

Final Report

Summary

1. Key Issues on Urbanization and Transportation in Ulaanbaatar

The population of Ulaanbaatar (UB) City was 58,000 in 1990 and doubled to 1.13 million in 2010.

About 27% of the country's population lived in UB City in 1990. The population concentration of UB City reached 41% in 2011. This trend is expected to continue and UB City's share in the population will become larger in the future. Over the last 20 years, the country's population has grown at an average rate of 1.3% per annum, while that of UB City is 3.3%.

Most immigrants to UB City have recently settled in ger areas where infrastructure is inadequately provided. Once these people settle in ger areas of little infrastructure, it would cost much time and money to reorganize the areas into a settlement with a good living environment. In order to avoid such expansion of the ger areas and to lessen the cost for infrastructure provision and adverse environmental impacts in forming a sustainable UB City, it is imperative to construct a compact urban spatial structure with a well-planned public transportation as its spine.

In addition, such population concentration in UB City has increased the demand for various infrastructure and utilities and has had an adverse environmental impact. These resultantly elicited urban problems including inadequate supply of water, electricity and heating, lack of treatment of wastewater and solid waste, and uncontrollable air pollution, water and soil contamination.

Particularly, motorized vehicles are the only current means of urban transportation in Ulaanbaatar. However, the present road network of UB City was planned in a master plan in 1975 when the city's population was 349,000, the number of cars registered was 10,044, and the car ownership ratio was 2.9%. The plan targeted to cope with only 400,000 to 500,000 people. In 2010, the population reached 1.11 million, the number of cars registered was 167,809, and the car ownership ratio became 14.6%. Compared to 1975, the population became 3.2 times greater, the number of cars registered was 16.2 times more, and the car ownership ratio was 5 times higher. For the past 35 years, the trunk road network has had limited improvements, that are inadequate to meet the increasing traffic volume. Consequently, this has led to traffic congestion. Improper traffic management, bad driving manners, and on-street parking have worsened traffic conditions.

Based on the future population by Khoroo, projected according to the future population framework, the number of trips will be double from 2011 to 2030, and the traffic demand (person-km) will be 3.1 times the present level. The main reasons for rapid increase of traffic demand compared to the rate of population increase (1.4 times the present rate) is because of the increase in average trip length in conjunction with expansion of urbanized areas and increase in the number of private cars (see Figure 1).

Traffic volume increase of private cars will be a burden to road transport system. The traffic capacity of main corridors especially Peace Avenue and Chingiss Avenue will be absolutely insufficient. By 2030, the total transport cost will be 14.1 times of the present level, two-thirds of which are shared by Travel Time Cost (TTC). Loss of time value will be serious because of the traffic congestion.

As for the traffic volume of cross section of main corridors in 2030, approximately 700,000 persons (200,000 PCU¹) will cross Peace Avenue daily. Though it will not be seriously congested inside the city center due to a high density road network, the volume-to-capacity (V/C) ratio of main trunk road access to city center will be 2.6-3.0. In terms of south-north direction, daily trips will be 600,000 persons (170,000 PCU) in Chingiss Avenue, and V/C ratio will be 5.0, which means the road will

¹ PCU stands for passenger car unit and is defined as the number of vehicles equivalent to passenger cars. It is a coefficient used to compare traffic volume consisting of different vehicle types at different spots; for example, a truck is considered equivalent to 2.0-2.5.

already be overloaded.

Lack of road capacities along major corridors will be absolutely serious, so the development of mass transit and effective road transport control will be crucial to expand transport infrastructure and services.

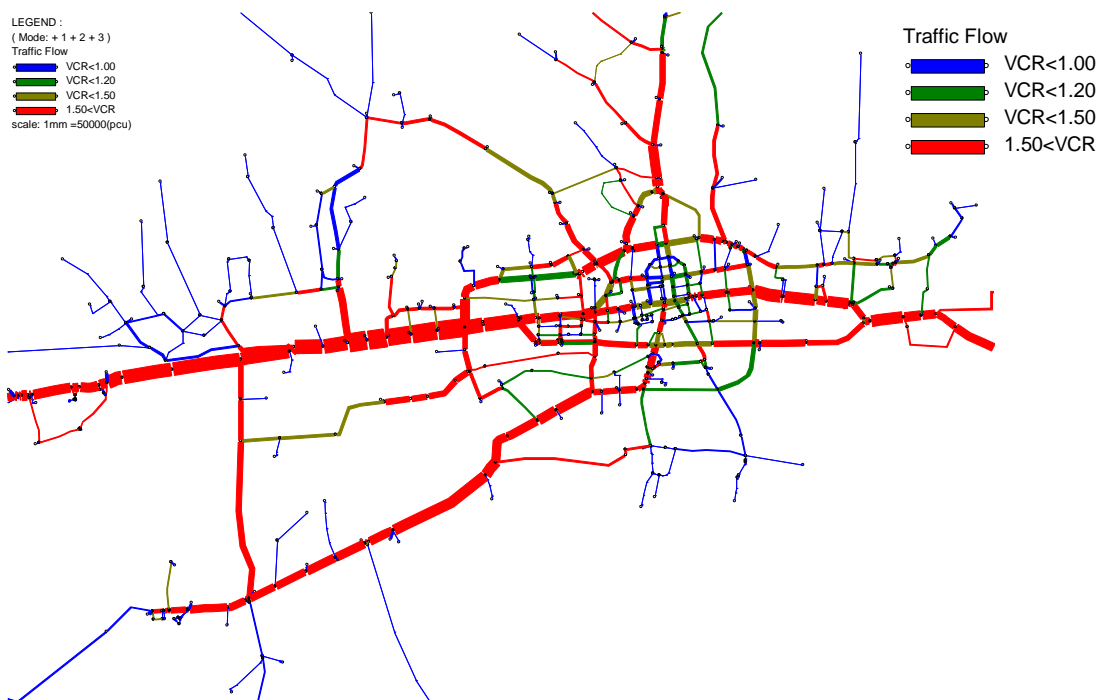


Figure 1: Future Traffic Demand (Baseline Case, 2030)

Source: JICA Study Team

2. Outline of Ulaanbaatar Metro Concept

1) Development of Comprehensive Urban Transport Network

The spatial structure of UB City is a ladder-shaped one, extending from east to west and is surrounded by mountains in the north and south. Peace Avenue is the only trunk road that connects east and west of the city, so most of urban facilities and traffic are gathered along this road. Based on the result of simulation of STRADA, a traffic demand analysis software developed by JICA, about 700,000 trips (approximately 35% of the 2 million trips) are concentrated in Peace Avenue. Among the 58 main bus routes of the city, 21 routes (36%) run along this trunk road.

