China

Ex-post monitoring for ODA loan projects
"Beijing Subway Construction Project &
Beijing Subway Construction Project Phase II"

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Field Survey: February 2008

1. Outline of the project and Japan's ODA loan

Location of the project


Jianguomen station

1.1 Purpose of the project

The purpose is to alleviate road traffic jams by constructing a subway along Changanjie, the main street of Beijing that is heavily congested, thereby contributing to the urban development of the areas along the subway.

1.2 Outline of the loan agreement

Loan Amount/Disbursed Amount	Beijing Subway Construction Project (1) 2,510 million yen/2,506 million yen Beijing Subway Construction Project (2) 1,490 million yen/1,489 million yen Beijing Subway Construction Project, Phase II (1) 3,281 million yen /3,281 million yen Beijing Subway Construction Project, Phase II (2) 6,235 million yen /6,178 million yen Beijing Subway Construction Project Phase II (3) 3,819 million yen /3,590 million yen Beijing Subway Construction Project, Phase II (4) 2,343 million yen /2,140 million yen
Date of Loan Agreement/ Final Disbursement Date	Beijing Subway Construction Project (1) August 1988 / August 1995 Beijing Subway Construction Project (2)

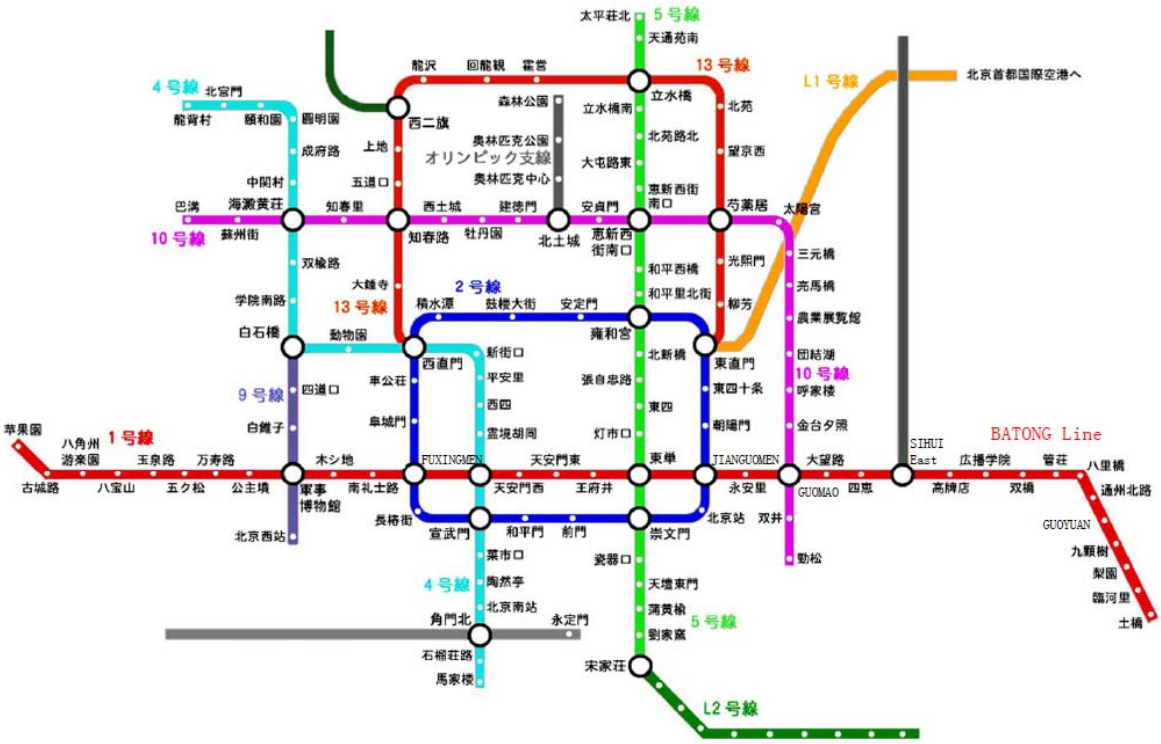
	May 1989 / May 1997 Beijing Subway Construction Project Phase II (1) October 1991 / November 1996 Beijing Subway Construction Project Phase II (2) October 1992 / November 2000 Beijing Subway Construction Project Phase II (3) August 1993 / October 2000 Beijing Subway Construction Project Phase II (4) January 1995 / May 2001
Ex-post Evaluation	Fiscal 2002
Executing Agency	Beijing Mass Transit Railway Operation Co., Ltd.
Main Contractors	Constructions Industrielles de la Mediterranee (France), China International Trust & Investment Corp. (China), Westinghouse Signals Limited (England)
Consultant Services	None

