

Republic of Bulgaria

Ex-Post Evaluation of Japanese ODA Loan Project

Sofia Metro Extension Project

External Evaluator: Masami Tomita, Sanshu Engineering Consultant

0. Summary

This project aimed at streamlining the city's transportation system by constructing tunnels and stations from the seventh to the ninth station, as part of Phase 2 (from the seventh to the sixteenth station of metro Line 1) of the Metro Line Construction Plan that existed at the time of project appraisal (covering approximately 19 km in total extension, from the first to the sixteenth station of metro Line 1) in Sofia, the capital of Bulgaria.

Relevance of this project is high, as the project is consistent with priority areas of Bulgaria's development plans and Japan's ODA policy, and moreover development needs for the project are high. The actual figure of daily passenger ridership at two years after project completion is approximately 80% of the figure estimated during the Mid-Term Review, and other indicators such as the number of running trains, operation interval, annual operational revenue and net profit of Metropolitan Company, which is responsible for operation and maintenance (O&M) of metro, showed an improvement to a large extent, compared with those at the time of appraisal. According to the result of beneficiary survey, travelling time became shortened since beneficiaries started using metro Line 1 and traffic congestions on roads along Line 1 and air/traffic noise pollutions were reduced after project completion. Thus, effectiveness and impact of the project are high. Efficiency of the project is fair, as actual project period largely exceeded planned period, while actual project cost was within the planned cost. Sustainability of the project is high, as no major problem has been observed in institutional, technical and financial aspects of O&M.

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

1. Project Description



Project Location



Platform at the Ninth Station

1.1 Background

Sofia city is situated in a basin and it is geographically difficult to expand the city, and thus the city has a high population density¹. At the time of project appraisal, the city was faced with serious traffic congestions due to generally very narrow roads and an increase in the number of vehicles (doubled over the past 10 years)². Moreover, public transportation systems in the city including tramcars, trolley buses, and buses were deteriorated, as necessary public investment had not been provided under the former socialist regime, and these systems were not consistent with passenger mobility needs in the city³. Aiming at modernizing its urban functions, Sofia city intended to streamline the city's transportation system that were intricately intertwined and redundant and reduce traffic congestions, through reorganization of its transportation system centering on metros and partial removal and/or realignment of tramcars and other existing routes⁴. Sofia city also focused on landscape improvement in the name of "Beautiful Sofia Campaign", as Bulgaria aimed at increasing foreign currency revenues from tourism industry. Construction of metro, as well as reorganization of ground public transportation, was regarded important, since it is the transport mode that does not defile cultural properties in the city center⁵. Therefore, the city began a study on metro projects in 1972, then from the first to the sixth stations of Line 1 were completed in 1998 and the seventh station was completed in 2000. However, these segments only linked the western residential area with part of the downtown area, and it was necessary to extend the existing route for reorganization of the city's overall public transportation system⁶. This project was implemented under such situation.

1.2 Project Outline

The objective of this project is to streamline the city's transportation system by constructing tunnels and stations from the seventh to the ninth station (approximately 2 km) as part of Phase 2 (the segment covering approximately 11 km from the seventh to the sixteenth station of metro Line 1) of the Metro Line Construction Plan (covering approximately 19 km in total extension, from the first to the sixteenth station), thereby contributing to the strengthening of urban functions and enhancing convenience for citizens in Sofia, the capital of Bulgaria.

Figure 1 below shows the project site map.

¹ Source: JICA appraisal document

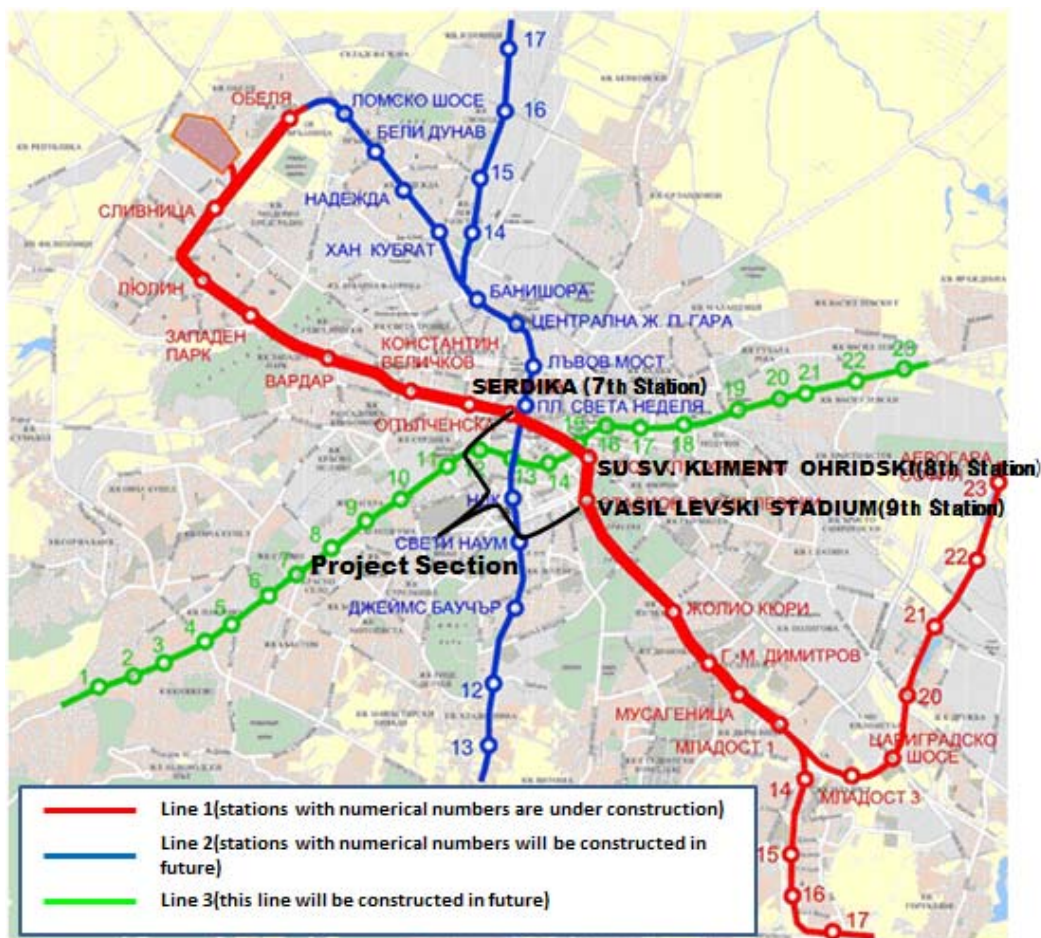
² Source: same as above

³ Source: same as above

⁴ Source: same as above

⁵ Source: same as above

⁶ Source: same as above



Source: edited based on BAGTC (Bulgarian Association for Geotechnical and Tunnel Construction) HP