In this way, Peace Avenue serves as the backbone of urban service, transport and utility service in UB City. There are various strategic development opportunities along this road.

Mass transit development along Peace Avenue has advantages in terms of the transport and urban development. The Ulaanbaatar Metro (UB Metro) project is proposed to develop a mass transit of 17.7 kilometers long between Amgalan Station and Tolgoit Station within the road spaces along Peace Avenue. The UB Metro will be properly connected to Ulaanbaatar Railway at the east and west terminal stations, which are Amgalan and Tolgoit, respectively. The following effects of the UB Metro are expected:

- The UB Metro will be developed within a road space without reducing the traffic capacity of Peace Avenue; traffic capacity can be increased by reducing vehicles.
- The UB Metro will not be an independent line but appropriately integrated with other transport network.
- The UB Metro will be properly connected to Ulaanbaatar Railway when it is possible to be developed as a “commuter railway of a UB city region” after Bogdkhan Railway is developed as a freight line of Ulaanbaatar Railway.

2) Promotion of Integrated Urban Development

An integrated urban development can be promoted by the mass transit development along Peace Avenue where urban activities are accumulated. In particular:

- The UB Metro will be a trigger to strengthen existing urban areas and to develop sub centers.
- The UB Metro will lead appropriate urban growth towards the west side (though urban expansion towards the east is not recommended in terms of water reservoir preservation).
- The UB Metro will be developed without serious social and technical disincentives.

3) Appropriate Railway System

When considering the selection of the mass transit system, some criteria such as i) demand at peak hour, ii) economic consideration, iii) safety, and iv) easy maintenance would be considered in a comprehensive manner.

In addition, with the long-term operation period, a flexible railway system to respond to future urban growth and increase of passengers is expected. Furthermore, selection of facilities and equipment which can adapt to special climate condition of UB City is indispensable. For this, v) flexibility for future expansion (increase in the number of cars and decrease in travel time), vi) resistance to cold climate, and vii) environmental aspect such as gas emission, noise/vibration and daylight interference are important criteria for UB City.

Prospective railway systems are assessed based on conditions of this project such as a route and transport capacity, and it is proposed to select “steel wheel and steel rail system MRT” as an optimum mass transit system for Peace Avenue. This railway system is a double-track urban railway and has the flexibility to respond to future demand increase.

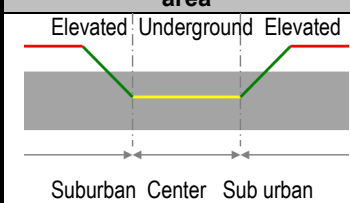
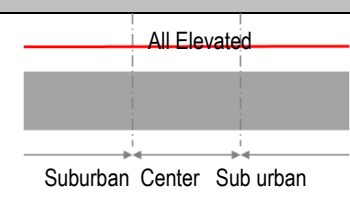
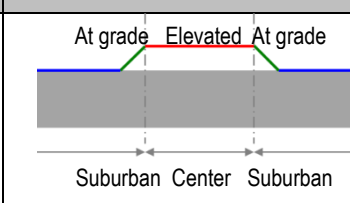
4) Structure

There are three types of Metro structures: elevated, at grade and underground. Based on the criteria listed below, three alternatives of structure are assessed (see Table 1).

- a) Socio-economic impact: land acquisition, land use
- b) Traffic function: impact on road transport (avoidance of decrease of carriageway, grade crossing with road, impact on intersection)
- c) Environmental consideration: landscape, noise and vibration, safety
- d) Technical appropriateness: construction method, construction cost

Based on the result of assessment, **alternative A, “underground in city center, elevated in sub urban area,”** is proposed in this project.

Table 1: Alternative Structures of UB Metro

	A: Underground in city center, Elevated in sub urban area	B: All elevated	C: Elevated in city center, at grade in sub urban area
Section Image			
Land Acquisition	○ Not necessary	△ Necessary to secure present width of carriageway and sidewalk in city center	× Necessary to secure present width of carriageway and sidewalk
Road Transport	○ Less impact on road transport	△ Some negative impacts on city center because of pillars	× Serious impacts because of grade crossing with road
Landscape	△ No negative impacts in city center but some negative impacts in suburban areas	× Serious Impacts both in city center and suburban areas	× Serious Impacts in both city center and suburban areas. Particularly, significantly affects the city center.
Environment	△ No negative impacts in city center but some negative impacts in suburban areas such as noise and vibration	× Serious negative impacts such as noise and vibration because of the elevated structure	× Serious negative impacts, such as creating noise and vibration, and splitting of communities
Cost	×	△	○

Note: Cost of each case includes only the development cost of the train infrastructure. This means that it does not include the cost of loss from the decrease in carriageway width, land acquisition of the reduced carriageway or grade crossing with road.

Source: JICA Study Team

5) Selection of Station Location

Based on some criteria such as potential of urban core, intermodal transfer condition, physical condition (existing medians, soil and underground water) and accessibility, 14 stations are proposed from Tolgoit Station to Amgalan Station, with a total of approximately 17.7 km. Underground section in the city center is 6.6 kilometers long between West Intersection and East Intersection. Other than that, the structure is elevated and completely separate from road traffic (see Figure 2).

A possibility of extension of the line is also assumed towards the west in accordance with the expansion of urbanized area and a new town development in the west of UB City.

