5 Station Area Development Plan of UB Metro Corridor

5. Station Area Development Plan of UB Metro Corridor

5.1 Objectives of Station Area Development Plan Necessity of Integrated Development

5.1.1 Necessity of Integrated Development

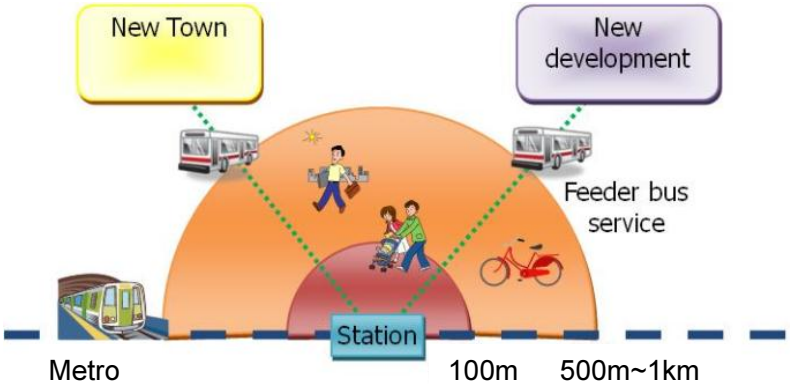
Ulaanbaatar (UB Metro) will cover various urban land uses from the Central Business District (CBD) to suburban and rural areas. With appropriate feeder bus service provision, accessibility of ger areas will be improved.

Different land uses at station areas require an adequate development approach to fit socio-economic activities and people's mobility, while the Metro is expected to encourage formulating and managing a station corridor development in an integrated manner, which is generally known as the "Transit Oriented Development" (TOD) concept.

- With the integration of the public transport system including metro, BRT and buses and the improvement of convenience of transfer, the number of passengers will be increased and accessibility of citizens will be improved.
- With the development of public service facilities and commercial and business facilities around metro stations, daily convenience will be enhanced; hence socio-economic development of the station areas will be promoted.

According to the TOD concept shown in Figure 5.1.1, Intermodal Transfer Facilities (ITFs) and commercial and business facilities, which serve for promoting public transport utilization, are developed with comfortable pedestrian space within approximately 100m radius from the station. Within the walking distance (app. 500m – 1km radius from the station), residential areas and various urban facilities of public service, commercial and cultural, are developed with bus feeder service.

In this chapter, a basic concept of the station area development and concept plans of each station are proposed, based on this TOD concept.



Source: JICA Study Team

Figure 5.1.1 TOD Concept

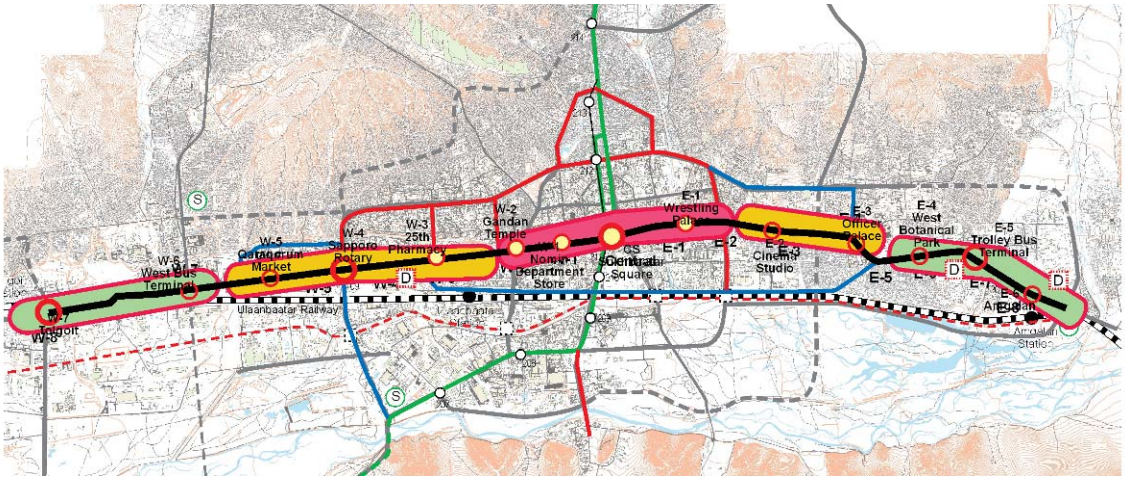
5.1.2 Current Status of the Land Use and Traffic along Peace Avenue

In general, there are three types of land uses along Peace Avenue from Tolgoit to Amgalan (see Table 5.1.1 and Figure 5.1.2).

Table 5.1.1 Types of Land Use Along Peace Avenue

Zone	Stations	Main Land Use and Building Type
City center	W2-E1	Commercial and business facilities and apartments (two to four stories high with shops on the first floor)
Built-up area	W3-W5, E2-E3	Commercial facilities and apartments (nine stories high with shops on the first floor)
Suburban area	W6-W7, E4-E6	Apartments, railway-related facility areas, factories

Source: JICA Study Team



Source: JICA Study Team

Figure 5.1.2 Typology of Land Use along Peace Avenue

There are three types of land rights in compliance with the Land Law and the Land Privatization Law: land ownership right, land possession right and land use right.

Apartment areas are state-owned, while an apartment association owns the land possession right. Many apartments have shops on the first floor and many of them encroach the sidewalk. In addition, most of these shops are not registered.

On the other hand, lands of ger areas are privatized and owned by Mongolian citizens, but some citizens do not register their lands. In the case of foreign companies and personnel, only a land use right can be given .

Table 5.1.2 and Figure 5.1.3 show the current condition of building use, land use and transport access for each station.

Table 5.1.2 Current Status of Building Use, Land Use and Transport

ID	Name of Station	Land Use and Building Type	Transport Access
W-7	Tolgoit	North: ger area of north of station South: Mixed land use including apartment, factories and warehouses	• Tolgoit station of Ulaanbaatar Railway • South-North road to Chingiss Airport • Flyover of railway (planned) • Extension of South-North road (planned)
W-6	West Bus Terminal	North: ger area South: apartments and industrial areas	• Access road to Bayankhoshuu • West Bus Terminal for long-distance buses
W-5	Qaraqorum Market	North: Unur South apartment complex South: market, apartments and industrial area	• Access road to Unur North ger area
W-4	Sapporo Rotary	North: apartments and commercial area South: apartments and industrial area	• 3rd Ring Road/ access road to 3rd Khoroolol (commercial area) • BRT (planned) • Flyover (planned)
W-3	25th Pharmacy	Apartment area	• Access road to 3rd Khoroolol • Narany Zam to Ulaanbaatar Station of Ulaanbaatar Railway
W-2	Gandan Temple	Commercial and apartment area Gandan Temple, Narantuul Hotel, Theater, Golomt Apartment, Grand Plaza, Ramada hotel, confectionery factory	• Access road to Ikh Toyruu (2nd Ring Road) • Flyover (planned)
W-1	Nomin Department Store	Apartment and commercial area Nomin Department, park, circus	• 1st Ring Road • Chingiss Street • Olympic Street
CS	Sukhbaatar Square	Public, commercial & business and apartment area Sukhbaatar Square, Central post office, Central Tower, Opera House, embassies	• 1st Ring Road • Chingiss Street • Olympic Street
E-1	Wrestling Palace	Apartment and commercial area Ulaanbaatar Hotel, Wrestling Palace, Kempinsky Hotel, 3rd Hospital	• BRT (planned)
E-2	Cinema Studio	North: Apartment area South: ger area Universities, supermarket	
E-3	Officers' Palace	North: Apartment area South: ger area Officers' Palace	• BRT (planned)
E-4	West of Botanical Garden	North: Apartment area and ger area South: ger area Botanical Garden	
E-5	Trolley Bus Terminal	Ger area Supermarket	• Trolley bus terminal
E-6	Amgalan	Ger area	• Amgalan Station of Ulaanbaatar Railway

Source: JICA Study Team

	
E6: Ger area around Amgalan Station	E2: Eastern side of East Intersection of Kempinsky Hotel
	
E1: Congested East Intersection of Kempinsky Hotel	E1 – CS: From East Intersection to Sukhbaatar Square
	
CS: Congested area in front of Sukhbaatar Square	CS - W1: Intersection in front of Central Post Office
	
W2: In front of Nomin Department Store	W3: West Intersection in front of Golomt Apartment
	
W3 - W4: Widened Peace Avenue on the western side of West Intersection	W6 - W7: Few vehicles and buildings around Tolgoit Station

Figure 5.1.3 The Current situation of Land Use and Traffic along the Metro Line

5.1.3 Potential of Promoting the Urban Redevelopment Projects.

The Ministry of Construction and Urban Development (MCUD) has prepared the draft Urban Redevelopment Law. The draft Article 11 stipulates the following five urban redevelopment projects:

i) Reconstruction of areas that do not meet architectural, urban development and urban planning requirements;

ii) Demolition and reconstruction of old buildings and structures that to not comply with exploitation requirements;

iii) Reorganization of ger area land;

iv) Replanning and development of ger areas; and

v) Replanning and development of public spaces.

Along Peace Avenue, there are various areas where land is not effectively used, such as old apartment areas, insufficiently built-up areas where roads and public facilities are lacking, and broad industrial areas and warehouses which are already closed. In such areas, renewal of land use and high-level efficient utilization are necessary in the future. It is expected that the implementation of urban redevelopment projects will be promoted particularly in areas along Peace Avenue in line with the City Master Plan and District Detailed Plan after constitution of the Urban Redevelopment Law. Thus, it is necessary to formulate an urban redevelopment project implementation plan around stations which are integrated with the UB Metro project.

5.1.4 Future Development Framework in Station Area

If the urban development is promoted and the transport condition is improved around stations, the daytime and nighttime population will be increased, and it is expected that these new residents, employees and students will be metro users.

To identify necessary volume of ITFs and station area development, future population framework is assumed.

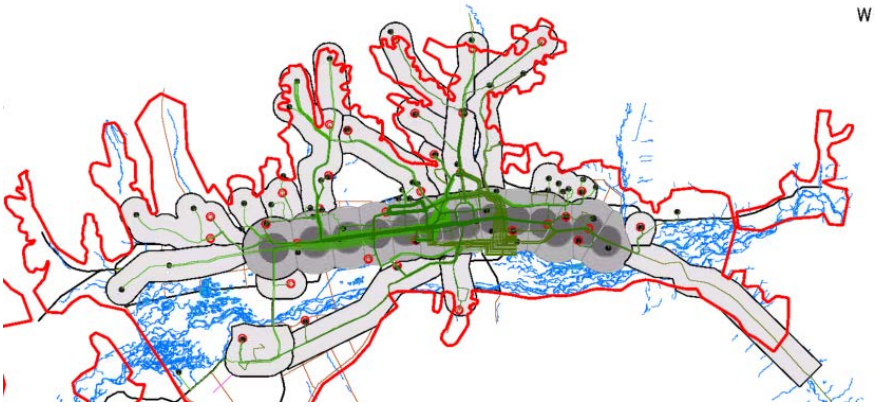
The population of the station area, including both station walking area (800m radius from station as a walking distance) and bus service coverage area, is estimated based on the future development plan of the UBMP 2030.

- Population is projected to continue to increase based on the trend until 2020, when an urban growth control policy takes effect.
- From 2020 to 2030, due to impacts of urban development policies and projects such as urban redevelopment projects in the city center, approximately 180,000 population, about 50% of the increased population of the city (population of city will be 1.4million in 2020 and 1.76 million in 2030, so increased population will be approximately 360,000), will live in the station area.
- A resettlement policy will be implemented for ger area residents who are prohibited to live (cf. hilly area, conservation area) in apartment areas. Approximately 55,000 populations, 25% of the target resettled population of the city, will live in the station area.
- The Metro corridor development is promoted with commercial and business establishment, highly developed educational facilities, and about 70% increase in the number of employees and 30% increase in the number of students will work and study in the station area.

Table 5.1.3 Estimated Increased Population of Station Area from 2020 to 2030

		Whole City	Share of station area	Station area
Increased night population	Increased residents	363,000	50%	181,500
	Resettled residents	221,110	25%	55,300
	Total	584,110	41%	236,800
Increased day population	Employment	222,300	70%	155,610
	Student	85,000	30%	25,500

Source: JICA Study Team



Source: JICA Study Team

Figure 5.1.4 Coverage of Station Areas (800m radius from station)

5.1.5 Number of Station Users and Population of Station Area

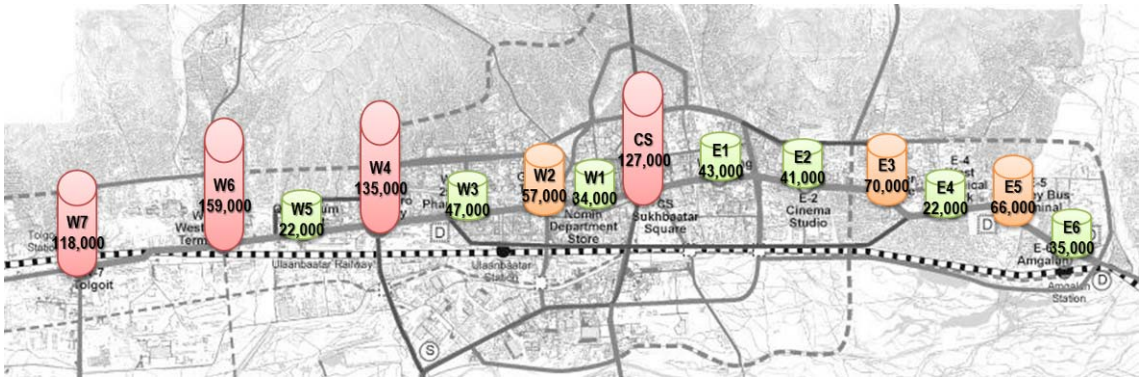
If the sub-center development will be realized in accordance with the UBMP 2030 draft, it is estimated that some station users of W6 West Bus Terminal will shift to use W7 Tolgoit due to the development of access road from ger areas to sub-centers. In case of E5 Trolley bus terminal and E6 Amgalan, station users will be appropriately distributed through the integrated sub-center development around these two stations. For estimation of volumes of ITF and future urban development in this chapter, based on the UBMP 2030 draft, the number of station users is redistributed from W6 and W7to E5 and E6, respectively. This is based on the result of traffic demand analysis in Chapter 3 on the assumption that the users are lead to the central station of sub-centers delivered by rerouting bus routes.

Table 5.1.4 shows the estimated population of the station influence area (800m radius from station) and station area (including station influence area and feeder bus service coverage area). The total estimated population of whole station area is approximately 1.23 million, which covers around 70% of total population of the city (1.76 million in 2030). The population in the station influence area of 800m radius from the station is approximately 550,000, which covers around 31% of the total population of the city.

Table 5.1.4 Estimated Number of Station Users and Population of Station Area in 2030

Station		No. of Station Users	Station Influence Area (800m radius from station)			Station Area (station influence area and bus service area)		
			Resident	Employment	Student	Resident	Employment	Student
W7	Tolgoit	117,572	63,600	9,400	53,400	244,900	62,700	201,400
W6	West Bus Terminal	158,941	29,500	5,300	25,000	76,500	18,600	58,600
W5	Qarakorum Market	21,582	28,300	6,400	19,500	39,500	10,000	29,800
W4	Sapporo Rotary	135,154	26,200	3,900	14,300	94,600	24,400	46,500
W3	25th Pharmacy	46,645	48,300	11,400	19,700	62,500	17,100	31,700
W2	Gandan Temple	56,617	48,900	10,000	25,000	105,000	26,800	68,300
W1	Nomin Department	33,637	31,900	8,100	21,000	41,500	12,600	31,300
CS	Sukhbaatar Square	127,108	66,300	13,400	59,700	215,700	62,600	151,000
E1	Wrestling Palace	42,527	37,500	7,800	21,000	93,900	26,100	46,900
E2	Cinema Studio	40,556	47,100	11,400	19,300	56,300	15,800	26,600
E3	Officer Palace	70,137	40,800	8,300	15,400	72,900	18,500	34,200
E4	West Botanical Park	22,130	31,100	7,200	11,000	33,600	8,800	12,400
E5	Trolley Bus Terminal	65,974	32,200	7,100	10,100	48,600	12,900	18,300
E6	Amgalan	35,370	20,000	3,600	15,800	42,500	10,200	35,800
	Total	973,950	551,600	113,300	330,200	1,228,000	327,100	792,800

Source: JICA Study Team



Source: JICA Study Team

Figure 5.1.5 Distribution of Station Users of Each Station

Source: JICA Study Team

Figure 5.1.6 Distribution of Population of Station Area (800m radius) of Each Station

5.1.6 Outline of Station Area Development Plan

(1) Issues of Station Area Development

To promote utilization of the metro and develop a station as an attractive district center, it is necessary to meet the following requirements:

a) To secure safe and convenient access from roads around station to station facility
→ development of station related facilities
b) To secure the safe and convenient transfer among other transport modes
→ the development of intermodal transfer facilities and transport improvement
c) To provide various services for station users and residents around stations
→ the urban development in station areas

(2) Components of Station Area Development Plan

The station area development plan aims to realize integrated urban and transport development based on the TOD concept. The plan includes a development orientation of the area with the proposed projects including station related facilities, intermodal transfer facilities and urban development.

Table 5.1.5 Components of Station Area Development Plan

Category	Components	Examples of Facility and Service
1. Station related facilities	a. Station	• Station facility (elevated, at grade, underground) • Entrance
	b. Access facility	• Stairs, elevators, escalators • Underground passages, elevated pedestrian decks
2. Transport development	c. Road improvement	• Access road to station (bus, taxi, car) • Intersection improvement • Pedestrian space and facility (pavement improvement, street light, signboard)
	d. Intermodal transfer facility	• Transfer facility to other public transport modes (underground path, pedestrian deck) • Station plaza, bus terminal • Bus stop improvement • Park and Ride facility
	e. Car parking	• Car parking space, parking building, underground parking
	f. Pedestrian network	• Sidewalk, pedestrian mall • footbridge, pedestrian deck, underground passage
	g. Traffic management	• Private vehicle control (road pricing) • Common ticket system
3. Urban development	h. Commercial and business promotion	• Kiosk, shop • Commercial and business building (high-rise, mid-rise) • Public service facility • Hotel, amusement facility • Underground commercial mall
	i. Residential facility development	• Reconstruction of old apartments • Residential complex development • Public apartment development for mid and low income groups, resettlement from ger area
	j. Living environment improvement	• Central infrastructure improvement • Independent infrastructure development • Public service improvement

	k. Urban design and amenity	• Green area, park, open space • Toilet, police box, signboard, landmark facility • Cultural and historical building preservation
	l. Institutional arrangement of urban development	• Land use control, zoning system • Construction control (building height, building use) • Institutional arrangement (Tax Increment Financing, tax benefits, etc.)

Source: JICA Study Team

(3) Station Related Facilities

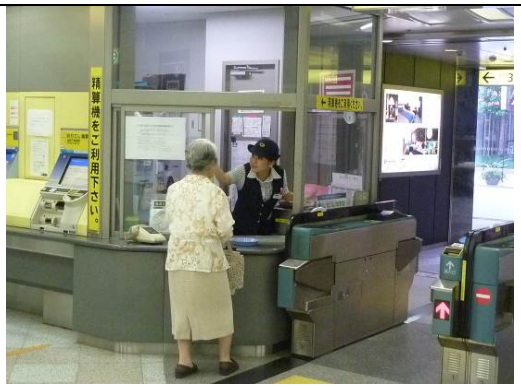
To make the UB Metro a new daily transport mode for citizens, the "universal design" concept should be adopted to design facilities which are easy and comfortable to be used by all users including elderlies and the disabled.

For this, (a) route setting with accessibility, (b) guide sign and information system, and (c) user-friendly facility and equipment are significant for station related facilities.

Elevator

Universal Design Toilet

Slope for Wheelchairs



Guidance by station staff

Source: JICA Study Team

Figure 5.1.7 Image Photos of Station Related Facilities

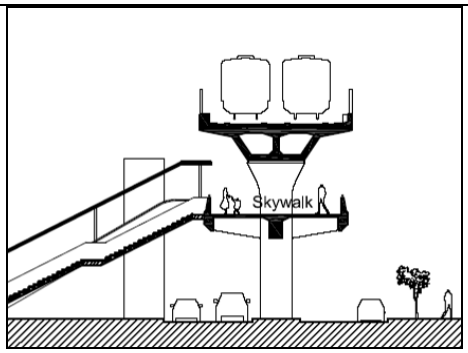
Access facilities are necessary to access from roads around the station to the station facility. Stairs, escalators (ESCs) and elevators (EVs) are basically installed for all stations. In addition, facilities for intersections and trunk roads are installed for pedestrian's safety.

- **Entrance:** Entrances of elevated and underground stations will be set as sidewalks or public spaces where land acquisition is not necessary. Stairs, ESCs and EVs are installed four directions for each station so that station users can access into the station directly

from the sidewalks. ESC and EV will be placed at least one each or two directions if possible.

- **Free concourse for elevated and ground stations:** Metro will be developed in the middle of the Peace Avenue. To have access to the station from the sidewalks , it is necessary to install two elevated free concourses (without payment) for both north and south sides (nine elevated stations of W7, W6, W5, W4, E3, E4, E5, E6, E7 and one ground station of E2). In case of E2 Cinema Studio Station, the concourse and gate will be elevated while the platform will be on ground, and so the elevated free concourse is necessary to secure accessibility. In case of W7 Tolgoit Station, the overpass for pedestrians is recommended to cross both the Metro line and the existing national railway line.
- **Underground passage for underground stations:** For underground stations (five stations of W3,W2,W1,CS,E1), underground passages (without payment) should be developed.
- **Pedestrian overpass at intersections:** For the stations located near the large intersections (W6 West Bus Terminal, W4 Sapporo Rotary, W2 Gandan Temple, CS Sukhbaatar Square), it is preferable to extend pedestrian decks or underground passages, and to develop pedestrian way under the elevated railway for safety of pedestrians crossing the intersections.

Pedestrian Deck



Pedestrian overpass under the elevated railway

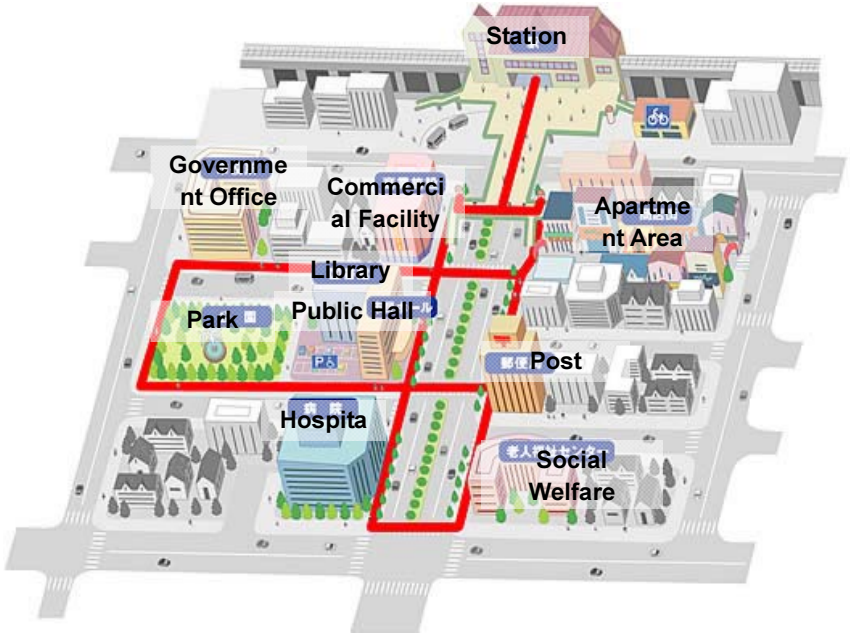
Source: JICA Study Team

Figure 5.1.8 Image of Access Facilities

(4) Intermodal Transfer Facility and Transport Improvement

Regarding the improvement of the transport condition, it is important not only to develop station related facilities above, but also to improve the transport condition of station areas for safe and comfortable accessibility and mobility to facilities around stations. Therefore, the following should be considered.

(a) Access road improvement: Main access roads around stations (500m radius from each station) should be developed through other facilities including the pavement improvement, installation of street lights, parking control, installation of signboards, etc. It is preferable to install signals and pedestrian crossings for pedestrians near station.



Source: Website MLITT of Japan

Figure 5.1.9 Image of Access Road Network around Station

(b) Connectivity of urban facilities: To secure accessibility to urban facilities (medical, public, commercial and business, culture, etc.), it is recommended that a direct connection between station facilities and urban facilities be provided based on the agreement of railway developers/operators and urban facility owners. Access roads and facilities to connect medical facilities (the Third Hospital of W4, the Railway Hospital of W3 and the Second Hospital of E1) should be designed carefully for facility users including patients, elderlies, etc.

(c) Development of Intermodal Transfer Facility (ITF): ITF is a facility for passengers of various transport modes (metro, BRT, bus, taxi, and car) to transfer to other transport mode smoothly. ITF is also called the Station Plaza. The ITF is a transport core facility and will be the center of the district (see 5.2 for details).

(d) Park and Ride: Park and Ride (P&R) is a system that allows citizens to park a private car at the nearest railway station of suburban areas and then ride the railway to the urban center. At the stations of suburban areas, the parking space for P&R is developed, and the discount ticket system for P&R is applied to promote P&R system. Basically, the parking space of P&R is not included in the ITF. The P&R facility is developed by local governments and/or railway operators and/or private sectors for promotion of the railway utilization to private car owners.

Source: Website

Figure 5.1.10 Image of Park and Ride

(5) Urban Development of station area

In combination with station related facilities and the transport improvement, urban development around stations should be planned and implemented. Citizens will go to urban facilities such as commercial and business, public, education, etc. through the UB Metro if these facilities are located near the stations.

Urban redevelopment projects are proposed in line with the metro development in an integrated manner to improve the socio-economic condition of station areas as a whole.

5.2 Development Orientation of Intermodal Transfer Facility

5.2.1 Necessity of Intermodal Transfer Facility

A station plaza is an integrated Intermodal Transfer Facility (ITF), including “transport facility” to manage the traffic flow of bus, taxi and pedestrian, and “environmental facility” to create a space for station users and residents to enjoy events in appropriate urban landscape. The volume of the station plaza is planned based on local characteristics and traffic demand of each station.

Main viewpoints for station area planning are summarized as follows:

- To formulate safe and convenient access route planning separating pedestrians and vehicles, and develop facilities with barrier-free concept.
- To integrate with urban and transport development to serve as a gateway of the district.
- To develop a station area with appropriate role sharing and participation of railway developers, operators, local governments, private sectors and local communities.

5.2.2 Outline of Intermodal Transfer Facility

In general, ITF includes transport facilities and spaces as follows:

- Bus facility: bus berth for boarding and alighting
- Taxi facility: taxi berth for boarding and alighting, taxi pool

- Private car facility: temporary car stop facility[1]
- Pedestrian and bicycle facility: sidewalk, elevator, escalator, underground passage, pedestrian deck, bicycle parking

5.2.3 Outline of Environmental Facility

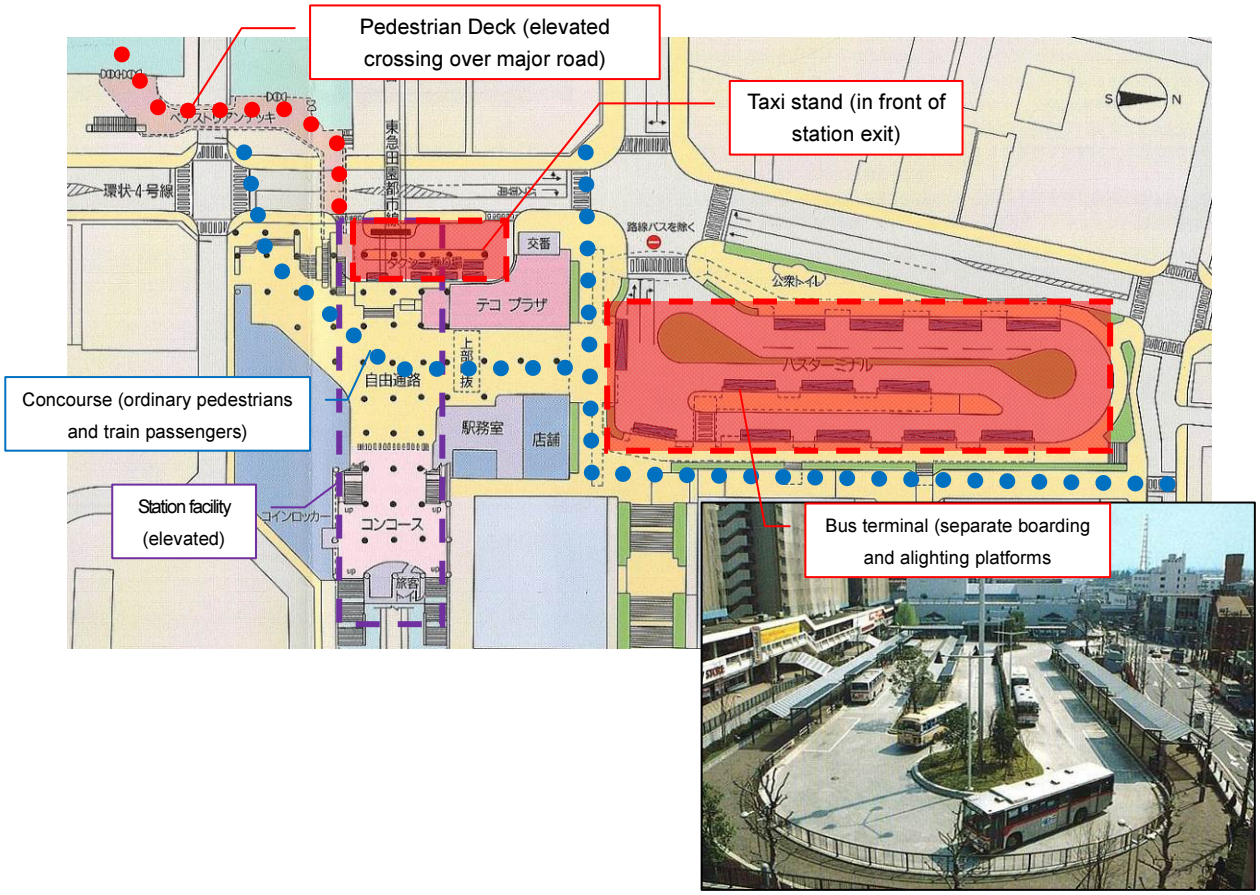
In addition to the "transport facility" above, the "environmental space" is developed as an open space with signboard, police box, toilet, bench, etc. In Japan, it is recommended to develop environmental space with 50% of the area of total transport facilities. Furthermore, to utilize ITFs safely and effectively, it is important to develop access roads to station, green space, and urban facilities to serve for railway users, in an integrated manner.

