

CHAPTER 1

BACKGROUND OF THE PROJECT

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While supporting countries organized by 24 leading developed nations in the world made the decision that the former Yugoslavia would be a subject country for assistance in July, 1990, they decided to suspend economic cooperation in November, 1991 in view of the subsequent developments in Yugoslavia. Japan also suspended its aid except for that through international organizations and grassroots grant aid cooperation provided from a humanitarian viewpoint. The present Project forms part of the components of the grant aid cooperation totaling US\$ 50 million which Japan pledged at the international donor conference to assist Yugoslavia held in June, 2000.

Although the Public Transport Company “Belgrade” (hereinafter referred to as GSP Belgrade), the implementation body for the Project, did not suffer any direct damage due to the bombing campaign of the NATO in 1999, it is finding the procurement of new buses, spare parts and repair equipment, etc. extremely difficult because of its financial difficulties caused by the economic sanctions since 1992.

Major public transportation systems of Belgrade consist of buses, street cars and trolley buses. Although, because bus transportation runs 87% of total operating length of public transportation systems, it holds 75 % of numbers of the passengers transportation, and, more over, it's service network covers whole area of the city, it is positioned as the only public transportation in Belgrade. The number of operable buses has decreased by more than 50%, from 913 in 1991 to 417 in 2001. Moreover, the buses currently in service are experiencing considerable deterioration, making public transportation in Belgrade near breaking point. Under these circumstances, the Government of Yugoslavia had requested the Government of Japan's provision of grant aid to restore public transportation in Belgrade in order to restore the stable daily lives of the public.

1.2 Outline of the Request

The City Assembly of Belgrade has formulated a plan to improve the bus transportation service in the city which is highly deteriorated. The basic concept of this plan is to restore the number of buses in service from the current 417 to 913 recorded in 1991 when the city's bus service operated most smoothly.

The plan sets 2005 as the target year and aims at securing 900 operable buses by 2005. As a short-term plan, it also aims at securing 600 operable buses as of 2002 against the prediction that given the deteriorated state of the current fleet, the number of operable buses will decline to some 336. Accordingly, the number of new buses to be procured by 2002 is put at 264.

Originally, the Government of Yugoslavia made a request for grant aid to procure these 264 buses but changed the number to 93 following the findings of the project formulation study conducted in May, 2001.

The finalized request by the Yugoslavian side consists of the following components.

- ① Provision of 93 buses, consisting of 75 articulated buses and 18 standard buses
- ② Provision of spare parts required for the maintenance of 93 buses
- ③ Provision of repair equipment required for the inspection and repair of buses

CHAPTER 2

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2.1 Basic Concept of the Project

(1) Objective of the Project

The total length of public transportation services in Belgrade is 1,379 km of which the bus service accounts for approximately 87% (1,201 km) with 98 bus routes serving all parts of the city. By number of passengers, bus transportation accounts for approximately 75%. As the service area of street cars and trolley buses is quite limited, bus transportation is an essential mode of transportation for the citizens of Belgrade. While GSP Belgrade smoothly operated the bus service prior to the beginning of economic sanctions in 1991 with 913 buses, the number of operable buses has declined to 417 in 2001. Moreover, the existing buses are considerably aged. Although GSP Belgrade receives a substantial subsidy from the City Assembly of Belgrade, its revenue significantly falls short of the required level because of low fares in consideration of refugees and other people with low income, resulting in difficulty to secure sufficient budget for the proper procurement of new buses and spare parts, etc. Because of the continual decline of the number of operable buses, GSP is already finding it difficult to operate and maintain the buses on the 98 municipal routes even though the demand for inexpensive public transportation has been increasing due to the stagnant economy and increase of the number of low income people. The buses during peak hours are so crammed that passengers can hardly move and long queues of passengers waiting for buses chronically form at bus stops. The long time required to get on and off of buses results in a longer travelling time for passengers, illustrating the severe shortfall of the transportation capacity of the bus service to provide adequate public transportation.

Concerned with this fragile state of operation of its public transportation system, the Municipal Authority formulated a public transportation improvement plan to restore reliable and efficient public transportation capacity, and aiming to stabilize citizens' lives. Restoring public transportation means restoring the transportation capacity of bus transportation. With the recognition of the importance of bus transportation, the Municipal Authority has set up the objective of the Public Transportation Improvement Plan to secure 600 operable buses by 2002 and 900 by 2005.

The objective of the Project is to provide buses and to procure repair equipment for maintenance in order to restore bus transportation which is vital amongst the old public

transportation modes, and is the main public transportation for citizens including many refugees and internal displaced people living in the city. The project is defined as the most important project in the transportation improvement plan currently undertaken by the Municipal Authority to realize the 2002 short-term immediate plan (ensuring 600 operable buses). It is especially applied to 8 bus routes in urban area where highest concentration of passengers exists.

(2) Outline of the Project

The severe travelling conditions for peak hours is not to maintain a good condition for commuters, students and shoppers, is illustrated by passenger rates of 150% (about 240 passengers in a bus with capacity for 160 passengers). With the implementation of the Project, and restoration of more appropriate transportation capacities, quality of life for the city's citizens can be expected. It is expected to improve the citizens' life as well as to restore the more appropriate transportation capacity of the public transportation service by improving the situation.

The Project aims at procuring and deploying 93 new buses (18 standard buses and 75 articulated buses) which are required to achieve the above-mentioned objective for eight existing bus routes (Nos. 16, 17, 18, 23, 26, 88, 95 and 511), which were chosen from the current 98 bus routes. It also aims at procuring needed repair equipment.

2.2 Basic Design for the Requested Japan's Grant Aid

2.2.1 Design Policy

(1) Basic Principles

1) Scope of Cooperation

The Project aims at the procurement of new buses and repair equipment, all of which are required to improve the dire situation of public transportation in Belgrade. The new buses to be procured under the Project will be deployed on eight (8) bus routes. The scope of the Project includes the procurement of buses, and daily inspection and repair will be at two depots, i.e. Karaburma and Novi Belgrade Depots.