6) Transport and Train Operation Plan

The transport plan of UB Metro is outlined in Table 2. Since there are a few sharp curves and the distances between stations are relatively long, the train running time required between two terminal stations can be shortened by setting the maximum speed to 100 km/h. To reduce the construction cost and to ensure effective train operation, the number of cars for a train should be six. Under this assumption, a section with the maximum volume of passengers is between Sappro Rotary station and 25th Pharmacy station. The maximum number of passengers carried to one direction during peak hour in 2030 is about 18,000.

According to the train operation plan, trains operate every eight to nine minutes in 2020 and every five minutes in 2030. The terminal stations through the whole length from east to west (17.7 km) will be connected in 27 minutes by metro.

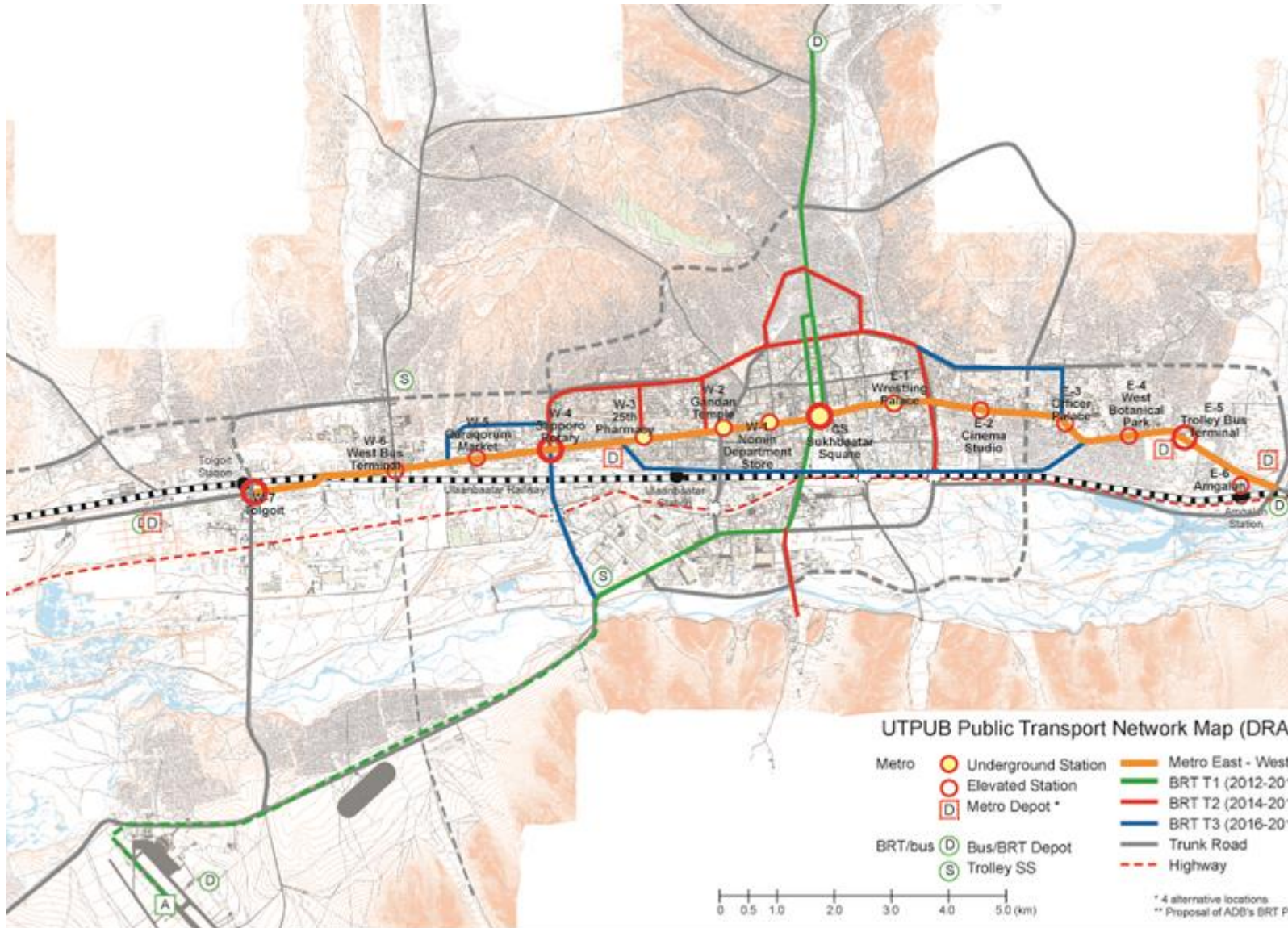


Figure 2: Location Map of UB Metro (Draft)

Table2: Transport and Train Operation Plan

Item	Description	
Corridor	Tolgoit Sta. – Amgalan Sta.	
Route length (km)	17.640 km (between starting and terminal stations)	
No. of stations	14 (including five underground stations)	
Service hours	6:00 AM to 11:00 PM	
Demand forecast		
Corridor	Sapporo Rotary Sta. – 25 th Pharmacy Sta.	
Year	2020	2030
PHPDT (pax)	10,729	17,767
Car composition for a train	6	
Train capacity (180%)	1,428	1,428
Headway (peak hour) (sec)	515	300
Schedule speed (km/h)	39.2	
Schedule time (minute)	27	
Maximum operation speed (km/h)	100 (80 for underground section)	
Train make-up	2020	2030
Required No. of trains	8	13
No. of spare trains for inspection	1	1
No. of spare trains for extra service	1	1
Total	10	15

7) Rough Estimate of Project Cost

This is the first urban railway project in Mongolia and large underground and elevated constructions are included in the project. And since it is very cold and construction is restricted in the winter in Mongolia, special specifications of system to be used for cold districts are required for the project.

The project cost has been estimated referring to procurement and winter construction circumstances described and comparing with Korean FS and construction cost of Japan and other foreign countries. Project costs of the following three options have been set up with the difference of procurement.