Figure 1: Project Site Map

Loan Approved Amount/ Disbursed Amount	12,894 million yen / 12,833 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	February, 2002 / February, 2002
Terms and Conditions	Interest Rate 2.2% (1.8% for Consulting Service)
	Repayment Period 30 years (Grace Period) (10 years)
	Conditions for Procurement: General Untied
Borrower / Executing Agency(ies)	Municipality of Sofia Guarantor: Government of Bulgaria
Final Disbursement Date	July, 2011
Main Contractor (Over 1 billion yen)	Taisei Corporation (Japan)
Main Consultant (Over 100 million yen)	PADECO (Japan) / Oriental Consultants (Japan) (JV)
Feasibility Studies, etc.	Feasibility Study (Oriental Consultants, 1998) Special Assistance for Project Formation (SAPROF) for Sofia Subway Extension Project (2001)
Related Projects	Dispatch of JICA experts (2004-2005) JICA training in Japan (2007)

2. Outline of the Evaluation Study

2.1 External Evaluator

Masami Tomita, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study: September, 2013 – August, 2014

Duration of the Field Study: November 16 – November 24, 2013/ February 10 –February 17, 2014

3. Results of the Evaluation (Overall Rating: A⁷)

3.1 Relevance (Rating: ③⁸)

3.1.1 Relevance to the Development Plan of Bulgaria

At the time of project appraisal, enhancing the urban functions of Sofia city, which is a capital of Bulgaria, was necessary, as EU accession was the most important policy issue for the country, and this project was stated as one of major projects to be implemented in Sofia regions in “National Plan for Regional Development (2000-2006)”⁹.

At the time of ex-post evaluation, “Operational Programme on Transport (OPT): 2007-2013” of Bulgaria, which stipulates that the country will develop its transport infrastructures in a manner that conforms to the EU’s transportation policy, states that projects such as metro extension are necessary for development of sustainable urban transportation systems, friendly to the environment, in Sofia, and extension of metro Line 1 to the nineteenth station and construction of Line 2 are stated as priorities¹⁰. Moreover, daily passenger ridership is estimated to increase from 75,000 (at the time of formulation of OPT) to 580,000 and the share of metro among public transportation is expected to increase to 45% when the metro line construction plan (Line 1 to 3) is completed¹¹.

Therefore, metro construction in Sofia is emphasized in Bulgaria’s national development plans both at the time of project appraisal and ex-post evaluation, and the project is consistent with national policies.

3.1.2 Relevance to the Development Needs of Bulgaria

At the time of project appraisal, as explained above, Sofia had very narrow roads and was faced with serious traffic congestions due to an increasing number of vehicles, and the city aimed at streamlining the city’s transportation system and reducing traffic congestions by partial removal and re-routing of existing tram routes based on re-organization of public transportation

⁷ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁸ ③: High, ② Fair, ① Low

⁹ Source: JICA appraisal document

¹⁰ Source: Operational Programme on Transport: 2007-2013

¹¹ Source: same as above

centering on metro. Metro lines in operation at the time of appraisal was Line 1 only from the first to the seventh stations, and in order to make metro serve as a core of the city's transportation system, it was necessary to construct the Phase 2 portion (approximately 11km from the seventh to the sixteenth station) and extend it through the downtown area to as far as the eastern residential area. However, construction of the segment from the seventh to the ninth station (approximately 2km) required the use of shield tunneling method, and since Bulgaria did not have experience in this method, technical support from Japan was necessary¹².

At the time of ex-post evaluation, as shown in Table 1, the number of registered vehicles (total of cars, trucks, buses, trolley buses and trams) in Sofia has been increasing steadily from approximately 650,000 in 2004 to approximately 740,000 in 2012 (increasing rate: 14%), though it is not a substantial increase¹³.

Table 1: Changes in the Number of Registered Vehicles in Sofia

(Unit: vehicle/year)

	2004	2012
Car	581,995	643,015
Truck	61,580	87,492
Bus	6,389	5,544
Trolley Bus	146	150
Tram	336	309
Total	650,446	736,510

Source: Bulgaria's National Statistical Agency

Existing public transportation routes such as buses and trams have been partially removed and re-routed¹⁴, and a study on optimization of public transportation has been on-going for extension of metro¹⁵. Moreover, at the time of ex-post evaluation, Line 1 (16 stations in total) and 2 (11 stations in total) are in operation, and these lines are connected at Obelya station and they are operated practically as one line. Currently, construction works for further extension of Line 1 to south-east of Sofia are on-going and construction works for the extension to Sofia Airport is planned to be completed in mid-2015¹⁶. According to the latest metro construction plan in Sofia, a total of 62km and 63 stations will be constructed in Line 1, 2 and 3, and 1.1 million passengers will be transported daily after completion¹⁷. The share of metro among public transportation in Sofia was 5% only in 2004, which increased to 14% in 2012, and it has

¹² Source: JICA appraisal document

¹³ Source: Bulgaria's National Statistical Agency

¹⁴ For example, Bus No.51 which used to be operated parallel to the section between Station 0 and 1 of metro Line 1 and Tram No.21 which used to be duplicated with Tram No.20 and 22 were closed (source: answers to the questionnaire).