2) Selection of Proposed Routes

The proposed routes of the Project are based on requests from the Yugoslavian side, and will be determined by taking the following into consideration: 1) the number of

bus passengers estimated by the population in the area of each route, 2) the congestion situation of each route, 3) the importance of each route, and 4) the concern for low income groups including refugees and internally displaced people.

3) Estimate of Number of Buses

The number of the buses to be procured in the Project was estimated by deducting the expected number for 2002 from the calculated number of required buses for the case of reforming passenger rate to 100% at peak hours on the 8 proposed routes. The number of required buses was estimated by taking the operating frequency and operating cycle time into consideration in addition to the number calculated by dividing the total bus passengers number in one hour during the peak hours with the transportation capacity per one bus.

4) Maintenance and Administration

With regards to bus maintenance, local specification buses currently operating without problems will be utilized as much as possible with the goal to standardize driving operation and maintenance wherever possible. Because of this, the GSP Belgrade's skills to maintain buses accumulated in the past will be continuously applied. Although Engine and chassis are made in Western Europe and bodies will be maintained by acquiring domestic parts, with the Project, regular replacement parts and high consumption parts will be procured within 2 years after the buses are procured.

Also, repair equipment in the Project will be procured after adjustment is conducted between the currently existing equipment at two depots where the procured buses will be disposed to be minimum required. Equipment is to be procured partly with an EBRD loan and will contribute to implement the maintenance of buses smoothly.

(2) Natural Conditions

1) Temperature and Humidity

Belgrade is located inland and its climate is characterized by a continental climate with large annual temperature fluctuations. Although the mean temperature in August is 25.7°C, it is not unusual for the daytime temperature to exceed 35°C. The coldest month in winter is January with a mean temperature of -1.0°C but the minimum temperature is often below -10°C. It is, therefore, necessary for the buses to have specifications which are suitable for a cold climate.

2) Rainfall

The annual rainfall is 700 – 800 mm and the mean monthly rainfall is 150-200mm. June, July and December have comparably intensive rainfall although the actual rainfall level varies from one year to another. While the actual rainfall during each period of rain is not particularly high, running water on the road surface can be observed at the time of rain due to poor maintenance of the road drainage facilities, however, rainfall conditions is not considered under the Project.

3) Snow

Winter lasts for approximately four months between November and March. While snow falls on 30 – 40 days, the snow depth is only some 10 cm each time. As a result, there is seldom continuous snow cover. An admixture of sand and salt is sprayed on the city's trunk roads to facilitate melting of the snow. The little snow cover on these roads means no use of snow tires or tire chains. There is no special need for snow to be considered for project implementation purposes.

4) Salt Damage

The field survey found a high level of corrosion of the steel panels used for the under-body of the existing buses. One cause for this is the admixture of salt and sand sprayed on the snowed road surface as snow liquefier in winter. Therefore, increased layers of painting and an increased thickness of the body panels should be considered for the new buses to reduce this corrosion as much as possible.

(3) Socioeconomic Conditions

The manufacturing process of new buses in the Project will be designed taking into consideration manufacturing capacity and administration of manufacturing processes according to socioeconomic situations.

(4) Procurement Situation or Special Conditions of the Target Sector

1) Related Laws and Regulations

For the design of the Project, the international standards and Japanese standards apply.

① Buses Fleets

- Relevant laws, regulations and standards in Yugoslavia
- European standards

② Repair Equipment

- JIS (Japanese International Standards)
- JEC (Japanese Electrotechnical Committee)
- JEM (Standards of Japan Electrical Manufacturer's Association)
- IEC (International Electrotechnical Commission)

2) Equipment Plan

In regard to the specifications of the new buses to be procured under the Project, it has been decided to employ local specifications as much as possible in order to ensure common maintenance requirements given the fact that many of the buses owned by GSP Belgrade were manufactured in Yugoslavia and also to secure a minimum service life of 12 years. In regard to the engines, EURO 3 standards which have become the mainstream in Europe are adopted as an environmental measure to ensure cleaner emission.

(5) Utilization of Local Manufactures

With concerns to activate the economy, technical specifications for articulated buses and standard buses of the Project will be decided to enable utilization of local bus manufactures. Unfortunately, production period of those local bus manufactures are not sufficient in the very tight production schedule of the Project. Therefore, OECD member nations will be included as eligible countries for procurement for the Project.

(6) Operation and Maintenance Capabilities of Implementation Agency

GSP Belgrade runs the public transportation service in Belgrade with an annual subsidy by the Municipal Authority which amounts to 60 – 65% of its expenditure. This subsidy is a major budget item of the municipal budget, accounting for 20 – 25% of the annual budget. The Municipal Authority is aware of the fact that bus transportation is practically the only means of public transportation for its citizens, plans to reform fare system etc., and has pledged to continue the provision of the subsidy to ensure the means of travel for the public.

GSP Belgrade currently maintains 417 old buses as of February, 2001. As the drivers work in three shifts, the recruitment of 354 new drivers, 160 maintenance staff and 3 operation staff is planned for the case of 93 new buses being added to the fleet under the Project. If this is implemented, it can be judged that there will be no problem with regard to operation and maintenance staff. GSP Belgrade also has a lot of experience and a high level of technical expertise regarding the overhauling of engines as well as the

dismantling, repair, and re-assembly of entire vehicles. Therefore there are no difficulties anticipated in regard to the appropriate operation and maintenance of an increased number of buses by GSP Belgrade.