- Option 1 : the assumption that Japanese firms etc. can enter into the project (base case)
- Option 2 : the assumption that international competitive bidding is conducted (competition case)
- Option 3 : the assumption that Japanese firms can enter into main constructions and procurements (Japan core case)

As for Option 3, it is assumed that Japanese firms would get involved into civil and architecture works for underground section (by shield method), procurements of signal and telecommunication equipment, safety system and rolling stock. In particular, civil works for underground section and rolling stock require advanced techniques and high credibility; and therefore, it is desirable that Japanese companies will get involved in such works and procurements. On the other hand, as for other constructions and procurements, it is preferable to conduct these items with lower cost through international bidding. Accordingly, the Japan core case is proposed in this study. As a result, the total project cost is US\$1.5 billion including US\$1.3 billion of construction cost for a tunnel, elevated bridge, stations and related facilities and US\$200 million of procurement cost for rolling stock and opening expenses (see Table3).

Table 3: Estimated Project Cost

Item		Cost (US\$ Million)
Construction Cost	Civil works	913.0
	Track	65.0
	Architect / System	300.0
	Removal of obstacle	25.0
	Sub-total	1,303.0
Land acquisition		30.0
Rolling stock		122.4
Contingency / Miscellaneous expenses		84.0
Total		1,539.4
Construction cost per km (US\$ Million)		67.51
Rolling stock cost per car (US\$ Million)		2.04
Project cost per km (US\$ Million)		79.76

3. Station Area Development

The UB Metro will cover various urban land uses from the Central Business District (CBD) to suburban and rural areas. With appropriate feeder bus service provision, accessibility of ger areas will be improved.

Based on the “Transit-Oriented Development” (TOD) concept,² the following are desirable to be implemented.

- Development of intermodal transfer function of station areas and bus feeder service system (Station plaza and intermodal facility development).
- Development of an intensive urban city with a highly dense population where high-level and efficient utilization of land is realized in the central area and intermodal transfer areas (development of sub-centers).
- Restriction of expansion of urban areas and promotion of resettlement of citizens in ger areas by reconstruction of old apartment buildings (promotion of a housing policy).

Currently, the Ministry of Construction and Urban Development is formulating the Urban Redevelopment Law. After the law is passed and enacted, projects will be implemented through the right conversion instead of land expropriation. Accordingly, urban redevelopment projects along Peace Avenue, including old apartment reconstruction projects, are expected to be facilitated. Therefore, it is necessary to formulate an urban redevelopment project implementation plan around stations which are integrated with the UB Metro project.

Furthermore, underground development and utilization of underground space are recommended as a part of the station area development since they are effective on revitalization of economy and improvement of accessibility and safety in the cold winter of Mongolia

Including these urban development projects, multi-faceted spillover effects are expected such as the effects on the citizens’ living condition, local economy, safety, environment and local society. Specific effects are shown as follows.

² To promote an urban development integrated with public transportation.

Improvement of Accessibility

- Time cost saving by the shortened travel time of citizens (45 minutes of travel time by bus will be reduced to 15 minutes by metro)
- Reduction of traffic congestion in urban areas (16% of reduction of traffic volume, 25% of increase in travel speed)
- Revitalization of business and commercial activities in the central areas and improvement of citizens' living condition by enhancement of accessibility to the city center (increase in the number of employees and shoppers).
- Improvement of safety and reduction of social cost by the decrease in the number of traffic accidents.

Revitalization of Local Economy

- Investment promotion : Establishment of new business facilities in station areas is expected.
- Revitalization of real estate market : 1,318 ha of floor demand for commercial and business services is expected in station areas.
- Creation of employment : 155,000 new employment opportunities are created at station areas (within 800 m) by the development of the UB Metro by 2030.
- Increase in tax revenue : Revenue from sale tax, income tax, real estate tax and new tax for redevelopment is expected to increase. The total amount of the increase in 2030 is assumed to reach US\$232 million.

Effects on Environment

- CO₂ emitted by cars on main roads is reduced by 34,000 tons per year by 2030
- NO_x emitted by cars on main roads is decreased by 1,754 tons per year as of 2030

Technical Transfer to Mongolia

- The UB Metro is the first electric urban railway in Mongolia and new technologies and systems such as civil works for underground (shield tunneling method), communication, train traffic control and power system will be introduced. UBMC will have 580 Mongolian engineers with the operation and maintenance skills to provide safe and comfortable urban railway services
- Know-how on the underground development is introduced in relation to the development of the Metro.

4. Public-Private Partnership (PPP) Implementation Scheme

1) PPP Scheme

With regard to the implementation scheme of the UB Metro, there are basically three types of schemes: the public work scheme, the Public-Private Partnership (PPP), and the hybrid public company scheme. According to the Railway Law of Mongolia, a two-tiered system is a basic structure of the railway business. Accordingly, the government will be the owner of the infrastructure and lease it to concessionaires under a long-term agreement. The concessionaires are supposed to develop, purchase or construct the rolling stock (owned or leased), and related facilities, and own them. After that, they begin to operate the urban public transportation system, which forms a part of this project.

On the assumption of a PPP implementation scheme, the following two schemes are possible:

- (1) A special purpose company (SPC) scheme: SPC operates the Metro based on the two-tiered system; and
- (2) A public company scheme: A public company by the joint-investment of the public and the private sectors operates the Metro based on the two-tiered system.

With regard to the legal aspect, in case of an SPC scheme, it is expected that the Metro Project will be a concession project under the Law on Concession as long as it is included in the concession list. As for a public company scheme, when the law is applied, the same process as the SPC scheme such as inclusion in the concession list is required. However, the concession law does not clearly stipulate conditions under which the joint investment public company must follow the concession law. Therefore, the procedure of the metro project must be based on the decision of concerned organizations (in this case, the Ministry of Economic Development, which is in charge of the concession law).

As for the implementation scheme, the two-tiered system (the national government is an owner of the infrastructure) is appropriate due to financial reasons as well as the regulation of the Railway Transportation Law of Mongolia.

According to the result of cash flow analysis of this project, Project Internal Rate of Return (PIRR) is around 2% on the assumption that the ODA loan is utilized and average fare is MNT 600. This shows that it is not realistic for one operating company to pay back the investment of the infrastructure with only fare revenue and implement a sustainable operation and management. The infrastructure should be paid back on a long term basis as public goods from the economic point of view. An operation scheme clearly different from the SPC management which provides comfortable metro service on the commercial basis is required.