¹⁵ Source: answers to the questionnaire

¹⁶ Source: same as above

¹⁷ Source: same as above. According to the latest metro construction plan, Line 1 will be composed of a total of 29km and 27 stations, Line 2 will be composed of a total of 17km and 17 stations, and Line 3 will be composed of a total of 16km and 19 stations.

been steadily increasing¹⁸.

Therefore, needs for metro extension for reduction of traffic congestions and streamlining the city's transportation system are high both at the time of project appraisal and ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

According to "Official Development Assistance (ODA) Country Data Book (2002)", transition to a market economy, environmental protection, and development of economic infrastructures were priority areas of Japan's ODA policy in Bulgaria, and this project was to contribute to development of economic infrastructures. Moreover, according to JICA Country Operation Policy (2001), priority areas for assistance were; 1) environmental fields in which both legal and operation systems were required to be largely improved to meet EU accession criteria; 2) transport sector in which it was demanded by EU to develop infrastructures based on the Pan-European Transport Corridors Framework¹⁹; and 3) agricultural and agricultural product processing fields which used to be Bulgaria's strength and had a potential to grow more. This project was to contribute to 2) above and consistent with Japan's ODA policy²⁰.

This project has been highly relevant to Bulgaria's development plan, development needs, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Effectiveness²¹ (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Passenger Ridership

An estimated figure and actual figures of passenger ridership on the project section (Line 1) are shown in Table 2.

Table 2: Passenger Ridership on Line 1

(Unit: 10,000 people/day)

2001 (Baseline)	2006 (Actual at mid-term review)	2010 (Estimated at mid-term review)	2009 (Actual at project completion)	2010 (Actual at 1year after completion)	2011 (Actual at 2years after completion)	2012 (Actual at 3years after completion)
5.7	7.0	20.4	11.7	16.9	16.1	17.6

Source: estimated: JICA internal document, actual: answers to the questionnaire

Note: the section up to the seventh station was in operation at the time of mid-term review (2006) and the section up to the thirteenth station was completed in 2009. The section from the fourteenth to the seventeenth station (a branch of Line 1) is under construction and the section between eighteenth and nineteenth station started operation in 2012.

While the baseline figure in 2001 is written as 69,000 in JICA appraisal document and the actual figure in 2006 is written as 80,000 in JICA internal document, correct figures are 57,000 in 2001 and 70,000 in 2006, according to Metropolitan Company.

¹⁸ Source: same as above

¹⁹ This is a framework aiming at connecting EU countries and central and east Europe via corridors.

²⁰ Source: JICA appraisal document

²¹ Sub-rating for Effectiveness is to be put with consideration of Impact.

While a target (estimated) figure was set for passenger ridership at the time of project appraisal, it was revised during mid-term review due to a delay of project implementation etc., and thus the revised figure is used as a target figure in this ex-post evaluation. The figure 204,000 people per day estimated during mid-term review is considered to be an estimated figure of ridership for the section from the station 0 to 13 at two years after project completion, and comparing the estimated figure with the actual figure in 2011, a target achievement rate is approximately 80%. The reason for the actual figure falling below the estimated figure by approximately 20% is that it has not been long since project completion and it takes time to materialize a modal shift²², according to Metropolitan Company, which is an operation and maintenance agency of this project.

3.2.1.2 Number of Running Trains

Actual figures of the number of running trains on Line 1 at the time of project appraisal and after project completion are shown in Table 3.

Table 3: Number of Running Trains on Line 1

(Unit: number per day, number per peak hour)

	2001 (Baseline)	2009 (Actual at project completion)	2010 (Actual at 1year after completion)	2011 (Actual at 2years after completion)	2012 (Actual at 3years after completion)
Daily	268	281	354	358	392
Peak 1 Hour	10	14	15	15	18

Source: answers to the questionnaire

While a target figure was not set for the number of running trains at the time of project appraisal, this is used as an evaluation indicator here, as this is a basic indicator to evaluate a railway project. Actual figures of the number of running trains on Line 1 at the time of ex-post evaluation show a steady increase since the time of project appraisal.

3.2.1.3 Operation Interval

Actual figures of operation interval during peak hour on Line 1 at the time of project appraisal and after project completion are shown in Table 4.

Table 4: Operation Interval during Peak Hour on Line 1

(Unit: minutes)

2001 (Baseline)	2009 (Actual at project completion)	2010 (Actual at 1year after completion)	2011 (Actual at 2years after completion)	2012 (Actual at 3years after completion)
6.0	4.5	4.0	4.0	3.5

Source: answers to the questionnaire

²² A modal shift in this context means to shift a mode of transportation from road transportation to railway (metro).

While a target figure was not set for operation interval at the time of project appraisal, this is used as an evaluation indicator here, as this is a basic indicator to evaluate a railway project. Operation interval on Line 1 at the time of ex-post evaluation was steadily shortened compared with that at the time of project appraisal.

3.2.1.4 Operating Rate of Rolling Stocks

Actual figures of operating rate of rolling stocks on Line 1 at the time of project appraisal and after project completion are shown in Table 5.

Table 5: Operating Rate of Rolling Stocks on Line 1

(Unit: %)

2001 (Baseline)	2009 (Actual at project completion)	2010 (Actual at 1year after completion)	2011 (Actual at 2years after completion)	2012 (Actual at 3years after completion)
83	78	81	81	83

Source: answers to the questionnaire

While a target figure was not set for operating rate of rolling stocks at the time of project appraisal, this is used as an evaluation indicator here, as this is a basic indicator to evaluate a railway project. Actual figures of operating rate of rolling stocks have been approximately 80% since the time of project appraisal and no major problem is seen. According to Metropolitan Company, the rest of approximately 20% are under regular inspection and repair and standby preparing for emergencies such as a sudden accident.

3.2.1.5 Annual Operational Revenues of Metropolitan Company

An estimated figure and actual figures of annual operational revenues of Metropolitan Company, which is an operation and maintenance agency of this project, are shown in Table 6.