(7) Bus and Equipment Grades

1) Buses Fleet

GSP Belgrade currently operates about 417 buses and 80% of those buses were manufactured domestically with imported engines, domestic chassis and bodies. However, there are problems with strength and corrosion-resistance, and the life expectancy of the buses manufactured in Yugoslavia is as short as 7 – 8 years which is comparatively inferior to buses manufactured in Western Europe (life expectancy is approx. 15 - 20 years). The planned specifications under the Project including specifications for strength of chassis, thickness of body panel, and coating were decided as to allow the local manufacture of new buses with a longer service life -at least 12 years through improved quality. Also regarding environmental plans for exhaust emissions, EURO 3 standard in Europe will be applied for engines.

① Chassis and Body

Chassis is the important structure to ensure the life expectancy, however, the Chassis produced in Yugoslavia is not to ensure the about 12 years of life expectancy due to shortage the strength. The Frame type Chassis produced in OECD members is adopted in the Project to ensure the quality and strength. The body strength should be increased with the use of thicker body panels.

Measures to prevent salt damage in winter will be necessary for the chassis and body. (as it is judged that the admixture of salt and sand sprayed on road surfaces to prevent frozen road surfaces in Yugoslavia has caused much damage to the existing buses).

② Engine

a) For the engines are the important part of bus fleet same as the chassis, it should be procured from the same manufacture of chassis as one of the part of bus fleet.

b) For emission control, EURO 3 will be applied because of the following reasons.

- EU member countries have been applying EURO 3 since October, 2001.

- Based on the above, it will be necessary for all new vehicles to be manufactured in Europe in the coming years to gradually adapt to EURO 3.
- European vehicle manufacturers will mainly manufacture engines meeting EURO 3. At present, the price of a EURO 3 engine is approximately 20% higher than that of a EURO 2 engine but the price will become lower than that of a EURO 2 engine within a year or so with the decline of EURO 2 engine production. In the near future (1 – 2 years), EURO 2 engines will become a special type of engines with a low production volume.

③ Heating System

Despite the drop of the temperature to some –10.0 °C in winter, the existing heating system is inadequate with only one hot air outlet. The heating capacity of the new buses should be improved for betterment of environmental aspects of the inside bus fleet.

2) Repair Equipment

GSP Belgrade has four depots in the city which are responsible for the maintenance of buses on certain routes. As it is planned that the new buses to be procured under the Project will be maintained at two depots, the necessary repair equipment/tools for the new buses will be procured because of the poor conditions of the existing repair equipment/tools.

3) Spare Parts

For the proper maintenance of the buses to be procured under the Project, the supply of spare parts required for an inspection and maintenance cycle of approximately two years will be considered to conduct daily maintenance as well as major maintenance work for the engines and transmissions, etc. in accordance with the inspection and maintenance schedule generally set forth by bus manufacturers in their maintenance manuals.

(8) Procurement Method and Work Schedule

1) Eligible Countries for Equipment Procurement

① Buses Fleets

As there are three bus manufacturers in Yugoslavia and many buses in GSP Belgrade are produced in Yugoslavia, the eligible countries for the procurement of the buses are principally Yugoslavia and Japan. However, OECD members are also considered eligible because of (i) uncertainty regarding the capability of domestic bus manufacturers to observe the delivery date and (ii) the need to ensure the competitiveness, transparency and fairness of the procurement process.

② Repair Equipment

The repair equipment manufactured in Yugoslavia covers only a small part of the repair equipment planned under the Project and most of the repair equipment currently used in Yugoslavia is imported. Therefore, the procurement of the repair equipment planned under the Project from Japan is judged to be appropriate.

③ Spare Parts

There are bus manufacturers in Yugoslavia and GSP Belgrade has been procuring domestically manufactured spare parts for its bus fleet. The procurement of spare parts will be done at the same time as buses, therefore, the eligible countries for procurement of spare parts are to be the same as competent countries for buses fleets.

2) Work Schedule

Should every process involved in the Project be smoothly implemented, the work must be completed by February, 2003. Furthermore, because bus manufacturing would take place at very likely at the same time as EBRD Project, to keep the manufacturing schedule on time, OECD member nations are selected as eligible countries in addition to Japan and Yugoslavia.

2.2.2 Basic Plan

The optimum basic plan for the Project has been formulated based on the basic principles described in 2.2.1 while incorporating the results of the basic discussions with GSP Belgrade on the items requested by the Yugoslavian side, the bus passenger survey (on the number of peak time passengers, distance between bus stops and traveling times, etc. for the requested eight routes), bus route survey, survey on the relevant standards and survey on local subcontractors, etc. The important items for formulation of the basic design consists of

selection of bus route plan, number of buses to be procured plan, type of buses plan, maintenance plan, and preparation of specifications. The examination method of the basic plan are described in this chapter.

The contents of the original request from the Yugoslavian side are as formally shown in 1-2, and the study flow based on them is shown in Fig. 2-2-1.