Regarding the validity of the investment ratio, further discussions between concerned agencies are necessary. The government of Mongolia has clear policies which state that “the government shall provide the public transport services with responsibility” and “the UB Metro is the first urban mass transit system in Mongolia and the know-how from the private sector will be utilized to improve the inefficiency of the public services.” Therefore, the study team proposes to choose a “Public Corporation” scheme in which the public does mainly the operation. The private sector will be strategic partners³ whose roles are to invest in the company and to provide their management know-how (see Figure 3).

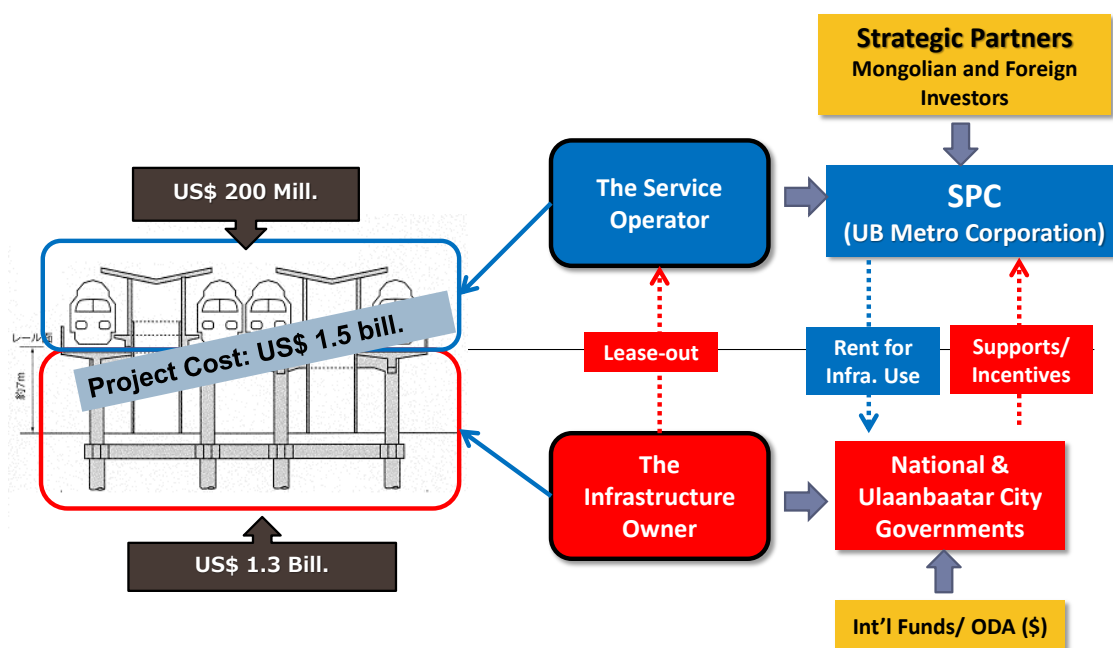


Figure 3: Two-tiered PPP Scheme of UB Metro

³ There are many projects with strategic partners such as the Light Railway Transit (LRT) Project in France and the Beijing International Airport Project in China.

2) Financing Scheme

On the assumption of the proposed public corporation scheme, a financing plan is prepared on the basis of the following policy. The basic policy is that the government of Mongolia is responsible for the financing because the UB Metro is a public transport service provided by the government. The initial investment is US\$1.5 billion (MNT 2 trillion) and this cost is divided into two parts: (i) US\$1.3 billion is for the fundamental structures (infrastructure portion) specified in the railway transportation law and (ii) US\$200 million is for rolling stock and related systems. The financing scheme is also separately examined for each part.

The starting point is that the UB Metro project must be approved as a national strategic project and granted the highest implementation priority. Regarding the fundamental structures (with US\$1.3 billion of investment), as a core fund, Japanese ODA fund, which is a long-term loan with a low interest rate, should be incorporated in the financing scheme, and bilateral technical assistance from Japan will also be provided. This brings about material and immaterial collaboration with partners from Japan. In addition, the budget from the government of Mongolia must be secured as a counterpart fund in order to receive the Japanese ODA fund. Government Special Fund such as Human Development Fund based on revenue from mineral resources and the development bank of Mongolia bonds with government guarantee and Samurai bonds with JBIC guarantee are utilized.

On the other hand, it is assumed that a newly established operator, “Ulaanbaatar Metro Corporation (UBMC)” procures the rolling stock and prepares the opening of the operations. In this case, UBMC needs US\$200 million of funding, 30% of which is procured as equity and 70% comes from loans.

A proposed UB Metro Scheme is shown in Figure 4.