1.3 Background and reason for conducting ex-post monitoring study

According to the ex-post evaluation carried out in fiscal 2002, the number of passengers on the subway Route 1 which had been built under this project was approximately 160 million persons per year. The feasibility study conducted by the Chinese government projected that the demand would reach approximately 590 million people two years after the opening of the subway (in 1995) and about 720 million people in 2005. Thus, the discrepancy between the estimate and the actual number was immense. In order to reconfirm the effect of the project after the time of ex-post evaluation, we carried out this field study. In this report we outline our field study, review its results per item, and draw conclusions.

New subway routes have been developed in Beijing one after another to connect the outskirts to the heart of Beijing after the construction of Route 1 under this project. They include, for instance, Batong Line which is a suburban line and routes 5 and 10 which connect to the central parts of Beijing from north to south. Metro Route 1 built under this project runs from east to west along Changanjie. It serves the convenience of local residents as a mode of public transport available for them in conjunction with the expansion of routes that connect to the outskirts or the neighboring districts. In order to evaluate correctly the effect of this project (Route 1) that constitutes a part of Beijing's subway network, we carried out an overall evaluation based on our belief that it would be essential to understand the impacts given by the whole metro network on the traffic conditions of Beijing.

Figure 1: Subway network of Beijing (2008)



(Source) New Media of Japan and China Co., Ltd. / Beijing International Media Center

2. Findings of the monitoring

2.1 Effectiveness

Route 1 has been amply used, and the effect to induce people from road transport services such as bus has been confirmed. It is believed that its construction has given effect to the alleviation of traffic jams to a certain extent. The punctuality and time-shortening effect of the subway have been maintained, whereby the significance of the subway has no doubt increased as a mode of public transport.

2.1.1 Use of subways

2.1.1.1 Alleviation of traffic congestions

(1) Use of each mode of main transport in Beijing

The ex-post evaluation report did not discuss any effect quantitatively on the alleviation of traffic jam, but assessed a potential effect on alleviating traffic congestions based on the findings of a questionnaire survey carried out on users concerning the effect to induce bus users to the subway. In this field survey, we appraised the effect based on the use of the main modes of transport in addition to the above viewpoint.

The following Table 1 indicates changes in the proportions of public transport users and of

bicycle and personal car users. As can be seen, bicycle users drastically decreased in number from 2000 to 2005. Obviously many of them shifted to driving their own cars, and others began to use public transport services.

Table 1: Main modes of public transport in Beijing

	2000	2005
Public transport (metro, bus)	26.5%	29.8% (+3.3%)
Personal car	23.2%	29.8% (+6.6%)
Bicycle	38.5%	30.3% (-8.2%)
Others	11.8%	10.1%(-1.7%)

(Source) Excerpted from the findings of the third survey on transport in Beijing

On the other hand, Table 2 shows the traffic volume of each mode of transport. The metro users in the following table cover the users of all subway lines. As can be seen, they have been increasing steadily in number, and in all likelihood the expansion of the subway network such as Routes 5 and 10 is an important factor for this increase. Under the circumstances in which no big changes can be observed in the traffic volume of the main modes of public transport, the proportion of subway users increased from 8.7% in 2002 to 14.4% in 2006.

Table 2: Change in traffic volume by mode of (public) transport

(In one hundred million persons)

Item	2002	2003	2004	2005	2006	2007[1]
Total volume of passenger transport	**55.20**	**47.84**	**56.85**	**58.98**	**53.22**	**55.2**
Bus users (including street car)	43.46	37.10	43.91	44.98	39.79	42.30
Micro-bus	0.93	0.84	1.00	0.70		
Subways	**4.80**	**4.72**	**6.06**	**6.80**	**7.68**	**6.5**
Subway built under this project (Route 1)	**2.20**	**2.08**	**2.55**	**2.79**	**n.a**	**n.a**
Taxi	5.98	5.18	5.88	6.5	6.4	6.4

(Source) Data for 2001~05 are taken from the Beijing's Transportation Commission and data for 2006 ~ 07 are taken from the official bulletin of the City of Beijing on National Economy and Social Development Statistics.

(Note) In 2003 the overall traffic volume declined due to an outbreak of SARS.