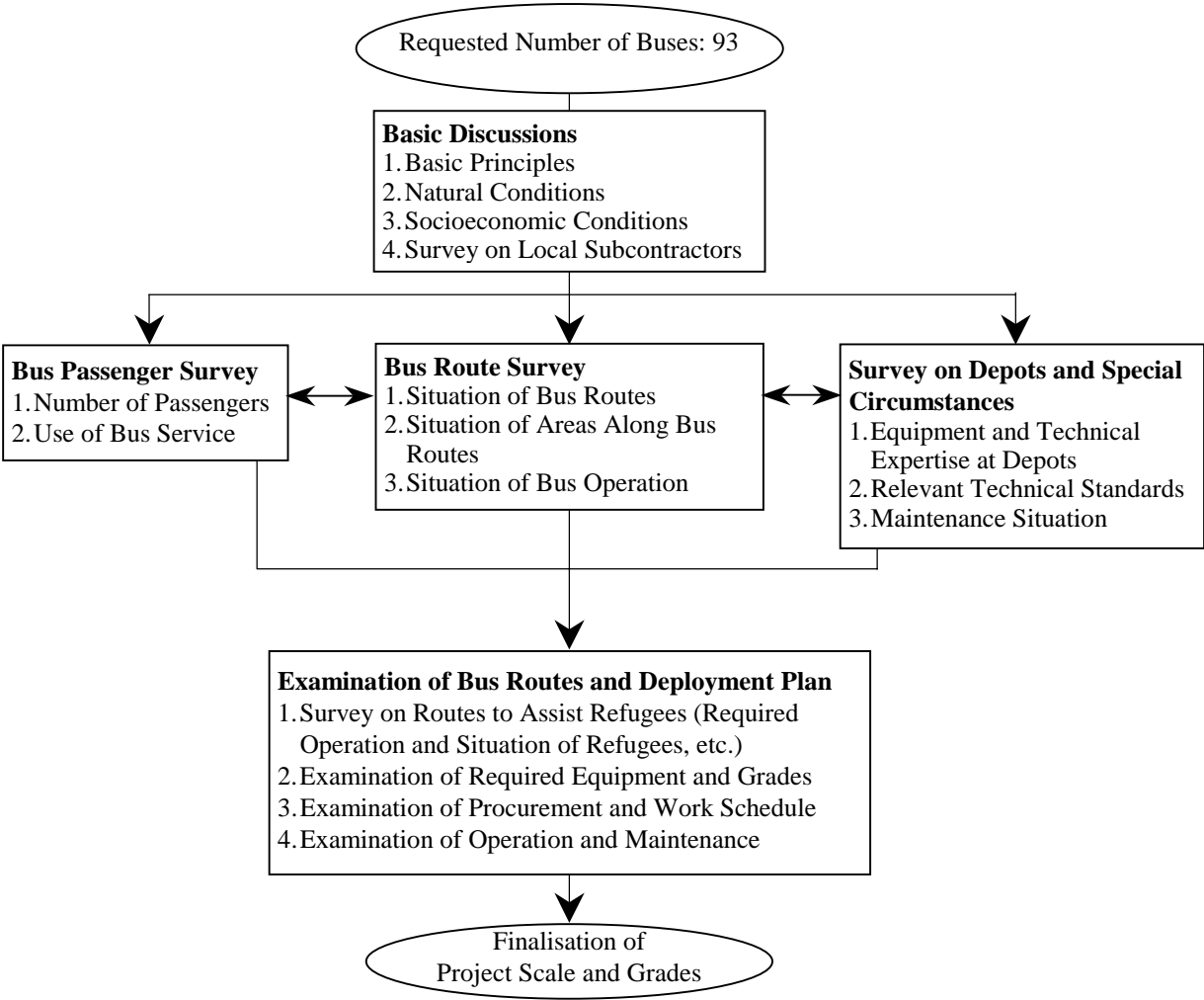


Fig. 2-2-1 Study Flow

(1) Relationship Between Higher Plan and the Project

The public transportation improvement plan prepared by the City Assembly of Belgrade sets 2005 as the target year and intends to secure the service of some 900 buses in the target year. The plan also sets 2002 as the interim (medium-term) target year by which time the service of 600 buses should have been secured. The necessity and suitability of the planned 900 buses by 2005 and 600 buses by 2002 were examined in the following manner in the formulation process of the Project.

At present, bus transportation in Belgrade consists of 98 routes. The required number of buses to operate on these 98 routes is basically calculated by dividing the projected passenger number by transportation capacity by bus. The calculation results were some 1,000 buses for 2005 and some 800 buses for 2002. The number of buses set by the plan for each target year (900 for 2005 and 600 for 2002) is lower than the calculated number by 100 – 200. Considering the shortage of budget of City and GSP Belgrade, the number of buses are decided as minimum requirement. Therefore, the number of buses set by the plan is judged to be appropriate.

(2) Bus Route Plan for Deployment of New Buses

The basic principle for the selection of the target bus routes under the Project is that these bus routes are primarily decided based on the Yugoslavian request while taking the expected number of passengers, the current state of passenger congestion on buses, the importance of the routes and appropriate care for low income people, including refugees from abroad and internally displaced people, into full consideration. As a results of examination, 8 bus routes as shown in Table 2-2-1 and Fig. 2-2-2 are selected, because these routes are extremely high bus passengers compare with other routes, and cover directly to the refugees areas.

Table 2-2-1 Target Bus Routes for Deployment of Procured Buses

No.	Target Bus Route	Type of Bus to be Deployed
1	No. 16	Articulated Bus
2	No. 17	Articulated Bus
3	No. 18	Articulated Bus
4	No. 23	Articulated Bus
5	No. 26	Standard Bus
6	No. 88	Articulated Bus
7	No. 95	Articulated Bus
8	No. 511	Articulated Bus

(3) Number of Buses to be Procured

The number of buses to be procured under the Project was determined by deducting the number of buses currently operated by GSP Belgrade from the number of buses required to operate the selected eight bus routes. The number of buses required to operate the eight bus routes was calculated by dividing the number of peak hours passengers by the transportation capacity of each bus for each route, taking the service frequency, cycle time and other relevant issues of the bus service into consideration.

The calculation results that the procurement of 93 buses, i.e. 18 standard buses and 75 articulated buses, will be necessary as shown in Table 2-2-2.