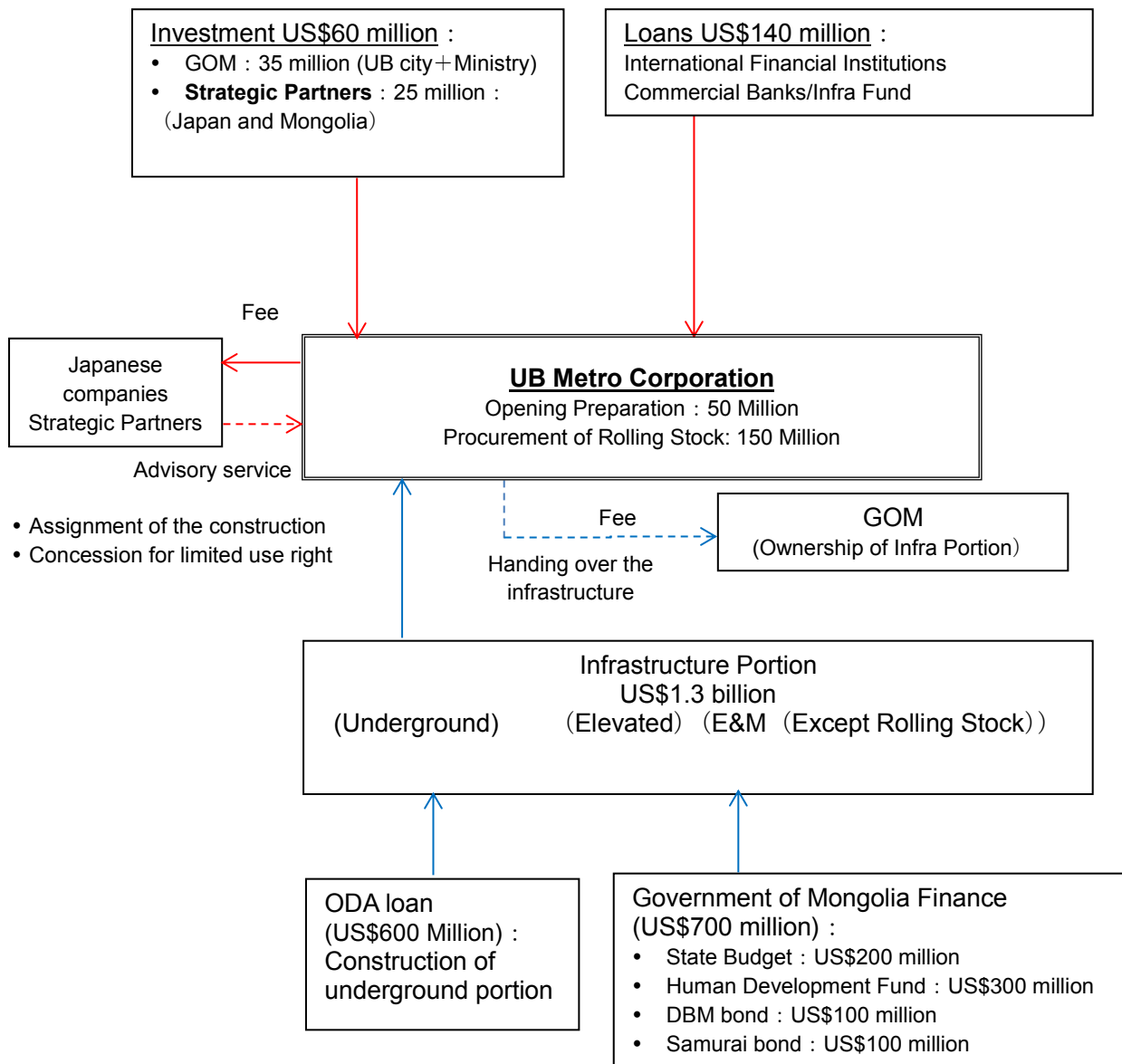


Figure 4: UB Metro Scheme (Draft)

3) Organizational Structure for Operation and Maintenance (O&M)

This study examined the most suitable scheme of the Operation and Maintenance (O&M) based on the legal standpoint of the railway, the Mongolian side's awareness of construction and operations through the concession system and private sector operation, and technological experiences. It is the most appropriate scheme to establish the UBMC, which conducts the O&M with assistance of experienced foreign strategic partners in terms of the techniques and services for urban railways. It is also advised that policies regarding the strategic partner agreement be developed such as strategic partners will transfer their stocks to the Mongolian side when there is already sufficient capacity and a structure for Mongolian personnel to conduct O&M by themselves after a certain period (7~8 years).

Among the personnel necessary for UBMC at the start of business operations, it will be necessary to train particularly the 50 or more drivers required prior to the start of operation. If continuity is taken into consideration, 70 drivers should be employed after that time. Due to the large numbers of required drivers, the hiring of a number of instructors at the stage when on-site training is possible is advised. The driving instructors who develop the system to train drivers on site by themselves must be trained overseas since there is no training facility in Mongolia. It will not be a problem if the training period in other areas is short compared to that of the drivers, but recruitment will need to be done one

year before starting operations.

It is expected that in 2030, 580 Mongolian personnel will already be working with various necessary training programs for the UBMC, including 80 head office staff which are not mentioned above.

5. Risk Management of the Project

The following are the risks related to the Metro Project: (1) Viability Gap Risk, (2) Revenue Risk, (3) Country Risk, (4) Foreign Exchange Risk and (5) Regulatory Framework Risk. In implementing the Metro Project, stakeholders need to analyze these risks and manage them by reflecting risk management measures in project contract, procuring various guarantees, and protecting it by insurance, etc.

The following are specific issues for risk management of the proposed UB Metro Corporation (UBMC) based on the two-tiered system. These issues are needed to be considered when private investors negotiate and enter into agreement with the Mongolian government:

1) Project Contract and Formulation of Public Corporation based on the Two-tiered System

A basic assumption of the two-tiered system is to construct the infrastructure portion using the public fund (with huge Viability Gap Funding of which the government is responsible) and to cover operating expenses and additional investment by operating revenues as much as possible to implement the metro operation independently. Therefore, notwithstanding the UBMC, with major shareholding owned by the Mongolian Government, risk management based on the above-mentioned principles of the two-tiered system is necessary to be pursued. Furthermore, a specific project agreement regarding the metro operation and management should be entered into between the government, UB City and the UBMC, in addition to the legal establishment procedure of the company.

2) Agreement of GGU (Government Guarantee and Undertaking)

It is essential to have an agreement with the Government Guarantee and Undertaking (GGU) which requires government support for critical risks of the company management and operations of the UBMC in order to stipulate and secure the support and guarantees from the Mongolian Government about the risks which UBMC is unable to manage and control such as financing risk for the infrastructure portion, demand (ridership) risk, foreign exchange risk, political risk, and force majeure risk.

3) Formulation of Financing Based on the Two-tiered System

Without viability of public funding, no commitment by financiers will be secured for rolling stock, which UBMC is obligated to procure. To this end, prior to the formulation of financing on the UBMC side, it is essential to clarify and verify the necessary degree of commitment of the government for the infrastructure portion in order for the commercial (and/or JICA PSIF) lenders to provide funding for UBMC. This condition should be assumed for the negotiation and contractual arrangement with Mongolian Government for financing obligated by the UBMC.