According to the findings of a beneficiary survey carried out on approximately 400 subway users (to be discussed in 2.1.2), roughly 70% of the users have shifted from public busses and bicycles to subways. Thus, it can be inferred that some segments of former users of road transport modes such as bus began to use subways.

[1] The data for FY2007 are provisional. Hence, the statistics for 2006 were used in this comparison.

(2) Road traffic volume on Changanjie

The cross-sectional traffic volume[2] of Changanjie (in the central area of Beijing) that runs on the surface under which the section of the subway constructed under this project runs is shown in the following table. Compared this with the traffic volume at the time of ex-post evaluation, there is a decrease of 21%. Against the backdrop, lie political measures such as limiting bicycle riding into the central parts of Beijing. It is difficult to assess the extent to which this project has directly contributed.

Table 3: Cross-sectional traffic volume on Changanjie

(In one thousand persons)

	2002	2005
Cross-sectional traffic volume	120,773	95,847(-21%)

(Source: Annual Report on the Transport Development of Beijing

Figure 1: Peak-hour traffic jams

In the evaluation for this monitoring survey we do not measure quantitatively the effect of the project on alleviation of traffic jams. However, as stated in (1), a certain number of road users (such as bicyclers) have shifted to public transport services, and in particular, the number of subway users has been on the increase in proportion. The findings of the beneficiary survey also endorse this trend. If the subway network had not been developed, the passengers of subways would have used any of the land transport modes such as personal cars. In the line of this reasoning, it is safely argued that the subway network developed through this project has yielded some effect to bring aggravation of traffic congestions in Beijing under control.

2.1.1.2 Volume of passenger transport

(1) Frequency of train services and train-interval during peak hours

The ex-post evaluation report affirmed a steady improvement in the number of train services in Route 1. Since the time of ex-post evaluation, the number of train services has increased further

[2] It is a traffic volume at a cross-section added by upstream and downstream traffic volumes at a given point of a street.

indeed, and the situation of train operations is satisfactory.

Table 4: The number of train services and operation interval during peak hours

At the time of ex-post evaluation

	1992	1993-1999	2000
The number of services(average number/day)	380	380	432
	1992	1993~1995	1996~2001
Interval during peak hours (min./peak hour)	4	4	3

(Source) Beijing Mass Transit Railway Operation Co., Ltd.

(Note) 1992: Began operation between Fuxingmen～Xidan / 2000: The entire line was opened between Fuxingmen and Sihuidong

At the time of ex-post monitoring

	2003	2004	2005	2006	2007
Route 1					
The number of services per day	434	434	434	452	562
Interval (min.) in peak hours	3	3	3	3	2.5
Interval (min.) in off-peak hours	5-12	5-12	5-12	5-10	5-8
As reference: Route 2					
The number of services per day	364	367	383	395	451
Interval (min.) in peak hours	3.5	3.5	3.5	3.5	3
Interval (min.) in off-peak hours	6-15	5-12	5-11	5-11	4-10

(Source) Beijing Mass Transit Railway Operation Co., Ltd. / (Note) The executing agency defines that the peak hours are from 7 to 9 in the morning and from 17 to 19 in the evening.

In particular, the frequency of train services greatly increased and the interval between trains became shorter in 2007. This is because Beijing Mass Transit Railroad Operation Co., Ltd.[3], the executing agency, increased the number of train services and progressively shortened the intervals between trains in response to a growing demand for the overall subway network in conjunction with the opening of Route 5 that connects to Route 1. An indicator to show the punctuality of subway train services has not been developed yet, but the executing agency claims that the accuracy of the train intervals has been maintained at a high level. We actually measured the intervals between trains during the time of this field survey and did not observe any long delay both during peak hours and during off-peak hours. The beneficiary survey, which will be discussed later, has revealed that many subway users evaluate the punctuality of subway services. Thus, it is assumed that punctuality is kept at a high level.

[3] The name was Beijing Metro Corporation at the time of appraisal. The present executing agency is Beijing Mass Transit Railway Operation Co., Ltd., which was separated from the former as an independent corporation.

(2) Volume of passenger transport

1) Present volume of passenger transport

Beijing Mass Transit Railroad Operation Co., Ltd. projected that the number of Route 1 users would be 221 million people in 2002. The number increased to 279 million people in 2005. Thus, an upward trend continues.