Table 5.2.1 Necessary Facilities of Station Plaza

Facility	Necessary Consideration
Sidewalk	• To avoid grade crossing with carriage way (consider elevated crossing) • Designed for the pedestrian flow line not to cross, as waiting area for passengers of bus and taxi, or as waiting space of pedestrian crossing • To secure smooth walking space with which pedestrians feel no sense of detour
Carriageway	• Designed to be one-way in principle • To minimize crossing, merging and splitting of traffic of car running within the plaza • To minimize the number of entrance and exit • Planned to avoid traffic through the plaza
Bus boarding & alighting facility	• To be located in front of the station facility or nearby • Consider installation of traffic lights and pedestrian crossings in case that the bus stop and the stations are far
Taxi stand and taxi pool	• To be located if possible, near the station exit for users' convenience especially those with much baggage and the elderly • Designed not to cross tangle with buses and private cars
Car parking	• To enable cars to come in and go out smoothly, and keep users from crossing the carriage way in the plaza
Temporary car stop	• Same considerations for the taxi stand and pool

Source: JICA Study Team

[1] This kind of system is called "Kiss and Ride, or K&R", which is a system in which family member delivers railway users (commuters, students) to a station by car, and drop him at the station. K&R facility is developed to secure temporary car stop space in front of a station.



Source: Project Team based on materials of Tokyu Railway Corporation

Figure 5.2.1 Example of Station Plaza (Aobadai Station, Tokyo Denentoshi Line)

5.2.4 Estimation of Volume of Intermodal Station Facility

It is assumed that users of UB Metro go to a station on foot, or by car, bus or taxi. Its modal share differs from each station and local characteristic. In case of sub-center stations and stations located near the intersection, many users will go there by bus. To the stations of sub-urban areas, users will have access through private cars, park them at P&R facilities, and transfer to UB Metro for commuting. Table 5.2.2 shows modal share of each station.

Table 5.2.2 Estimated Modal Share of Each Station

Station	Modal Share (%)				Station	Modal Share (%)			
	Walking	Car	Bus	Taxi		Walking	Car	Bus	Taxi
W-7	21.4	25.5	43.1	10	CS	25.7	24.5	39.7	10
W-6	38.1	19.4	32.6	10	E-1	35.3	21.3	33.4	10
W-5	64.9	12.8	17.3	5	E-2	68.7	11.8	14.5	5
W-4	22.7	24.6	42.7	10	E-3	51.7	17.4	25.9	5
W-3	66.7	12.3	16	5	E-4	71.5	11.1	12.4	5
W-2	44.8	19.9	30.3	5	E-5	63.3	13.2	18.5	5
W-1	66.6	12.4	16.1	5	E-6	42.2	18.1	29.6	10

Source: JICA Study Team

The volume of ITFs is estimated based on the number of station users and its modal share.

Necessary volume of each facility is estimated based on the station plaza planning standard in Japan (See Table 5.2.3). These volumes have been calculated based on the future demand estimation as reference; and In actual, the station plazas shall not necessarily be developed as such.

Table 5.2.3 Necessary Volume of Intermodal Transfer Facility of Each Station [1)]

Station	No. of Station Users		No. of Bus Berth		No. of Taxi Berth			No. of Private Car Berth			Total Area (m^2)
	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Pool	Boarding	Alighting	Wheel chair	
W-7	52,953	64,619	7	5	2	5	9	13	14	1	30,300
W-6	76,898	82,044	7	5	2	8	12	13	17	1	38,200
W-5	9,845	11,737	1	1	1	1	1	2	2	1	3,500
W-4	65,921	69,233	8	6	2	7	10	14	18	1	37,400
W-3	28,268	18,377	1	1	1	2	2	2	4	1	6,300
W-2	31,378	25,239	2	2	1	2	2	4	7	1	10,300
W-1	22,281	11,356	1	1	1	2	1	2	3	1	5,100
CS	67,967	59,141	6	6	2	7	9	12	19	1	34,700
E-1	26,123	16,404	2	2	1	3	3	3	7	1	10,400
E-2	18,412	22,144	1	1	1	1	2	2	3	1	5,400
E-3	32,918	37,219	3	2	1	2	3	5	6	1	11,700
E-4	6,002	16,128	1	1	1	1	2	2	1	1	3,200
E-5	30,535	35,439	2	2	1	2	3	4	5	1	10,000
E-6	17,474	17,896	2	1	1	2	3	3	4	1	7,500

1) For estimation of facility volume, following periods of parking of each mode is applied: 5 min for boarding and 3 min for alighting at bus berth, 10 seconds for boarding and 30 seconds for alighting at taxi berth, 30 seconds for both boarding and alighting at car berth.

Source: JICA Study Team

5.2.5 Development Policy of Intermodal Transfer Facility at Each Station

ITFs are to be planned on the following design conditions, namely: (i) necessary volume of ITFs calculated based on the estimated future demand (See Table 5.2.4); (ii) necessity of connection with road network and other transportation modes; and (iii) necessity of development of transportation facility to enhance urban function.

In a short term, bus stops and walking environment for pedestrians shall be improved at all the stations, and ITFs shall be developed at the three major stations at W7 of Tolgoit, CS of Sukhbaatar, and E6 of Trolley Bus Terminal). These should be given priority. Table 5.2.4 describes of ITFs at each station and Figure 5.2.2 illustrates a development policy of ITFs at the major stations.

To develop ITFs, selection of the implementation body from the railway development body, state, city or the private sector, land acquisition or expropriation corresponding to the required size, location, and budget allocation need to be examined

Moreover, after the Urban Redevelopment 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. Development of ITFs together with such urban redevelopment projects should be considered.

Table 5.2.4 Outline of Intermodal Transfer Facilities at Each Station

		W7	W6	W5	W4	W3	W2	W1	CS	E1	E2	E3	E4	E5	E6	E7
Convenience in transferring from other transport modes	Development of ITF and Bus terminal	●							●						●	●
	Improvement of bus stop		●	●	●	●	●	●		●	●	●	●	●		
	Development of P&R (car parking)	●		▲											●	
	Development of K&R (temporary car stop)	●			●				●			●			●	●
	Connection with BRT[1)]			▲			▲		●			▲				
Pedestrian environment nearby	Installation of Sign board	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Development of Concourse (Elevated, underground)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Connection with nearby facilities and passage (concourse)			▲	▲		▲	▲		▲						
	Improvement of Access road	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Note:
1)Excluding North-south Line; BRT plan is not approved yet by Public Transportation Dept., UB City ▲
2)P&R means park and ride. It is a system that allows citizens to park a private car at the nearest railway station and then ride the railway by the development of parking spaces connected to stations.
3)K&R stands for kiss and ride. The driver of a car (usually a family member) drops off his or her passenger at a station after a goodbye kiss. The system is used to promote the use of the railway. A K&R facility is developed to secure a passenger drop-off space in front of a station.
Source: JICA Study Team

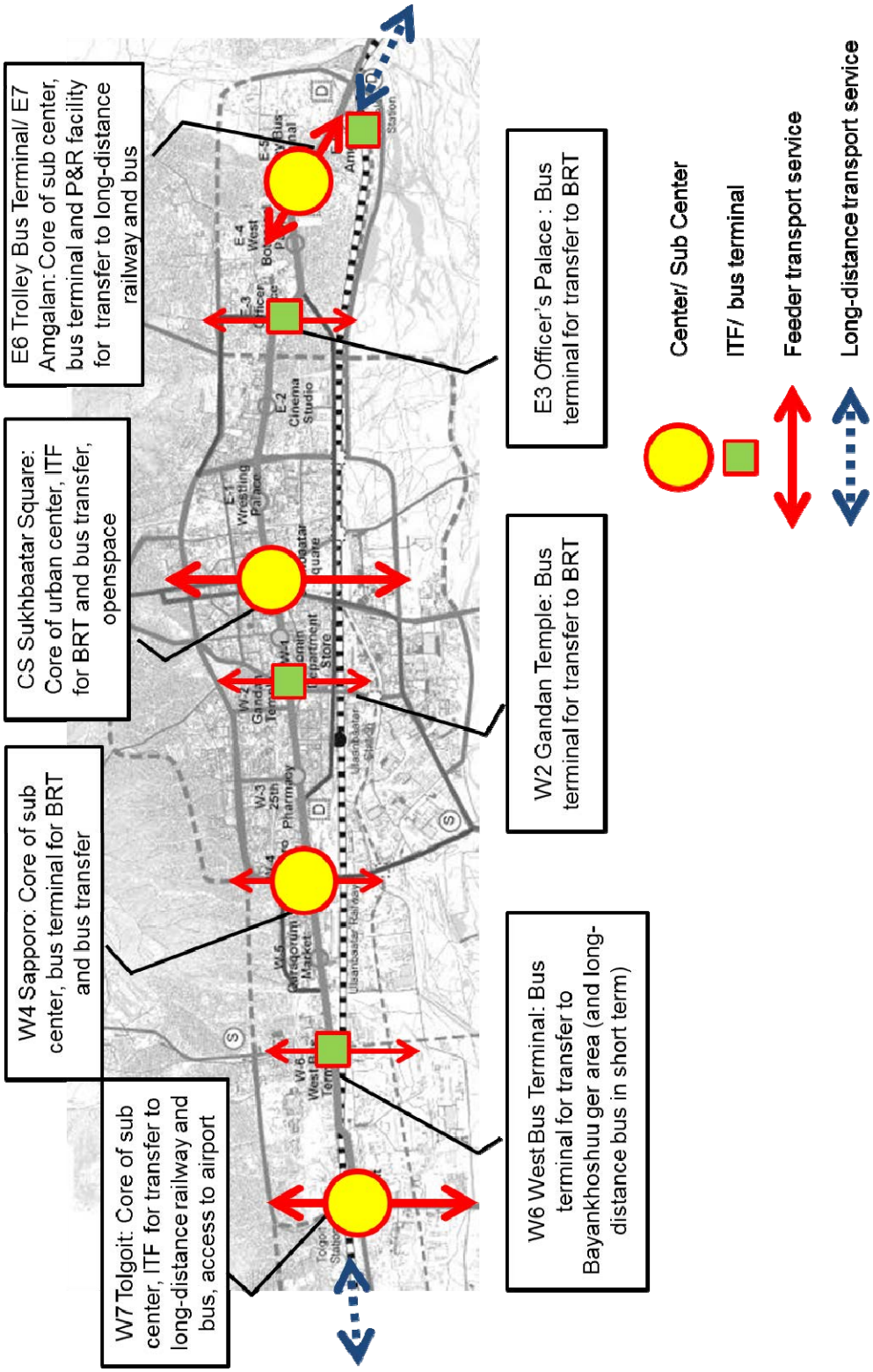


Figure 5.2.2 Intermodal Transfer Facility Location of UB Metro Network

Source: JICA Study Team

5.3 Proposed Implementation Mechanism of Station Area Development Projects

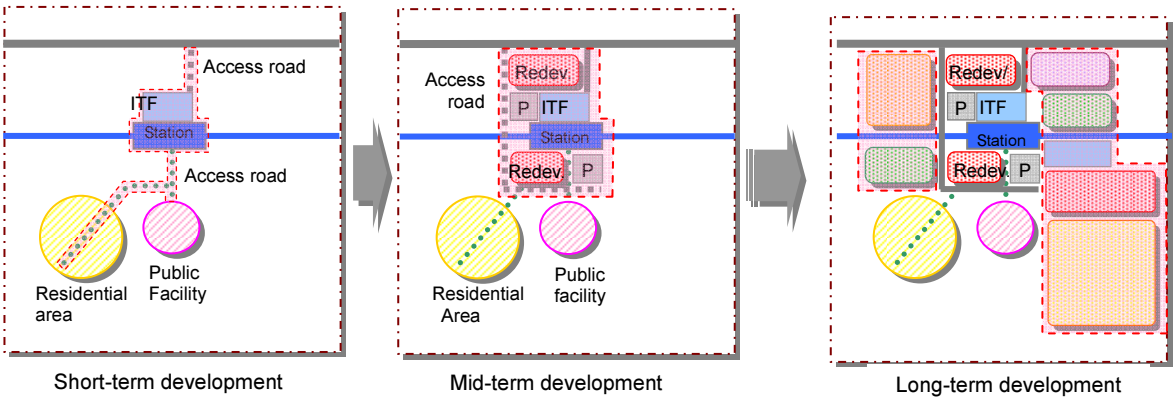
5.3.1 Consideration for Station Area Development and Necessity of Phased Implementation

In general, urban development projects take a long time to materialize. Particularly, as an area along Peace Avenue is already built up, it seemingly takes too long especially for coordination of rights and acquisition of land. In addition, the metro development and the station area development have different project areas and organizations concerned. Accordingly, it is required to coordinate the concerned organizations and clarify their roles and functions prior to making the plan and implementation of the project. Although the Urban Redevelopment Law is scheduled to be constituted before long, and regulations will also be developed to implement such urban development projects, the following items need to be considered:

(i) Consistency with the UB City Master Plan and District Detail Plans;
(ii) Coordination with the metro project;
(iii) Coordination with the road development plan and the public transportation plan;
(iv) Land acquisition and compensation; and
(v) Clarification of rules and functions of the public sector, the railway operator and the private sector.

Station area development, as described in section 5.1.6, is classified into three types: (a) development of station-related facilities, (b) development of intermodal transfer facilities and transport improvement, and (c) urban development in station area. A phased development approach is preferable for implementation of these projects. The phased development is briefly described below (see Figure 5.3.1).

- **Short-term development:** This involves the development and improvement of station-related facilities for station use such as an intermodal transfer facility (station plaza), car parking, bus stop, access road to the station, and pedestrian path.
- **Mid-term development:** This involves highly implementable projects such as small-scale ones or those which can easily acquire land, and urban development projects with high synergy effect when developed concurrently with the metro's opening such as commercial area development near stations, old apartment reconstruction projects, improvement of utilities.
- **Long-term development:** The time required for this type of development is medium to long term considering the aspects of land acquisition and financing, investment from the private sector, infrastructure conditions, and legal setting, e.g., urban redevelopment projects and new town development projects.



Source: JICA Study Team

Figure 5.3.1 Image of Phased Station Area Development

5.3.2 Implementation Body of Station Area Development

Major stakeholders involved in urban development integrated with the metro are the public sector, the metro operator, and the private sector. Their roles and functions are as follows:

(a) **Public Sector:** (i) Promotion of metro project, (ii) Coordination for formulation and implementation of grand design of station area development, (iii) Improvement of transportation environment to promote the metro use such as the improvement of bus service and the development of other public transport, and (iv) Land acquisition for station area development

(b) **Metro operator:** (i) Improvement of facilities and service integrated with other transportation modes, and (ii) Request necessary for the improvement of the metro operation and service to organizations related to the urban development

(c) **Private sector:** (i) Participation in commercial and service business related to the metro operation, and (ii) Participation in urban development in station area

5.3.3 Materialization Approach by Project and Schedule of Station Area Development

The scope of the metro project encompasses the construction of station facilities and tracks, with sections elevated, underground and at grade. Station-related facilities such as an intermodal transfer facility, car parking, and an access road are not included in the railway development area and therefore these are not part of the metro project. In addition, such urban development projects nearby stations are implemented separately from the metro project. It is preferable that the development of the station-related facilities (short-term), and urban redevelopment projects (mid-term) should be realized in the following steps.

(a) **Development of station-related facilities (short-term project):** Station-related facilities and access roads are categorized as public facilities, and UB City, especially the Master Plan Department and the Road Department, is expected to be involved. UB City is required to secure land and financing for facilities which are minimally necessary to operate the metro and provide safe service. By this, the possibility of urban development in the station area is enhanced, thereby triggering the private

sector's involvement. It is better to utilize public-owned land for the development of station-related facilities. In the case of acquisition of private land, land should be acquired by paying compensation.

(b) **Urban development in station area (mid- and long-term project):** Various projects are promoted, examples of which are projects which enhance the possibility of the socio-economic development in the station area, such as development of commercial facilities around the metro stations and along Peace Avenue, old apartment reconstruction project, and effective use of public land and idle land. Once the Urban Redevelopment Law is constituted, these types of area development projects will be implemented based on "right conversion system," which is the transfer of original right before the project to right after the project, keeping the original right during the project implementation and conferring to the holder the right to live in the same area. As consensus of the right holders should be gained before the implementation, from the early stage of the project, it is expected, for a smooth project implementation, to formulate a detailed plan around the station, designating the project area and boundary, consensus building of the right holders, and selecting the project implementer based on the Urban Redevelopment Law. Table 5.5.1 summarizes a draft implementation schedule of station area development.

Table 5.3.1 Implementation Schedule of Station Area Development (preliminary)

<table>
<tr><td rowspan="2">Target Year</td><td rowspan="2">Metro project</td><td colspan="3">Station Area Development Project</td></tr>
<tr><td>Short-term</td><td>Mid-term</td><td>Long-term</td></tr>
<tr><td>Station facility, track, signaling, system</td><td>Station-related facilities, access roads, etc.</td><td>Small-scale development in station area</td><td>Urban development in station area</td></tr>
<tr><td>2013</td><td>Approval procedure</td><td rowspan="2">Decision of facilities to be developed, implementation body, financing</td><td colspan="2" rowspan="2">Establishment of legal framework for urban redevelopment projects[1)]</td></tr>
<tr><td>2014</td><td rowspan="2">Detailed Design</td></tr>
<tr><td>2015</td><td rowspan="2">Plan & design of station-related facilities development</td><td colspan="2" rowspan="2">Formulation of Station Area District Detailed Plans</td></tr>
<tr><td>2016</td><td rowspan="4">Construction</td></tr>
<tr><td>2017</td><td rowspan="3">Facilities development</td><td rowspan="4">Facilities development</td><td rowspan="5">Formulation of Project Implementation Plan and Implementation</td></tr>
<tr><td>2018</td></tr>
<tr><td>2019</td></tr>
<tr><td>2020</td><td>Metro opening</td><td>Completion, start of operation</td></tr>
<tr><td>2025</td><td></td><td></td></tr>
<tr><td>2030</td><td></td><td></td><td></td></tr>
</table>

1) This includes the Urban Redevelopment Law and its related rules and regulations, land-related laws and the amended Urban Development Law.
Source: JICA Study Team

5.4 Development Effect of UB Metro

5.4.1 Effect, Impact and Indicator of Station Area Development

With regard to the "effect and impact of the railway business," multi-faceted spillover effects are expected such as the effects on the citizens' living condition, local economy, safety, environment and local society. These expected spillover effects by 2030 are listed in the following table.

Table 5.4.1 Effects, impacts and indicators of the railway development

Evaluation Criteria			Effect/Impact	Indicator
Effect / impact on the residents' life	Effect / impact on users		Travel time is lessen.	Reduction of travel time from Tolgoit to Sukhbaatar Square (67 min → 18 min) Fare increase (400MNT→650MNT) Long time saving effect
			Increase in service frequency and punctuality enhance accessibility compared to bus service.	Increase in service frequency
			Connection between the public transportation gets more efficient by the restructure of the bus routes.	Decrease in the number of public transport transfer.
			A feeling of comfort and security in traveling are increased by connecting the east and west areas with one railway line on which trains frequently run.	Better accessibility in a whole city （higher traveling speed）
	Effect / impact on suppliers		Increase in the number of passengers that leads to the stabilization of management	Increase in the number of passengers (500,000 to 600,000 passengers per day)
	Residents' living condition	Improvement of accessibility to district centers	More people have access to the center/sub-centers due to the reduction of travel time.	The nighttime population in areas within 10-minute distance by train from the center/sub-centers of target areas is increased.
		Improvement of accessibility to intermodal transfer facilities	Reconfigured bus routes and connection with BRT reduce travel time to the city center.	The nighttime population in areas within 20-minute distance by train from stations and sub-center stations of target areas is increased.
		Reduction of regions which has no railway	New stations improve the accessibility of local people living in areas where it was inconvenient to move by the public transport.	The nighttime population in areas within 10-minute distance by train (800 m) from stations of target areas is increased.
		Improvement of convenience	Residents are able to get access to more facilities related to their living since travel time is shortened by train.	It is easier to get access to facilities related to living, public facilities (e.g. community centers), commercial buildings such as shopping malls and high advanced medical facilities, which are planned to be built in 20 minute-distance areas from stations.

	Local economy	Revitalization of local community	Productivity is increased due to better accessibility.	Business potential (sales potential) at station areas is increased.
		Investment promotion	Possibilities to lure companies and scale of the investment are increased by the increased productivity of the improvement of accessibility.	Potential of investment (possibility of establishment of new business facilities) in station areas is increased. Large scale investment in station areas is expected along with the railway business.
		Revitalization of real estate market	Additional real estate investment is generated with better accessibility.	1,318ha of real estate investment for commercial purposes will be done in station areas.
		Creation of employment	Incremented city functions by redevelopment at station areas is expected to increase employment	155,000 new employment opportunities are created at station areas (within 800m) by the development of the UB Metro by 2030.
		Increase in tax revenue	Increase in tax revenue with the growth of economic activities is expected.	Increase in revenue from tax on sales, CIT, real estate tax and new taxes related to redevelopment.
Effect/impact on the society	Local community	Redevelopment of urban city	The density of the urban areas is increased and city functions are accumulated according to the scale of the intermodal transfer facility	The population of the railway station sphere is increased. Redevelopment of the station areas is promoted.
	Environment	Improvement of global environment	It minimizes the impact of global warming since car users are expected to change their transport mode to the Metro for better accessibility.	CO_2 emitted by cars on main roads is reduced by 34,000 tons per year by 2030 NOx emitted by cars on main roads is decreased by 1,754 tons per year as of 2030
		Improvement of local environment	It assumes to solve the environmental problems in local areas since car users are expected to change their transport mode to the Metro for better accessibility.	
	Safety	Decrease in road accidents	It is expected to decrease the number of road accidents since car users are urged to use the Metro for better accessibility.	It is expected to decrease the number of road accidents which is quite high on the main roads along the railway.

Source: Manual on Evaluation Tool for Railway Project 2012 added by JICA Project

5.4.2 Effect and Impact on Life of the Metro Users

(1) Effect and impact on metro users

1) Travel time saving

- The average speed of the UB Metro is 30km/h and that of buses is 8km/h which means that it is possible to save travel time by taking the metro.
- Travel time from Tolgoit to Sukhbaatar Square (about 9km) is reduced (from 67 minutes to 18 minutes).

- Reliability and punctuality of the public transportation system is secured.
- Commuting time is reduced drastically by the shortened travel time and punctuality.

2） Time cost saving

- The UB Metro fare is 600MNT/trip which is higher than bus fare, 400MNT/trip. But, the reduction of commuting time brings the time cost saving, and as a result the total travel cost is reduced.
- The time cost saving effect of the public transport on users by the reduction of travel time is estimated as follows. The time value of the public transport users is 0.725USD per hour (16.7MNT/min) in 2020 (See table 10.1.2). When it is assumed that the travel time is saved by 12 minutes through the UB Metro compared to the travel time by bus, its economic value is about 200MNT. Therefore, it is possible to say that if the time saved by the metro is 12 minutes, its economic effect is equivalent to the increase in the fare from 400MNT to 600MNT[2].

3） Improvement of punctuality and accessibility

- Reconfigured bus routes decreases the number of changing public transportation services.
- The service frequency of the UB Metro is assumed to be one train per five minutes, which improves accessibility.
- Connecting the east and west areas with one railway line, on which trains frequently run, provides a feeling of security and comfort in travel due to easy access and fast transit.

(2) Effect and impact on suppliers

- The stability of the management is seen through the increase in the metro users (5 to 6 billion passengers per day are expected in 2030).
- The Ulaanbaatar Metro Authority (UBMA) is possible to secure enough operational profit (financial viability) from its fare revenue (refer to 10.2 of Chapter 10).

(3) Residents' living condition

1） Improvement of accessibility to district centers

- More people are able to get access to the center of each district since travel time is reduced.
- The nighttime population of areas within 20-minute distance by train from central districts of target areas is increased.

2） Improvement of accessibility to intermodal transfer facilities

- The restructuring of bus routes from stations and the connection to BRT save the travel time to the city center.
- The nighttime population of areas within 20-minute distance by train from stations and sub-center stations of target areas is increased.
- The current public transport services are trolley bus, fixed-route bus and minibus. The most routes of these transport services are directly connected to the city center

[2] The economic effect is discussed in detail in 10.1 of Chapter 10.

where the traffic is attracted. Therefore, there is a heavy traffic congestion in the center during rush hour, which makes the travel time longer.

- The public transport which people take is expected to drastically change in the metro areas after it starts operation.
- The public transport system caters to almost 70% of the urban area population since the division of roles (covered areas and functions) among the different public transport services is developed such as the restructuring of bus routes.
- It is possible for residents to reach their destinations in a shorter time as well as on time by the development of more convenient railway network integrated with north-south BRT line and bus networks.
- Traffic congestion is eased and travel time by car is reduced.

3） Improvement of accessibility related to the living condition

- Residents are able to get access to more facilities related to their living since travel time is saved by train.
- It is easier to get access to facilities related to living, public service facilities (e.g. community centers), commercial buildings such as shopping malls and high advanced medical facilities, which are planned to be built in 20minute areas from the stations.
- Opportunities to go shopping, take medical treatment and do recreational activities are increased through having an easier access to the city center and sub-centers.
- In the center, it's possible to make comfortable urban spaces where people can enjoy shopping and recreations even in a season of severe cold by the development of underground passages and shopping centers.
- A guideline for the underground pedestrian network makes it easier for pedestrians to move between buildings in the center during severe winter.

- Economic activities in UB city are revitalized during severe winter.

(4) Local economy

1） Revitalization of local economy

- Better traffic accessibility increases the productivity of local business.
- Business potential (sales potential) at station areas is increased.
- Revitalization of economic activities in UB city through the development of the UB Metro increases citizens' income.

2） Investment promotion

- Possibilities to lure companies and large scale investors are increased by the increased productivity brought about by the improvement of the accessibility.
- Potential of investment (possibility of establishment of new business facilities) in station areas is increased.
- Urban redevelopment is promoted in areas within a distance of 800 m from stations which increases up to 1,317 ha of the floor area development in 10 years from 2020 to 2030.

3） Revitalization of real estate market

- Currently, the land price is on the upward trend and it seems to be the land bubble. The UB Metro contributes to increase the land productivity by leading increased population to the urban areas and revitalizing economic activities of enterprises located in station areas.
- As a result, it is assumed that about 1,318 ha of real estate investment will be done in station areas (within 800 meters from stations) from 2020 to 2030 and the market size will be **one billion USD**.

Increase in gross floor area in 2020～2030		Net floor area ratio		Net floor area
1,318ha	×	80%	＝	1,054ha
Net floor area		**market price**		**Total value of real estate market**
1,054ha	×	1000$/m^2	＝	10,500 million USD

- The UB Metro creates a new real estate market and increases economic activities. In addition, it is expected that networks with other railway stations are formulated and the downward trend of the land price around the city center and station areas goes down.

4） Creation of employment

- It is expected that 155,000 of new employment is created at station areas by the development of the UB Metro. The increase in new employment is promoted particularly in the center and sub-centers and the formulation of business areas is accelerated.
- The UB Metro contributes to the formulation of the sub-centers as well as in keeping the center active.
- The UB Metro contributes to the formulation of efficient commercial and business centers along the railway line and realizes a compact city.