4) Management of Construction for the Two-tiered System

It is essential for the UBMC to secure a position in charge of management of design and construction as its intention is appropriately incorporated in the design, construction and construction supervision of the infrastructure portion. Regarding the procurement of advisors for the design, construction and construction supervision, besides the one for the infrastructure portion, which is to be constructed using the public fund, an in-house advisor should be procured specifically for the UBMC who could comprehensively manage the design and construction process of the Metro development on the basis of the Strategic Partner agreement.

5) Management of Completion Risk for the Government Portion

Risk of delays in the completion must be managed very stringently. To cover the risk caused by the government, Liquidated Damage Penalty Payment mechanism and compensation payment for the

material delay and so on must be stipulated. Furthermore, it is generally practiced in the contractual arrangement that appropriate compensation conditions for the damage of the UBMC caused by the government should be stipulated. These cases must be thoroughly examined and discussed with the government to be included in the project contract.

6) Organizing SPC (UB Metro Corporation: UBMC)

Regarding the establishment of UBMC, it would be preferable in terms of the accumulation of know-how to first establish a specific “UB Metro Preparation Unit” inside the UB City Government. Then the major members of the Unit are to be transferred to the UBMC as its core members. The private sector strategic partner would enter into the strategic partner agreement with this UB Metro Preparation Unit, and support the Unit in all aspects of the Metro preparation. They would then participate in the UB Metro Corporation as major shareholders when the Unit transferred to the UBMC. Eventually, each specific expertise of the Metro project enters into an advisory agreement with the UBMC.

7) Fare Revision Risk

Revision of fare (timing and level) must be stipulated in the project contract entered into between the Mongolian Government and the UBMC because the revision of fare could not sometimes be controlled by the UBMC alone due to politics and other reasons.

8) Application of Minimum Revenue Guarantee Mechanism

It is specifically difficult to control revenue risk during the launching period of the metro business. Therefore, it is required to apply a minimum revenue guarantee mechanism at least during the initial phase of the operation when commercial financing is structured for the procurement of rolling stock by UBMC.

9) Subsidy Mechanism for Additional Investment

It is also necessary to examine and prepare a subsidy provision mechanism at least for the risk of additional investment (addition of rolling stock, renewal of facilities, etc.) which is the most critical risk for the cash flow of the UBMC in the future.

10) Establishment of Bank Account to earmark Infrastructure Use (Lease) Fee

It is preferable to pool the payment of the infrastructure use (Lease) fee which is to be paid by the UBMC to the Mongolian Government, the owner of the Infrastructure. It is also preferred that the payment is managed under the responsibility of the public. The pooled fund should be used for the purpose of the compensation payment for the risk caused by the Government, the subsidy payment for additional investment by the UBMC with certain conditions and so on.

11) Adjustment with Station Plaza Development

It is necessary for the Metro Project to adjust with the station plaza development and other commercial development projects based on master plans created by the public. It is preferable that UB City government initiate the tender for the development of the station plaza area and UBMC participate in the implementation of these master plans and the evaluation committee of such tenders in order to incorporate the proper intentions of the UBMC to the station plaza development along the Metro corridor.

12) Adjustment for the Risks of Initial Phase of Operation

In order to mitigate risks of the initial phase of the operation, it may be worthwhile to examine an adjustment mechanism for such risks in which the risk adjustment (renegotiation of contract conditions including the finance) is to be made after both parties experience the first year of operation. However, in such cases, the procurement of purely commercial financing may be difficult, thus much more involvement of the public and more elaborated financing structure may be necessary.

6. Economic and Financial Evaluation

The economic analysis is to analyze if the return on a project is worth the investment from the viewpoint of the national economy as a standpoint of the government, and the yardstick is the

Economic Internal Rate of Return (EIRR). The rationality of the investment in the project is evaluated based on the EIRR estimate by comparing the economic costs and benefits over the life of the Project, which is normally assumed to be 30 years after opening.

In general, the economic benefit of the transportation development project is defined as the savings in vehicle operation cost (VOC) and travel time cost (TTC) of users attributable to the project. The benefit is comparatively easy to quantify and is estimated through a “with-and without” comparison of traffic demand analysis.

When the proposed mixed fare system (200 Tg within 2 km, 50~70 Tg/km over 2 km) based on the traffic demand analysis is applied, EIRR is 18.6~20.6, which means that the project is economically justified. In this case, the average fare is 426 Tg~452 Tg, but even in the case of the flat fare system with the average fare of 600 Tg, EIRR is 16.0%.

As for financial evaluation, cash flow analysis is conducted to evaluate the project’s financial viability. Evaluation indicators are Project Internal Rate of Return (PIRR) and Equity Internal Rate of Return (Equity IRR).⁴ This study conducted cash flow analysis of two cases:

(1) An entity is supposed to be responsible for the metro project with all the investments of US\$1.5 billion.

(2) The UBMC invests in US\$200 million worth of rolling stock and related facilities based on the two-tiered system.

In the first case, the cash flow situation of the entity will be too difficult to manage the project. Given the average fare of MNT 600/passenger, the financial internal rate of return (FIRR) is computed at a low 2.0% p.a. This means that the commercial operation of the project will be practically impossible.

Therefore, a two-tiered system is recommended to make the metro project financially feasible, that is, as the infrastructure owner and as the service provider. As the service provider, or the operation management body, the UBMC shall be established as a public company. The UBMC shall invest a total of US\$200 million for procurement of rolling stock and related E&M, and the operation cost and renewal costs of rolling stock and E&M shall be covered by the fare revenue. Moreover, the UBMC shall have a responsibility of paying a certain amount of the concession fee (or the infra-rent) to the infrastructure owner (the state government) out of the fare revenue.

A cash flow analysis of the UBMC was conducted based on the following two fare systems:

- P₀ Case: Average fare of MNT 400
- P₁ Case: Average fare of MNT 600

Under an assumption that the annual infra-rent is equivalent to 2% of the initial infrastructure cost (or US\$26 million), the following results are revealed:

In the case of P₀, PIRR is computed at 11.2%, and it drops to 6.0%, given a 10% increase of the cost cum a 10% decrease of the revenue. Thus, the elasticity for risks is low, which concludes that the metro project is not feasible enough.

