengers) analyzed in the feasibility study. Since the targets have not been established after the substantial change in alignment, it is difficult to properly assess the effectiveness of the project. Since the change in the project scope greatly affects the project's objective and effectiveness, a detailed review and assessment of scope of work should have been made to the level required at appraisal. The review and assessment work including reconfirmation of the scope of work, review of revised implementation schedule, analysis of its impacts due to revisions, establishment of new targets of operational monitoring indicators, and economic/financial analysis should be made[6], when the change in the project scope, which would greatly affect the project's objectives and effectiveness was made.

[6] Since 2004, the mid-term review system has been introduced for the Japanese ODA loan projects on a trial basis. Regarding the project, which needs the confirmation at the mid-term stage because of some factors affecting the achievement of project effectiveness, its originally identified relevance and planned effectiveness are reassessed so that planning of the project, including reestablishment of monitoring indicators are made as needed.

(3) Due to delay in completion of phase 2 section (from the planned 2007 to July 2010), the expected impact/effectiveness to be achieved through phase 1 section of the project, particularly the average number of passengers per day, have not appeared. The timely completion of the phase 2 section, which was not funded by JICA, was essential in achieving the expected impact/effectiveness under phase 1 section. Thus, the progress of the project, which is not funded by JICA, but would affect the achievement of the JICA-funded portion, should be monitored by JICA as well, even after the loan was closed so that it is possible to assess the influence to the impact/effectiveness of the JICA-funded portion.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs		
Civil work/tracks	Zongguan - Huangpulu with a total length of 10 km (viaduct) 10 stations (viaduct)	as planned as planned
Signals/telecommunication facilities	ATC and ATO by signals in cars Telecommunication between stations: optical cable, Between cars: wireless communication, communication with ground maintenance staff: wireless communication	
Power supply/disaster prevention facilities	Substation: 13 locations	as planned
Management facilities	Control center, toll collection system	as planned
Trains	12 trains (48 cars)	as planned
Environmental protection	Sewage/drain water treatment, Noise protection wall	as planned
Depot/yard	One Unit (Qiaokoulu - Lijibeilu with a total area of about 26,000 m^2)	32,700 m^2, about 25% increase
2. Project Period	March 2001 – December 2003 (34 months)	March 2001 – July 2004 (41 months)
3. Project Cost		
Amount paid in Foreign currency	2,894 million yen	2,340 million yen
Amount paid in Local currency	24,037 million yen (1,849 million yuan)	22,048 million yen (1,577 million yuan)
Total	26,981 million yen	24,388 million yen
Japanese ODA loan portion	2,894 million yen	2,340 million yen
Exchange rate	1 yuan = 13 yen (As of March 2001)	1 yuan = 13.981 yen (Average between January, 2000 and December, 2004)