5） Increase in tax revenue

It is expected that the tax revenue of the government and UB city is increased because the national income is raised and economic activities are revitalized which increase the asset value.

i) Impact on tax revenue on a house rent

If it is assumed that 30 % of increased floor areas between 2020 and 2030 is rental offices and housings, the following formula shows that the increased VAT revenue reaches about **76 million USD per year**.

Increased floor area in 2020～2030	Rent rate	Net floor area ratio	Average rent fee	month	Tax rate	Increased tax revenue per year
1,318ha	× 30%	× 80%	×20USD/m^2	× 12	× 10%	=75.9 million USD

ii) Impact on individual income tax revenue by the employment growth

The revenue of individual income tax is also expected to increase with the growth of

employment. As the following formula shows, the total increased tax revenue is about USD 46.5 million per year on the assumption that the average monthly income is USD 500 per person, 50% of which is taxable.

The number of employment increased by 2030	Average monthly income	Rate of taxable income	month	Tax rate	Increased tax revenue per year
1,550,000 人	×$500	×50%	×12	×10%	=46.5million USD

iii) Impact on real estate tax

The amended real estate tax was enforced on January 1, 2013, which raises the tax rate from 0.6 % to 1.0 %[3] of the taxable value of property[4]. Here, it is assumed that 60% of the floor area value is the amount of registered property and the tax rate is 1.0 %. The increased tax revenue is expected to be 63.3 million per year.

Developed floor area	Floor area ratio	Net Floor price	Registration rate	Tax rate	Increased tax per year
1,318ha	× 80%	× 1,000USD/m^2	×60%	×1.0%	=63.3 million USD

iv) Impact on corporate Income Tax (CIT)

The increased revenue of CIT is calculated based on sales related to the employment in station areas and the sales profit ratio. As the following formula shows, the increased revenue of CIT is USD 46.5 million on the assumption that the sales labor cost ratio is 30%, the sales profit ratio is 10%, and the average CIT is 15%.

Labor cost	Sales labor cost ratio	Sales profit ratio	CIT rate	Increased tax per year
$930million	÷30%	×10%	×15%	=46.5million USD

6） Effect on the tax increase

In summary, the amount of increased taxes in 2030 is as follows.

Tax on a house rent: 75.9 million USD

Individual income tax: 46.5 million USD

Real estate tax: 63.3 million USD

Corporate income tax: 46.5 million USD

Consequently, the total amount of increased taxes is expected to reach 232 million USD in 2030.

[3]According to the amendment of the real estate law in Jan 1, 2013, 1% of tax rate is applied to citizens and enterprises/organizations that own properties in the first grade area. 0.8 % is for the second and third grade areas and 0.6 % is for the fourth and fifth grade areas.

[4] The amount of the ratable value of other registered property than land

(5) Recommendation of a new tax related to the station area development

1） Tax on the urban development

The rate of land use fee[5] is classified by area zone. But, the land value should be assessed according to its profitability in the market economy. Particularly, it is expected that the development of the real estate in station areas proceeds prior to that of the railway business. Therefore, the government need to secure the tax revenues for the urban development.

However, in order to reevaluate the value of land according to the profitability, the amendment of the land law is necessary and the amendment may not be completed before the development starts. Consequently, it is necessary to provisionally secure the tax revenue for the urban development related to the metro project by imposing tax (tax on urban development) on a part of the profit from the development of station areas. Another option is to issue a bond based on the future tax increment which is guaranteed by the investment in the urban development like the Tax Increment Financing (TIF) adopted by the US. In this case, it is possible to issue 279 million USD of bonds on the assumption that the interest rate is 7 % and the maturity is 20 years.

2） Revenue from a new tax on the urban development

As a general principle, beneficiaries who receive urban services shall pay taxes according to the services. In particular, the basic principle of sustainable urban development is that the tax revenue according to the volume of economic activities is secured. Therefore, it is necessary to impose taxes on the beneficiaries based on the new urban services (the UB Metro).

In addition, the establishment of an impact fee system is another option to secure immediate funds. Under the system, the impact fee of 50 USD／m^2 is imposed with the approval of the development concession. The redevelopment area is supposed to be about 331 ha and therefore the tax revenue of 165.5 million USD is expected.

(6) Effect and impact on the improvement of global environment

- The current car users are expected to take the metro for better accessibility after the UB Metro is developed. It is assumed that the number of cars is decreased, and consequently CO_2 emitted by cars is reduced by **34,000 tons** per year and NOx is decreased by about **1,754 tons** per year
- It is expected that people change the transport mode from cars to the metro which reduces the car traffic volume. This equals to the reduction of the total traveled kilometer per day by **198,000 km**. Therefore, it is also expected that the number of traffic accidents is reduced and the environment load such as air pollution and global warming is reduced.

(7) Improvement of safety and comfort and decrease in the traffic accidents

- The UB metro urges local people to use it instead of cars and decreases the car traffic volume by 16%. As a result, the velocity of cars is increased by 25% and the traffic congestion in the city center is relieved.
- The number of traffic accidents is expected to decrease because car users are urged to take the metro for better accessibility.

[5] The land use fee in the center (the first grade zone) for the commercial purpose is $1m^2$＝440Tgs.

5.4.3 Necessity of Integrated Urban Development

The UB Metro is expected to be a backbone of the public transportation systems, which connects centers and sub-centers of a central business area and residential and market areas stretching from east to west along Tuul river. This connection revitalizes relations between the centers which have a variety of functions. In addition, the UB Metro is a primary transport mode for commuters integrated with the BRT north-south line.

Besides, it is certain that the UB Metro is an effective project which has a big impact on urban development and local economy of UB city. The metro is a trigger of restructuring of the city and vitalizes economic activities in various fields. It is essential to take the following measures in order to ensure these effects and impacts.

- To formulate an urban city structure in which the city center and sub-centers play a role of promoting integration of urban functions as the hub centers. In addition, the centers and other areas within the UB city region should be organically linked. It is also necessary to increase the density of urban areas by promoting an efficient utilization of land and develop the city areas with an intensive utilization, establishment of tall buildings and transforming it with a highly dense population.
- To relieve the traffic congestion and restrict expansion of urban areas by urging to reconstruct old apartment buildings and move people from an urban fringe of ger areas.
- To develop district centers hierarchically in metro station areas and to build the urban spaces which have necessary functions for residents on easy access.
- To secure the urban accessibility and reduce energy per unit traffic by the way of connecting various public transportation systems such as MRT, BRT, Bus to expand areas covered by the public transportation services.
- To develop urban cities responding to contemporary issues, such as an energy -saving city, a city with high accessibility or a comfortable environment, an eco-city and a compact city.

6 Environmental and Social Consideration

6 Environmental and Social Consideration

6.1 Environmental and Social Consideration System and Organization in Mongolia

6.1.1 Laws and Regulations for Environmental and Social Consideration in Mongolia

Laws and Standards related to environmental and social consideration are listed as follows.

Table 6.1.1 Laws and Standards for Environmental and Social Consideration

Field	Laws and Standards	Year
General	Law on Environmental Protection	1995 Amended total 12 times including 2005/ 2006/ 2008/ 2010
Environmental Impact Assessment	Law on Environmental Impact Assessment	1998, Amended in 2001, 2006 and 2012
	Guidelines on Method of Natural Environmental Impact Assessment	2010
	Regulations and Guidelines on Preparation of Natural Environmental Protection Plan, Environmental Management and Monitoring Plan, and Rehabilitation Plan	2006
	Regulations and Guidelines on Method of Detailed Natural Environmental Impact Assessment	2000
Air	Law on Air	1995 Amended in 2010 and 2012
Water	Law on Water	1995, 2004, 2012
Protection Area	Law on Special Protected Areas	1994 Amended for 7 times including 1997/ 2002/ 2003/ 2004/ 2006/ 2008
Ecology	Law on Natural Plants	1995 Amended in1997/ 2002/ 2010
	Law on Forests	1995 Amended in 2012
Land	Law on Land	(1994) Amended for 10 times including 2002/ 2003/ 2004/ 2005/ 2009/ 2010
	Law on Land Privatization	2002 Amended in 2005, 2008 and 2011

Field	Laws and Standards	Year
Waste	Law on Solid Waste	2003 Amended in 2012
Others	Law on Protection from Toxic Chemicals	1995
Standards	MNS 0017-0-0-06: Environmental protection standard system.	2000
	MNS 0017-5-1-13: Rehabilitation of destroyed lands. Terminology and determination	1979
	MNS 0017-5-1-18: Rehabilitation. Classification of disturbed lands	1993
	MNS 0017-5-1-19: General requirements for rehabilitation of disturbed lands	1983
	MNS 3473: Environment. Land. Land use. Terminology and determination	1992
	MNS 4191: Environmental protection standard system. Climate of Mongolia. Main parameters	1983
	MNS (ISO) 4226: Air quality. General subject and general requirements	1993
	MNS 4585: Air quality parameters. General requirements	1998 Amended in 2005 and 2007
	MNS 17-2-0-07: Environmental protection. Air emissions. Classification	1979
	MNS: 0017-2-3-16: Air. Rules of air quality monitoring of city and settlements	1998
	MNS 4586: Indicator of water environment quality. General requirements	1998
	MNS (ISO) 4867: Water quality. Sampling third part. Recommendation for storage and protection	1999
	MNS 3342: General requirements for protection of groundwater	1982
	MNS 0900: Drinking water. Hygienic requirements and quality control	1992 Amended in 2005
	MNS 4943: Water quality. Effluent standard.	2000
	MNS 3297: Soil. Volume of hygienic parameters of soil of city and settlements	1991
	MNS 4917: Environment. Requirements for determination of the fertile soil layer standard for disposal while performing earth-moving activities	2000
	MNS 5850: Soil quality. Soil pollutants elements and substances	2008
	MNS 4990: Workplace atmospheres. Hygienic requirement.	2000
	MNS 5803: Occupational safety and health. General requirements for lead content in workplace air and the workplace.	2007

Source: JICA Study Team

The Mongolian Law on Environmental Protection, which is the basic law of environmental protection and management, was established in 1995 and amended 12 times. The law briefly addresses on Environmental Impact Assessment (EIA). The details of EIA is written in the Mongolian Law on Environmental Impact Assessment (EIA law), which was established in 1998 and amended in May, 2012.

Three items of "Strategic Environmental Assessment (SEA)," "Environmental Baseline Assessment" and "Cumulative Impact Assessment" were introduced in addition to the "Environmental Impact Assessment" through the revision in May 2012. Strategic assessments shall be carried out by a professional entity licensed by the Ministry of Nature, Environment and Green Development and the entity will make a report. The report shall first be discussed by the Technical Board and then presented to the government by the cabinet member responsible for nature and environment. Although the EIA law has been revised, related guidelines are not yet revised as of November 2012. The Technical Board was not held and procedures under the previous EIA law continue. Because SEA shall be applied for wide area projects which stretch over several provinces, the Ministry of Nature, Environment and Green Development determines that SEA is not applicable to the Metro project. An "Environmental baseline assessment" shall be carried out before EIA and the contents of "cumulative impact assessment" shall be investigated during SEA. Since concepts and details of them are not yet clear, information on new or revised guidelines needs to be gathered.

EIA in Mongolia shall be implemented by the two steps of "General Environmental Impact Assessment (GEIA)" as a screening procedure and "Detailed Environmental Impact Assessment (DEIA)". The Metro project is categorized as a target project which needs to undergo GEIA by the Ministry of Nature, Environment and Green Development before land possession and land use license application by the implementation body.

At screening stage, projects are categorized into three based on screening criteria: (1) implementation proposal of project is remanded and rejected, because of following reasons. Proposed technology, implement method and activities have high possibility of negative impacts, land use is not reflected in the land management plan, or the project does not comply with the policy, strategic assessment result, and related laws and regulations, (2) project is to be implemented without DEIA under certain conditions, and (3) project requires DEIA conduct. The projects with the conditions of the category which apply to the DEIA (category 3) are the cases with large negative impacts that affect people's health and environment, or cases in which impact cannot be predicted. It will require further detailed study as it develops and uses large amount of natural resources. The Metro project will fall on the category with which DEIA is required by the Ministry of Nature, Environment and Green Development. DEIA implementation can only be carried out by the companies which are designated by the Ministry of Nature, Environment and Green Development to perform such. The outline of the revised EIA law is shown in Table 6.1.2.

At present, related laws do not mention treatment of resettlement and land acquisition.

Table 6.1.2 Summary of Mongolian EIA Law

Assessments of Environmental Impact (Article 4)	1. Assessments of environmental impact shall include the following: Strategic environmental assessment (SEA) Environmental baseline assessment Environmental impact assessment (EIA) Cumulative impact assessment 2. Technical Board with responsibilities to regulate issues that may arise in connection with environmental impact assessment; review of assessments and reports based on SEA; cumulative impact assessment and EIA shall work at the Ministry of Nature, Environment and Green Development. Technical Board Member shall be appointed by the Ministry of Nature, Environment and Green Development.
Environmental Baseline Assessment and Cumulative Impact Assessment (Article 6)	1. The project implementer is responsible for commissioning the environmental baseline assessment to identify potential impacts of the project. 2. The project implementer shall ensure that the environmental baseline assessment is performed with the due participation of a licensed professional entity or research institution and, if necessary, shall seek guidance from the Ministry of Nature, Environment and Green Development. 3. The Ministry of Nature, Environment and Green Development shall conduct the assessment to analyze the effects on the specific regions and basins from various projects implemented by individuals and business entities with due inputs from a licensed professional entity. 4. If deemed necessary, the cabinet member in charge of nature and environment may appoint a team of experts for conducting the assessment. 5. The costs associated with the cumulative impact assessment shall be borne by the project implementers according to its range of impacts. 6. The professional licensed entity shall submit for review the environmental baseline assessment report and cumulative impact assessment report to the Technical Board at the Ministry of Nature, Environment and Green Development.
Environmental Impact Assessments (Article 7)	1. An environmental impact assessment shall consist of a general environmental impact assessment (GEIA) and detailed environmental impact assessment (DEIA). 2. Applications for a license for the use of natural resources, extraction of petroleum and minerals, and possession and use of land for business purposes and an approval for any other projects are subject to screening. 3. The project implementer shall apply for a GEIA to the Ministry of Nature, Environment and Green Development, the Aimag or Ulaanbaatar city governor's office, whichever is applicable according to the classification, by submitting a brief description of the project, a feasibility study (F/S), the engineering design and drawings, baseline description of the proposed project environment, written opinions of the relevant Soum and district governor and other related documents. 4. The screening shall be performed by an assessment expert who shall complete the assessment within 14 working days and issue a formal opinion as to whether: (1) The project should be rejected on the grounds that it is likely to cause considerable harm to the environment by virtue of its proposed technology, technique and activities; that it lacks land management planning; that its activities are inconsistent with the state policy, strategic assessment results or relevant legislation; (2) The project may be implemented without a DEIA subject to specific conditions; (3) The project requires DEIA.

	If deemed necessary, the time period specified above may be extended once by a further 14 days.
Detailed Environmental Impact Assessment (Article 8)	1. The result of the screening shall define the objectives, areas, scope and duration of the work for the DEIA. 2. The DEIA shall be conducted by a Mongolian entity authorized to do so. 3. The entity authorized to conduct the DEIA shall prepare a report presenting the findings of the DEIA and develop an environmental management plan. 4. The DEIA Report shall include the following: (1) The baseline data and indicators of the environment in which the project is proposed to be implemented; (2) Estimations and findings of studies that are conducted to identify a potential and the major negative impact of the project and establish their magnitude, spatial extent and consequences; (3) Recommendations for measures to mitigate and eliminate potential as well as the major impact of the project; (4) Recommendations for alternative methods and technology that may potentially reduce the pollution level expected from the proposed project and for environmental considered method and technology; (5) Risk assessment of impacts of the proposed project on human health and the environment (if the general environmental impact assessment requires so doing) ; (6) Objectives, scope and indicators of the environmental management plan; (7) Notes of consultations made with local authorities and communities likely to be affected by the proposed project; and (8) Other issues pertaining to the cultural stratum and special nature of the project. 5. The project implementer shall be officially asked to comment on the DEIA report. 6. The project implementer shall bear the costs associated with the conduct of the detailed environmental impact assessment. 7. The entity that has conducted the DEIA shall keep the original copy of the data and information collected in the field and findings of the investigation carried out by the assessment specialist. It shall prepare a DEIA report in four copies, one of which is to be submitted to the Ministry of Nature, Environment and Green Development, another to the project implementer, and third to the Aimag, Soum or district governments having jurisdiction over the proposed project. The entity shall retain the remaining copy.
Environmental Management Plan (Article 9)	1. An environmental management plan shall form an integral part of the DEIA. 2. The entity that has performed the DEIA shall develop an environmental management plan in order to protect and ensure sustainable use and conservation of the nature and environment in which the proposed project is to be implemented, ensure the realization of recommendations outlined in the SEA, mitigate, eliminate and prevent adverse impacts that are identified by the detailed impact assessment, and monitor and identify potential negative consequences that may arise in the proposed project environment. 3. The Ministry of Nature, Environment and Green Development shall approve the environmental management plan for the proposed project and grant the permit to go ahead with the project. 4. An environmental management plan shall consist of an environmental protection plan and environmental monitoring program. 5. The environmental protection plan shall address measures to mitigate and eliminate adverse impacts identified during the EIA and provide for the timeframe and estimated budget for implementation of those measures. 6. The environmental monitoring program shall address the monitoring and analysis of changes made to the state of the environment as a result of the

	project activity and shall clarify reporting requirements and ways to implement the plan as well as providing the timeline and estimated budget.
Appraisal of DEIA (Article 10)	1. The licensed entity having completed the DEIA shall submit the DEIA report and related documents to the entity that performed the screening within the period specified. 2. The expert who has received the report on the DEIA shall appraise the quality of the assessment and issue an opinion within 18 working days. (The chief assessment expert of the Ministry of Nature, Environment and Green Development may extend the appraisal period once by 18 days.) The chief assessment expert of the Ministry of Nature, Environment and Green Development may exclusively appoint a team of experts to do an appraisal of the assessment report. 3. The Ministry of Nature, Environment and Green Development shall decide whether the project should go ahead based on the DEIA report and the opinions of the expert and the Technical Board that have appraised the quality of the report. 4. The DEIA report shall be advertised and presented by the project implementer and the professional entity having performed the assessment to the communities likely to be affected by the project.

Source: Made by JICA Study Team on Japanese Translation of EIA

6.1.2 Difference from JICA's Guideline for Environmental and Social Considerations

The EIA law of Mongolia was developed based upon the guidelines of donors and does not differ largely from the "Guidelines for Environmental and Social Considerations" by JICA. The Revised EIA law in May 2012 includes SEA and descriptions on stakeholders and public participation. However, the target of Mongolian EIA law is the physical environment, and social considerations and Resettlement Action Plan (RAP) are not stated. Even if land resettlement occurs, the necessity of preparation of RAP is not regulated at present in the other laws. The draft Land Acquisition Law of Mongolia is being drawn up at present; constitution period of which is not yet clarified.

The UB Metro project and its related facilities are categorized as in the Guidelines for Environmental and Social Considerations by JICA issued in April 2010. The project will implement underground construction and sufficient considerations on possible negative effects when necessary. Possible negative effects are related to topographical and geological features such as land subsidence, air pollution, noise/vibration and accidents noise/vibration during construction and after the Metro operations begin. This project will be defined at the GEIA stage as a case where negative effects to human health and natural environment are expected to be large or impossible to estimate, detailed investigation is necessary, or huge amount of natural resources need to be developed through the project implementation; and therefore a DEIA will be applied to conduct.

The implementation of the project is assumed and the EIA is usually conducted immediately

before the project implementation. Prediction and analysis on negative effects in each evaluation item seems not emphasized. Environmental monitoring is regulated in article No.9, EIA law. Implementation report which is mentioned in next year plan needs to be submitted every December of the year.

Stakeholder meeting is described in article 18, EIA law in Mongolia, which is stipulated in the JICA Guidelines, but it is not emphasized. Also, the public notice of the report to be done within 30 days to acquire public comment is shorter than its period stated in the JICA Guidelines.

6.1.3 Roles of Related Authorities

The related authorities to EIA are as in Table 6.1.3 and the Study Team made interviews to them on related information.

Table 6.1.3 Related Authorities

Organization	Authorized Tasks
Ministry of Nature, Environment and Green Development	Approval of EIA
Implementation and Coordination Bureau of Railways and Maritime Transportation Policy, Ministry of Road and Transportation	One of the windows of the project and the candidates for counterpart of project and EIA implementer
Public Transportation Department of Ulaanbaatar City	The department is responsible for public transportation in Ulaanbaatar city and one of the windows to the Metro project and the candidates for counterpart of project and EIA implementer. They were in charge of implementation and management of the former F/S by Korean Metro.
Capital City Master Plan Department of Ulaanbaatar City (name of Construction, Urban Development and Planning Department of Ulaanbaatar City was changed and part of the functions of Land Authority of Ulaanbaatar City simultaneously was absorbed under the new government after election in 2012)	The department is in charge of management of application for construction and one of the windows to the Metro project and the candidates for counterpart of project and EIA implementer.
Environmental Pollution Department of Ulaanbaatar City	The authority is in charge of collection and compilation of general information on environment and present status of air, water and soil pollutions of Ulaanbaatar city
Property Related Department of Ulaanbaatar City (part of function of Land Authority of Ulaanbaatar City as absorbed under new government)	The authority is in charge of land register and permits and license on land in Ulaanbaatar city.
Upper Surface and Groundwater Authority of Ulaanbaatar City	In charge of water and sewer services

Source: JICA Study Team

6.2 Screening and Environmental Category of the Projects

This project is for developing the Metro, which is categorized as Level A in the "Guideline for Environmental and Social Consideration" of JICA issued in April 2010. The project will implement underground construction and sufficient considerations on possible negative effects 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 the Metro operations begin. This project will be defined as a case where negative effects to human health and natural environment are expected to be large or impossible to be estimate, detailed investigation is necessary, or large scale of natural resources are developed by the project implementation at the GEIA stage, and therefore DEIA will be required to conduct.

Based on the Metro plan which is proposed in this report, land acquisition is necessary but involuntary resettlement is less expected.[1]

6.2.1 Draft Scoping

The plan and design of the project needs sufficient considerations for environmental and social acceptance. Expected environmental impacts by the project and draft-scoping plan was examined based on the first and second stakeholders meetings and the present status summarized above.

(1) Coverage for Scoping

The area for scoping includes the "Ulaanbaatar Metro Line 1 (East and West line)" of 17.7 Km lengths (elevated railroads of around 11.1 km and underground railroads of around 6.6 km) and candidate areas for the depot. The project does not include related projects conducted by Ulaanbaatar city like station area development.

(2) Draft Scoping

The results of scoping for the above mentioned area as shown in Table 6.2.1 are based on the site visit survey, measurements, interview survey, stakeholders meetings, and literature reviews. In the literature review, following reports were reviewed: the F/S study conducted by the Korean company under contract with Ulaanbaatar city in 2009, "The Study on City Master Plan and Urban Development Program of Ulaanbaatar City" by JICA in March 2009, and "Capacity Development Project for Air Pollution Control in Ulaanbaatar City, Mongolia (ongoing project)" and so on.

Table 6.2.1 Draft Scoping

Impacts	Evaluation		Explanation on Evaluation
	Before and during construction	Under operation	
Pollution			
Air	A-	B+	**Before and during construction:** Air pollution will temporarily become worse due to exhaust gas by construction machines and vehicles, fugitive dust and traffic congestion. **Under operation:** Air pollutant emission by automobile use will be expected to be reduced by traffic reduction and traveling speed increases resulting from the modal shift from automobile to the Metro.
Water	A-	D	**Before and during construction:** River water and groundwater pollution will temporarily become worse due to effluent water by construction and related facilities, and excavation.

[1] In this report, depot site selection has not been done but alternatives are proposed. For the depot site selection in the further study, the size of resettlement area will be considered and if the number of population for resettlement exceeds 200 in some candidate sites, these will be excluded from the alternatives.

Impacts	Evaluation		Explanation on Evaluation
	Before and during construction	Under operation	
			Under operation: No serious impact is expected since a drainage system will be used for wastewater from station facilities.
Soil	C-	C-	**Before and during construction:** The Environmental Pollution Department of Ulaanbaatar city pointed out that soil contamination by lead is a problem and one of the causes is lead-contained exhaust gas from automobiles using leaded gasoline. However, use of leaded gasoline was prohibited in 2007, and there is no evidence of leaded gasoline importations at present. Lead contamination cannot therefore be expected during construction. Television reports which indicated probable lead gasoline use was broadcasted in 2012 and investigations into use of lead gasoline was considered necessary. **Under operation:** If treatment of wastewater like washing water from train basis is insufficient, soil contamination occurs.
Waste	A-	B-	**Before and during construction:** Soil waste from tunnel excavation and construction waste will be generated. Suitable waste management, such as soil outflows countermeasures, is necessary for soil dumping sites. **Under operation:** Waste will be generated from stations and train depot.
Noise/ Vibration	B-	A-	**Before and during construction:** Noise by the operation of construction machines and vehicles is expected. **Under operation:** Noise by trains running on the ground and elevated sections, and vibration by trains running on the whole line is expected.
Subsidence	C-	D	**Before and during construction:** Subsidence by groundwater level change is not expected because fine sand and silt is less in the construction site ground. Additionally, proposed shield tunneling method generally does not cause ground subsidence under normal tunneling management. However, it is necessary to be confirmed by soil survey. **Under operation:** No pumping of groundwater that causes subsidence is requested, no large impact is expected.
Odor	D	D	**Before and during construction:** No work which causes odor is expected. **Under operation:** No work or facility which causes odor is expected.
Sediment	D	D	**Before and during construction:** No work which affects sediment is expected. **Under operation:** No activity which affects sediment is expected.
Natural Environment			
Protected Area	D	D	The project site is far from areas protected by the Law on Special Protected Areas and there will be no impact.
Ecosystem	C-	C-	The surroundings of the project site are urban and does not include rare species in biota or ecosystem requiring special consideration. However, a part of routes and one candidate for train depot are planned in part of a botanical garden owned by the National Science Academy. Thus, an ecosystem impact examination is necessary.
Hydrology	A-	C-	Under the project sites, it is expected that a groundwater vein from a northern hill to the southern reverbed of Tuul River and Selbe River exists. **Before and during construction:** There are possibilities of changes of groundwater level and water flow direction by water shielding of underground routes and pumping and pouring of water during construction. It is reported that use of groundwater is prohibited in surroundings of the planned underground section, but examination of the information is necessary. **Under operation:** Hydrology might somehow be affected

Impacts	Evaluation		Explanation on Evaluation
	Before and during construction	Under operation	
			because of underground facilities. Underground hydrology change may affect the flow volume of Tuul River. These need to be assessed. Additionally, effect on flooding which is caused by heavy rain in every few years is necessary to be checked.
Topography and geology	D	D	**Before and during construction:** Topography of the project sites is gentle and most of the routes are planned as elevated or underground, so any large embankment or excavation is not expected. **Under operation:** Because ballast-less track is applied for reduction of maintenance costs and weight saving, ballast preparation is not necessary. Changes in topography and geography are not expected.
Ground Freezing	D	D	Groundwater may freeze from ground surface to GL–3 to 4 meters. Impact on ground freezing is not expected because the tunnel is designed below freezing depth.
Climate Change	A-	B+	**Before and during construction:** GHG emission will temporally increase because of fuel consumption by construction machines and vehicles. **Under operation:** GHG emission reductions by automobile use are expected by traffic reduction and traveling speed increases resulting from the modal shift from automobile to the Metro.
Social Environment			
Involuntary Resettlement and Acquisition	B-	D	**Before construction:** The plan was made under the condition of minimizing involuntary resettlement and acquisition. As a result, in this plan, land acquisition is necessary only at the station near the botanical garden, train depot and its connection to the main line; and involuntary resettlement is not generally necessary. However, after detailed designs, (1) gateway of stations, (2) gateway to the underground section for construction, and (3) "West Intersection" where piers of flyover roads may affect the Metro construction, may requires expropriation. Although these sites are generally located in public lands, small scale involuntary resettlement may be necessary. Under the detailed planning from now, if possibility of involuntary resettlement is found in any option, possible resettlement populations estimated precisely, and then the option may be excluded from the plan and rethink the site selection if resettlement is not small. **During construction and Under operation:** Involuntary Resettlement is not expected in construction or operation.
Land Use	C-	C+	**Before and during construction:** If the botanical garden is selected as train depot, green area would decrease. **Under operation:** Intensive land use and economic vitalization is expected by developments along the Metro line and stations.
Public Health	C-	D	**Before and during construction:** Impact by construction of lodgings for workers is expected, but its impact is considered limited because construction period is not long. **Under operation:** Negative impact to public health is expected.
Risks by Infections	D	D	**Before and during construction:** There are risks of infections occurrence including HIV and so on by inflow of workers, but its impact is considered limited because construction is short-term. Furthermore, it is expected to be manageable through education and training of workers if management of inflowing workers follows the way of on-going large-scale projects. **Under operation:** Inflows from other areas were mainly due to the snow disaster. There is little possibility of infection risk change by the Metro operation.
Impact on Road Traffic	A-	B+	**Before and during construction:** There is possibility of traffic congestion due to an increase in construction vehicles and land occupation. **Under operation:** **P**lans like intermodal and station area development are proposed, and as their results of the modal shift