Table 6: Annual Operational Revenues of Metropolitan Company

(Unit: million leva)

2001 (Baseline)	2006 (Actual at mid-term review)	2010 (Estimated at mid-term review)	2009 (Actual at project completion)	2010 (Actual at 1year after completion)	2011 (Actual at 2years after completion)	2012 (Actual at 3years after completion)
7.6	12.4	30.0	23.5	37.6	36.8	44.8

Source: estimated: JICA internal document, actual: answers to the questionnaire

While a target (estimated) figure was set for annual operational revenues of Metropolitan Company at the time of project appraisal, it was revised during mid-term review due to a delay of project implementation etc., and thus the revised figure is used as a target figure in this ex-post evaluation. The actual figure in 2011 (two years after project completion) exceeds the figure estimated at the time of mid-term review. The reason is considered to be that a metro fare

was increased from 0.3 leva for a single trip at the time of project appraisal to 1.0 leva at the time of ex-post evaluation, while the actual number of passengers was a little below the estimated figure²³.

3.2.1.6 Net Profit of Metropolitan Company

Actual figures of net profit of Metropolitan Company since the time of project appraisal are shown in Table 7.

Table 7: Net Profit of Metropolitan Company

(Unit: million leva)

2001 (Baseline)	2006 (Actual at mid-term review)	2009 (Actual at project completion)	2010 (Actual at 1year after completion)	2011 (Actual at 2years after completion)	2012 (Actual at 3years after completion)
0.009	▲0.055	0.821	5.977	2.580	0.843

Source: answers to the questionnaire

Note: the actual figures are written as 0.002 million leva in 2001 and 1.663 million leva in 2006 in JICA internal documents, however, according to Metropolitan Company, correct figures are 0.009 million leva in 2001 and -0.055 million leva in 2006. JICA internal documents also state that net profit written in these documents does not take into account depreciation cost of assets such as station buildings which were handed over from Sofia Municipality to Metropolitan Company in 2003, and that if the depreciation cost is taken into account, net profit in 2006 is in deficit.

Net profit has largely increased since project completion compared with that at the time of project appraisal, however, net profit in 2012 was decreased from that of the previous year, as material cost, utility cost, consumables expense, personnel cost and depreciation cost etc. increased accompanying the opening of Line 2 in 2012.

3.2.2 Qualitative Effects

3.2.2.1 Travelling Time in Certain Sections

Travelling time by metro between the seventh station (Sofia city center) and the thirteenth station (southeast part of the city) of Line 1 is approximately 14 minutes. On the other hand, when the evaluator travelled a road which runs parallel to the section between the seventh and thirteenth station by a car (sedan) during the field survey (9:00 am on Thursday, November 21, 2013), travelling time was approximately 24 minutes in both directions. While it cannot be generalized as the survey for travelling time was conducted for part of roads only in Sofia city, travelling time by road transport is approximately 1.7 times of that by metro for the above section, and thus metro has more advantage than road transport.

²³ Consumer price indices (CPI) in Bulgaria increased by 1.67 times from 2002 (at the time of project appraisal) to 2013 (at the time of ex-post evaluation)(source: National Statistical Agency), however, metro fare increased by 3.3 times, whose increasing rate is higher than consumer price increase rate.

3.2.2.2 Qualitative Effects Identified from the Beneficiary Survey

The beneficiary survey was conducted in the ex-post evaluation in order to see qualitative effects of the project²⁴. The overview of the results of the survey is shown below.

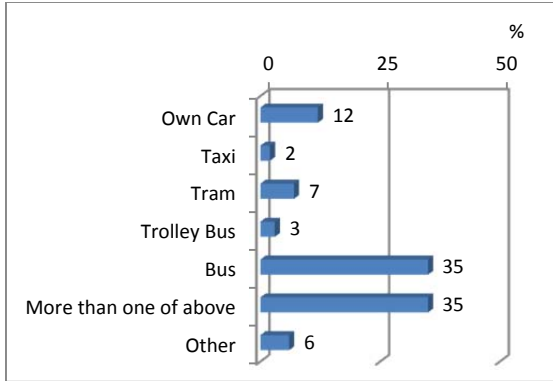


Figure 2: Transport Mode Used before Beneficiaries Started Using Line 1

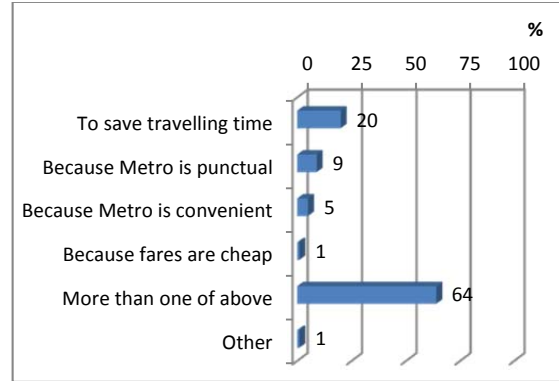


Figure 3: Reasons for Using Line 1

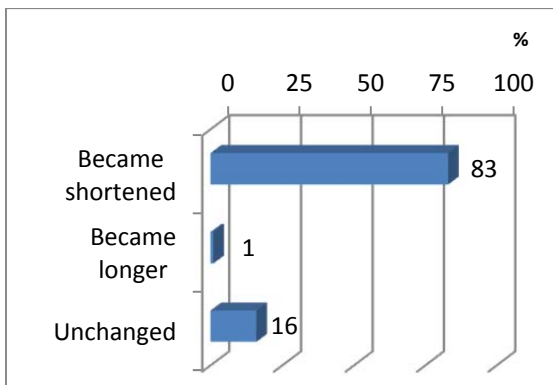


Figure 4: Changes in Travelling Time after Beneficiaries Started Using Line 1

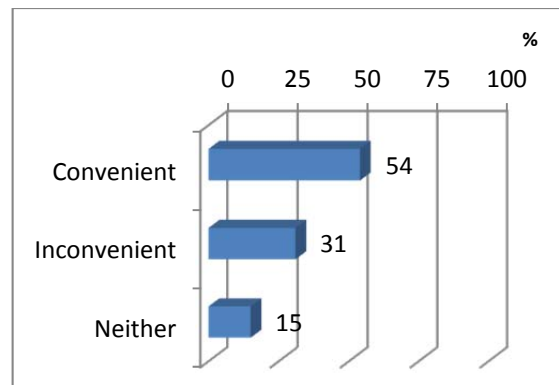


Figure 5: Connection of Line 1 with Other Modes of Transportation

Among those who answered that travelling time was shortened, 53% said reduced time was 10 to 20 minutes and 31% said reduced time was 20 to 30 minutes.