On the other hand, in the case of P₁, PIRR is 18.7%, which shows that the project is viable. Furthermore, the PIRR can still stay at 13.8%, which is high enough, even if the cost and the revenue changed with +10% and -10%, respectively.

The P₁ Case shows another result that even though the infra-rent fee is raised to 3% (US\$39 million/year), the PIRR is 15.9 %, which means that the metro business will still be viable.

⁴ Equity IRR is a converted quantity of future return to the capital as an annual rate of interest. It is also defined as a discount rate at which the present value of all future cash flow is equal to the initial investment. To avoid confusion with Economic IRR (EIRR), this section mentions it as Equity IRR.

7. Key Issues towards the Development of the UB Metro

In the development of the UB Metro, the following are the priorities to be addressed.

1) Consistency with the Railway Transportation Law

With a current railway transport law which is not updated with consideration of an urban railway, and because the government issuing a permit for railway operation and arranging supervision is a basic thing, it should be fairly flexible in terms of the law for the two-tiered system. It is also possible to accept international standards and overseas standards as applicable in a special case.

If these are considered, it is possible to proceed with a comprehensive upgrade of the Metro under the current law. However, from the very beginning, the current law is based on the concept of the “Ulaanbaatar Railway,” which is a government-owned railway and does not presuppose an independently operated railway like the Metro. And because the administrative agencies of government employees in charge of supervision are not clearly separated from those in charge of operations, there are a lot of unclear portions in terms of which laws actually apply to the Ulaanbaatar Metro. Therefore it will be necessary to proceed with gradual coordination with the related government agencies on how the law will apply to the progression of operations.

2) Establishment of “Ulaanbaatar Metro Corporation (UBMC)”

The UBMC, as the implementing and operating body of the metro project, needs to conduct a survey for a detailed plan and basic design of the UB Metro through discussions with the national government. In addition, it is required to promptly establish the UBMC which is structured collaboratively with the national and city governments and the private entities in line with the Mongolian systems and actual circumstances because recruitment and training of staff need to be conducted prior to the start of the operation.

3) Security of Multiple Financial Sources

The infrastructure is expected to be developed as public works to be executed by the government sector, with support of ODA budget. The state budget and the Development Bank of Mongolia’s (DBM’s) bonds, as well as Japanese Yen loan, will be utilized. In addition, it is expected that tax revenue will increase in the future and it is also suggested to consider the development of a subsidy mechanism under which a part of increased tax revenue is utilized for the metro project.

4) Formulation of Fare System and Policy

A rational public transport policy with a sustainable fare system, including social support to commuters, students, elderly people, low income people, etc., needs to be established.

8. Next Actions towards the Realization of the UB Metro Project

The following actions are required as preparatory work towards the implementation of the UB Metro Project.

1) Official Approval as a Priority National Project

In order to implement the UB Metro Project with the state budget and ODA loans, it is essential to obtain Cabinet approval and be included in the national project list prepared by the Ministry of Economic Development. Thus, UB City or the preparatory unit needs to proceed with the approval process.

2) Establishment of an Implementation Mechanism (UBMC)

It is required to establish a UBMC preparatory unit and proceed with preparatory work through discussions with stakeholders.

3) Improvement of Legal Framework for Construction and Operation of “Urban Railway System”

The Railway Transportation Law covers the necessary items for railway business and has flexible

contents, although the law does not assume urban railways. However, it is necessary to examine the addition and revision of the technical regulations. In addition, the development of a legal system for underground city development and underground space utilization is also necessary.

4) Implementation of Detail Design (D/D)

Once this project is approved as a national priority project and the government makes a decision of the project implementation, the detail design (D/D) of the infrastructure component will be the next step. The D/D is a package of engineering services, including:

- (1) Detailed geological surveys;
- (2) Detailed design for all infrastructure facilities and stations;
- (3) Review of the project costs and the procurement scheme;
- (4) Preparation of all tender documents;
- (5) Environmental Impact Assessment (EIA);
- (6) Review and improvement of related legal framework (the Railway Law and new regulations for “Underground Development”); and
- (7) Preparation of ODA loans for the infrastructure construction.

Possible finance sources for the engineering services above are two:

A: Mongolian state budget; or

B: Engineering Service (E/S) loan⁵ by JICA.

Needless to say, the first option is the most desirable. However, it is hard for the Mongolian government to conduct the detail design of the infrastructure development by itself because the project is the first urban transport system in Mongolia. Therefore, direct and indirect instructions should be given to them by experienced countries. Thus, the second option is recommended to be chosen on the assumption of Japanese technical support.

Regarding JICA’s support, there is another option that the D/D work be granted by JICA, only when the Mongolian government requests a STEP loan⁶ for the infrastructure development project in advance. However, this option usually takes a long time for JICA’s technical appraisal prior to the official commitment. On the other hand, it may be hard for the Mongolian side to make a decision on the use of JICA-STEP loan before the D/D work is completed. Therefore, the grant option is not necessarily recommendable.

5) Conduct of Environmental Impact Assessment (EIA)

According to the EIA Law of Mongolia and the Guidelines for Environmental and Social Consideration of JICA, sufficient considerations on possible negative effects of the Metro project seem necessary. Possible negative effects are related to topographical and geological features such as land subsidence, groundwater pollution, air pollution, noise/vibration and accidents during construction and noise/vibration after Metro operations begin. Therefore, EIA needs to be conducted during the detail design prior to the start of the Metro Project.

⁵ Loan conditions: Annual interest rate: 0.01%; Payback years: 25 years; Grace Period: 7 years; Procurement: Tied.

⁶ STEP stands for Special Terms for Economic Partnership. Its loan conditions are as follows: Annual interest rate: 0.1%; Payback years: 40 years; Grace period: 10 years; Procurement: tied; a special condition: more than 30% of the procurement shall be covered by Japan-origin goods.