Impacts	Evaluation		Explanation on Evaluation
	Before and during construction	Under operation	
			from automobile to the Metro a positive impact on traffic congestion is expected.
Impact on Users of Existing Public Transportation	B-	B+	**Before and during construction:** There is a possibility of traffic congestion worsening due to an increase in construction vehicles and land occupation. **Under operation:** There will be a positive impact for many citizens since there is high possibility of smooth transportation by the Metro operations and less traffic congestion. The route reconstruction plan for bus service will be investigated by the Public Transportation Department of Ulaanbaatar city. Due to introduction of the Metro on arterial road large size buses would provide main feeder routes services. To reduce burden for users who live in suburban areas and probably take feeder buses, introduction of IC card tickets, setting of transit fees and transit facility at station will be considered.
Impact on Operators of Existing Public Transportation	B-	B+	**Before and during construction:** There is possibility of increased traffic congestion due to an increase of vehicles and land occupation for construction. **Under operation:** Passengers may decrease after the Metro operation. Reconstruction of existing large bus routes is examined and there is possibility of reconstruction of existing large bus companies and personnel reduction.
Division of Area	D	D	Part of the Metro line runs on ground, but the route is planned in a median strip of the existing arterial road; hence the dividing of the area is not occurred due to the project. Train depot is expected to be built in lands not open to public, such as existing land for railway and the botanical garden and so on. Hence the dividing of the area is not occurred due to the project.
Sunlight Obstruction	B-	B-	The site is located at around 48 degrees north latitude and there is a possibility of sunshine obstruction at the northern side of the elevated section.
Electromagnetic Interference	B-	B-	Because a television tower is located at the northern side of the route, there is a possibility of electromagnetic interference at the southern side of the elevated section.
Heritage	C-	D	**Before and during construction:** Moving monuments and other structures at the roundabout near Officer's Palace station is probable. **Under operation:** There is no heritage, which cannot be moved, at lands on the route and train depot candidates, so no large impact is probable after operation.
Landscape	B-	B-	**Before and during construction:** There is no special landscape for consideration, but landscape will be changed by construction. **Under operation:** There is no special landscape for consideration, but landscape will be changed by the elevated structure. Since sites to be considered in the landscape, including Sukhbaatar Square are generally located in the central part of the city along the underground section, impact on landscape is limited.
Poor People, Ethnic Minorities and Indigenous People	D	D	**Before and during construction:** There is no residential place of poor people, ethnic minorities and/or indigenous people. **Under operation:** Positive impact, such as easier commuting and access to working places, social services and market places and so on, is expected because mobility of citizens without their own vehicle will be improved. Economic benefit will be improved accordingly.
Working Environment	B-	D	**Before and during construction:** Consideration of working environment of construction workers is necessary. **Under operation:** No negative impact is expected on workers for the Metro operation.
Impact on	D	D	**Before and during construction:** There are risks of damaging

Impacts	Evaluation		Explanation on Evaluation
	Before and during construction	Under operation	
Underground Utilities			the underground utilities by the boring survey and construction work. Points for the boring survey will be carefully selected and the survey will not be conducted during wintertime when heating systems cannot stop working. Therefore, the impact is considered extremely minimal. Risk will be avoided by constructing tunnel deeper than the utilities. **Under operation:** No event which can damage the underground utilities is to be expected.
Local Economy Employment Opportunity and Means of Livelihood	B+	C-	**Before construction:** No impact on employment opportunity is expected. **During construction:** Employment opportunities for construction work will increase. **Under operation:** The number of operations of buses and trolley buses on Peace Avenue will decrease. Enlarging trolley buses on the other routes and reconstruction to feeder routes which connects the Peace Avenue to other areas are to be examined. Examination is also necessary on whether the impact on employment opportunity is positive or negative. Various employment opportunities are expected to be created on the Metro operations.
Other Impacts on Daily Life	D	B+	**Before and during construction:** No other impact on daily life is expected. **Under operation:** Commuting and access to social services and market places will be easier as one of the benefits of the Metro. Positive impacts such as no waiting in the cold temperature at stations during wintertime are certain.
Others			
Accidents	B-	C-	**Before and during construction:** Accidents during construction work and operations of vehicles are expected. Capacity building in relation to daily inspection and maintenance is required by the start of operation in order to minimize accidents. **Under operation:** Because the Metro is the first urban railway system in Mongolia, countermeasures against accidents involving operators and passengers, power failure reduction measures, and countermeasures against power failure are necessary.

Notes: Evaluation Criteria

A-: Negative significant impact is supposed. A+: Positive significant impact is supposed.

B-: Negative impact is fair. B+: Positive impact is fair.

C-: Negative impact is slight. C+: Positive impact is slight.

D: No impact or extremely minimal impact is supposed.

Source: JICA Study Team

(3) Draft DEIA Specification-Contents, Prediction and Assessment Methodology

Based on the draft scoping above, a draft DEIA specification is developed as presented in Table 6.2.2, including its baseline survey, prediction and assessment methodology.

Table 6.2.2 Baseline Survey Content, Prediction, and Assessment of EIA Items in Implementation Steps of Projects (Draft)

EIA Items			Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements		Effecting Factors			
Air	NO_2, PM_{10}	(Before and during construction) - Operation of construction equipment - Operation of vehicles to transport materials and equipment	1. Survey Items Meteorology (wind direction and wind speed), NO_2, and PM_{10} 2. Basic Method of the Survey - Literature review Collect, organize, and analyze the meteorology and existing atmospheric environment monitoring data. The target period shall be the most recent 3 years. - Field survey Operate measurement survey according to the measurement method set by the Mongolian Standard to obtain meteorology, NOx and PM_{10} data. 3. Survey Areas Areas which may be affected by NOx and PM_{10} emitted by operation of construction equipment or vehicles used to transport materials and equipment targeting tunnels, underground stations, elevated section, depot, and ventilation facility. 4. Survey Locations Select about five locations assumed to be affected by operation of construction equipment. Survey location numbers may increase or decrease based on the content of the project plans. 5. Survey Period 4 times of weeklong continuous field surveys (At least one survey must be conducted in winter when high	1. Estimation Items NO_2 and PM_{10} which will be emitted by the operation of construction equipment or operation of vehicles to transport materials and equipment. 2. Estimation Method Estimate quantitatively by using Plume/ Puff equations. 3. Estimation Area Set as similar to “Survey Areas”. 4. Estimation Location Select the location that will be affected the most, within the estimation area. 5. Estimation Target Period The target period shall be the peak of construction.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body. - Consider the consistency with the Mongolian environmental standards of NO_2 and PM_{10}.

EIA Items			Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements		Effecting Factors			
			concentration is expected.)		
	Dust	(During construction) - Operation of construction equipment - Operation of vehicles to transport materials and equipment	1. Survey Items Meteorology (wind direction, and wind speed) 2. Basic Method of the Survey - Literature review Collect, organize, and analyze the meteorology and existing atmospheric environment monitoring data. The target period shall be the most recent 3 years. - Field survey Operate measurement survey according to the measurement method set by Mongolian Standard to obtain meteorology data. 3. Survey Areas Areas which may be affected by dust emitted by operation of construction equipment or vehicles used to transport materials and equipment targeting tunnels, underground stations, elevated section, depot, and ventilation facility. 4. Survey Locations Select about five locations assumed to be affected by operation of construction equipment. Survey location numbers may increase or decrease based on the content of the project plans. 5. Survey Period 4 times of weeklong continuous field surveys (At least one survey must be conducted in winter when high concentration is expected.)	1. Estimation Items NO_2 and PM_{10} which will be emitted by the operation of construction equipment or operation of vehicles to transport materials and equipment. 2. Estimation Method Estimate quantitatively by analysis. 3. Estimation Area Set as similar to “Survey Areas”. 4. Estimation Location Select the location which will be affected the most, within the estimation area. 5. Estimation Target Period The target period shall be the peak of construction.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body. - Consider Total Suspended Particulate (TSP) acceptable concentration which can be estimated by PM_{10} air quality standard and PM_{10}/TSP ratio

EIA Items			Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements		Effecting Factors			
Water	Turbidity and pollution of rivers	(Before and during construction) - Excavation works or removing existing structure - Construction of tunnels - Installation of construction yard and roads	1. Survey Items Suspended Solids (SS), hydrogen ion concentration (pH), discharge, meteorology, and soil quality. 2. Basic Method of the Survey - Literature review Collect, organize, and analyze the water quality data of public waters. The target period shall be the most recent 3 years. - Field survey Operate measurement survey according to the measurement method set by Mongolian Standard to obtain SS, pH, and discharge. 3. Survey Areas Rivers which may be affected by excavation works, removing existing structure, construction of tunnels, and installation of construction yard and roads for construction of tunnels, underground stations, elevated sections, depot, and ventilation facility. 4. Survey Locations Select four locations from rivers which are assumed to be affected by construction. Survey location numbers may increase or decrease based on the content of the project plans. 5. Survey Period 4 times per year for field survey (Schedule should be selected to cover seasonal characteristics of water quality)	1. Estimation Items Suspended Solids (SS) and hydrogen ion concentration (pH). 2. Estimation Method Estimate quantitatively by analysis. 3. Estimation Area Set as similar to “Survey Areas”. 4. Estimation Location Select the estimation location that will be affected by the excavation works, removing existing structure, construction of tunnels, and installation of construction yard and roads within the estimation area. 5. Estimation Target Period The target period shall be the construction period.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body. - Consider the consistency with the Mongolian water quality standards.

EIA Items			Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements		Effecting Factors			
	Quality and water level of groundwater	(Before and during construction) - Excavation works, removing existing structure, and construction of tunnels and elevated structure (Under operation) - Presence of tunnels, elevated structure, and stations	1. Survey Items Groundwater quality (water temperature, pH, transparency, conductivity) and water level. 2. Basic Method of the Survey - Literature review Collect and organize the distribution and measured data of wells and spring water. Conduct a visiting survey for areas largely affected, since literature information is not available in many cases in Mongolia. - Field survey Conduct measurement survey according to the measurement method set by the Mongolian Standard or Japanese guideline on groundwater survey and monitoring 3. Survey Areas Wells and spring water around tunnels, underground stations, elevated sections, depot, and ventilation facility, which may be affected by excavation works, removing existing structure, and construction of tunnels and elevated structure. 4. Survey Locations Select about six locations from rivers assumed to be affected by construction. Survey location numbers may increase or decrease based on the content of the project plans. 5. Survey Period Field survey: 3 times for groundwater level, once for groundwater quality.	1. Estimation Items Groundwater affected by excavation works, removing existing structure and construction of tunnels and elevated structures. 2. Estimation Method Groundwater quality: evaluate quantitatively by considering influencing factors. Groundwater level: estimate by quantitative method, or estimation method. 3. Estimation Area Set as similar to “Survey Areas”. 4. Estimation Location Select the estimation location which can estimate adequately by considering distribution of groundwater within the estimation area. 5. Estimation Target Period The target period shall be the construction period or after completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body. - Consider the consistency with the Mongolian water quality standards.

EIA Items			Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements		Effecting Factors			
Soil	Soil contamination	(Before and during construction) - Excavation soils or removing existing structure - Construction of tunnels	1. Survey Items Contamination of soil and geological conditions. 2. Basic Method of the Survey - Literature review Collect and organize the documents and data relating to soil contamination. Conduct on-site survey accordingly to complement literature review. 3. Survey Areas Construction areas within construction project zones targeting tunnels, stations, elevated section, and depot.	1. Estimation Items Soil contamination accompanies with excavation soils, construction wastes, and construction of tunnels. 2. Estimation Method The influence of implementation of the project shall be grasped quantitatively by considering project characteristics and soil types and their distribution. 3. Estimation Area Estimation area shall be set as the project target area. 4. Estimation Target Period The target period shall be the construction period or after completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body. - Consider the consistency with the Mongolian soil quality standards.
Waste	By-product accompanies with construction	(Before and during construction) - Excavation soils and construction wastes accompanied with construction. (Under operation) - Wastes from the Metro stations and depot.	1. Survey Items Operation of waste management 2. Basic Method of the Survey - Literature review Collect and organize documents and data relating to waste. Conduct on-site survey accordingly to complement literature review. - Interview survey Confirm waste management methodologies through interviews on public administration. Survey soil waste management as follows; 1) Volumes of soil waste from the Metro construction	1. Estimation Items Disposal condition of excavation soils and construction wastes. 2. Estimation Method Estimate the waste amount and disposal condition/method during construction and operation by quoting and analyzing case studies. 3. Estimation Area Estimation area shall be set as the project target area. 4. Estimation Target Period The target period shall be the construction period or after completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.

EIA Items			Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements		Effecting Factors			
			2) Methods of waste processing and disposal 3) EIA on sites to where waste will be delivered 4) Development of mitigation and monitoring plans 3. Survey Areas Construction sites and waste dump sites		
Noise	Construction noise / road traffic noise Noise of running the Metro	(Before and during construction) - Noise from operation of construction equipment and vehicles (Under operation) - Running the Metro above the ground and elevated sections.	1. Survey Items Environmental noise and ground surface conditions. 2. Basic Method of the Survey - Field survey Environmental noise: operate measurement survey according to the measurement method set by Mongolian Standard. Surface conditions: operate on-site survey. 3. Survey Areas Areas affected by noise from operation of construction equipment and vehicles. 4. Survey Locations Select 10 locations within areas affected by construction. Use survey locations of F/S for reference. Survey location numbers may increase or decrease based on the content of the project plans. 5. Survey Period Once for one day (24 hours) on a weekday.	1. Estimation Items Estimate noise from operation of construction equipment and vehicles. 2. Estimation Method Estimate the noise by adding operation noise of construction equipment and vehicles to the noise before construction. 3. Estimation Area Set as similar to “Survey Areas.” 4. Estimation Location Select the estimation location that can estimate the influence of noise from operation of construction equipment and vehicles adequately within the estimation area. 5. Estimation Target Period The target period shall be the construction period or after completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body. - Consider the consistency with the Mongolian noise standards.

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
Vibration	(Under operation) - Vibration assumed from operation of the Metro throughout the whole line.	1. Survey Items Environmental vibration and ground conditions. 2. Basic Method of the Survey - Literature review Collect and organize the ground condition from documents and data. - Field survey Environmental vibration: Operate measurement survey according to the measurement method set by the Mongolian Standard. 3. Surveying Areas Areas affected by vibration of operation of the Metro. 4. Survey Locations Select 10 locations within survey locations affected by operation of the Metro. Use survey locations of F/S for reference. Survey location numbers may increase or decrease based on the content of the project plans. 5. Survey Period Once for one day (24 hours) on a weekday.	1. Estimation Items Estimate vibration from operation of the Metro. 2. Estimation Method Estimate the vibration by quoting and analyzing case studies. 3. Estimation Area Set as similar to “Survey Areas” 4. Estimation Location Select the estimation location that can adequately estimate the vibration from operation of the Metro within the estimation area. 5. Estimation Target Period The target period shall be the completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.
Ground Subsidence	(Before and during construction) - Ground subsidence by tunnels	1. Survey Items Ground subsidence conditions. 2. Basic Method of the Survey Collect and organize the documents and data relating to ground subsidence since shield tunneling method is planned and no large risk on ground subsidence is expected. 3. Survey Areas	1. Estimation Items Ground subsidence potential cause by the Metro construction 2. Estimation Method Cite reference cases or analyze possibility of ground subsidence 3. Estimation Area Set as similar to “Survey Areas”	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
		Select points from areas where tunnel and stations may impact environment geographically or geologically. Approximately 44 points are expected assuming 200 ~ 400m interval for the underground section, and 500m interval for the elevated section. 44 points x 2 seasons per year	4. Estimation Location Select the estimation locations that can adequately estimate the subsidence by the Metro construction within the estimation area. 5. Estimation Target Period The target period shall be the completion of the Metro facility.	capacity of the implementation body.
Offensive Odor	Not target of the survey.			
Sediment	Not target of the survey.			
Protection Area	Not target of the survey.			
Ecosystem	(Before and during construction and under operation) - Ecosystem in Botanical garden	1. Survey Items Impact on ecosystem by the Metro 2. Basic Method of the Survey - Literature review Main line and one candidate of train depot affect a part of the botanical garden owned by the National Science Academy. Study possible ecosystem impact through literature review. - Field survey Survey possible ecosystem impact through field survey.	1. Estimation Items Ecosystem impact on the botanical garden by one of the train depot options. 2. Estimation Method Assess possible ecosystem impact qualitatively based on the Metro plan 3. Estimation Area Set as similar to “Survey Areas”	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.
Hydrology	(Before and during construction and under operation) - River change caused by decrease of rainwater discharge accompanied with	1. Survey Items Changes of groundwater level or flow direction caused by water shielding in the underground section and groundwater pumping and pouring during construction. Water flow volume of rivers and flooding. 2. Basic Method of the Survey	1. Estimation Items Groundwater level change caused by water shielding in the underground section and groundwater pumping and pouring during construction. 2. Estimation Method Estimate groundwater level change quantitatively based on	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
	the Metro construction	- Literature review Find groundwater users in the area where the Metro tunnel may effect groundwater level (There is a part of the area where groundwater use is prohibited). Collect data of water flow volume of Tuul River, for both in summer (from June to August) and non-summer. Collect flooding history information to identify when and where flooding happened along the Metro line. Survey groundwater well usage and groundwater level. - Field survey Survey groundwater well usage and groundwater level via interview to the groundwater well owners along the Metro line. Survey groundwater level by boreholes. 3. Survey Areas Select points from areas where tunnel and stations may impact groundwater. Approximately 44 points are expected assuming 200 ~ 400m interval for the underground section, and 500m interval for the elevated section. 44 points x 2 seasons per year.	groundwater study, considering the Metro plan and geological condition. 3. Estimation Area Areas where water shielding in the underground section or groundwater pumping and pouring during construction may affect the groundwater level.	implementation body.
Topography and Geology	Not target of the survey.			
Ground Freezing	Not target of the survey.			
Climate Change	(During construction) - GHG emission increase caused by		1. Estimation Items Estimate GHG from operation of construction equipment or operation of vehicles to transport	

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
	construction equipment and vehicles.		materials and equipment. 2. Estimation Method Estimate quantitatively from vehicle numbers, etc. 3. Estimation Area All project target areas. 4. Estimation Target Period The peak period of construction.	
	(Under operation) - GHG emission changes caused by traffic decrease and higher travel speed due to the usage of the Metro facilities.		1. Estimation Items Estimate GHG from traffic decrease and higher travel speed due to the usage of the Metro facilities. 2. Estimation Method Estimate GHG according to Clean Development Mechanism (CDM) method. 3. Estimation Area All project target areas. 4. Estimation Target Period At completion of the Metro facilities.	
Involuntary Resettlement / Land Acquisition	(Before construction) - Resettlement of residents affected by construction.	1. Survey Items Area size and owners list of required land acquisition Population, the number of household and housing unit of involuntary resettlement 2. Basic Method of the Survey - Literature review Survey on land and building registration documents managed by Ulaanbaatar city government		- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
		- Field survey If involuntary resettlement is necessary, survey on the number of housing unit and household and population of involuntary resettlement which may not be precisely covered by official documents of Ulaanbaatar city government 3. Preparation of simplified "Resettlement Action Plan" Small number of involuntary resettlement is expected in this project. A simplified "Resettlement Action Plan (RAP)" which is necessary for JICA's supporting project will be prepared.		
Land Use	(Before and during construction) - Decrease of green spaces by constructing depot.	1. Survey Items Decrease of green spaces by constructing depot. 2. Basic Method of the Survey - Field survey Visit the candidate site of the depot to survey the green space. 3. Survey Area All project target areas.	1. Estimation Items Estimate the decrease of green spaces by constructing depot. 2. Estimation Method Estimate the influence of green spaces qualitatively by considering the distribution of depot and green spaces. 3. Estimation Area All project areas. 4. Estimation Target Period During period of construction.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.
	(Under operation) - Development along railroad and station area development.		Positive impacts from intensification of land use or economic revitalization are expected. This should be evaluated in the EIA for station area redevelopment but not for this Metro line project.	

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	**Effecting Factors**			
Public Health	(Before and during construction) - Influence by construction of laborer's lodges	1. Survey Items Condition of public health caused by laborers' accommodation. 2. Basic Method of the Survey - Literature review Collect and organize laws, documents and data relating to accommodation of laborers. - Interview survey Interview the laborers regarding awareness of public health. 3. Survey Area Laborer's accommodation and surroundings areas.		
Risks by Infections	Not target of the survey.			
Impact on Road Traffic	(Before and during construction) - Traffic congestion caused by construction vehicles and securing land for construction work (Under operation) - Decrease of traffic by operation of the Metro.	1. Survey Items Increase of traffic congestion caused by construction vehicles and securing of land for construction work. Decrease of traffic by operation of the Metro. 2. Basic Method of the Survey - Field survey Conduct traffic survey, if traffic conditions are different from this study. 3. Survey Points For case considered that traffic survey is necessary, select about 20 points assumed to be affected by road traffic. 5. Survey Period Field survey: One for one day (24 hours) on a weekday.	1. Estimation Items Conduct a future estimation of traffic. 2. Estimation Method Estimate the traffic volume by using JICA STRADA, etc. 3. Estimation Area Set as similar to "Survey Points" 4. Estimation Points Set as center of Ulaanbaatar city 5. Estimation Target Period The peak period of construction and at completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.
Impact on Users of Existing Public	(Before and during	Ditto.	Ditto.	Ditto.

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	**Effecting Factors**			
Transportation	construction) - Traffic increase caused by construction vehicles and securing of land for construction work. (Under operation) - Decrease in traffic by operation of the Metro.			
Impact on Operators of Existing Public Transportation	(Before and during construction) - Traffic increase caused by construction vehicles and ensure of land for construction work.	Ditto.	Ditto.	Ditto.
	(Under operation) - Re-organization of bus operation routes and staff reductions	1. Survey Items Changes caused by re-organization of bus routes and employees 2. Basic Method of the Survey - Literature review Collect documents and data on current conditions of bus operation and employees. - Interview survey Interview survey from bus and trolley-bus companies.	1. Estimation Items The number of employment from organization of trolleybus route other than Peace Avenue and feeder route connecting Peace Avenue and other areas. 2. Estimation Method Estimate personnel reduction caused by bus re-organization associated with the Metro construction plans. 3. Estimation Points Within project target area. 4. Estimation Target Period	

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
			During construction and at completion of the Metro facility.	
Dividing of Area	Not target of the survey.			
Sunshine Obstruction	(Under operation) - Possibility of sunshine obstruction on the north side of the elevated section.	1. Survey Items Condition of land use and topography. 2. Basic Method of the Survey - Literature review Collect and organize the related documents and data for land use and topography. - Field survey Conduct on-site survey accordingly to complement literature review. 3. Survey Area Areas that may possibly be affected by sunshine obstruction caused by the existence of the elevated structure.	1. Estimation Items Sunshine obstruction caused by existence of the elevated structure. 2. Estimation Method Estimate areas affected by the sunshine obstruction through sun shadow diagram. 3. Estimation Area Set as similar to “Survey Area” 4. Estimation Points Within estimation area, select the point most affected by sunshine obstruction caused by the existence of the elevated structure. 5. Estimation Target Period At completion of the Metro facility.	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.
Electromagnetic Interference	(Under operation) - Electromagnetic interference caused by the elevated structure.	1. Survey Items Condition of land use, topography, and electromagnetic reception. 2. Basic Method of the Survey - Literature review Condition of land use and topography: collect and organize the documents and data relating to land use and topography. Condition of electromagnetic reception: ascertain the location of TV tower, the direction of broadcasting	1. Estimation Items Electromagnetic interference caused by existence of the elevated structure. 2. Estimation Method Estimate the interference areas by calculation of electromagnetic interference caused by the elevated structure. 3. Estimation Area Set as similar to “Survey Area” 4. Estimation Points	- Consider the assessment and estimation results and environmental conservation measures, and evaluate if the pollutant is reduced or emitted as the maximum capacity of the implementation body.

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
		electromagnetic waves and the position of community reception facility. - Field survey Conduct measurement of image evaluation and electromagnetic wave strength using TV electromagnetic wave mobile monitoring station. 3. Survey Area Areas which may possibly be affected by electromagnetic interference caused by the existence of the elevated structure. 4. Survey Points Select about 5 points (towers) which are located on the north side of the elevated structure around TV towers. 5. Survey Period Once.	Within estimation area, select the point most affected by electromagnetic interference caused by the existence of the elevated structure. 5. Estimation Target Period At completion of the Metro facility.	
Heritage	(Before and during construction) - Displacement of heritage for construction	1. Survey Items Condition of main heritages 2. Basic Method of the Survey - Field Survey Literature review to check the location of heritage sites which would be affected by the Metro project. 3. Survey Points Select from areas where displacement of heritages is necessary to ensure property from the Metro facility and construction work spaces.	1. Estimation Items Disturbance to the heritages by construction of the Metro facility. 2. Estimation Method Evaluate the disturbance of the cultural heritage qualitatively. 3. Estimation Points Set as similar to “Survey Points”. 4. Estimation Target Period At completion of the Metro facility.	
Landscape	(Under operation) - Existence of the elevated structure and station facility	1. Survey Items Condition of main landscape. 2. Basic Method of the Survey	1. Estimation Items Disturbance of the landscape by the existence of the elevated structure and stations above	

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
	above ground	- Literature review Collect and organize the documents and data relating to landscape. - Field survey Survey the landscape by taking photograph of the major prospect. 3. Survey Points Select about six points, with consideration of the location of the elevated structure and stations above ground. 4. Survey Period Once. Select an appropriate period within a year.	ground. 2. Estimation Method Estimate changes of scenery by using a photomontage method. 3. Estimation Points Set as similar to “Survey Points”. 4. Estimation Target Period At completion of the Metro facility.	
Poor, Ethnic Minorities and Indigenous People	Not target of the survey.			
Working Environment	(Before and during construction) - Consequences on working environment of construction workers.	1. Survey Items Laws and its operating condition relating to labor conditions. 2. Basic Method of the Survey - Literature review Collect the laws, documents and data relating to labor conditions, and organize information about any consequences on the working environment.		
Impact on Underground Facilities	Not target of the survey.			
Local Economy Such as Employment Opportunity and Means of Livelihood	(Before and during construction) - Impact of regional economy via employment by the Metro itself and bus	1. Survey Items Living environment and incomes of employees 2. Basic Method of the Survey - Literature review Collect and study laws, documents and	1. Estimation Items Growth of employment from expansion of trolleybus route other than Peace Avenue and re-scheduling of feeder route connecting Peace Avenue and	

EIA Items		Survey Methods	Prediction Methods	Assessment Methods
Environmental Elements	Effecting Factors			
	re-routing	data on living environment and incomes of employees in detail. - Interview survey Interview from employers of bus and trolley-bus operation.	other areas. 2. Estimation Method Estimate the number of employment from the Metro plan, and evaluate qualitatively by considering the decrease of labor by bus re-organization. 3. Estimation Points Within project target area. 4. Estimation Target Period During construction and at completion of the Metro facility.	
Other Impacts on Daily Life	Not target of the survey.			
Accidents	(Before and during construction) - Accidents during construction and during operation of construction vehicles (Under operation) - Accident of passengers and power failure		1. Estimation Items The number of construction vehicles and accident rates. 2. Estimation Method Evaluate qualitatively from the number of construction vehicles and accident rates from the Metro construction plan.	

Source: JICA Study Team

6.3 Draft TOR for Assessment Environmental and Social Consideration

Draft TOR for assessment is shown in this section to carry out DEIA after this study. According to the EIA law of Mongolia, a Mongolian research company licensed by the Ministry of Nature, Environment and Green Development can only conduct an EIA.

(1) Purpose

An assessment on each environmental and social impact shall be conducted according to instruction of the EIA law of Mongolia revised on 17th May, 2012 and the "Guidelines for Environmental and Social Considerations" by JICA. Based on the results of the survey, DEIA report shall be elaborated upon and necessary procedures for applications shall be implemented.

(2) Scope of Work

Scope of Work is as follows.

- Review this study report and other reports on environmental and social impacts in Ulaanbaatar, and make a draft survey implementation plan which determines environmental impacts and survey methods for each impact
- Implement a literature review, measurement survey and prediction for each impact, and summarize the results by each impact based on the survey implementation plan
- Prepare Environmental Management Plan
- Organize stakeholders meetings
- Prepare DEIA report and necessary documents for application procedures of EIA
- Implement a cumulative impact assessment

1) Preparation of Survey Implementation Plan

To review the final report of this "Preliminary Study on Urban Development Project in Ulaanbaatar City" and other environmental and social impacts related reports targeting in Ulaanbaatar, and prepare a draft survey implementation plan which determines environmental and social impacts and survey methods for each impact. The draft survey implementation plan shall include the following items.