As explained above, the passenger volume on Line 1 at the time of ex-post evaluation is 176,000 people per day, and the result of the beneficiary survey above suggests that the transport mode that was used the most by beneficiaries before they started using Line 1 was buses, and converting the passenger volume of Line 1 into the number of buses (assuming 15 passengers per vehicle on average) results in approximately 12,000 buses per day, which suggests that the project contributed to reduction of traffic volume on roads to some extent.

²⁴ The beneficiary survey was conducted in the following manner. Time: December 2013, the number of samples: 100 in total (48 at the eighth station and 52 at the ninth station (male: 43 and female: 57)), method: questionnaire survey

Moreover, reasons for using Line 1 are that beneficiaries can save time and metro is punctual and convenient etc., and over 80% of beneficiaries answered that travelling time was reduced after they started using Line 1.

In light of the above, this project is considered to have contributed to streamlining Sofia city's transportation system to a certain extent. However, approximately 30% of beneficiaries feel that the connection of Line 1 with other modes of transportation is inconvenient as shown above, and in addition, approximately 60% feel that Line 1 is overcrowded and a little less than 40% want operation interval to be further shortened. Thus these aspects need to be taken care of in order to promote a modal shift from a road transport to metro further.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Changes on Traffic Congestions on Roads and Environment after Project Completion

The results of the beneficiary survey on changes on traffic congestions on roads and environment (traffic noise and air pollution) along Line 1 after project completion are shown below.

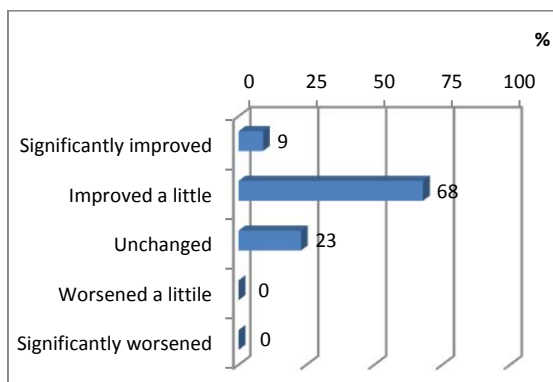


Figure 6: Traffic Congestions on Roads along Line 1

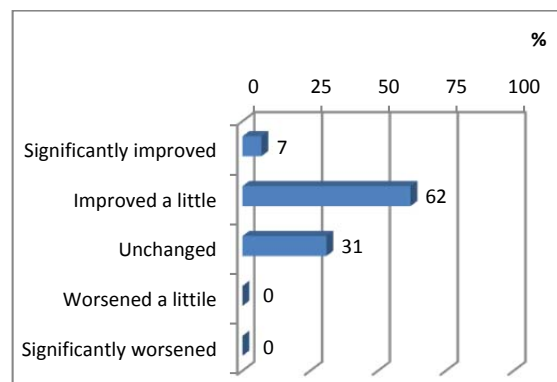


Figure 7: Traffic Noise in Areas along Line 1

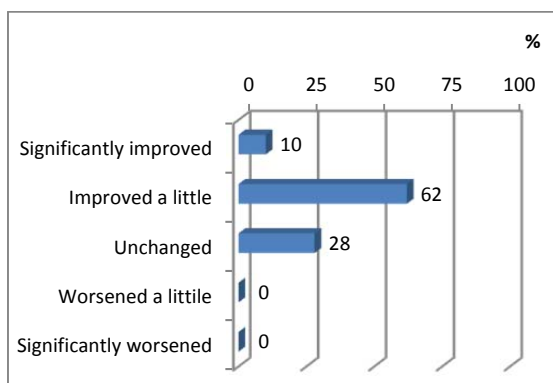


Figure 8: Air Pollutions in Areas along Line 1

Nearly 80% of beneficiaries feel that traffic congestions on roads were improved after project completion and approximately 70% feel that traffic noise and air pollutions were reduced. Therefore, this project is considered to have contributed to improvement of traffic congestions on roads and urban environment to a certain extent, which further contributed to enhancing convenience for citizens and strengthening urban functions of the capital to a certain extent.

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

At the time of project appraisal, the project section was expected to pass through a part of cultural property protection areas (around the seventh station), and the environmental protection law of Bulgaria obliged stakeholders of all railway projects to conduct two steps environmental impact assessment (EIA)²⁵. The first EIA was approved by the Ministry of Environment in December 2000, and the second EIA was to be conducted as soon as after completion of a basic design and before procurement of contractors²⁶.

At the time of ex-post evaluation, all EIA procedures by the Ministry of Environment were completed (the second EIA was completed in 2002), and cultural remains were not found around the seventh or eighth stations, which thus did not affect construction works²⁷. However, in 2005, it became necessary to cut down some trees in the park near the eighth station, and an NGO opposed this, and then the Sofia Municipality presented a solution whereby it would transplant the trees to a different location and replant the trees in their original locations after completion of construction works, and the issue was solved²⁸. Moreover, construction works were considered to cause some cracks in the historical Military Club building, which was located near the construction site, however, restoration and enforcement works were conducted by contractors and the issue was solved²⁹. According to the executing agency, while some problems were seen as above, monitoring of EIA procedures was properly conducted and necessary environmental measures were taken by consultants in cooperation with contractors during project implementation.

3.3.2.2 Land Acquisition and Resettlement

There was no land acquisition or resettlement under this project³⁰.

This project has largely achieved its objectives. Therefore its effectiveness and impact is high.

²⁵ Source: JICA appraisal document

²⁶ Source: same as above

²⁷ Source: JICA internal document and answers to the questionnaire

²⁸ Source: JICA internal document

²⁹ Source: same as above

³⁰ Source: answers to the questionnaire

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

Outputs of the project (planned and actual) are shown in Table 8.