Table 5: Transition in the number of subway passengers

（In 100 million people）

	2002	2003	2004	2005	2006	2007
1) All subway network	4.80	4.72	6.06	6.80	7.68	6.54
2) Route 1 (Project target sections)						
Estimate at the time of appraisal	**n.a**	**n.a**	**n.a**	**7.7**	**n.a**	**n.a**
Actual figures	**2.20**	**2.08**	**2.55**	**2.79**	**n.a**	**n.a**

(Source) Beijing Mass Transit Railway Operation Co., Ltd.[4]

The present number, 279 million people, has not reached the number estimated at the time of ex-post evaluation. However, we believe that it is not meaningful to use the estimate in our comparison, because there is a possibility that the estimate itself is not appropriate. Instead, we evaluate the use of Route 1 by comparing the number of Route 1 passengers with the number of passengers of subway lines under the control of the Tokyo Metropolitan Government that have a similar scale and length.

Table 6 Comparison with the passengers of Tokyo's subway

(In one thousand persons)

Route	Business kilometer (km)	No. of passengers
Route 1 (2005)	**38**	**279,000**
Toei Asakusa Line（2006）	18.3	218,056
Toei Mita Line（2006）	26.5	192,639
Toei Shinjuku Line （2006）	23.5	222,156
Toei Oedo Line （2006）	40.7	262,859

(Source): Bureau of Transportation, Tokyo Metropolitan Government

As is self-explanatory, the number of passengers of Route 1 has already exceeded that of Oedo-line that is the closest in terms of length. As for the peak-hour congestion rate, accurate statistics are not available. However, the executing agency projects that it is already 130~140%[5].

[4] The number of Rout 1 passengers means the number of passengers for the entire line. It is not the number obtained by the following formula: "Transportation volume (passenger kilometers) = the number of passengers carried during a year being multiplied by mileage."

[5] The Beijing Mass Transit Operation Co., Ltd. (the executing agency) states that it has not developed an accurate indicator of the congestion rate. The above data are based on visual estimating by station attendants (on the condition

That is, it has exceeded the limit number. At the time of this field survey, the evaluator also visually inspected that the conditions of peak-hour congestions can be compared with the congestions in the metropolitan area in Japan. Thus, it can be argued that the use of Route 1 has been expanding at a good pace even in comparison with similar urban railroads.

As for the expansion of subway users in the future, an expert[6] who accompanied our field survey expressed the following views.

1. Route 1 (constructed under this project) runs from east to west in the central parts of Beijing. That is, its full use is premised upon connection to the northern and southern districts that have high demand in order for the Route l to be used by commuters and students. In the future, it is expected that the number of passengers of Route 1 will increase in tune with the opening of these lines.
2. It is expected that the further expansion of the route (related to 1) will bring about an effect to stimulate potential demand in the areas that have no access to subway stations in the neighborhoods or no bus services to go to subway stations.

In addition, it is deemed that the following measures taken by the executing agency will increase the number of subway users in the future.

1. Since October 2007, the service has been improved, for instance, by introducing a uniform fare system for the entire route of subways (an actual cutback to 2 CNY) and by introducing an IC card system.
2. The aggregate number of subway users for the routes from 4 to 13 that are now under construction is estimated at over 815 million people in 2010. It is inferred that the demand for Route 1 will be expanded as a mode of trunk public transport services in the central Beijing when these routes are developed.
3. In order to lessen traffic congestions which are getting worse in conjunction with the growth of the number of persons who own cars, the executing agency has been trying to improve access to Route 5 that has a particularly high demand by introducing, for instance, park-and-ride[7] system and a through-fare with the city route bus.

(3) Shortened travel time

In this field survey, we actually measured the time required for travelling during peak hours and off-peak hours for a section of Route 1, i.e. between Xidan station and Sihuidong station, separately by bus, by taxi and by subway.[8]

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that design capacity = 8 persons/1 m^2).

[6] The expert is Assistant Professor Lee of Beijing Normal University.

[7] It is a system in which a person parks his/her car in a parking lot in the outskirts of the city and takes a public transportation system such as train and bus to the city center, thereby alleviating traffic jams in the central area of the city. In Beijing a measure has been taken to give a special discount on the parking fee to subway users.