(i) Survey contents (purpose, outline of the project, area of potential impact (survey area), and environmental impact).
(ii) Survey method, which includes measurement, prediction and evaluation methods for each environmental and social impact.
(iii) Survey schedule
(iv) Organization chart of the survey (contents of tasks, number of staff, responsible persons)
(v) List of literatures for the survey
(vi) Other necessary items

2) Conduct of Survey, Prediction and Evaluation

Survey, prediction and evaluation on each environmental and social impact during the project implementation shall be conducted based on the survey implementation plan. Survey items and points for the field survey will be set based on location, scale and local characteristics, etc.

3) Preparation of Environmental Management Plan

An Environmental Management Plan shall be made, which includes a series of countermeasures to eliminate, prevent and mitigate adverse impacts to affordable levels, monitoring and institutional enforcement during the Metro project implementation and operations.

4) Preparation and Operation of Explanation Meetings to the Public

In DEIA procedure, explanation meetings for the public shall be held to outline the draft scoping, survey and prediction methods for each environmental and social consideration impact and evaluation results to decision-makers, environmental NGOs and stakeholder residents (see Table 6.4.3). The meetings aim mainly for open discussions and opinion hearings. Measures to take opinions of affected, low-income and socially disadvantaged people must be prepared.

To make explanation materials on draft scoping and evaluation results, etc., prepare and operate the explanation meetings to the public, and make memorandums. Opinions submitted at the meetings shall be incorporated into DEIA if necessary. All materials shall be prepared in Mongolian and English.

Table 6.3.1 Purposes and Contents of Explanation Meetings to the Public

	Purpose	Content
1st	Explanation shall be conducted on the Metro project, survey contents, prediction and evaluation methods of environmental and social impacts for information sharing and open discussion.	・Explanation on the Metro project outline ・Necessity of transportation network ・Introduction of alternative options ・draft scoping for EIA implementation ・Open discussion
2nd	Evaluation results based on DEIA shall be explained for information sharing. Open discussion shall be held on the results of evaluation.	・Explanation for evaluation results and the draft environmental management plan (impact evaluation, mitigation measures, etc.) ・Open discussion

Source: JICA Study Team

(3) Preparation of Report

DEIA, which includes the scoping results, the survey results for each impact and results of the explanation meetings, shall be made. The following items shall be included in the report to satisfy the requirements of the Mongolian DEIA and "Guidelines for Environmental and Social Considerations" by JICA.

- Results of scoping for each environmental and social consideration impact
- Current environmental and social condition and data based on literature review and

field survey as baseline data
- Indicators on baselines and measurable performance targets
- Predicted results of environmental and social impacts (direct, cumulative and induced impacts)
- Environmental protection and mitigation measures (avoidance, minimization, compensation)
- Environmental management plan which contains mitigation plans on environmental impact, methodology and frequency of monitoring, cost, budget and implementation entity
- Resettlement Action Plan (RAP) if large negative impact occurs on involuntary resettlement and loss of livelihood.
- Public consultation, complaint procedure, contents of discussions at stakeholder meetings

Opinions from governmental authorities, Ulaanbaatar city, NGOs, the public and the other stakeholders, comments from business entities, peer review results by JICA on draft DEIA shall be introduced. Also, all comments from stakeholders shall be reflected in the final report.

(4) Applications on EIA

To Necessary procedures on EIA implementation for the Metro project must be conducted. Additionally, DEIA report must be submitted to the Ministry of Environment and Green Development of Mongolia, and “environmental clearance certificate” or its equivalent must be issued.

6.3.2 Procedures on Future EIA Implementation

Details of procedures for EIA implementation of the Metro project are shown in Figure 6.3.1. Details of application procedures for cumulative environmental assessment are shown in Figure 6.3.2. The implementing entity is not yet identified at present and Ulaanbaatar city assumes the responsibility.

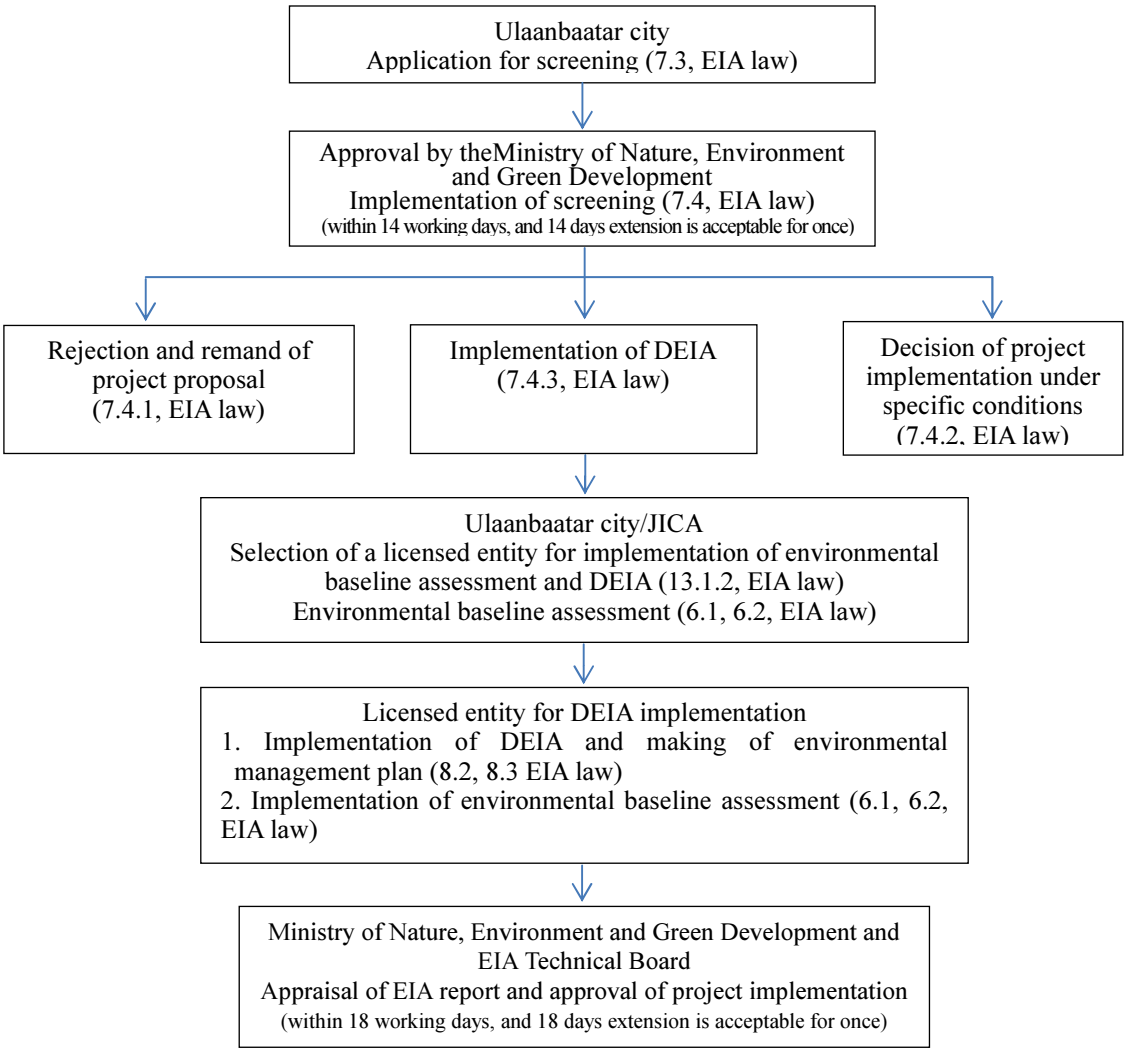


Figure 6.3.1 Procedures of EIA Implementation for the Project

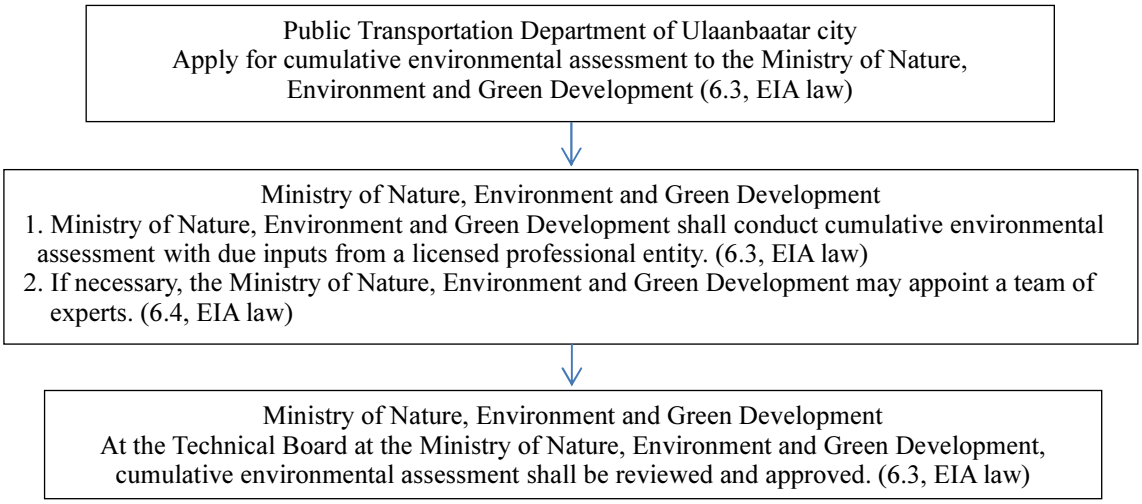


Figure 6.3.2 Implementation Flow of Cumulative Environmental Assessment

6.3.3 Development of Simplified "Resettlement Action Plan"

Since a small number of involuntary resettlement is expected in this Metro plan. Simplified "Resettlement Action Plan (RAP)" is to be developed according to JICA's "Guidelines for Environmental and Social Considerations". Simplified "Resettlement Action Plan (RAP)" must contain the following items:

1) Needs on land acquisition and involuntary resettlement
2) Analysis of legal framework on involuntary resettlement
3) Result of population census survey and property and land survey that covers all the occupants in the project sites
4) Result of household economy and lifestyle survey that covers 20% or more of all the occupants in the project sites
5) Requirements for beneficiaries of asset loss compensation and life reconstruction measures
6) Procedures for asset loss compensation according to reacquisition cost, based on reacquisition cost survey
7) Life reconstruction measures which improve (or restore in minimum) beneficiaries' household economy and living standard compared with the pre-resettlement status, based on life reconstruction needs survey
8) Responsibility of organization which handles complaint and procedure of complaint handling
9) Identification of organization (executing organization, local government, consultant, NGO, etc.) having responsibility for involuntary resettlement and their responsibilities
10) Implementation schedule to start physical resettlement after the completion of the asset loss compensation payment
11) Cost and its funding
12) Monitoring system and form used by the executing organization
13) Report of discussions with residents on project initial design and alternative plans for life reconstruction measures

7 Public-Private Partnership (PPP) Implementation Scheme

7. Public-Private Partnership (PPP) Implementation Scheme

With regard to the implementation scheme of the Ulaanbaatar Metro (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 railway business.

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.

This chapter examines the optimal implementation scheme for the UB Metro based on the funding and management aspects.

7.1. PPP-Related Legal System, Licenses and Permissions in Mongolia

This section provides key issues regarding the legal system, licenses and permissions for both the SPC scheme and the public company scheme.

7.1.1. SPC (Concession Project) Scheme

If the UB Metro project is implemented under the SPC scheme as a concession project, it is expected that it will be a concession project under the Law on Concession enacted in January 2010 (amended in August and December in 2012) as long as it is included in the concession list.

It is desirable that the agreement is guaranteed by the central government when Ulaanbaatar City is a party of the agreement: (1) a loan guarantee as stated in Article 30.1.1; (2) provision of a portion of financing in Article 30.1.2; (3) guarantee of the minimum amount of the concessionaire's revenues under the concession agreement in Article 30.1.5; and (4) the Viability Gap Funding (VGF) in Article 30.3.Considering the implementation of this Metro project, an entity that submits a proposal for inclusion in the list should be determined.

The study team is considering an implementation scheme on the assumption of the adoption of the "Two-tiered System." In this case, it is assumed that Ulaanbaatar (UB) City (or national government) will develop the infrastructure, such as tunnels, elevated structures, railroad tracks, stations and power plants as public works, with financial assistance from foreign countries granted to the government, including ODA. Accordingly, the government will be the owner of the infrastructure according to the Railway Law 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. If the concession item is the infrastructure, its owner will be the government, which means that the entity that submits the list is the government (Ministry of Roads and Transportations: MRT)—in accordance with Articles 7.1 and 9.4. In this case, the government (MRT) invites tenders for the Project according to Article 6.2.8 as applied in Article 7.1. In addition, the government is supposed to conclude the concession agreement according to Article 6.2.9.

However, as Article 3.1.7 defines "authorized entity," it has not yet been discussed who would own the Metro: is it the central government or Ulaanbaatar City? Thus, it is important to make clear the entity with which to negotiate, the central government (the ministry in charge) or Ulaanbaatar City. Specifically, it is necessary to confirm which body is the entity to submit the list, invite tenders, and conclude the agreement when the proposal is submitted. Generally,

Mongolian stakeholders recognize that it is appropriate to choose the concession of the government not UB City from the viewpoint of the project scale and hence it is highly possible that the government will be the entity that submits the list[1].

When an entity submits an unsolicited proposal for this project, it must follow the procedure specified in Article 18. Even if the proposed project is adopted, it is to be tendered. However, according to Article 18.6, if several entities participate in the tender, the original proponent is given some preference in the process of evaluating the proposals and such preference is to be included in the tender documents.

Article 3.1.6 states that the state regulatory authority grants the permission and licenses, determines the price and tariffs, and also adopts and enforces regulations. The state regulatory authority is thought to be MRT but UB City is in charge of the operation of the Metro such as the determination of the price and tariffs. In particular, a method to determine the price and tariffs is a key issue and Article 21.1.3 specifies that it should be included in the concession agreement.

Other necessary agreements in addition to the concession agreement are: (1) agreements between share holders and (2) contracts between the operator and contractors (contracts for design, construction, maintenance and operation) and so on. Besides, in the case of project finance loans, (3) loan agreements between the operator and lenders, (4) mortage agreements regarding assets owned by the operetor and stocks owned by share holders and (5) a direct agreement between the government or UB City and the operator are necessary.

In relation to the concession law, in order to implement this Metro project it is assumed that additional permissions and licenses from relevant governmental organizations are necessary based on the laws and regulations. The following are laws relevant to this project: (1) the Law on Land Use and other related regulations for the infrastructure development; (2) the Commercial Code, the Company Law, the Foreign Investment Law, the Tax Law and other related regulations for investment and business; and (3) the Railway Transportation Law and other related regulations for the public transportation services and the railway business. Concessionaires should be granted necessary permissions and licenses based on the relevant laws. Thus, when implementing this project, it is necessary to examine whether there is any permission or license to be given on the basis of the above laws. With regard to the rail transport services, the Railway Transportation Law regulates the following matters: 1) construction and use of the foundation structure; 2) generation, assembly and repair of the foundation and the system and rolling stock; and 3) special permission for the railway transport services (Article 16). Therefore, the study team needs to consider if the permission is required (refer to Chapter 8 as for the special permissions).

In addition to the permissions and licenses based on the laws and regulations, it is presumed that the government may be involved in the implementation of the project based on the contract. For instance, such matters as obtaining the right to develop the vicinities of railway stations using the SPC, provision of subsidies by the government and request for compensation for business may be conducted on the basis of contract with the government.

When the Metro project is implemented based on the concession law, it is necessary to make a decision taking into consieration which type of concessions is adopted and if the target area is not a strategic area of the government.

7.1.2. Public Company Scheme

Some people stated that even with a public company established for the Metro project, as long as the private sector invests in the company, the project shall be implemented under the concession law. However, others mentioned the possibility that, in case of a lower share of the

[1] From the interview with a former staff of MRT

private sector, the concession law is not applied.[2] If the concession law is applied, the same process and agreements explained in the previous subsection are needed. 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).

In addition, the process of the establishment of the public company depends on which is the main body, the national government or the UB city, and the process in case of the national government and the UB city must be clarified. It is appropriate that UB City is responsible for the operation of the railway since beneficiaries of the Metro are citizens of UB City only. When it comes to the public company, according to discussions with MRT, there are no legal problems with the establishment of Joint Venture (JV) of three parties: the government, UB City and private companies. The JV is supposed to be established based on the company law. It has also been clarified[3] that the operation of the UB Metro by the JV composed of the public and private sector does not violate the railway transportation law.

However, the Ministry of Economic Development expressed their opinion that the share of the JV parties is a key issue to be examined later. Consequently, regarding the possibility of the investment by both the government and UB City and the ratio of the private investment, details should continue to be considered through discussion with the Mongolian side after this feasibility study.

In addition, in case that the private companies are main investors of the public company, the operation is expected to be based on the economic rationality. but it is not justified to seek the guarantee of a public aspect of the UB Metro (public financial responsibility to the sustainable operation). On the contrary, in case that the public consisting of mainly UB City is the majority of the public company, inefficiency in the operation including financing and decision-making process may not be avoided. This is probably the biggest constraint for the private investors.

When it comes to whether the public company scheme is adopted or not, the following matters should be considered: (1) whether or not, and how much the government and the UB City are able to make an investment in the public company from the political and financial viewpoints, and (2) whether agreements related to the subcontracting and procurement between the private investors and the public company is not forbidden by Mongolian laws and regulations in relation to the procurement. In particular, (2) is an important condition for private companies to decide the capital participation of the public company.

7.2. PPP Scheme

As for the implementation scheme of the UB Metro, the two-tiered system (the government will be the infrastructure owner) should be chosen since the railway transportation law specifies that the infrastructure shall be owned by the government. The fare revenue is not enough to pay back the investment and therefore the two-tiered system of the separation of the infrastructure owner and the operator should be examined from the viewpoint of the cost of investment.

Another rational reason to choose the two-tiered system is a financial aspect. Financial profitability of the metro project is analyzed in Chapter 10. The financial analysis examines two cases: (1) with ODA soft loan (40% of the total cost) and (2) without ODA soft loan. According to the result, 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

[2] From the interview with the Ministry of Economic Development and UB city mayor.
[3] From the interview with a former staff of MRT

implement a sustainable operation and management. The infrastructure should be paid back in a long term 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.

The following three operation schemes are considered by the degree of involvement of the public sector:

(i) Two-tiered private management PPP scheme (100% privately owned)

(ii) Two-tiered joint investment PPP scheme (Over 51% owned by the public)

(iii) Two-tiered public management scheme (100% owned by the public)

As mentioned above, regarding the validity of the investment ratio, further discussions between concerned agencies are necessary. The government of Mongolia has clear policies which say 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 (e.g. power industry)." Therefore, the study team proposes to choose (ii) above, a two-tiered joint investment PPP scheme. and a "Public Corporation" scheme in which the public does mainly the operation. The private sector will be strategic partners[4] whose roles are to invest in the company and to provide their management know-how.

7.3. Optimal PPP Scheme for the UB Metro

The urban railway business is not simple and has many issues to be considered such as the policy formulation, technical standards, economic regulations, the approval of fare rates, safety management, drivers' licenses, maintenance of railroad tracks, railway management, asset management, and the cooperation and competition with bus operations. The division of roles among stakeholders, namely, the government, other governmental agencies, Ulaanbaatar city, bus companies, the private sector, should be clarified considering the following points.

- The basic division of roles between the government and Ulaanbaatar city is that the government constructs and owns the infrastructure and Ulaanbaatar city procures Electrical and Mechanical (E&M) equipment and operates the metro.
- It is necessary to make clear the roles of the private sector in the above framework.

On the above premise, this study proposes details of (ii) a two-tiered joint investment PPP scheme (over 51% owned by the public). In the proposal, detailed plans will also be developed, considering the rough sharing plan of financing the project based on the amount of the investment cost and the result of analysis for profitability. The following points should be noted in the establishment of the implementation scheme.

(i) Whether the scheme matches national policy intentions, and roles and capacity of the relevant organizations in Mongolia.

(ii) Whether the scheme optimizes know-how from the private sector, brings benefits to both the public and private sectors, and has sufficient motivation to implement the metro project.

(iii) Whether the scheme matches the capacities to bear the large project cost and implement the project including human resources of the Mongolian side.

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

(iv) Whether the scheme has an appropriate framework and conditions for the investment participation to attract the private investors from inside Mongolia as well as overseas.

Figure 7.3.1 shows a proposed two-tiered PPP scheme of the metro project based on the above. The next section explains details of a financing scheme but this figure describes the mutual relationship between a body which constructs and owns the infrastructure (national government) and a body which obtains the concession of the infrastructure, procures rolling stock and related facilities, and operates the metro (SPC).

Specifically, the Ulaanbaatar Metro Corporation (UBMC) is established as an operator of the metro and operates with the assistance of the private strategic partners. UBMC pays a flat rate of infra-rent fee to the national government every year and the government, in turn, provides the necessary support for the operation of the public transport system such as a guarantee to UBMC.

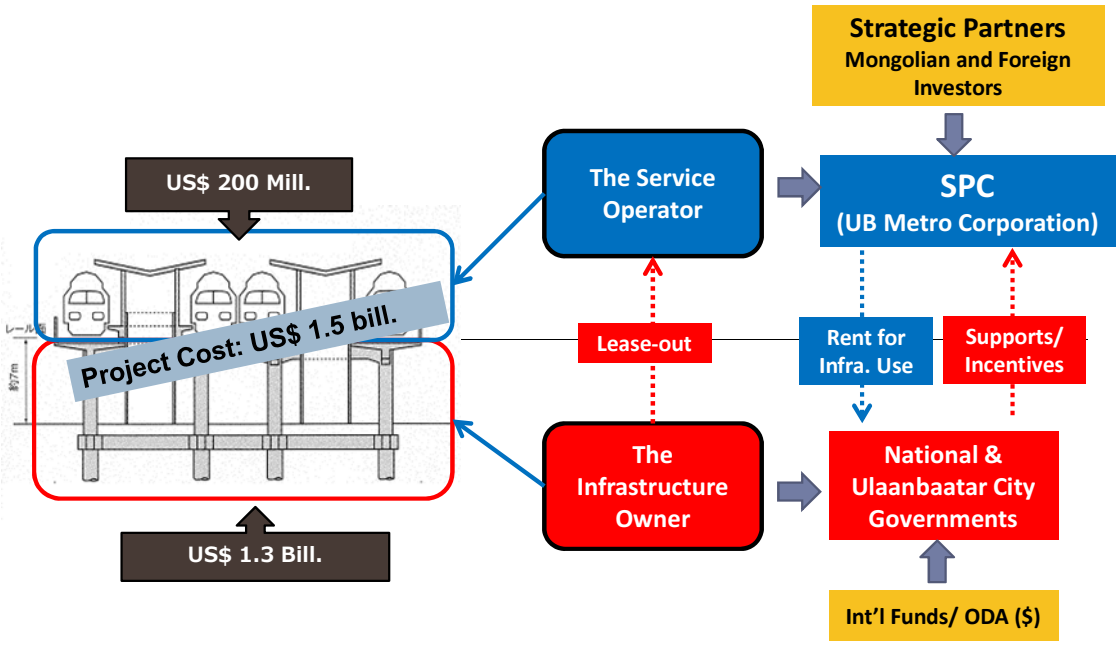


Figure 7.3.1 A Proposed Two-Tiered PPP Scheme for the UB Metro

7.4. Financing Scheme and Source of Fund

7.4.1. Financing Policy

On the assumption of the public corporation scheme proposed in the previous section, 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 (2 trillion MNT) 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.

(1) Construction Cost of Infrastructure

The starting point is that the UB Metro project must be approved as a national strategic project and granted the highest implementation priority. The Ulaanbaatar city master plan was formulated in cooperation with Japan and the UB Metro project was proposed as a strategic project for the formation of a compact city in the master plan. Therefore, 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 be also 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. In this regard, the following are considered:

(i) The construction of the infrastructure is implemented as a project for the development of public facilities with the assistance of ODA funds. In this case, over 51% of the construction cost is expected to be covered by the Mongolian government and the rest is financed by ODA.

(ii) The owner of the project is the minister of the Ministry of Roads and Transportation (MRT) in terms of the budget inclusion and funding. Thus, the budgeting for the UB Metro must follow the budgeting process of MRT.

(iii) A government special fund (e.g. Human Development Fund) based on the revenue from the mining industry is proactively utilized.

(iv) Funding from the international capital markets (issuance of the government guarantee bond of the bank of Mongolia) based on the potential of the future revenue from the mining industry is optimized.

(v) Funding from the capital markets with credibility increased by the Japanese government support system (e.g. funding by issuance of samurai bonds with a JBIC guarantee).

To illustrate the possibility of securing the above mentioned government funding, there is an estimate of potential impact to the government revenue in the future which Tavan Tolgoi (TT) and Oyu Tolgoi (OT) would have, and which has been prepared in cooperation with the Frontier Securities of Mongolia (see Table 7.4.1). As widely known, the impact of the interest from the mineral resources development on the improvement of the national finance is greatly expected. However, there are some risks such as the international market price (especially to China) and political risk, and therefore it is difficult to forecast the impact in the long run. This analysis assumed a pessimistic scenario (Scenario 1) and an optimistic scenario (Scenario 2) and the most probable baseline scenario between the pessimistic and the optimistic was forecasted.

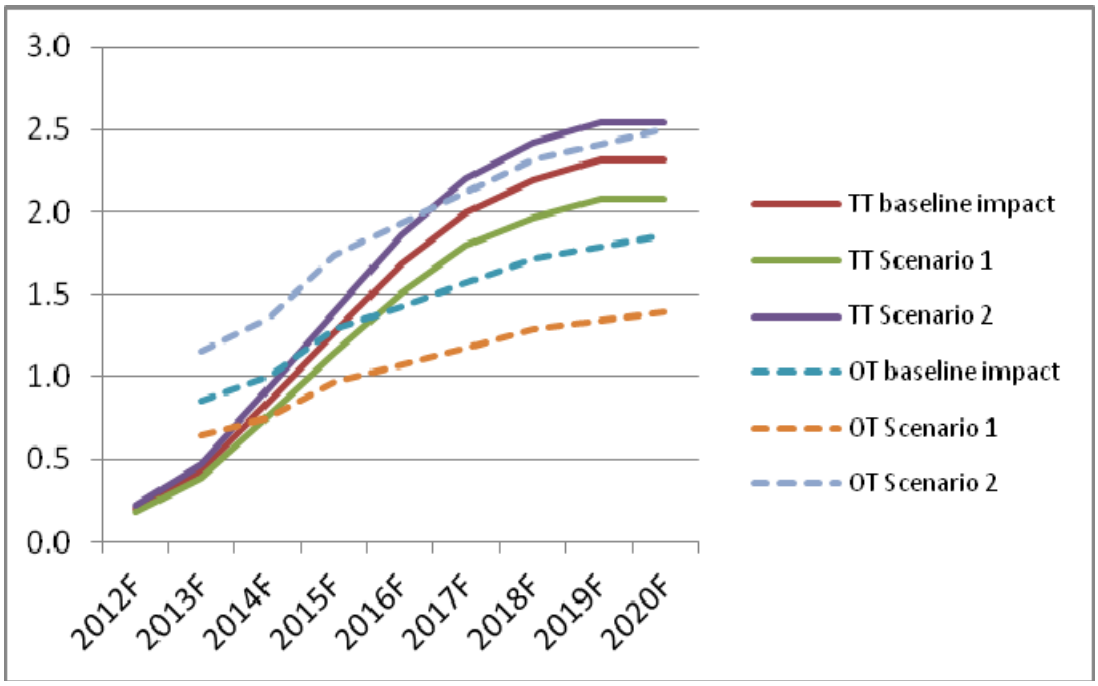
Under the baseline scenario, the additional impact of the government revenue by these two projects as of 2015 would be about US$2.6 billion, and for the next five years after 2016, when construction of the UB Metro starts (therefore the Mongolian Government is to start allocating its budget), the impact would translate to about US$3.5 to US$4.2 billion. Accumulated additional increase in the government revenue would reach US$18.9 billion during the five years. Figures 7.4.1 and 7.4.2 illustrate the impact of the OT and TT development under different scenarios on the government revenue.

Total investment of the Mongolian Government is estimated at this moment to be US$1.3 billion, which is equivalent to 7% of the accumulated additional increase in the government revenue by the mine development during the five years. Total budget of Mongolian Government (Expenditure) for FY 2013 is MNT 7.5 trillion (about US$5.3 billion) and the estimated budget size for FY 2016 is estimated to be over US$10 billion.