Table 8: Comparison of Outputs (Planned/ Actual)

Item	Planned	Actual
Construction Works/ Procurement	<ul style="list-style-type: none"> • Construction of tunnels from the seventh station to the ninth station (1.83km per direction x 2 = 3.66 km in total) * • Construction of stations at the eighth and the ninth stations (110m each) • Construction of turn-back facilities • Signal, telecommunication, power supply works 	<ul style="list-style-type: none"> • Construction of tunnels from the seventh station to the ninth station (1.74km per direction x 2 = 3.48km in total) * • Construction of stations at the eighth and the ninth stations (110m each) • Construction of turn-back facilities • Signal, telecommunication, power supply works
Consulting Service	<ol style="list-style-type: none"> 1) Engineering Consultant <ul style="list-style-type: none"> • Review of bidding documents and assistance for selection of contractors and suppliers • Design of shield tunnel and construction supervision • Environmental management (coaching on environmental impact during construction works) etc. 1,664M/M in total 2) Management Consultant <ul style="list-style-type: none"> • Establishment of new financial structures of Metropolitan Company • Institutional building of management and operation of Metropolitan Company • Provision of staff trainings etc. 72M/M in total 	<ol style="list-style-type: none"> 1) Engineering Consultant <ul style="list-style-type: none"> • Review of bidding documents and assistance for selection of contractors and suppliers • Design of shield tunnel and construction supervision • Environmental management (coaching on environmental impact during construction works) etc. 1,731M/M in total 2) Management Consultant <ul style="list-style-type: none"> • Establishment of new financial structures of Metropolitan Company • Institutional building of management and operation of Metropolitan Company • Provision of staff trainings etc. 344M/M in total

Source: planned: JICA appraisal document, actual: answers to the questionnaire

* Note: As tunnels from the seventh to the ninth station were twin shield tunnels with single track, the length of the tunnels was calculated by a length per direction x 2.

Actual outputs are almost as planned, and the actual period of consulting service was extended due to a delay of project implementation.



Platform at the Eighth Station



Remote Control and Surveillance System

3.4.2 Project Inputs

3.4.2.1 Project Cost

The planned project cost at the time of project appraisal was 17,192 million yen (foreign currency: 8,661 million yen, local currency: 8,531 million ten), of which Japanese ODA loan portion was 12,894 million yen³¹. On the other hand, the actual project cost was 12,901 million yen (foreign currency: 12,821 million yen, local currency: 80 million yen), of which Japanese ODA loan portion was 12,833 million yen³², and it was lower than planned (75% against the plan)³³. The actual project cost does not include value-added tax (VAT) which was refunded after project completion, however, the refunded amount of VAT was not identified in ex-post evaluation. Then, comparing the actual cost with the planned cost excluding taxes (15,770 million yen) results in 82% against the plan, which is still lower than planned. The reason for the actual cost being lower than the planned cost is considered to be because the planned cost was calculated taking into account risks of cost overrun, as actual project cost turned out to be more than planned cost in the past Japanese ODA loan projects in Bulgaria.

3.4.2.2 Project Period

The planned project period at the time of project appraisal was 56 months in total from February 2002 (signing of the loan agreement) to September 2006 (completion of construction works)³⁴. On the other hand, the actual project period was 92 months in total from February 2002 (signing of the loan agreement) to September 2009 (completion of construction works)³⁵, and it was significantly longer than planned (164% against the plan). The reasons for the actual project period significantly exceeding the planned period were; 1) regarding a selection of contractors, a long time was required for correction of pre-qualification (P/Q) documents prepared by the executing agency, clarification of P/Q criteria and correction of bidding documents etc., and in particular, the Sofia Municipality did not have an experience of implementing a large scale project with overseas borrowing and was unaccustomed to required procedures, which required inquiries from the Municipality several times; 2) while the Municipality requested JICA of concurrence to bidding results, in which 3 out of 5 companies passed technical evaluation, some deficiencies were found in the evaluation report and thus re-evaluation was required, and as a result 1 company out of the above 3 companies became disqualified, which also required a long time; 3) a selection of sub-contractors by contractors

³¹ Source: JICA appraisal document

³² Source: answers to the questionnaire and JICA internal document

³³ The actual project cost above is different from the amount written in the Project Completion Report, however, according to Metropolitan Company and the engineering consultant, the above figure provided by Metropolitan Company is the correct figure.

³⁴ Source: JICA appraisal document

³⁵ Source: JICA internal document

was delayed and a change to specification of a tunnel boring machine and segment (blocks that consist of segmented tunnels) was required; and 4) a long time was required for re-design of the connection point with the seventh station and for a change of location of vertical shaft, as the structure of common duct (which contains essential utilities such as electricity, gas and water), which was located near the seventh station, was deteriorated more heavily than expected³⁶.

Table 9: Comparison of Planned and Actual Project Period

Content	Planned	Actual
Selection of Consultant	January 2002 - June 2002 (6 months)	Unknown - August 2002
Selection of Contractor	April 2002 - September 2003 (18months)	September 2002 - November 2004 (27months)
Construction Works/ Procurement	October 2003 - September 2006 (36months)	November 2004 - September 2009 (59months)
Consulting Service	July 2002 - September 2006 (39months)	September 2002 - December 2010 (100months)

Source: planned: JICA appraisal document, actual: JICA internal document

Note: according to JICA appraisal document, the planned period of consulting service does not seem to include a defect liability period, however, the actual period includes a defect liability period.

3.4.3 Results of Calculations of Internal Rates of Return (Reference only)

3.4.3.1 Financial Internal Rate of Return (FIRR)

The precondition written in the SAPROF (Special Assistance for Project Formation) report and the actual situation is different (a passenger volume was calculated in the report based on an assumption that a passenger volume between each station is calculable, for example, the volume from the first to the seventh station is estimated to remain constant and the volume from the eighth to the tenth station is estimated to increase after opening of the thirteenth station. However, at present, a passenger volume between each station is not calculable), and thus FIRR cannot be correctly calculated.

3.4.3.2 Economic Internal Rate of Return (EIRR)

EIRR cannot be calculated, as necessary data was not available.