Table 2-2-2 Number of Buses to be Procured Under the Project

Bus Route No.	Total Length (km)	Travelling Time (min/one way)	No. of Peak Time Passengers (persons/one way)	Transportation Capacity (persons/bus)	Required No. of Buses (Inbound + Outbound = Total)	No. of Buses Currently in Service	No. of Buses to be Procured
No. 16	11.278	40	2,700	160	17+11=28	14	28-14 =14 (A/B)
No. 17	16.208	48	1,780	160	12+10=22	12	22-12=10 (A/B)
No. 18	18.807	56	1,740	160	11+11=22	10	22-10=12 (A/B)
No. 23	18.408	64	1,830	160	12+13=25	15	25-15=10 (A/B)
No. 26	9.741	44	1,635	110	15+12=27	9	27-9=18 (S/B)
No. 88	20.653	55	1,680	160	11+10=21	12	21-12=9 (A/B)
No. 95	20.861	62	1,850	160	12+13+25	15	25-15=10 (A/B)
No.511	22.673	54	2,460	160	16+15=31	21	31-21=10 (A/B)
Total					201	108	Total: 93 S/B: 18 A/B: 75

Note: A/B – articulated bus; S/B – standard bus

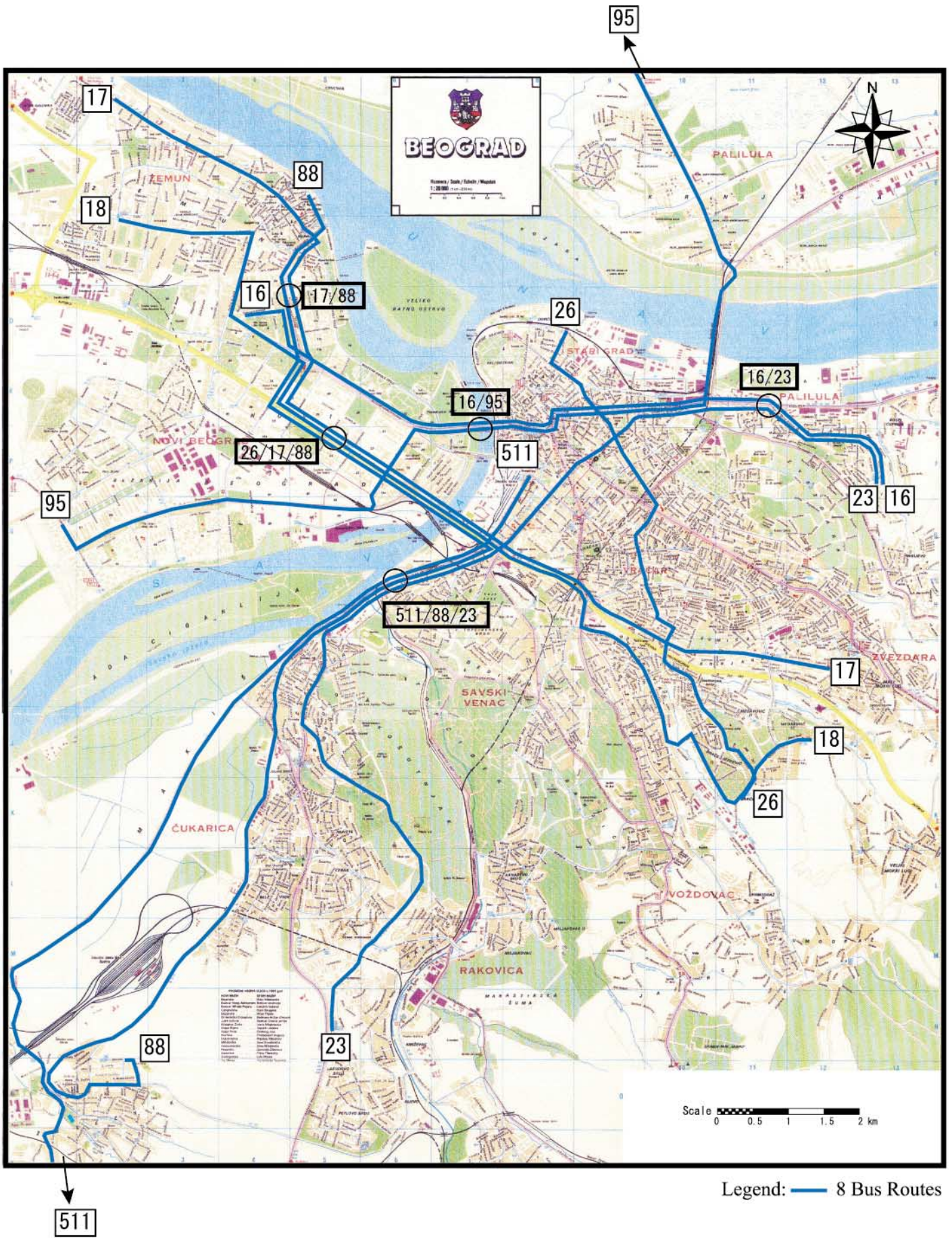


Fig.2-2-2 Locations of Eight Selected Bus Routes for Deployment of Newly Procured Buses

(4) Types of Buses

The basic principles for the selection of the types of buses for the selected eight routes are (i) inheritance of the type of buses currently operated on each route and (ii) consideration of the existing road conditions for each route. Except for Route No. 26, all of the selected routes are currently served by articulated buses using the trunk roads of the city. These trunk roads are at least dual carriageways (four lanes or more in total) and their geometric configuration allows their use by articulated buses. In the case of Route No. 26, as it uses a trunk road with a single carriageway, the introduction of articulated buses is difficult. Accordingly, this route is served by standard buses.

Therefore, based on the above basic principles and the field survey findings on roads, etc., it has been decided to use standard buses for Route No. 26 and articulated buses for the other seven routes.

(5) Maintenance of Buses

1) Deployment Sites(Depots) for Procured Equipment and Others

At present, the buses running on the selected routes are maintained at the following two depots (with maintenance facilities and parking spaces).