Table 7.4.1 ：Aggregate Impact of OT and TT on Government Budget Revenue（US$ Billion）

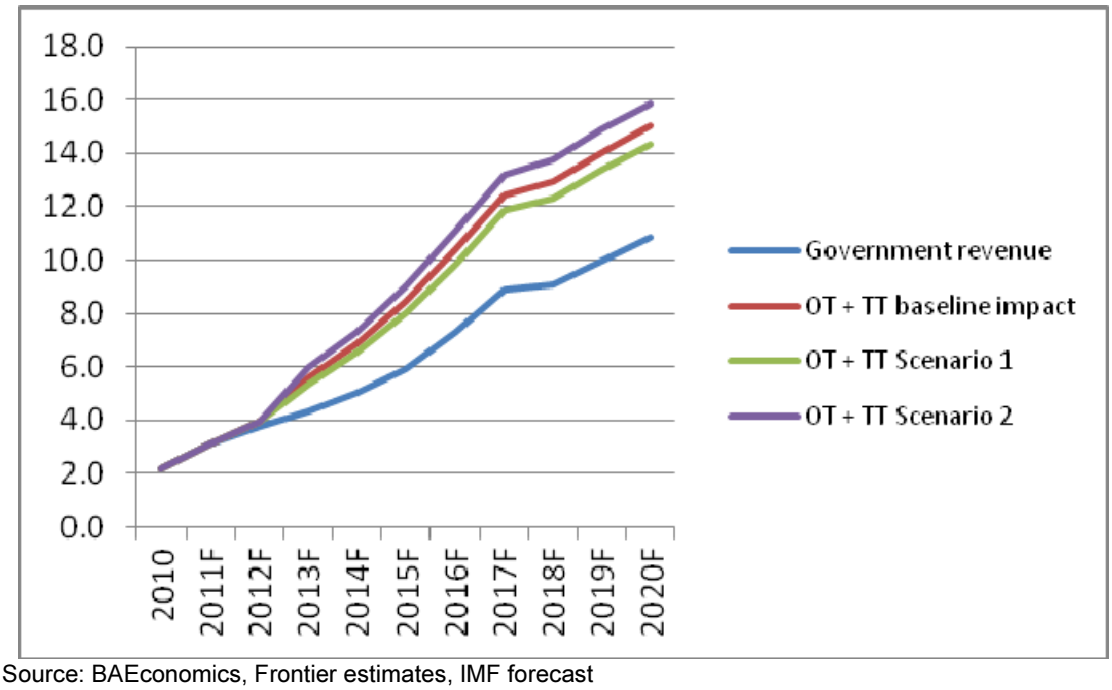
		2010	2011F	2012F	2013F	2014F	2015F	2016F	2017F	2018F	2019F	2020F
1	**Government Revenue: (IMF Forecast, not including impacts from TT and OT)**	**2.2**	**3.1**	**3.8**	**4.3**	**5.0**	**5.9**	**7.3**	**8.9**	**9.1**	**9.9**	**10.8**
2	TT Baseline Impact			0.2	0.4	0.8	1.3	1.7	2.0	2.2	2.3	2.3
3	TT Scenario 1			0.2	0.4	0.8	1.1	1.5	1.8	2.0	2.1	2.1
4	TT Scenario 2			0.2	0.5	0.9	1.4	1.9	2.2	2.4	2.5	2.5
5	OT Baseline Impact				0.9	1.0	1.3	1.4	1.6	1.7	1.8	1.9
6	OT Scenario 1				0.6	0.8	1.0	1.1	1.2	1.3	1.3	1.4
7	OT Scenario 2				1.2	1.4	1.7	1.9	2.1	2.3	2.4	2.5
8	**Baseline Aggregate Impact <2+5>**			**0.2**	**1.3**	**1.8**	**2.6**	**3.1**	**3.6**	**3.9**	**4.1**	**4.2**
9	Aggregate impact Scenario 1 <3+6>			0.2	1.0	1.6	2.1	2.6	3.0	3.3	3.4	3.5
10	Aggregate impact Scenario 2 <4+7>			0.2	1.7	2.3	3.1	3.8	4.3	4.7	4.9	5.0
11	**Government Revenue with TT and OT impacts (Baseline Scenario) <1+8>**	**2.2**	**3.1**	**4.0**	**5.6**	**6.8**	**8.5**	**10.4**	**12.5**	**13.0**	**14.0**	**15.0**
12	Government revenue with TT and OT impact (Scenario 1) <1+9>	2.2	3.1	4.0	5.3	6.6	8.0	9.9	11.9	12.4	13.3	14.3
13	Government revenue with TT and OT impact (Scenario 2) <1+10>	2.2	3.1	4.0	6.0	7.3	9.0	11.1	13.2	13.8	14.8	15.8

Source: BAEconomics, Frontier estimates, IMF forecast



Source: BAEconomics, Frontier estimates, IMF forecast

Figure 7.4.1 : Impact of OT and TT under Different Scenarios on Government Budget Revenue (US$ Billion)



Source: BAEconomics, Frontier estimates, IMF forecast

Figure 7.4.2 : Aggregate Impact of OT and TT (US$ Billion)

(2) Financing for rolling stock and related equipment

The Ulaanbaatar Metro Corporation (UBMC), an implementing agency of the UB Metro is assumed to procure the rolling stock and related equipment based upon the following policies.

(i) The government or UB city provides the direct investment in the majority (over 51%) of the capital.

(ii) As for the remaining capital (less than 49%), investment from the private investors in both Mongolia and Japan is promoted as strategic partners.

(iii) Possibilities of financing by the issuance of the UB Metro public bond with the government guarantee are examined.

(iv) As for funding for the purchase of rolling stock, co-financing of commercial banks and International Financial Institutions (IFIs) or JICA Private Sector Investment Fund (PSIF) and loan is examined.

(v) As for other working capital, loans from commercial banks or IFIs are utilized.

7.4.2. Financing Schedule

In accordance with the policies above, two concrete financing schemes are proposed (Figure 7.4.1 and Figure 7.4.2). The schemes share a common policy on the construction of the infrastructure as a public works with ODA fund from Japan. The main body of the project is the MRT but the UBMC is to be outsourced for the government to construct the infrastructure. After completion, the ownership of the infrastructure will be transferred to the government and the UBMC will be granted the right to use the infrastructure for a certain period (50 years) by paying a fixed infra-rent fee to the government.

Option A assumes that the UBMC is responsible for both the procurement of the rolling stock and related equipment and preparation for the opening of the metro. In this case, the UBMA needs the fund of 200 million USD, 30% of which will be from capital and 70% will be financed by loans.

On the other hand, option B does not require that the UBMC be responsible for the procurement but simply to fund the 50 million USD of opening expenses. In this case, rolling stock will be leased by a leasing company, newly established by the private sector. Thanks to this, the liabilities in the UBMC's balance sheet will be less, but the UBMC must pay a lease fee to the leasing company.

Which option should be taken naturally depends on the possibility of financing by investment and loans. In addition, the appropriate rate of the infra-rent fee also relies on the profitability of the UBMA and the rate is possibly a kind of subsidy by the government (refer to Chapter 10).

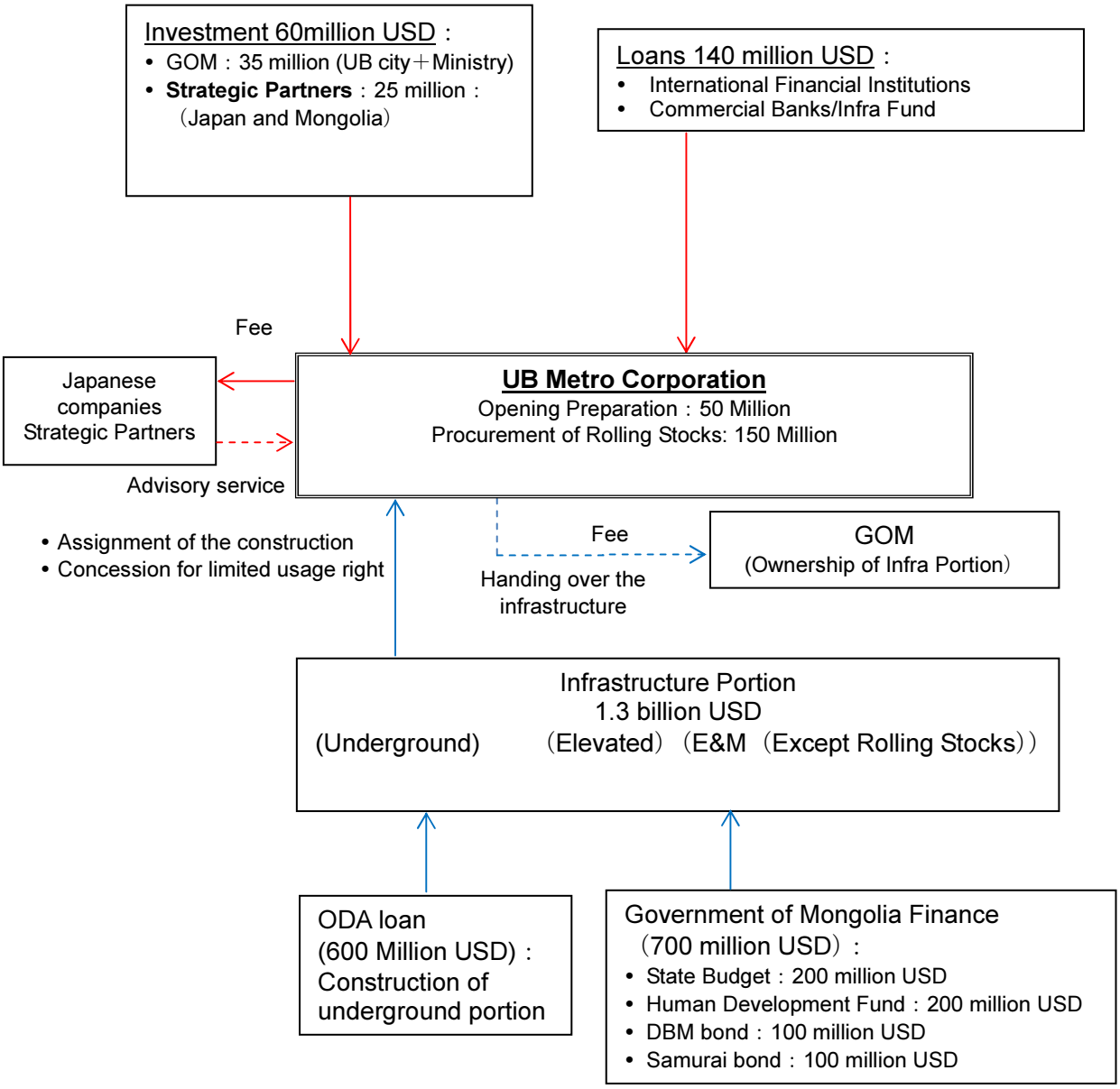


Figure 7.4.3 UB Metro Scheme (Draft) (Option A)

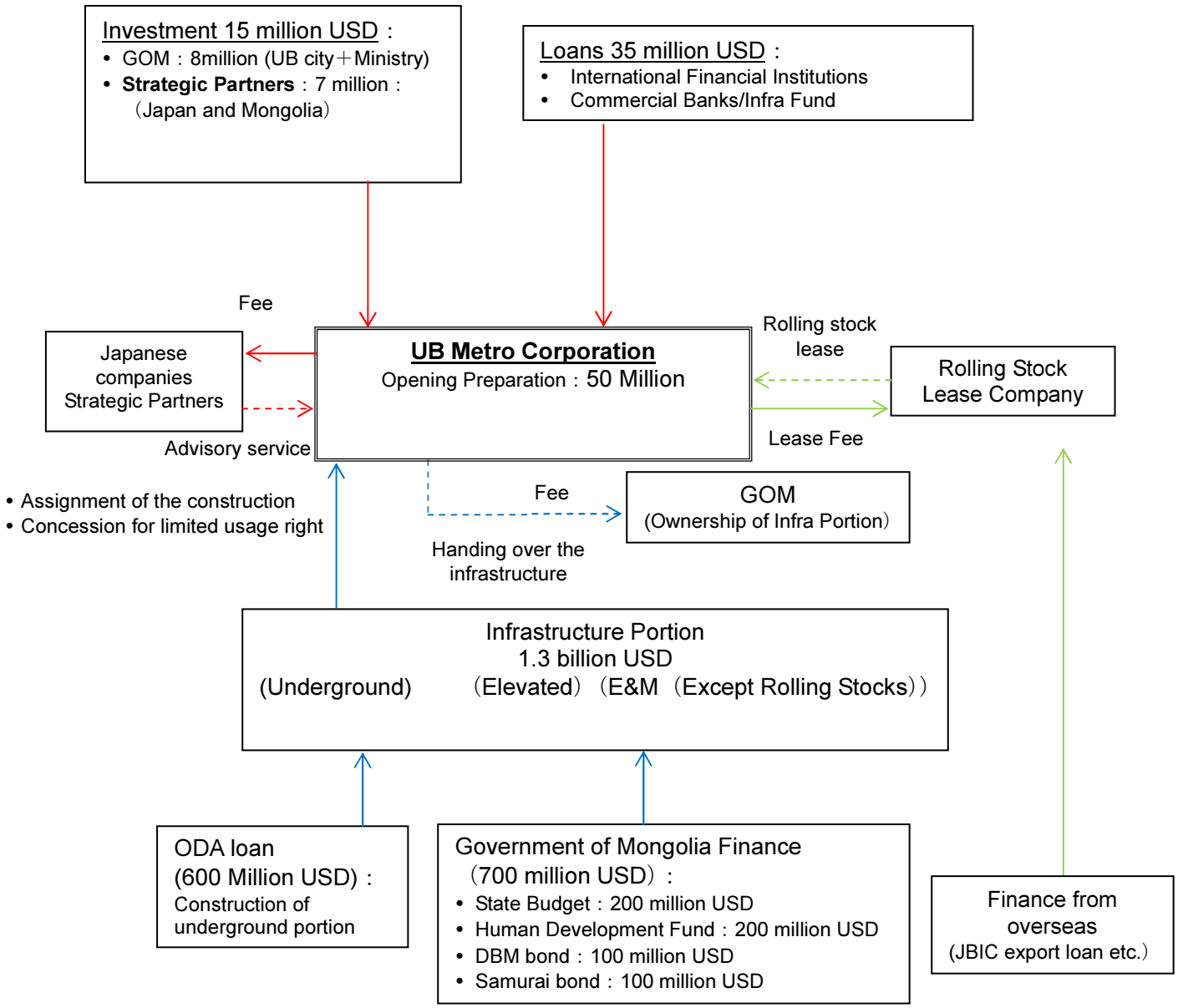


Figure 7.4.4 UB Metro Scheme (Draft) (Option B)

7.5. Overall Project Schedule

The overall project schedule greatly depends on how long a preparatory phase takes until the commencement of the construction. The construction phase takes at least four years and therefore it is necessary to be done with the preparation for the construction by the end of 2016, aiming the opening of the metro in 2020.

The critical point during the preparatory phase is a work for the preparation of the national budget of Mongolia and financing by ODA. At the same time, the schedule must consider administrative processes of Mongolia such as the amendment of the railway transportation law to introduce the urban railway system, budgeting and establishment of the UBMA, the approvals and permissions based on the concession law. The following is a schedule which considers a time span necessary for these processes and the detailed design, and has each step moves forward most efficiently (Figure 7.5.1).

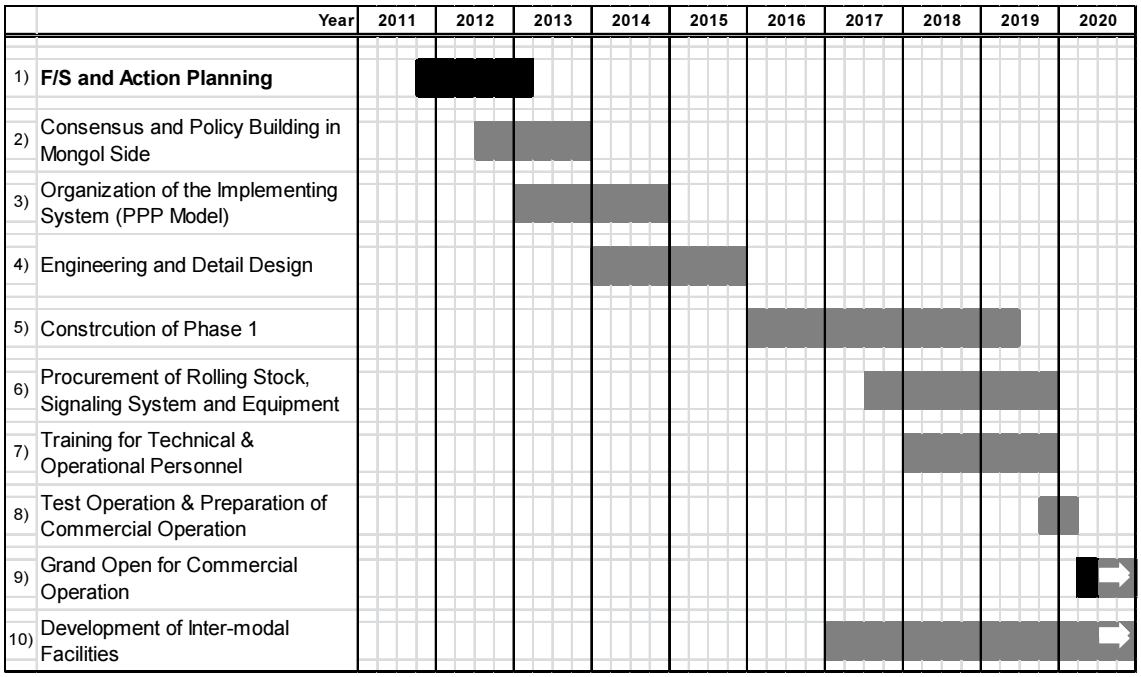


Figure 7.5.1 Overall Project Schedule (Draft)

8 Operation, Maintenance, and Management Structure

8 Operation, Maintenance, and Management Structure

The previous chapter examines an overall implementation scheme of the UB Metro and proposes the two-tiered public-main PPP scheme (public company scheme) as an optimal scheme. Based on this assumption, in this chapter, an optimal implementation scheme of operation and maintenance is examined.

8.1 Structure of Operation and Maintenance

The operator and the maintenance contractor's objective in developing the organizational structure should be to ensure that the organization will provide clear lines of formal communication and control, and effective informal communications (networking). The organization must also function smoothly both internally and in its relationship with its counterpart (UBMC/Contractor) and the various agencies that will be involved directly or indirectly with the project. Regarding the contract between those organizations, it must provide the correct balance of management and operational staff, the optimum numbers, and training for staff to ensure the technical and managerial success of the maintenance activities for the UB Metro.

Accordingly, the operator/maintenance contractor should take guiding principles in its organization structure and adopt the concept of fully integrated teams. The entire organization could be subdivided into management/administration and site maintenance groups.

An organizational chart of the operator (UBMC) is shown in Figure 8.1.1 and that of the maintenance contractor is shown in Figure 8.1.2, which is a suggested functional framework assuming a relatively large-scale maintenance operation can be introduced instead of individual facilities. Maintenance operators can be segmented depending on the subject, or alternatively, there is a great possibility that one section will directly supervise the operators; but whichever the case may be, the organizational development must be performed in order to implement a singular operations and maintenance structure from the total framework of the operators and maintenance operators.

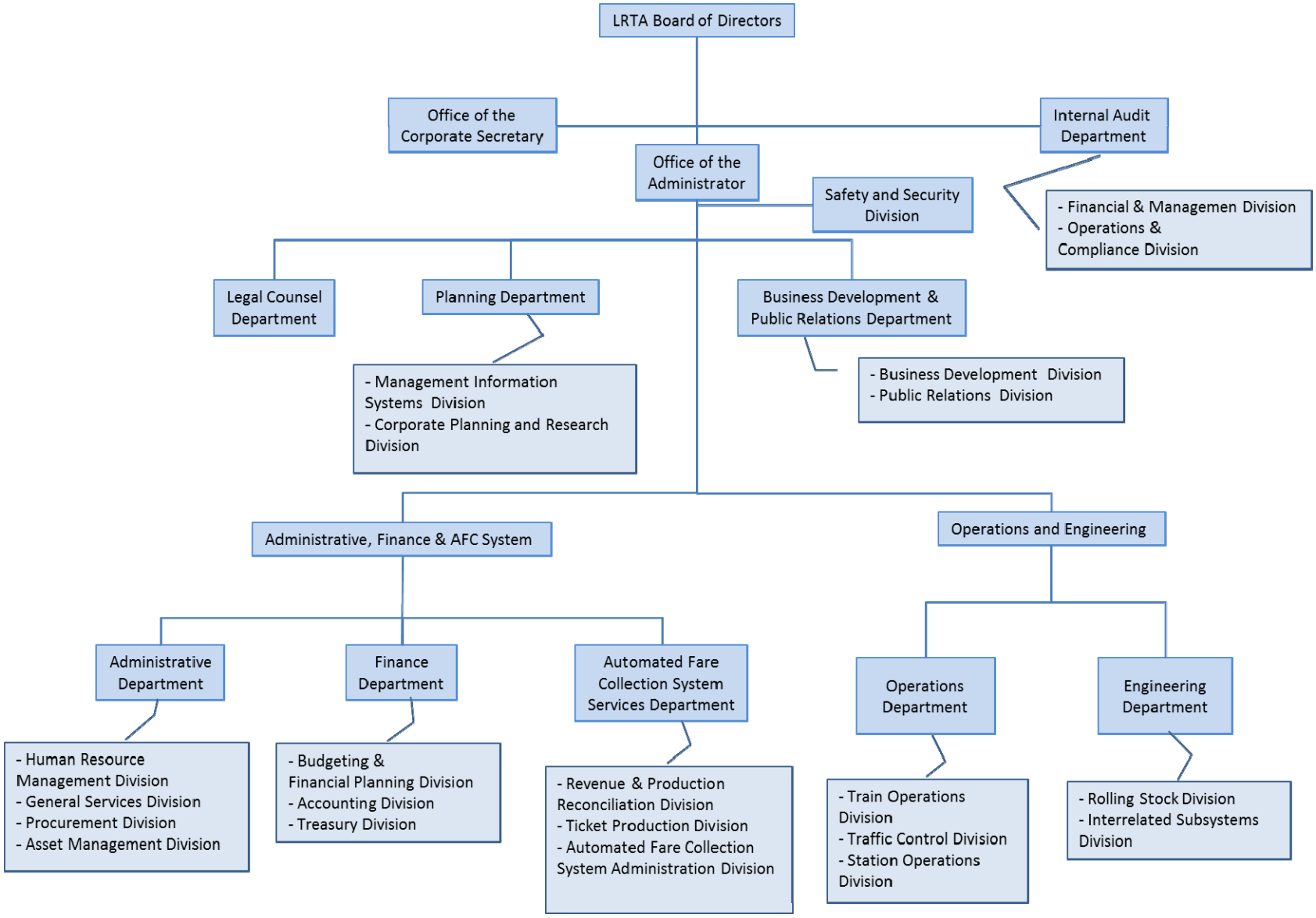


Figure 8.1.1 Organization Chart of Operator / Supervisory Agency

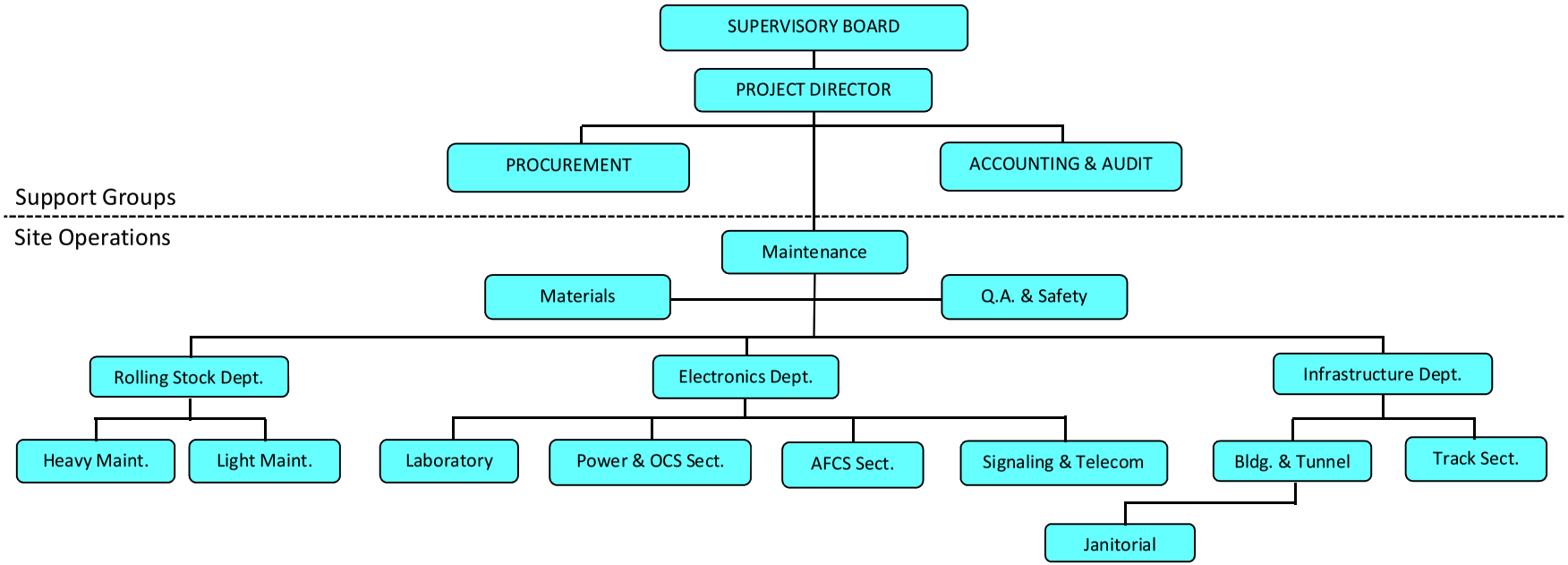


Figure 8.1.2 Organization Chart of Maintenance Contractor

8.2 O&M Cost for UM Metro

The Operation and Maintenance cost for the UMRT was estimated based on the Operation plan envisaged in Chapter 4. The parameters used to determine the cost are the track length, number of stations, number of trains, train-km/year, number of RSS, etc.

Except for electrical power rates, the prices of each item were estimated using current unit prices of existing railway system, in this case LRTA of Manila, which both countries have similar price level. Thus, no correction was made for unit prices.

The unit price and quantities used as the basis of the calculations, as well as the resulting yearly itemized breakdown of costs, are shown in Table 8.2.1.

Table 8.2.1 Operation & Maintenance Cost

Item/Year	Unit Price	Unit	2020		2030	
			Qty.	Cost	Qty.	Cost
Manpower				**11,650.5**		**12,116.2**
Administration, OCC, fixed	3,895.86	LS	1	3,895.9	1	3,895.9
Stations	186.15	Stations	14	2,606.2	14	2,606.2
Civil, Tracks	102.79	track km	17.64	1,813.2	17.64	1,813.2
Rolling Stock	93.14	trains	10	931.4	15	1,397.2
Power	49.92	No. of RSS	7	349.5	7	3495
Janitors	146.74	Stations	14	2,054.4	14	2,054.4
Spare Parts				**17,815.8**		**19,743.2**
Capital	8,769.96	train-km	1,468,001	12,874.3	1,648,282	14,455.4
Consumables	3,366.14	train-km	1,468,001	4,941.5	1,648,282	5,287.9
Power	3,733.44	train-km	1,468,001	**5,480.7**	1,648,282	**6,153.8**
Office Rental & Maintenance	0.36	m^2	2,700	**975.6**	2,700	**975.6**
Station Services	355.31	Stations	14	**4,974.4**	14	**4,974.4**
Total (Mill. MNT)				**40,897.0**		**43,963.2**
(Mill. US$)				**(29.2)**		**(31.4)**

8.3 Establishing the Operations and Maintenance System

On the assumption that the operation and maintenance organization will be an implementing agency as proposed in the previous section, steps in preparation for opening the UB Metro will be shown as follows.

8.3.1 Steps in Establishing the Operations and Maintenance System

(1) Planning/Basic Design Stage

The hardware plan for the railway is essentially something that must be decided based on what sort of operations in what kind of scheme will be implemented. Therefore, an entity which mainly carries out that operation is required when planning the railway.

Generally, in an urban railway, a local government authority will, based on urban transport policies, independently carry out facility planning based on an operations structure and a standard of provided services. However, Mongolia has no experience in operating urban railway systems and it is difficult for Ulaanbaatar city by itself make decisions.

On the other hand, as discussed so far in this chapter, in order to upgrade the UB Metro and make use of a variety of overseas knowledge, it is proposed to develop operations and establish a public company

"Metro Public Corporation (UBMC)" which would be comprised of the city and the external private sector combined into a single body. For the concept of a railway that aims to actualize and fulfill the role of an urban transportation railway in the future, operations must be developed using a structure decided by Ulaanbaatar city which is the principal shareholder of the UBMC, and is also ultimately the main planning body that will take advice from overseas businesses participating in the UBMC—based on their experience for upgrading and operating urban railways.

In order to implement this, the UBMC must be established prior to the planning stage of UB Metro. It is also preferable that a system is developed for possible discussions about an overall scheme, including the hardware plan by members who can fulfill the primary role of the UBMC from the initial stage.

Therefore, if it is firmly decided to develop the UB Metro, the UBMC or the UBMC preparatory organization (collectively referred to as the "UBMC") must be established as soon as possible. At this stage, the UBMA is assumed to be the minimum organization to make decisions in the future.

Furthermore, with the city and UBMC as the main body and with cooperation from the national government, it is necessary to implement the basic design and detailed planning of the UB Metro. After securing the investment necessary to address this kind of system and basic planning operation, a period of two years will be necessary to finish basic planning and start construction.