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

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance (O&M)

At the time of project appraisal, the transportation system in Sofia city was managed under a

³⁶ Source: same as above

system in which the Sofia Municipality (the Transportation Bureau headed by the deputy mayor of transport) makes policy decisions and in the case of metro, Metropolitan Company (a special governmental corporation which is wholly owned by the Municipality and is entrusted by the Municipality to operate and manage metro exclusively) implements the policy decisions, and in the case of other public transportation such as buses and trams, the respective O&M agencies implement the policy decisions³⁷. There is no change to this system at the time of ex-post evaluation, and management, operation and maintenance of metro are conducted by Metropolitan Company. The total number of employees of the company at the time of ex-post evaluation is 1,403, of which 923 employees are in charge of O&M of Line 1³⁸.

Table 10: Breakdown of the Number of Employees in Charge of O&M of Line 1

Section	Number
Management	42
Depot	288
SCADA and Communication System	74
Power Supply	67
Traffic Operation	337
Electro-mechanics	47
Rail Tracks and Infrastructure	68
Total	923

Source: answers to the questionnaire

O&M of almost all facilities except for a few special electro-mechanics is conducted by own employees in Metropolitan Company³⁹. The number of employees in charge of O&M of Line 1 was estimated to be approximately 1,000 in 2015 (when Line 1 was expected to be extended to the sixteenth station) in the SAPROF report, and as a nearly equal number of employees are currently assigned, there seems to be no problem regarding the number of employees.

3.5.2 Technical Aspects of Operation and Maintenance

Among 923 employees in charge of O&M of Line 1, 305 are engineers, 104 are university graduates (not engineers) and 317 are graduates of secondary technical schools⁴⁰. Maintenance manuals for rolling stocks, tracks, ventilation and air-conditioning systems, and water supply and sewerage systems are in place, and O&M is conducted based on these manuals⁴¹. During project implementation, various trainings were provided for train drivers (4 months), experts of security equipment including SCADA system and CCTV (2 months), energy experts (40 days), experts of rail tracks and switch-points (30 days), by recruiting experts from inside and outside

³⁷ Source: JICA appraisal document

³⁸ Source: answers to the questionnaire

³⁹ Source: interviews with Metropolitan Company

⁴⁰ Source: answers to the questionnaire

⁴¹ Source: interviews with Metropolitan Company

of Metropolitan Company, and even after project completion, trainings are conducted at least once a year, which end up with exams to check the level of understanding⁴². Sufficient number of technical staff is assigned, various maintenance manuals are in place, and trainings are regularly conducted, and thus there seems to be no problem regarding technical aspects of O&M.

3.5.3 Financial Aspects of Operation and Maintenance

At the time of project appraisal, Metropolitan Company recorded profit in its income statement in the financial year of 2000, however, the company was not able to accurately count the number of passengers and thus it could not efficiently formulate an operation and investment plan for the future (as commutation tickets for metro are commonly used for buses and trams as well, Sofia Public Transport Company-Holding sold these tickets to passengers and distributed profit to each operating agency)⁴³. Thus, under this project, a dispatch of JICA experts and an implementation of training in Japan were planned for management improvement of the company, and management consultants employed for the project were to analyse management and financial problems faced by the company and formulate and implement a future improvement plan so that the company could establish a corporate management to reduce financial burdens on Sofia Municipality⁴⁴.

During project implementation, 3 short-term experts in total were dispatched from JICA to the Municipality (a transportation system advisor: 3 months, a public sector finance advisor: 6 months and an advisor for streamlining and promoting the transportation system: 7 months), and an economist from Metropolitan Company attended the “railway management course” held in Tokyo in January and February 2007⁴⁵. Moreover, as explained in “3.4.1 Project Outputs”, management consultants employed under the project provided support for establishment of new financial structures of and institutional reform of Metropolitan Company (for example, centralized information management of ridership and ticket sales, optimization of the number of employees and expenses etc.). As a result, at the time of ex-post evaluation, the number of passengers is correctly counted by automatic ticket gates installed at each station. However, only incoming number of passengers is able to be counted and exiting number of passengers at each station is not yet able to be counted. A fare of metro is currently 1.0 leva for a single trip regardless of distance, which is the same for other public transportation system, however, tickets for 10 single trips (8.0 leva) and monthly tickets (35.0 leva per month) etc. are also available. Fare revenues of Metropolitan Company consist of 1) direct ticket sales to passengers and 2) a

⁴² Source: answers to the questionnaire

⁴³ Source: JICA appraisal document

⁴⁴ Source: same as above

⁴⁵ Source: JICA internal document

revenue distributed by Sofia Urban Mobility Center (similarly as at the time of project appraisal, commutation tickets for metro are commonly used for other public transport, and the Center sells these tickets to passengers and distributes profit to each operating agency in accordance with operating distance)⁴⁶. Financial data of Metropolitan Company in recent three years are shown below.

Table 11: Income Statement of Metropolitan Company

(Unit: million leva)

	2010	2011	2012
Sales (Operational Revenue)	37.615	36.804	44.827
Services (Fares)	36.795	35.781	40.567
Others	0.820	1.023	4.260
Cost of Sales	9.641	11.428	15.965
Raw-materials, Goods, Consumables	5.951	7.039	9.500
Hired Services	3.690	4.389	6.465
Gross Profit	27.974	25.376	28.862
Selling, General and Administrative Expenses	28.401	29.890	39.513
Wages and Social Securities	15.082	16.568	22.038
Depreciation Costs	8.541	9.200	13.262
Others	4.778	4.122	4.213
Operating Profit	▲0.427	▲4.514	▲10.651
Non-Operating Income	7.269	7.830	12.150
Non-Operating Expense	0.021	0.011	0.030
Extraordinary Profit	0.000	0.000	0.000
Extraordinary Loss	0.374	0.433	0.532
Tax	0.470	0.292	0.094
Net Profit	5.977	2.580	0.843

Source: prepared based on answers to the questionnaire

Note: "Others" in "Sales (Operational Revenue)" includes revenues from advertisement, rents and service fees paid from Sofia Municipality for construction management. "Non-Operating Income" includes government grants etc.