① The routes which use Novi Belgrade Depot are as follows:

- Route No. 17 (articulated buses)
- Route No. 18 (articulated buses)
- Route No. 88 (articulated buses)
- Route No. 511 (articulated buses)

② The routes which use Karaburma Depot are as follows:

- Route No. 16 (articulated buses)
- Route No. 23 (articulated buses)
- Route No. 26 (standard buses)
- Route No. 95 (articulated buses)

There is sufficient parking space at each depot but the deteriorated state of the maintenance facilities. The increased number of buses to be serviced with the implementation of the Project will not affect the existing maintenance system or facilities at these depots. Therefore, these two depots are selected to maintain the new buses to be procured under the Project. In addition, delivery and installment of the spare parts and repair equipment/tools for the new buses will also be deployed at

these two depots to make the maintenance of these buses easier. The actual scale of deployment of the 75 articulated buses and 18 standard buses at each depot is shown in Table 2-2-3.

Table 2-2-3 Deployment of Buses and Repair Equipment

No.	Depot	Articulated Buses	Standard Buses	Repair Equipment
1.	Karaburma	34	18	One set
2.	Novi Belgrade	41	-	One set

The maintenance situation at the two depots at which the new buses to be procured under the Project will be deployed is outlined below.

- ① The buses to be procured under the Project will be deployed at the site marked 「D」 on Drawing No. BG-03 (Karaburma Depot) and the site marked 「P2, P3」 on Drawing No. BG-05 (Novi Belgrade Depot) in 2.3. While there are many buses which have been withdrawn from service at the planned parking sites at these depots, GSP Belgrade plans to remove these old buses from the sites.
- ② The car park and workshop building at these two depots are severely deteriorated with the indoor floor being slippery due to oil, etc. This situation will be rectified under the EBRD loan project.
- ③ The repair equipment to be deployed at these two depots will be installed or stored at the locations marked 「⊗」 on Drawing No. BG-04 (Karaburma Depot) and the locations marked 「⊗」 on Drawing No. BG-06 (Novi Belgrade Depot) in 2.3. At present, these locations are empty and, therefore, no problems are anticipated in regard to the installation or storage of the repair equipment.

2) Maintenance Capability

As of August, 2001, GSP Belgrade has 6,226 regular staff and 210 temporary staff, totaling 6,436 employees. With this staff strength, GSP Belgrade operates and maintains bus, street car and trolley bus services in Belgrade. Given the fact that everyday inspection and repair works as well as major repair work are smoothly conducted, GSP Belgrade's present technical level is high.

GSP Belgrade already has a staff increase plan, as shown in Table 2-2-4, to increase 160 maintenance staff, 345 drivers, 256 conductors (temporary employment), and 3 operation staff in planned in preparation for the implementation of the Project. Should 93 new buses be procured under the Project, because the current three shift system will be followed and considering drivers' days off and absences due to sickness, the new recruitment of 345 drivers appears to be appropriate. Also as maintenance staff will follow the current system with the experience of managing one bus with less than two people, the new recruitment of 160 maintenance staff appears to be appropriate.

Table 2-2-4 Staff Increase Plan for Bus Maintenance

Item	Karaburma Depot		Novi Belgrade Depot		Total Number of Increase
	2001	2002	2001	2002	
Bus	135	187	145	186	93
Maintenance Staff	269	357	264	336	160
Driver	577	775	520	676	354
Operation Staff	24	25	21	23	3
Conductor (temporary)	-	143	-	113	256

(6) Equipment Plan

1) Buses Fleets

The specifications for articulated buses and standard buses to be procured under the Project have been discussed with GSP Belgrade, and they are shown in Table 2-2-5(articulated buses) and Table 2-2-6(standard buses) respectively. Following are points specifically taken into consideration to plan the specifications: i) EURO 3 standards are adopted for the engine in view of social environmental concerns in European countries and environmental conservation in Yugoslavia. ii) In order to improve the durability of the buses, it has been decided to improve parts of the standard specifications for buses to be manufactured in Yugoslavia. The planned improvements include the use of thicker body panels, improvement of the chassis and improvement of the passenger seats.

Table 2-2-5 Specifications for Articulated Bus

No.	Items	Requirement	Remarks
A. Specification of engine and chassis			
1. Major specification			
(1)	Type of vehicle	Heavy duty bus for city operation	
(2)	Driving position	Left hand drive front	
(3)	Engine location	Rear or middle mounting engine, horizontal or vertical	
(4)	Chassis frame	Frame or truss type (Chassis is same maker with engine maker)	
(5)	Driving wheel (power axle)	3 (power axle: rear or middle drive)	
(6)	Loading capacity	No. of passenger's seats: 40 (minimum) No. of passengers: 150 (minimum)	
(7)	Gross vehicle weight (GVW)	24,000kg (minimum) including weight of passengers	Total weight of passengers 150passengers x 80kg = 12,000kg
(8)	Design condition		
	1) Ambient temperature	-20 to 40 deg. C The proposed diesel engine must have low fuel consumption and low noise, be capable of cold starting down to -20 deg. C.	Cold proofing specification
	2) Altitude	117 m above sea level	
	3) Heating system	Passengers compartment 18 deg. C in winter season. When ambient temperature is below -10 deg. C, the indoor temperature shall not deviate by more than 5 deg. C.	
(9)	Steering system	Power steering	
2. General dimensions			
(1)	Wheel base	Approx. 5,500 mm (front side) / 6,000 mm (rear side)	
(2)	Overall length	16,800 - 18,000 mm	
(3)	Overall width	2,400 - 2,500 mm	
(4)	Overall height	3,250 mm (maximum)	
(5)	Inner height	2,100 mm (minimum)	
(6)	Front overhang	2,800 mm (approx.)	
(7)	Rear overhang	2,800 mm (approx.)	
(8)	Enter and exit height	360 mm (maximum)	
(9)	Floor height	930 mm (maximum)	
(10)	Road clearance	250 mm (minimum)	
3. Performance			
(1)	Maximum speed	70 - 90 km/h	
(2)	Turning radius	24 m (maximum)	
4. Engine			
(1)	Type	Direct injection type	
(2)	Used fuel	Diesel	
(3)	Cycle	4 cycle	
(4)	No. of cylinders	6 cylinders inline arrangement	
(5)	Cooling	Water-cooled	