[8] Sihuidong is located at the eastern end of Route 1 and serves as the transfer point from the Batong Line. Xidan is the station next to Tiananmen Station. This section covers an area from the residential districts in the eastern part of

Table 7: Travel time by major transportation modes

Outbound	Xidan→Sihuidong	Peak hours(7-9)	Other hours
1	Route bus	32 min.(+6 min.)	38 min.(+14 min.)
2	Taxi	27 min.(+3 min.)	28 min.(+4 min.)
3	Subway	24 min.	24 Min.
Inbound	**Sihuidong→Xidan**	**Peak hours(7-9)**	**Off-peak hours**
1	Route bus	44 min.(+20 min.)	34 min. (+10 min.)
2	Taxi	55 min.(+31 min.)	44 min.(+20 min.)
3	Subway	24 min.	24 min.

(Note) The figure in parentheses indicates a comparison with the travel time by subway.

All comparisons indicate that the travel time by subway is much shorter than the travel times by other modes of road transport. Thus, the subway still holds a greater advantage in terms of the travel time. The questionnaire survey carried out on the users (discussed in 2.1.2) also endorses this result. That is, 87% of the users highly evaluate the effect of shortening travel time from the area of a station to the area of another station that has been brought about by subways in comparison with the modes of transport that they had used before.

2.1.2 Findings of the subway user survey

In the ex-post evaluation, a satisfaction survey was carried out by questionnaire on subway users.[9] The findings indicate that the level of overall satisfaction has reached 89% (very satisfied 10% and satisfied 79%). The users enumerated the shortened travel time, a high degree of convenience, and safety as main factors for their satisfaction, whereas they enumerated high subway fares and long distance from the point of departure/destination to a subway station as factors for their dissatisfaction. During this field survey we also carried out a questionnaire survey in the same manner to confirm changes after the time of ex-post evaluation (in 2002).[10] The following table shows its findings.

Beijing to the places of work. The ex-post evaluation report states that the travel time measured at that time was 23 minutes by subway and about 30 minutes by bus during off-peak hours and more than one hour during peak hours.

[9] The questionnaire survey was carried out under a random sampling method at three stations including Jianguomen in November 2002. The number of effective respondents was 396.

[10] The survey was conducted at Jianguomen and at Guomao in February 2008. The number of effective respondents was 343.

Table 8: Findings of the beneficiary survey

Question	Response					
1.Mode of transport before the use of subway	Route bus	Taxi	Personal car	Bicycle		
	67.3%	9.9%	9.9%	13.4%		
2.How to get the closest station (for both ways)	Personal car	Route bus	Bicycle	On foot		
	4.1%	49.6%	4.1%	42.7%		
3.Reason for the use of the subway	Shorter travel time	Punctuality	Convenience	Economy	Safety	Convenience
	63.8%	48.1%	35.3%	18.4%	17.8%	7.6%
4.Satisfaction level	**Very satisfied**	**Satisfied**	Neither	Dissatisfied	Very dissatisfied	
	19.0%	**57.1%**	10.5%	12.2%	1.2%	
5.Comparison with former travel times	Shorter	No change	Longer			
	87.2%	10.5%	1.7%			
6.Shortned time	~10 minutes	~20 min.	~30 min.	~1 hour		
	22.2%	36.4%	26.2%	2.9%		
7.Fare	Too high	Proper	Low			
	8.16%	84.26%	7.0%			

Responses to each question are summarized below.

1) Question 1: Approximately 70% of subway users have shifted from a public bus. Thus, the result endorses the purpose of this project, that is, to induce people from road transport services.
2) Question 2: Like at the time of ex-post evaluation, a nearly half of the respondents take a bus to go to their closest subway stations. Notable is that a number of users take a feeder-bus to go to their subway stations.
3) Question 3: Like at the time of ex-post evaluation, many respondents' opinions were especially marked by the punctuality of the subway and shorter travel times as main reasons for their shift from the conventional transport modes to the subway.
4) Question 4[11]: As for the services, approximately 76% of respondents answered that they were satisfied, thus maintaining a high level of satisfaction. The reasons are shorter travel times and punctuality compared to the modes of transport used in former days.
5) Question 5 & 6: About 90% of the respondents recognize the effect of shorter travel time, which endorses the advantage of the subway in travel time over land transport systems.
6) Question 7: In the survey at the time of ex-post evaluation, many respondents considered that the fare was too high, whereas in this survey 84% of the respondents answered that it was appropriate. In all likelihood, this is due to the uniform fare system (2 CNY) introduced in October 2007.

[11] On the other hand, there were many opinions as to a small number of subway routes (a small area served by subways) and a demand for alleviation of peak-hour congestions, as free remarks.