Table 12: Balance Sheet of Metropolitan Company

(Unit: million leva)

	2010	2011	2012
Assets			
Long-Term Assets	1,032.871	1,340.148	1,702.078
Current Assets	52.614	50.232	67.231
Total Assets	1,085.485	1,390.380	1,769.309
Equity and Liabilities			
Equity	14.746	15.596	16.439
Long-Term Liabilities	1,000.897	1,342.127	1,690.309
Current Liabilities	69.842	32.657	62.561
Total Equity and Liabilities	1,085.485	1,390.380	1,769.309

Source: answers to the questionnaire

⁴⁶ Source: answers to the questionnaire and interviews with Sofia Municipality and Metropolitan Company

Table 13: Cash Flow Statement of Metropolitan Company

(Unit: million leva)

	2010	2011	2012
Cash Flows from Operating Activities	▲6.425	76.088	65.323
Cash Flows from Investing Activities	▲245.050	▲427.525	▲442.933
Cash Flows from Financing Activities	252.509	354.037	376.824
Net Increase in Cash and Cash Equivalents	1.034	2.600	▲0.786
Cash and Cash Equivalents at the Beginning of the Year	4.784	5.818	8.418
Cash and Cash Equivalents at the End of the Year	5.818	8.418	7.632

Source: answers to the questionnaire

O&M cost of Line 1 in recent three years is approximately 18-27 million leva per year (approximately 1,200-1,800 million yen per year), of which O&M cost of the project section (between the seventh station and the ninth station) is approximately 1.8-2.6 million leva per year (approximately 120-180 million yen per year)⁴⁷.

As shown above, sales (operational revenue) of Metropolitan Company have steadily increased, and while operating profit is in deficit due to depreciation cost, net profit is in surplus due to government grants etc. According to the company, it makes a plan for a necessary amount of grants and submits to the Municipality and the amount is allocated every year. The current ratio of the company in recent years is over 100%, which suggests no major problem on short-term liquidity, and cash flow is positive. Material cost, utility cost, consumables expense, personnel cost and depreciation cost etc. increased accompanying the opening of Line 2 in 2012, which resulted in a decrease of net profit in 2012 compared with that of the previous year, and the future trends should be monitored, however, O&M cost of the project facilities is sufficiently covered by sales, and there seems to be no major problem regarding financial aspects of O&M.

3.5.4 Current Status of Operation and Maintenance

As for rolling stocks, regular inspection, functional verification and change of spare parts in accordance with running distance as well as daily inspection and cleaning are conducted, and moreover, maintenance is conducted for tracks, ventilation and air-conditioning facilities, and water supply and sewerage systems based on maintenance manuals⁴⁸. According to Metropolitan Company, there is no problem on facilities and equipment provided by the project. Stations and a depot (this was not covered by the project) were visited during the field survey, and all facilities were well maintained and no particular problem was seen.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the project effect is high.

⁴⁷ Source: answers to the questionnaire

⁴⁸ Source: interviews with Metropolitan Company

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed at streamlining the city's transportation system by constructing tunnels and stations from the seventh to the ninth station, as part of Phase 2 (from the seventh to the sixteenth station of metro Line 1) of the Metro Line Construction Plan that existed at the time of project appraisal (covering approximately 19 km in total extension, from the first to the sixteenth station of metro Line 1) in Sofia, the capital of Bulgaria.

Relevance of this project is high, as the project is consistent with priority areas of Bulgaria's development plans and Japan's ODA policy, and moreover development needs for the project are high. The actual figure of daily passenger ridership at two years after project completion is approximately 80% of the figure estimated during the Mid-Term Review, and other indicators such as the number of running trains, operation interval, annual operational revenue and net profit of Metropolitan Company, which is responsible for operation and maintenance (O&M) of metro, showed an improvement to a large extent, compared with those at the time of appraisal. According to the result of beneficiary survey, travelling time became shortened since beneficiaries started using metro Line 1 and traffic congestions on roads along Line 1 and air/traffic noise pollutions were reduced after project completion. Thus, effectiveness and impact of the project are high. Efficiency of the project is fair, as actual project period largely exceeded planned period, while actual project cost was within the planned cost. Sustainability of the project is high, as no major problem has been observed in institutional, technical and financial aspects of O&M.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency (Sofia Municipality)

As explained above, a fare is a flat-rate in all public transportation systems in Sofia for convenience of passengers, and revenues from indirect ticket sales are distributed from Sofia Urban Mobility Center to each operating agency according to operating distance. While no major problem is seen regarding financial aspects of O&M at the time of ex-post evaluation, fares should be determined reflecting actual number of passengers and actual O&M cost. As O&M cost of metro is more expensive than other public transports in general, fares should be set utilizing a zoning system, for example, based on actual number of passengers and actual O&M cost in future.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Necessity to manage risks when providing a Japanese ODA loan to an executing agency for the first time: During project implementation, a selection of contractors and construction works were overly delayed and as a result, the actual project period largely exceeded the planned period. JICA should consider how to deal with these problems during project appraisal if there is a risk of delay because borrowers or executing agencies are unfamiliar with Japanese ODA Loan procedures. For example, the World Bank prepares a procurement assessment report for a new project during appraisal based on the country procurement assessment report, and the Bank assesses executing agencies' capabilities and risks related to procurement and formulates a detailed project implementation plan based on the report, which could be one of the options.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs	<ul style="list-style-type: none"> • Construction of tunnels from the seventh station to the ninth station • Construction of stations at the eighth and the ninth stations • Construction of turn-back facilities • Signal, telecommunication, power supply works 	As planned
2. Project Period	February 2002 – September 2006 (56 months)	February 2002 – September 2009 (92 months)
3. Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	8,661million yen 8,531million yen (148 million leva) 17,192million yen 12,894million yen 1 leva = 57.65 yen (As of June 2001)	12,821million yen 80million yen (1.2 million leva) 12,901million yen 12,833million yen 1 leva = 69.09 yen (Average between February 2002 and July 2011)