No.	Items	Requirement	Remarks
(6)	Output	180 – 220 kW	
(7)	Torque	1000 – 1500 Nm	
(8)	Fuel consumption	40 - 45 liters/100km (maximum)	
(9)	Exhaust emissions	Meet to European Standard (EURO3)	
5. Injection pump			
(1)	Type	In line plunger with limit speed governor	
6. Main oil filter			
(1)	Type and capacity	Based on the type of engine	
7. Air cleaner			
(1)	Type	Paper element replaceable type	
8. Transmission			
(1)	Type	Automatic transmission with minimum 4 speeds integrated retarder	
9. Axle			
(1)	Type of axle	Individual wheel suspension or rigid axles are allowed	
(2)	Power axle (differential)	Banjo, fully floating type	
(3)	Axle load for min. 180 passengers (front/middle/rear)	7.0 / 10.0 / 7.5 tons for middle mounting engine (minimum) 7.0 / 9.0 / 11.5 tons for rear mounting engine (minimum)	
10. Brake			
(1)	Service brake	Disks or drum brakes The power brake system shall be designed by compressed air system	
(2)	Parking brake	Spring brake	
(3)	Others	Anti-blocking system (ABS) shall be provided	
11. Suspension			
(1)	Type	Pneumatic suspension suitable for heavy duty city bus on each wheel	
12. Shock absorber			
(1)	Type	Hydraulic double acting telescope on each wheel	
13. Wheels			
(1)	Tire size	11R22.5 or 295/80-R22.5 or manufacturers standard, Radial	
(2)	Rim and wheel	7.5V – 20 (minimum)	
(3)	Type	8 – 10 studs	
14. Fuel system			
(1)	Tank capacity	250 liters (minimum)	
(2)	Fuel cleaning system	Water sedimenter with dual fuel filter or separator	
15. Electrical equipment			
(1)	Battery	12Volts, 180AH (minimum)x2 in series connection	
(2)	Alternator	28V - 100A (minimum)	
(3)	Horn	Dual electric horn	

No.	Items	Requirement	Remarks
B. Specification of body			
1. Seating capacity		Number of seat: minimum 40 seats	
2. Body structure			
(1)	Construction	Rear or middle engine body, left hand drive	
(2)	Exterior panels	1.2 – 1.5 mm thickness steel panel	
(3)	Ceiling inner panels	Not less than 0.8 mm thickness steel panel or 4 mm plywood (compressed wood) panel	
(4)	Side inner panels	0.8 mm thickness steel panel or 4 – 5 mm plywood (compressed wood) panel	
(5)	Fascia and front inner panels	Fascia panel: steel or plastic plate. Front inner panel: 1.0 – 1.2 mm thickness steel panel or 2.5 mm plywood (compressed wood) panel.	
(6)	Step	Non-slip steel treads and risers	
(7)	Battery storage	Steel compartment with drawer under the floorboard for easy maintenance	
(8)	Thermal insulation	To meet with the interior temperature requirements	
3. Doors			
(1)	General	The current position of all doors shall be indicated at the driver's seat. The doors must be locked when the bus is moving. The door edges to be covered with rubber profile. The doors can be opened from inside and outside the bus in case of emergency. Front door shall be locked from outside. Rear and middle doors shall be locked from inside or outside.	
(2)	No. of doors	4 doors on right hand side for passengers	
(3)	Type	Electro-pneumatic inward swinging doors glazed with safety glass	
(4)	Dimension of door width	3 double wing doors: min. 1200mm 1 single wing door: min. 650mm	
(5)	Door control mechanism	Operation by driver from driver's seat	
4. Windows			
(1)	General	The bus must be equipped with emergency windows (minimum 30% of total windows). Windows and their moldings must be vandalism-proof. Safety glass and tinted (sunshine protected)	
(2)	Front windshield	One part(non-divided) laminated windshield	
(3)	Side windows	Upper area opening type to be equipped	
(4)	Driver's window	Sliding opening type to be equipped	
(5)	Rear window	Protection bars shall be installed at inside for the protection for rear window	

No.	Items	Requirement	Remarks
5. Floor			
(1)	Flooring	16 - 25 mm thickness water glued proof plywood or hard wood. Noise protection shall be considered.	
(2)	Floor coating	Non-slip cover (PVC resinous sheet with thickness minimum 3 mm)	
6. Seats			
(1)	Driver's seat		
1)	Type	Seat adjustable to height, back and forth	
(2)	Passenger's seat		
1)	Type	Heavy duty vinyl leather with seat cushion, without arm-rest	
2)	Arrangement	Seats must be mounted in transverse position, arranged 2x2, 2x1 and 1x1 format	
7. Electrical equipment			
(1)	Head lamps	2 - 4 lamps	
(2)	Fog lamps	2 yellow fog lamps on both sides of front bumper	
(3)	Front combination lamps	2 lamps on both sides of front panel. Amber (turn), white (parking)	
(4)	Rear combination lamps	2 lamps on both sides of rear panel. Amber (turn), red (stop, parking)	
(5)	Marker lamps	4 lamps on both corners of front and rear roof. Amber	
(6)	Back lamps	2 white lamp under the rear bumper	
(7)	Room lamps	20W fluorescent lamps on the ceiling over aisle, 2 integral switches on the instrument panel. 100 lux measured at 1m above the floor required.	
(8)	Step lamps	Both side of step	
(9)	Buzzer	Reverse warning buzzer	
(10)	Windshield washer	Electric washer with 2 nozzles under both sides of front windshield	
(11)	Windshield wiper	2 speeds wiper	
(12)	Electric outlet	An outlet for inspection lamp	
8. Ventilation			
(1)	Front ventilator	Hatch type inlet under front windshield	
(2)	Roof ventilator	4 hatches 6 turbo ventilators	
9. Exterior equipment			
(1)	Bumpers	Painted steel or PVC bumpers on front and rear	
(2)	Rear view mirrors	2 pieces of mirror on both ends of front	
(3)	Towing hooks	2 pieces (front and rear)	
(4)	Mud guards	Synthetic rubber behind each tire	
(5)	Destination sign box	Electrical display, one at the front and one at the side	