(2) Construction Bidding/Construction Management Stage

After the completion of basic planning and procurement of the necessary capital for construction, implementation of bidding and ordering and construction management will be conducted by the UBMC. At this stage, it is also necessary to procure the needed personnel in order to implement outsourcing of construction management as well as bidding.

Therefore, it is necessary to start the recruitment of personnel six months before the completion of basic planning, and when the basic planning is completed, it will only be necessary to secure the suitable personnel to transfer for bidding works.

Also, if operations and investment procurement is performed in an orderly manner, one year is required from the start of bidding until the commencement of construction, and the period for construction will be 4~5 years until completion.

(3) System expansion towards the start of business

Prior to the start of business operations, it will be necessary to train the personnel, particularly the 50 or more drivers require for 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.

The selection of personnel to be trained overseas must be in accordance with the training system of the concerned parties abroad. In this regard, the personnel will be required to speak the language of the corresponding country. On the assumption of training in Japan, for example, 10 Mongolian personnel will be selected and pursue one year of training in Japan with proper education allowing them to become instructors themselves. This would necessarily include Japanese language lessons. Subsequently, the personnel will train the drivers, including test drives at the start of operations for a part or section of the completed area. In case the period of training in Mongolia will take one year and the test drive will take six months to complete, training in Japan for the driving instructors will have to take place two and half years before the start of operations.

It will not be a problem if the training period in other areas is short compared to that of the drivers, but train control center personnel require six months training before the start of test-driving. There are 10 personnel, so a Japanese person will conduct training at the actual site. In order to be able to start training, recruitment will need to be done one year before starting operations. The training period for station

employees should take half a year from the start of test-driving. However, the number of personnel is more than 200, and therefore it is desirable that 20 personnel will be trained as instructors in Japan and the on-site training system will be developed. The training period for each instructor is assumed to be one month.

As for the required maintenance personnel, there will be no problem if training is started at the actual site from the time the test-drive commences. Therefore, like the station employees, the employment to secure the necessary number of maintenance personnel will be carried out half a year before the start of operations. However, two Japanese-speaking persons per area should be employed before that to undergo training in Japan.

Furthermore, regarding maintenance, it is necessary to decide what to do regarding the division of outsourcing and self-production as well as the assignment of outsourcing. In order to address this at the start of test-driving, it is necessary to proceed with preparations for each.

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 (see Figure 8.3.1).

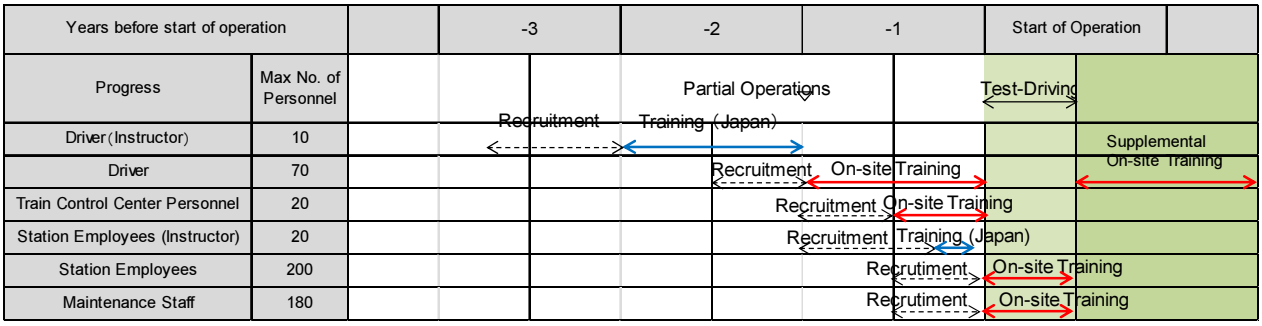


Figure 8.3.1 Schedule of personnel training for the start of operations

8.3.2 Costs for establishing the system as well as the transfer of know-how

The operational costs including the investment needed for supervision of operations after the start of business as well as to establish the system indicated in Figure 8.3.1 and before starting operation is indicated below.

Table 8.3.1 Operational Costs for the Preparation for Starting Operation

Cost Item	Years Before Operations Start							Years After Operations Start			
	7	6	5	4	3	2	1	1	2-4	5-9	10+
Japanese Personnel	5,330	5,330	5,330	5,330	5,830	9,080	10,080	10,420	9,000	5,170	0
On-site Personnel	1,830	1,830	2,330	2,330	2,500	3,250	8,080	11,650	11,650	11,650	12,120
Training cost in Japan	290	0	0	0	830	830	1,000	0	0	0	0
Electricity	0	0	0	0	0	670	3,740	5,480	5,480	5,480	6,150
Maintenance,Service & Others	670	670	830	1,170	1,670	4,170	16,070	23,770	23,770	23,770	25,690
Total (Mill.MNT)	8,120	7,830	8,490	8,830	10,830	18,000	38,970	51,320	49,900	46,070	43,960
Total (Mill.US$)	5.8	5.6	6.1	6.3	7.7	12.9	27.8	36.7	35.6	32.9	31.4

8.4 Legal Issues related to the Construction, Operation, and Maintenance of UM Metro

8.4.1 Important procedures in the current Railway Transportation Law

(1) Special permission for the support of railway transport services (Article 16)

The required permission from the government in the Railway Transportation Law is to acquire a special permit as stated in Article 16. The permit is divided into three items: construction and use of fundamental structures; production and assembly of fundamental and operating structures; and repair and operation.

Aside from what is determined by Article 11 of the "Special Business Permit Law", the entirety of the permit includes permits from "General F/S" and "Special permit regarding the operation of possessed railway facility, notarized certified copy." In addition, for the construction and use of basic structural materials, an "Environmental Impact Evaluation," "Investment Scale/Method of Procuring Investment," and "Starting Business Period/Borders of Occupied Land" must be created.

After the acceptance of these by a governmental agency, safety and performance checks will be made to comply with standards and regulations, and after confirming that there is no problem concerning environmental damage, a permit will be issued. A detailed explanation of the blueprints will be necessary in order to carry out these inspections; therefore a submission will needed although not mentioned in the law.

(2) Technical standards (Article 17)

The fundamentals of technical standards is set by the government, but as a special case such as "if it is not against regulations and producer and consumer interests, and not harmful to domestic safety, public interest, public health, and the natural environment," international standards or overseas excellence standards can be used with the permission of the government. In order to develop the technical standards for urban railways such as the Metro, the assistance from the experienced countries is essential.

(3) Others

Aside from the above, procedures such as the receipt of a certificate for construction and operation of the section related to railway transport safety (12.4.5), supervision of railway construction expansion and new additions (12.4.6), the approval of a "route map" important in coordinating routes (25.1), registration of management machines for important route maintenance (25.4), preparation of a duty roster related to safety (12.4.9), supervision of carriage fees/service area/contract modification (12.4.3), and creation of a database for railway transport area statistics (12.4.10) will be required with the authority of a government agency.

These procedures and the important areas that have jurisdiction over the Metro will need to be coordinated later because the current law basically does not have urban railways and independently operated railways in mind.

8.4.2 Challenges for the Metro Construction and Operation in the Current Railway Transport 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.

Also, because technical standards are essentially established by the national government, it should be checked, reviewed, upgraded and arranged so that it is possible to accept international standards and overseas standards as applicable in a special case. There is a worry that delay in an upgrade to technical standards will lead to a delay in operations, so if this article is invoked, even without possessing the government's upgrade standard, there is a strong possibility of compliance with the application of the special case[1] .

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.

[1] The area of "overseas" meaning is unclear and it must be a complete copy of overseas standards.

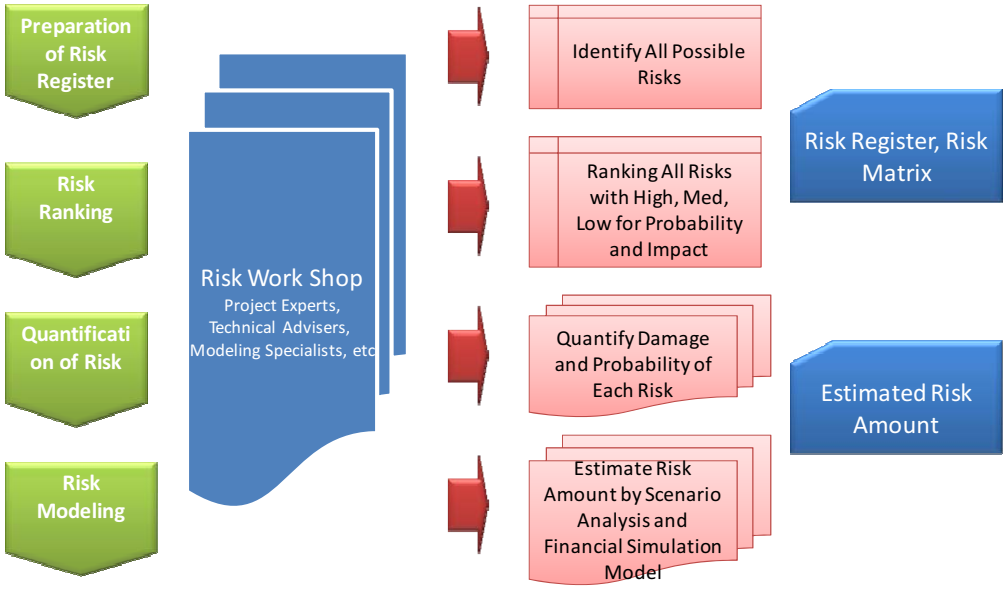
9 Project Risk Analysis and Security Package

9 Project Risk Analysis and Security Package

9.1 Methodology for Risk Analysis

9.1.1 Steps of Risk Analysis

The risk analysis of this study was conducted on the basis of the procedures as illustrated in the figure below: (i) Identifying and listing up all the possible project risks; (ii) Ranking those risks; (iii) Quantifying those risks; and (iv) Incorporating those possible risks into financial simulation model .

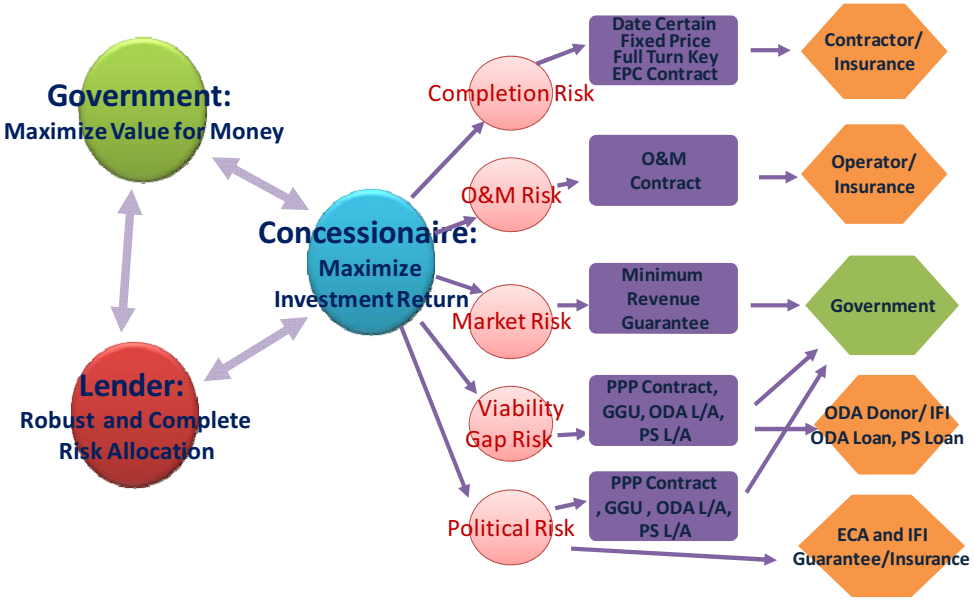


Source: JICA Study Team

Figure 9.1.1 Steps of Risk Analysis

9.1.2 Methodology for Risk Allocation

Risk allocation of PPP project, as illustrated in the following figure, aims to make adjustment with three major stakeholders who have opposing interests, and to consider how individual project risks such as completion risks, O&M risks, market risk, viability gap risk, political risk and so on, are managed by reflecting risk management measures in project contract, procuring various guarantees, and protecting it by insurance, etc. It is a process in which a private sector concessionaire is to make adjustment of requests and requirement from both the public sector and financier, and to allocate individual risks to various stakeholders through contracts, insurances and guarantees.



Source: JICA Study Team

Figure 9.1.2 Methodology for Risk Allocation

9.2 Risk Management Measures for Major Project Risks

9.2.1 Major Risks for PPP Metro Project

The following figure shows general perception of important risks in a PPP Metro project. The following risks are considered important:

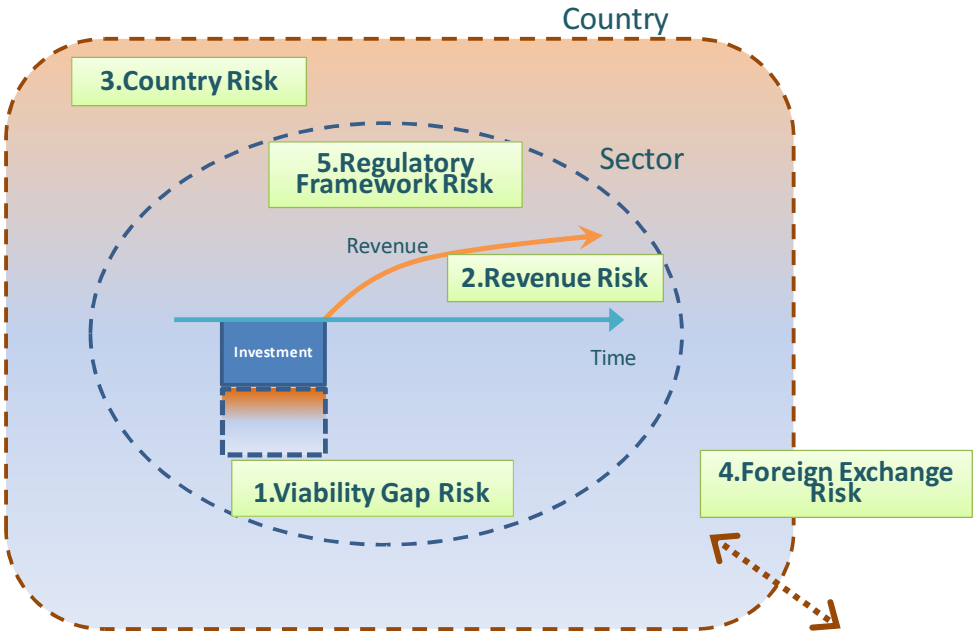
(1) Viability Gap Risk

(2) Revenue Risk

(3) Country Risk

(4) Foreign Exchange Risk

(5) Regulatory Framework Risk



Source: JICA Study Team

Figure 9.2.1 Major Risks of PPP Metro Project

9.2.2 Viability Gap Risk

The most important project risk is the financial Viability Gap Risk. A Metro project could bring about significantly large economic benefit and could contribute to economic growth of that area. For example, the Economic IRR calculated for this project is over 15%[1], which tells that although its investment is huge, the economic benefit is also huge.

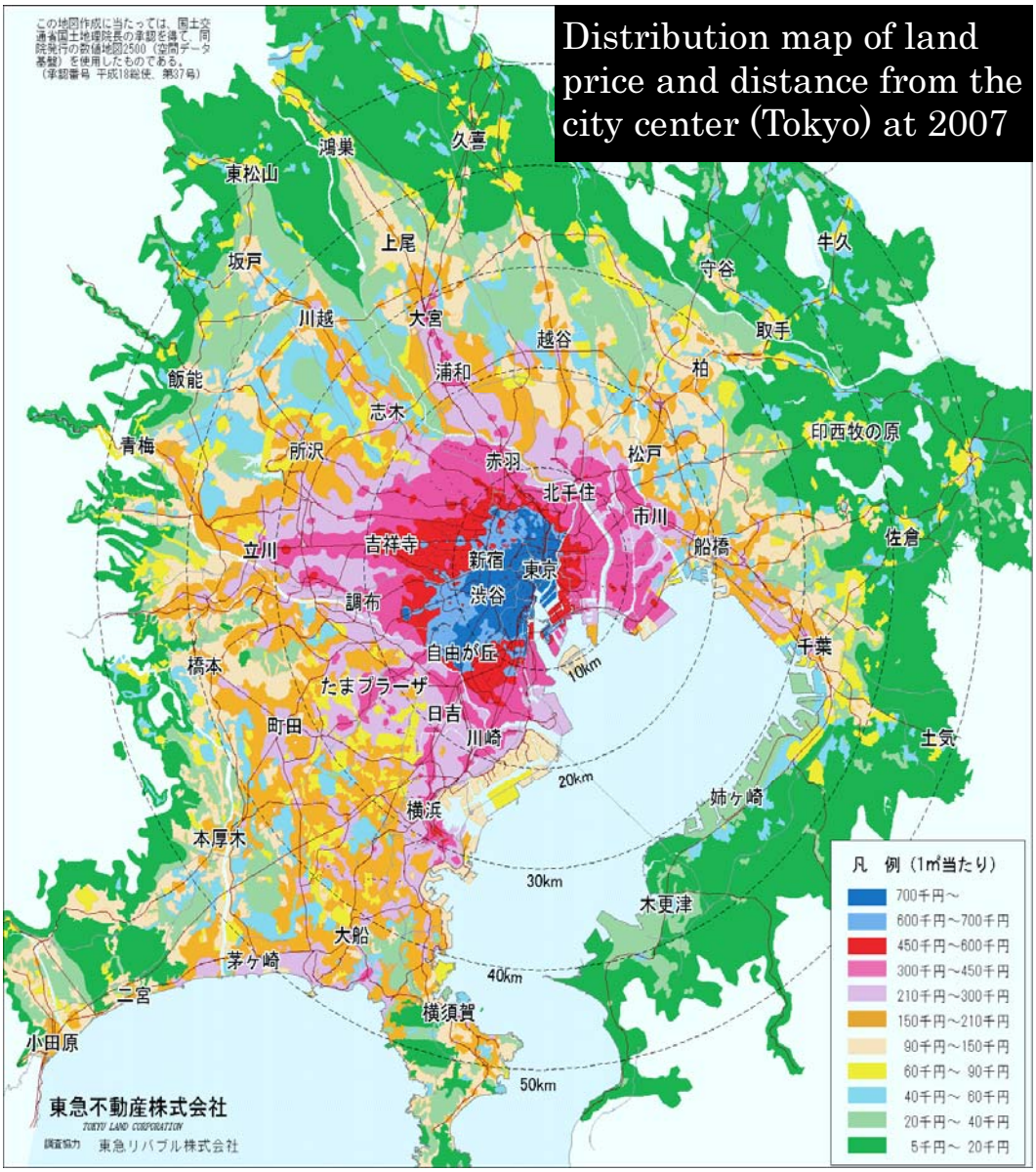
Source: Study Team

Figure 9.2.2 Large Benefit of Metro Project

The following figure shows the distribution of land in terms of price in Tokyo Region. High-price land areas radiate along the railway lines forming a human hand shape. As such, a railway line could facilitate economic activities; thus a raise in land prices along the railway line.

[1] Refer to Chapter 10 for details about EIRR.

This is one of the proofs that a metro project could bring about large economic benefits.

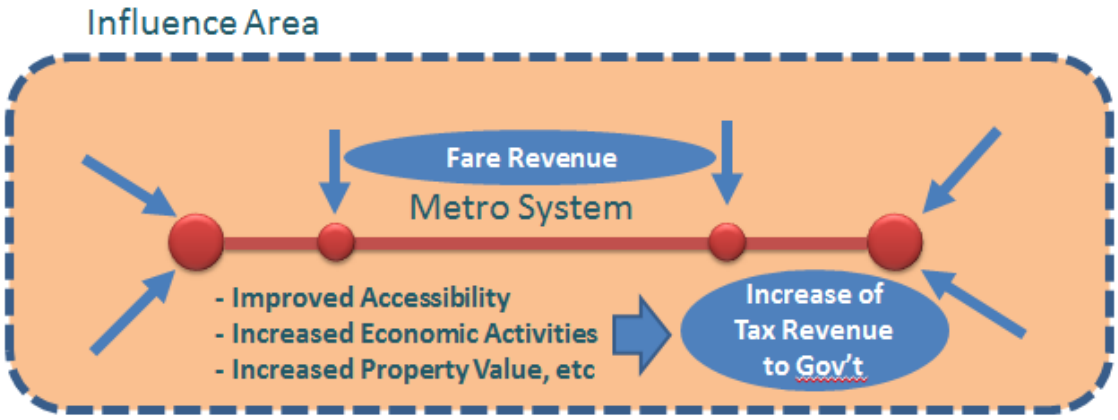


Source: JICA Study Team

Figure 9.2.3 Distribution Map of Land Price along railway lines in Tokyo Region

However, a metro project has two different kinds of benefits. As described earlier, the total benefit of the metro project is huge but the fare revenue which a metro company would directly receive is not that large. The benefit other than the fare revenue from the metro users is the activation of the economy of that area and this benefit is to be ultimately recovered by the government in the form of increased tax revenue[2] as illustrated in the following figure.

[2] Refer to Chapter 5 for details about the expected tax revenue by the metro project.



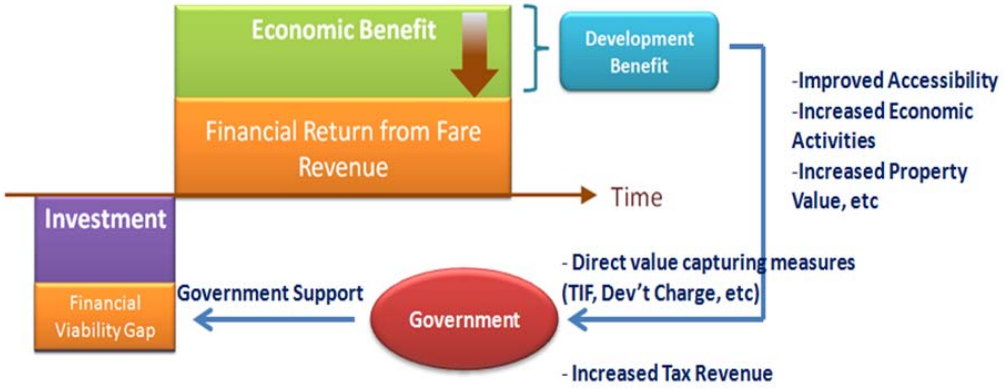
- **Fare Revenue** form Metro Users = **Direct Revenue** from Metro System => Small to cover full investment
- **Increase of Tax Revenue** to Government from Residents and Companies in the Metro Corridor
  - VAT from Property and other Business Transactions
  - Land related Tax and Fee
  - Corporate Income Tax, etc

Source: JICA Study Team

Figure 9.2.4 Two Kinds of Benefit of Metro Project

Huge initial investment of metro project is difficult to be recovered through only the direct fare revenue from the metro users, the situation in which a metro project has (Financial) Viability Gap risk. Therefore, in order to invite the private sector to participate in the metro project, the government must extend financial support for the initial investment ("extend viability gap funding" in PPP term), considering future recovery of this huge viability gap funding through the expected benefit. Increased tax revenue in the future is the primary source of this investment recovery and application of various value capturing methods are the secondary source of the investment recovery.

In any means, the government must finance most of the initial investments of the metro PPP project. The government should not heavily depend on the funding from overseas such as ODA money which has potential foreign exchange risk, but should consider how much of that huge initial investment, including the increased tax revenue in the future, could be financed by domestic funding sources in a responsible manner.

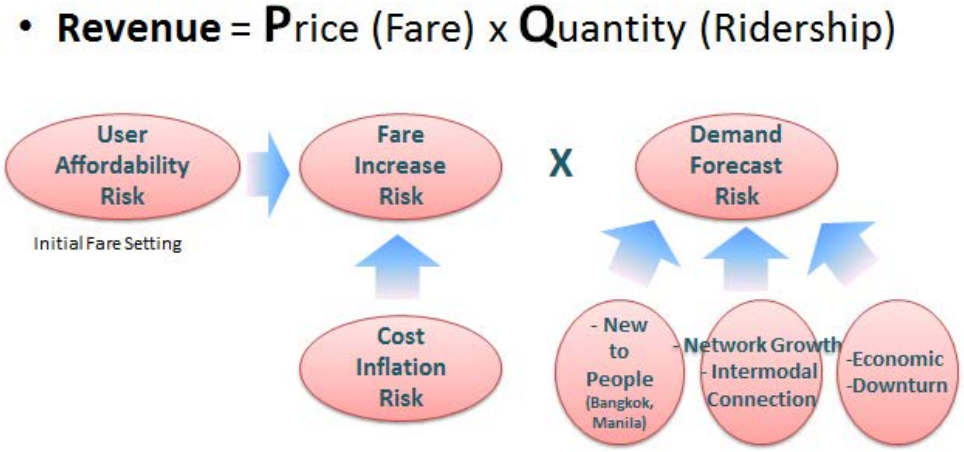


Source: JICA Study Team

Figure 9.2.5 Government Support for Viability Gap Risk and Value Capturing of Development Benefit

9.2.3 Revenue Risk

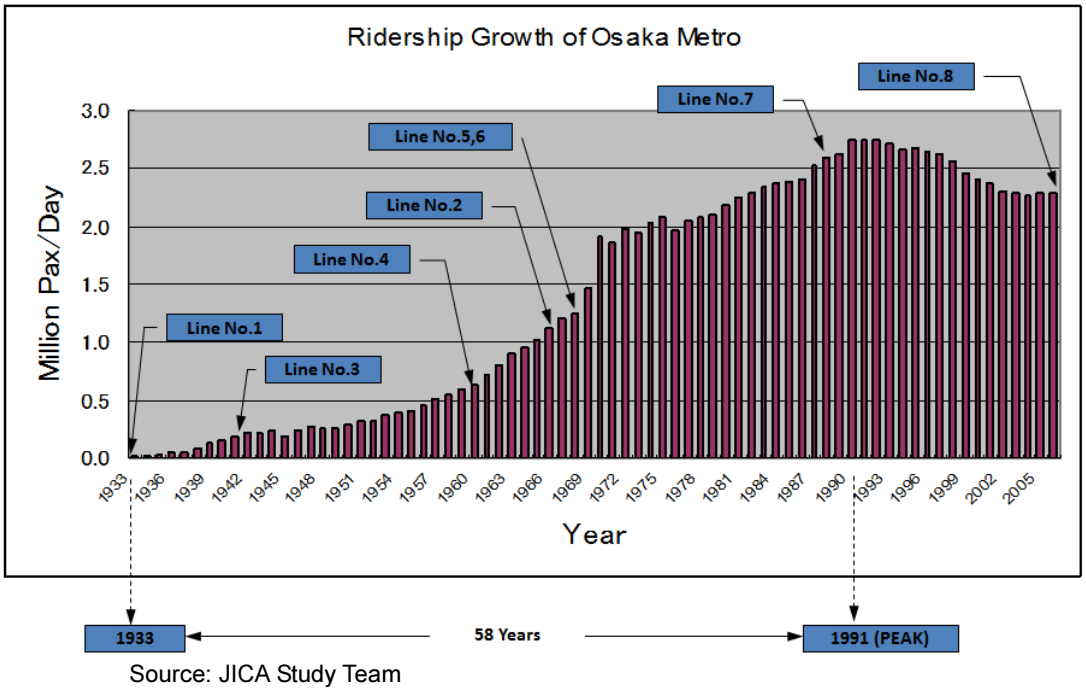
The second important thing is the management of revenue risk. As illustrated in the following figure, revenue is calculated by multiplying P (Price: Fare) with Q (Quantity: Number of users). The change in revenue, however, is affected by various factors. In the first place, there is a risk of initial fare setting considering affordability of metro users. This risk is about whether the user could pay the fare level set by metro company without problem or not. To mitigate this risk, various detailed analyses should be taken into consideration such as comparison analysis of metro fare levels among neighboring countries, survey on willingness to pay for potential metro users, comparison of the current bus fare level, ridership forecast simulation based on the time value, and so on. If the fare level could not be increased as scheduled, constant cost increase based on inflation would eat up profit and a severe business problem would occur. There is also a risk of ramping up ridership as the metro is a completely new transport mode to people (it means that ridership forecast based on the past trend is impossible). Bad linkage and connection with other public transport modes and networks could give negative effects to the growth of ridership while stagnant economy could slow down the growth of ridership, etc. As such, revenue risk is a very complex project risk which could be affected by various factors.



Source: JICA Study Team

Figure 9.2.6 Revenue Risk of Metro Project

The following figure shows the increase of ridership of Osaka Metro in Japan. The ridership growth is illustrated as the first line is connected with other newlines (as the network was being formulated). Osaka Metro had taken 60 years to formulate and mature its metro network. In a similar manner, connection of UB metro with Bus Rapid Transit (BRT) and feeder bus routes, and development of inter modal facilities at the metro stations could be closely related with the network formulation and the revenue risk of the UB metro.



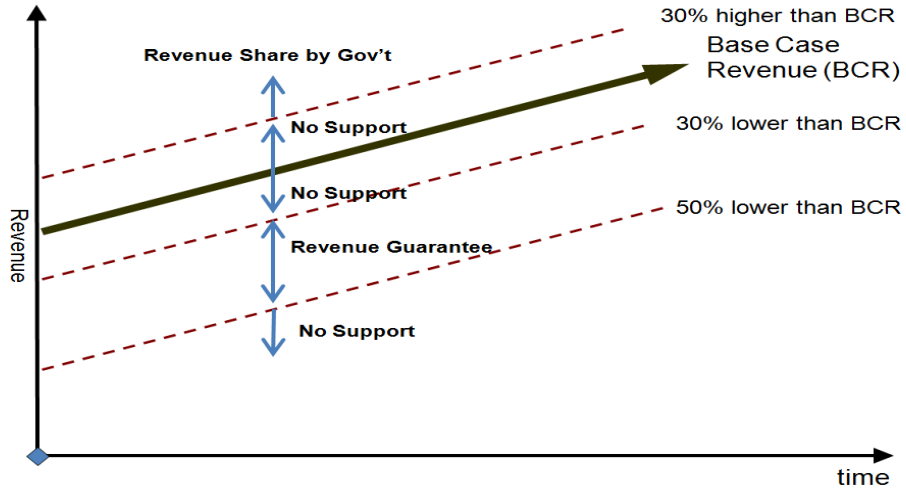
Source: JICA Study Team

Figure 9.2.7 Transition of Network Formulation and Growth of Ridership for Osaka Metro

Popular risk mitigation measure for this complex revenue risk of a green field metro project for the sake of private investors is a Minimum Revenue Guarantee Mechanism. As illustrated in the Figure 9.2.8, Base Case Revenue (BCR) line is set on the basis of base case ridership forecast which is agreed between the public and the private. If actual revenue is lower than 30%[3] from BCR, the government guarantee is triggered to make compensation payment for the insufficient amount to SPC.

There are also other risk mitigation measures such as property development rights along the metro line, subsidy mechanism by the government for renewal investment by SPC, and so on.

[3] BCR is generally set for a certain period such as 10 years since the commencement of the operations because the amount is decided based on the standard which covers at least the amount of debt service and the minimum revenue guarantee is a mechanism to cover risks when the business starts up. In the case of highway and urban railway projects on Korea, BCR started with 20% (the government takes more risks) and it finally reached 30% through trials and errors.



Source: JICA Study Team

Figure 9.2.8 Minimum Revenue Guarantee Scheme

9.2.4 Country Risk

The country risk of this project is explained in this section. Country rating of foreign currency borrowing for Mongolia is currently Single B 1. As explained in the footnote of the following table, this rating level is four notches below the speculative rating, which means that this is the level at which foreign currency commercial loan from overseas is very difficult to be given especially to domestic currency revenue generating projects in Mongolia.

With this kind of country rating, it is necessary for domestic currency generating projects like the metro project to procure long term financing in foreign currency to cover the project risks by getting various support and risk covering measures from creditworthy foreign countries, loans and guarantees from International Financial Institutions (IFIs) such as World Bank and ADB and from Export Credit Agencies (ECAs) of donor countries. By doing this, international commercial banks could start examining the financing of the project.

Table 9.2.1 Country Rating of Foreign Currency Borrowing for Mongolia

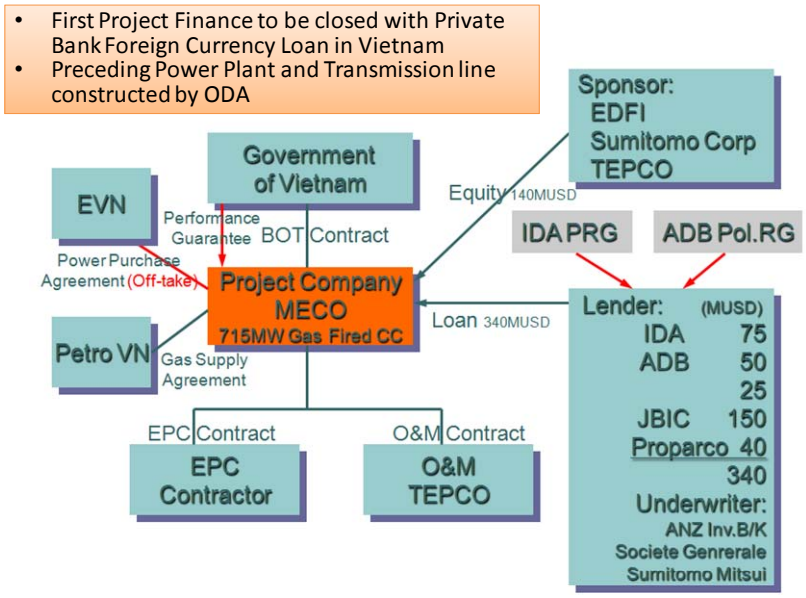
Country	Country Rating (Moody's 2012.2.13)	GNI /Capita (2010 in US$)
China	Aa3	7,640
Korea	A1	29,010
Russia	Baa1	19,190
Kazakhstan	Baa2	10,770
India	Baa3	3,550
Mongolia	B1	3,670
Ukraine	B2	6,620
Vietnam	B1	3,070

Note: Aaa>Aa>A>Baa>Speculative>Ba>B>Caa>Ca>C (1>2>3)

Source: JICA Study Team

An example of such country risk covering for commercial financing is shown in the following figure, which shows the first power generating project in Vietnam successfully procuring long term commercial project finance loans in foreign currency. As illustrated in the figure, World

Bank, ADB, JBIC and Proparco extended long term loans and guarantees, but only 10% of the total debt was able to be financed by the commercial loan. Mongolia has the same rating as Vietnam, thus it is necessary to structure the finance in similar manner of country risk covering in order to procure long term project finance commercial loan in foreign currency.



Source: JICA Study Team

Figure 9.2.9 Example of Country Risk Cover in Structuring Project Finance (BOT type power generation project in Vietnam)

There are various finances, insurances and guarantees of different IFIs and ECAs as shown in the following table for covering political risk (such as foreign exchange regulation, change of law/regulation, expropriation, requisition, nationalization, general strike, civil war, war, breach of contract and obligation by government owned entity, etc), a part of country risk.

Table 9.2.2 Support Programs of IFIs and ECAs

Major Support Programs by ECAs for Infrastructure Development Project in Developing Countries

	Name of the Organization	Category	Support Program				
			Equity	Loan	Investment Insurance	Loan Guarantee /Insurance	Coverage of guarantee/insurance
ADB	Asian Development Bank	International Financial Institutions	O	O	O	O (Guarantee)	◆ Political risk guarantee and partial credit guarantee ◆ Political risk guarantee covering four major political risk (*)
MIGA	Multilateral Investment Guarantee Agency	International Financial Institutions			O	O (Guarantee)	◆ Political risk guarantee covering four major political risk (*)
IFC	International Finance Corporation	International Financial Institutions	O	O		O (Guarantee)	◆ Partial risk guarantee
OPIC	Overseas Private Investment Corporation	Export Credit Agencies (US)		O	O	O (Insurance)	◆ Political risk insurance ◆ Covering political violence, expropriation /nationalization, regulation on transfer or exchange of foreign currencies, generally
JBIC	Japan Bank for International Cooperation	Export Credit Agencies (Japan)	O	O	(**)	O (Guarantee)	◆ Political risk guarantee is common in project finance. ◆ Covering four major political risk
NEXI	Nippon Export and Investment Insurance	Export Credit Agencies (Japan)			O	O (Insurance)	◆ Loan insurance covering credit risk in addition to political risk ◆ Covering four major political risk

(*) ①Political violence such as War and Civil-war (although coverage depends on agencies, ②Expropriation/ nationalization, ③Regulation on transfer or exchange of foreign currencies, ④Breach of contract (whose coverage depends on agencies)
(**) As for the equity back finance, "Political risk immunized" loan program is available which indulgence of loan repayment when nonpayment of dividend occurs.

Source: Integrated by JICA Study Team

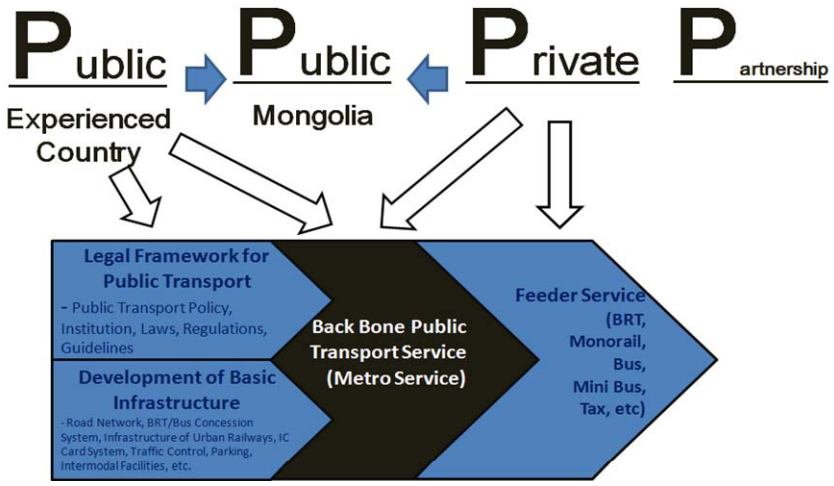
9.2.5 Foreign Exchange Risk

Metro project is a domestic currency revenue generating project. If the project procures foreign currency financing, foreign exchange risk must be considered in repayment of that financing. There exists foreign exchange risk also in procuring equipment and rolling stock which are often manufactured abroad. Depreciation rate of MNT against JPY is about 7% per annum in the last 10 years, and against USD at about 2% per annum. This is foreign exchange risk. In order to mitigate this risk, the following measures may be adopted: i) lending loan with premium interest in domestic currency of local bank which is back financed by foreign banks in foreign currency for the same project; ii) utilization of NEXI's foreign exchange insurance; and iii) utilization of a domestic currency loan from Development Bank of Mongolia.

9.2.6 Regulatory Framework Risk

Another important risk is regulatory framework risk. As the metro project is initiated and controlled by the public sector, the following expertise and know-how must be required from the public sector side, as illustrated in Figure 9.2.10 : (i) Legal framework (public transport policy and institutional/organizational frameworks in which the metro project is appropriately positioned, necessary set of laws, regulations, standards and guidelines); and (ii) Basic infrastructure development (road network considering public transport, development of necessary infrastructure for BRT, bus route network, urban railway infrastructure, common IC card system, traffic management system, a parking system, intermodal facilities, etc).

However, the metro project is very new to Mongolia, thus no such expertise and know-how in the public sector of Mongolia can be expected. This is considered a large project risk to the private sector. Therefore, it is essential to mitigate this risk for the Mongolian Government to form a strategic partnership with the public sector of metro experienced country, thus the metro project is considered as PPPP (Public, Public and Private Partnership) project.



Source: JICA Study Team

Figure 9.2.10 Metro Project is PPPP

Another regulatory framework risk is the immature development of implementation system and capability for a PPP project on the government side. In order to implement a PPP project, sufficient accumulation of various specific expertise and human resources are essential on the public side such as expertise in project structuring, tender preparation, contract negotiation and

so on. At least ten (10) years may be necessary to develop such expertise and implementation system in the government considering the time the experienced countries such as UK and Japan spent for developing their capabilities.

In order to mitigate such risk in Mongolia, at least the following technical and financial assistances from the metro and PPP experienced country should be provided:

(i) Formulation of a road map for developing regulatory framework and implementation system/ human resources
(ii) On the basis of above development, necessary expertise and human resources development
(iii) Implementation of activities in accordance with the road map and plans above possibly by sector wise and local government wise, especially UB City
(iv) Preparation of basic guidelines for task process and for specific subject
(v) Preparation of standard contract and guidelines
(vi) Policy, guidelines and methodology for viability gap funding and procurement method for funding resources

By all means, formation of a strategic partnership with the public side of the experienced country is a prerequisite for mitigating such regulatory framework risk.

The above mentioned risk mitigation and management measures are essential to implement the metro project in Mongolia. However, the details of each risk mitigation measure could vary depending on the kind of project scheme and project implementation body is adopted. The risk mitigation measures mentioned in this section are described on the basis of "UB Metro Public Corporation (UBMC)[4]" scheme which is proposed in this study.

9.3 Risk Management Issues for the UB Metro Corporation based on the Two-tiered System

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. The operation portion of the metro then aims to become a "corporation form" in order to cover "total expenses" by "revenue", and along the process (i) to expand revenue autonomously, (ii) to save expenses efficiently, and (iii) to generate profit, to achieve economic efficiency of the metro operations.

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. It is also essential to prepare the contractual arrangement for the UBMC in order to secure the sustainable company management and operations based on independence and self-sustainability.

Furthermore, there may be many conditions to be agreed between the Mongolian Government

[4] For details about the UBMC, refer to Chapters 7 and 8.

and the UBMC, thus a specific project agreement regarding the metro operation and management should be entered into between the government and the UBMC, in addition to the legal establishment procedure of the company.

(2) Agreement of Government Guarantee and Undertaking (GGU)

If the UBMC is to be operated and managed independently and autonomously and to secure the financial sustainability based on the two-tiered system, 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. The purpose of the agreement is to stipulate and secure the supports 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, force majeure risk and so on. Details will be discussed in the following section of the Security Package.

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

Since the basic assumption of the financing for the infrastructure portion is to utilize the public funds including ODA fund, without viability of such public funding, no commitment by financier will be secured for E & M portion including the rolling stock which is obligated by the UBMC. 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 the E&M portion obligated by the UBMC.

(4) Management of Construction for the Two-tiered System

One of the critical risks pertaining to the two-tiered system is that the efficient operation and management would be hindered by the Metro's hardware facilities (the infrastructure portion) for which the intention and know-how of the private sector has not been effectively reflected. It is essential for the UBMC to secure such a position 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

If the completion for the construction of the infrastructure portion through the government funding is delayed, the scheduled generation of revenue by the UBMC would also be delayed and in turn affect the cash flow of the UBMC to a large extent. Therefore, this risk of the delay 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)

Regarding the establishment of UBMC, it would be preferable in terms of the accumulation of know-how to first establish specific "Task Force for UB Metro Preparation" or "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 (such as design, construction, procurement, construction supervision, opening, operation, maintenance, etc.) enters into the 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 political reasons and others. It is also necessary to stipulate in the project contract specific compensation conditions if such fare revision risk is to be materialized due to the reasons of the government.

(8) Application of Minimum Revenue Guarantee Mechanism

Revenue risk occurs with the combination of the complicated causes and it is specifically difficult to control during the launching period of the metro business. In case of two-tiered system, it seems extremely difficult for the UBMC to procure commercial financing for its procurement of rolling stock without the application of some kind of the minimum revenue guarantee mechanism at least during the initial phase of the operation especially if it is a green field metro project and the first metro project in the country. Therefore, it is preferable for the Mongolian Government to examine thoroughly the possibility of applying this mechanism from the beginning. The mechanism is outlined in 9.2.2.

(9) Subsidy Mechanism for Additional Investment

The implementation mechanism proposed in this report is a mechanism to minimize the provision of subsidy from the Mongolian Government to the UBMC. However, it is necessary to examine and prepare also 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 Usage (Lease) Fee

It is preferable to pool the payment of the infrastructure usage (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 to have a master plan for the district development which is to be prepared by the public side, for the adjustment of the station plaza development along the Metro corridor. This master plan should include the connection function of inter-modal facilities, coordination with BRT and trunk bus routes as basic conditions for the adjustment. It is preferable that UB City government initiate the tender for the development of the station plaza area on the basis of the master plan. UB Metro Corporation must 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.

Therefore it is preferable that this kind of master plan of the station plaza development should be prepared prior to the establishment and project contract of UB Metro Corporation.

(12) Adjustment for the Risks of Initial Phase of Operation

Various project risks are expected in the initial phase of operation. Especially if the project is a green field metro project and the first one in Mongolia, many things may not be materialized as

assumed. It may be worthwhile to examine an adjustment mechanism for the risks in the initial phase of the operation 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.

10 Economic and Financial Analysis

10 Economic and Financial Analysis

10.1 Economic Analysis

10.1.1 Objective and Method of Economic Analysis

The economic analysis is to determine whether a proposed public infrastructure project deserves investment of public monies. The concept 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 costs (VOC) and travel time costs (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.

- Metro user's benefit: reduction in vehicle operating cost (VOC) and savings in travel time cost (TTC) due to Metro use (shift from private/public transport on road to Metro).
- Road user's benefit along Metro Corridor: reduction in traffic congestion on the existing road (along Metro corridor), as can be seen in increases in travel speeds and reduction in VOCs.

10.1.2 Conditions of Economic Analysis

Economic Analysis is conducted by comparing with/without Metro, based on the condition of new roads development (proposed by UBMPS and planned by UB City) and restructuring of the bus route network (without other mass rapid transit and highways).

Basic preconditions are as follows:

- Project period: starting from 2013, opening in 2020
- Operation and maintenance cost: 1.5%/year of the total project cost
- Social Discount Ratio: as the opportunity cost of capital, 12% per annum is assumed as the social discount rate (benchmark year is 2014 when construction will start)
- Project life: 2049 after 30 years of opening
- Exchange Rate: 1 US$ = 1,700 Tg, 1 US$ = 100 Japanese Yen
- Fare system: 200Tg+(km-2)x50Tg (200Tg within 2km distance, 50Tg/ km over than 2km)

EIRR was compared under two cases below:

1) by project cost options
2) by fare system options

10.1.3 Estimation of Economic Benefit

1) VOC: Vehicle Operation Cost

The savings in VOC is one of the major sources of economic benefits in transport projects. The most important is that the VOC should be a function of vehicle speed so that the improvement of road conditions would be duly reflected as an economic benefit.

Table 10.1.1 VOC (US$/1000km)

Average Speed (km/h)	Private Transport	Public Transport
5	467.7	326.8
10	268.8	184.3
20	165.8	110.8
30	130.0	86.4
40	111.1	73.3
50	102.0	68.4
60	100.2	68.2
70	101.2	70.4
80	104.6	74.3
90	110.6	79.0

Source: JICA Study Team

2) VOT: Value of Time

The savings in passenger time cost is another major source of economic benefit of transport projects. The following table presents the unit value of time assumed by the result of the Stated Preferences (SP) survey. VOT of private transport users is more than twice that of public transport users.

Table 10.1.2 VOT (US$/h)

Year	2011	2020	2030
Private Transport	0.832	1.596	3.081
Public Transport	0.378	0.725	1.399

Source: JICA Study Team

3) Estimation of Economic Benefits

By applying the above unit costs to the results of traffic demand and summing VOC and TTC, aggregated transportation cost was estimated. Economic benefit is the difference of the aggregate costs between “with project” and “without project” cases. Table 10.1.3 shows the estimated economic benefits of benchmark years (in the case of the project costing 170 billion yen). In 2020, the opening year, about 70% of the benefit will be travel time cost savings.

Table 10.1.3 Economic Benefits of Benchmark Years

Year	Economic Benefit (mil. US$)		
	TTC Saving	VOC Saving	Total
2020	67.06	29.15	96.22
2025	259.33	30.73	290.06
2030	451.59	32.31	483.89
2031	490.04	32.62	522.66
2035	643.85	33.88	677.73
2040	836.11	35.46	871.57

Source: JICA Study Team

10.1.4 Comparison of Project Cost Option

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 the main constructions and procurements (Japan core case)

As for Option 3, it is assumed that Japanese firms would get involved into civil and architectural works for the underground section (by shield method), procurements of signals and telecommunications, the safety system and rolling stock.

The coverage of economic analysis is the infrastructure including (i) all civil engineering (underground and elevated), (ii) depot, station, air condition of Electronic and Mechanical (E&M), (iii) all railway truck (installment, depot + railroad siding). EIRR was estimated based on the project costs of 1.321 billion of Option 1, .0987 billion of Option 2, and 1.111 billion of Option 3.

Table 10.1.4 Cost of Infrastructure, EIRR and NPV by Project Cost Option

		Option 1: Base case	Option 2: Competition	Option 3: Japanese core
Infrastructure cost*	(Million USD)	1,321.0	987.0	1,111.0
EIRR	(%)	17.5%	20.6%	19.3%
NPV	(Million USD)	773	1,004	917

*Infrastructure cost includes civil works, depots of E&M, stations, air conditioning and tracks.

Source: JICA Study Team

10.1.5 Comparison by Fare System

As explained in Chapter 3, a mixed fare system is proposed on the basis of the results of the traffic demand analysis, the result of a willingness to pay survey, and the current bus fare system

200 Tg + (km-2) x 50 Tg (200 Tg within 2 km, 50 Tg/km over 2 km).

Based on the project cost of Option 2: Competition Case, EIRR was estimated by each fare system and the summarized result is shown in Table 10.1.5.

As the table clearly shows, when the proposed fare system (200 Tg within 2 km, 50~70 Tg/km over 2 km) 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%.

Table 10.1.5 EIRR by Each Fare System

	Fare System		No. of users (per/day)	Revenue (US$/day)	Average price (Tg/per)	Average trip length (km/trip)	EIRR
Free	0 Tg		914,904	0	0	6.0	22.6%
Flat Fare	400 Tg (same as bus)		409,521	122,856	400	8.1	18.8%
	500 Tg (bus x1.25)		310,606	118,030	500	8.6	15.1%
	600 Tg (bus x1.5)		238,600	107,370	600	9.0	16.0%
	700 Tg (bus x1.75)		176,682	93,641	700	9.6	12.1%
	800 Tg (bus x2.0)		116,665	69,999	800	10.0	5.9%
Distance-based Fare	20 Tg/km		865,424	77,888	120	5.8	25.1%
	40 Tg/km		808,746	137,487	226	5.6	24.7%
	60 Tg/km		706,864	162,579	306	5.1	22.4%
	80 Tg/km		594,090	154,463	346	4.3	17.4%
	100 Tg/km		508,238	142,307	372	3.7	14.0%
Mixed Fare	200 Tg within 2km	**200+(k-2)x50**	**486,975**	**155,832**	**426**	**6.3**	**20.6%**
		200+(k-2)x60	466,080	158,467	452	6.1	18.6%
		200+(k-2)x70	439,565	149,452	452	5.5	18.6%
	400 Tg within 4km	200+(k-4)x50	570,685	142,671	333	6.4	20.8%
		200+(k-4)x60	558,562	150,812	359	6.2	20.8%
		200+(k-4)x70	541,685	151,672	372	5.9	19.1%
	300 Tg within 4km	300+(k-4)x50	418,070	142,695	466	6.8	18.5%
		300+(k-4)x60	404,958	146,342	479	6.6	19.7%
		300+(k-4)x70	389,560	144,700	492	6.3	17.2%

Source: JICA Study Team

10.1.6 Sensitivity Analysis

The sensitivity analysis was made by changing the projected cost upward and benefit downward, or economic benefits traffic demand downward.

The following table shows the result of sensitive analysis by changing cost and benefit, targeting Option 2 Competition Case. EIRR still keeps 15% if the cost increase by 15% or the benefit decreases by 15%.

Table 10.1.6 Sensitive Analysis by Changing Cost and Benefit (Option 2)

		Project Cost Increase		
		Base (0%)	10% up	20% up
Benefit Decrease	Base (0%)	20.6%	19.6%	18.6%
	10% down	19.5%	18.5%	17.6%
	20% down	18.2%	17.3%	16.4%

Source: JICA Study Team

10.2 Financial Analysis

10.2.1 Purposes and Assumptions of Financial Analysis

(1) Objectives and Methodology

This section conducts cash flow analysis to evaluate the project's financial viability. This study, as discussed in Chapter 7 and 8, proposes the establishment of a public company "Ulaanbaatar Metro Corporation (UBMC)," which would be in charge of operations on the assumption of the two-tiered system. Firstly, cash flow analysis of the overall metro project (project cost: US$ 1.5 billion) is conducted and the profitability of the project is examined. Secondly, cash flow analysis of the UBMC is conducted in case that the UBMC would make an investment in a part of E&M, rolling stock and related facilities as well as in inauguration expenses—approximately US$200 million out of the US$1.5 billion construction costs. A part of the revenue from passenger fares would be paid as a rental fee to the government, the actual owner of the infrastructure.

Evaluation indicators are Project Internal Rate of Return (PIRR) and Equity Internal Rate of Return (Equity IRR)[1].

(2) Assumptions

Assumptions of the analysis are listed in Table 10.2.1.

Table 10.2.1 Assumptions of financial analysis

Assumption		Remarks
Start of the project:	2013	
Opening year:	2021	
Analysis period:	Construction period: from 2013 to 2020 Operational period: from 2021 to 2040 (20 years)	
Investment cost:	The total investment cost is MNT 2.4 trillion and MNT 400 billion (JPY 150 billion), of which respective amounts of MNT 2 trillion and MNT 80 billion (JPY 130 billion) are for infrastructure and MNT 320 billion (JPY 20 billion) is for rolling stock and related facilities invested by UBMC. A breakdown of the MNT 320 billion is shown below. Construction cost: MNT 230 billion (JPY 14 billion), includes maintenance of depots, a part of stations (ticket machines and gates), rolling stock and related facilities, design costs and price escalation. Opening expenses: MNT 90 billion (JPY 6 billion), includes labor cost, training cost and operation cost.	
Useful life	Civil works: 40 years Railway track: 30 years E&M: 15 years Rolling stock: 20 years	

[1] 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.

Infra-rent fee:	2% of infrastructure (US$26 million)	
Revenue:	Fare box revenue and off-rail business revenue The following is the rate of off-rail business revenue to fare box revenue: 2021－2024: 2% 2025－2030: 4% 2031－2040: 6% Profit ratio of off-rail business: 40%	
Fare system:	Increase by 10% every three years Discount fare is not included（100% of fare revenue is considered）	Three cases of fare system are proposed.
Users:	Year 2021: 326,219 people Year 2030: 486,975 people Growth rate4.55% until 2030, 1% after 2013	
Average trip length:	Year 2021: 6km Year 2030: 6km	The length is fixed as 6 km.
Tax:	CIT: 10%（below 3 billion MNT）、25%（3 billion MNT or over） VAT:10%	
Exchange rate:	1USD=94.16JPY 1MNT=0.07JPY 1USD=1395MNT 1EUR=1878.78MNT	OANADA rate on April 1st , 2013
Inflation rate:	The following inflation rate is applied to the fare and O&M cost 2011－2017:9.8% 2018－2023:7.0% 2024－2040:5.0% Labor cost of Mongolian staff is assumed to increase at the rate of 70% inflation rate	IMF statistical data

10.2.2 Conclusion

On the assumption that one operator implements the UB Metro Project, profitability in three cases are examined. Two cases are with an ODA loan (STEP and general loan) and the third is without ODA. In cases 1 and 2, with ODA, PIRR is 2% for P_1 (MNT 600) and 3.5% for P_2 (MNT 800), respectively. In addition, Equity IRR is 10.4% in case 1 and 5.8% in case 2 and the payback period is very long, from 14 to 17 years. Consequently, even if the average fare is the same amount as that citizens are willing to pay (MNT 600) or over, this project will not be profitable.

On the other hand, the result of analysis of UBMC's investment cost is US$200 million based on the two-tiered system. On the assumption that the infra-rent fee is 2% (US$26 million) of the infrastructure cost, PIRR in the case of an average fare of MNT 400 is around 10~11% in all financing cases, which shows this fare system does not make the metro operation feasible. On the other hand, in the case of MNT 800, PIRR is greater than 22% and profitability is high. However, the fare is higher than UB city citizens are willing to pay (MNT 500~MNT 600) and it may possibly reduce the demand. Then, in the case of MNT 600, which is almost the same as

the willingness to pay, PIRR is around 18.5% and Equity IRR is around 19.7%. In conclusion, MNT 600 secures profitability sufficient to make the metro business viable.

Alternatively, the result of the sensitivity analysis of Case 2 shows that with an average fare of MNT 600, PIRR is over 15%, which is high enough if the revenue and the cost vary between +10% and -10%, except the worst condition that the revenue decreases by 10 % and the cost increases by 10% and the second worst condition that revenue decreases by 10 % and the cost increases by 5%. In addition, when the infra-rent fee is 3% (US$39 million), PIRR of P_1 is 15.9%, which also shows the metro project is feasible.

Appendix

Member List
of
JCC, Working Group and
JICA Study Team

JOINT COORDINATING COMMITTEE (JCC) I
(From September 2011 to December 2012)

Chairperson:	Mr. J.Bat-Erdene	State Secretary of MRTCUD
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Secretariat:	Mr. Kh.Bulgaa	Head of Transportation Planning Division, Public Transport Department, UB City
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	Mr. E.Hurelbaatar	Head of Construction Urban Development Planning Department, UB city
	Mr. G.Nandinjargal	Head of City Development Policy Department, UB city
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Japanese side	Mr. Toshinori Isogai	Resident Representative, JICA Mongolian Office

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(From January 2013 to May 2013)

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	Mr. D. Nanzaddorj	Director of Road Department, UB city
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	Mr. Naoshi Okamura	Traffic Analysis & Forecasting
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	Mr. Kazumasa Yamaoka	Tunnel Structure Design
	Mr. Tastumi Sakamoto	Utility Planning
	Mr. Shohei Ishikawa	Station and Related Facility Planning
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