No.	Items	Requirement	Remarks
10. Interior equipment			
(1)	Sun visors	2 acryl resinous sun visors above front windshield	
(2)	Driver's compartment	Window side: Roll up screen Behind of driver: Plastic panel	
(3)	Step mirror	Around mirror on ceiling above the rear step	
(4)	Room mirrors	2 interior rear view mirrors on ceiling above front windshield	
(5)	Fire extinguisher	A fire extinguisher near the driver's seat (Based on the regulation M.N5.504)	
(6)	First-aid kit	Near the driver's seat (box only)	
(7)	Safety wheel blocks	2 equipped, made by steel	
(8)	Labels	Written in Serbian language	
(9)	Announce system	Three speakers and one microphone for the driver	
(10)	Clock	One clock at the front	
(11)	Exit signal	Four push buttons near the doors	
(12)	Grab rail	Steel pipes covered by PVC	
(13)	Power supply for ticket machine	To provide the power cable pipings only (near the all doors)	
11. Coating			
(1)	Corrosion protection	Anti-corrosion protection. Salt protection is needed (the use of salt on the road in winter season). Chassis shall be anti-corrosion coated inside and outside of chassis.	
12. Other requirement			
(1)	Standard tool for emergency	Manufacturer's standard	
(2)	Triangle reflector	Provide	
13. Painting			
(1)	Exterior	Two coats of Melamine Plastic Paint	
(2)	Interior	Manufacturer's standard	
(3)	Finish color of exterior and interior	Based on requirement by the Client	

Table 2-2-6 Specifications for Standard Bus

No.	Items	Requirement	Remarks
A. Specification of engine and chassis			
1. Major specification			
(1)	Type of vehicle	Heavy duty bus for city operation	
(2)	Driving position	Left hand drive front	
(3)	Engine location	Rear mounting engine, horizontal or vertical	
(4)	Chassis frame	Frame or truss type (Chassis maker is same maker with engine maker)	
(5)	Driving wheel (power axle)	2 (power axle: rear drive)	
(6)	Loading capacity	No. of passenger's seats: 30 (minimum) No. of passengers: 100 (minimum)	
(7)	Gross vehicle weight (GVW)	18,000kg (minimum) including weight of passengers	Total weight of passengers 100passengers x 80kg = 8,000kg
(8)	Design condition		
	1) Ambient temperature	-20 to 40 deg. C The proposed diesel engine must have low fuel consumption and low noise, be capable of cold starting down to -20 deg. C.	Cold proofing specification
	2) Altitude	117 m above sea level	
	3) Heating system	Passengers compartment 18 deg. C in winter season. When ambient temperature is below -10 deg. C, the indoor temperature shall not deviate by more than 5 deg. C.	
(9)	Steering system	Power steering	
2. General dimensions			
(1)	Wheel base	Approx. 5,700 mm	
(2)	Overall length	11,000 - 12,000 mm	
(3)	Overall width	2,400 - 2,500 mm	
(4)	Overall height	3,250 mm (maximum)	
(5)	Inner height	2,100 mm (minimum)	
(6)	Front overhang	2,800 mm (approx.)	
(7)	Rear overhang	3,500 mm (approx.)	
(8)	Enter and exit height	360 mm (maximum)	
(8)	Floor height	930 mm (maximum)	
(10)	Road clearance	250 mm (minimum)	
3. Performance			
(1)	Maximum speed	70 - 90 km/h	
(2)	Turning radius	24 m (maximum)	
4. Engine			
(1)	Type	Direct injection type	
(2)	Used fuel	Diesel	
(3)	Cycle	4 cycle	
(4)	No. of cylinders	6 cylinders inline arrangement	
(5)	Cooling	Water-cooled	

No.	Items	Requirement	Remarks
(6)	Output	180 – 220 kW	
(7)	Torque	1000 – 1500 Nm	
(8)	Fuel consumption	35 - 40 liters/100km (maximum)	
(9)	Exhaust emissions	Meet to European Standard (EURO3)	
5. Injection pump			
(1)	Type	In line plunger with limit speed governor	
6. Main oil filter			
(1)	Type and capacity	Based on the type of engine	
7. Air cleaner			
(1)	Type	Paper element replaceable type	
8. Transmission			
(1)	Type	Automatic transmission with minimum 4 speeds integrated retarder	
9. Axle			
(1)	Type of axle	Individual wheel suspension or rigid axles are allowed	
(2)	Power axle (differential)	Banjo, fully floating type	
(2)	Axle load for min. 100 passengers (front/rear)	7.0 / 11.5 tons (maximum)	
10. Brake			
(1)	Service brake	Disks or drum brakes The power brake system shall be designed by compressed air system	
(2)	Parking brake	Spring brake	
(3)	Others	Anti-blocking system (ABS) shall be provided	
11. Suspension			
(1)	Type	Pneumatic suspension suitable for heavy duty city bus on each wheel	
12. Shock absorber			
(1)	Type	Hydraulic double acting telescope on each wheel	
13. Wheels			
(1)	Tire size	11R22.5 or 295/80-R22.5 or manufacturers standard, Radial	
(2)	Rim and wheel	7.5V – 20 (minimum)	
(3)	Type	8 – 10 studs	
14. Fuel system			
(1)	Tank capacity	250 liters (minimum)	
(2)	Fuel cleaning system	Water sedimenter with dual fuel filter or separator	
15. Electrical equipment			
(1)	Battery	12Volts, 180AH (minimum)x2 in series connection	
(2)	Alternator	28V - 100A (minimum)	
(3)	Horn	Dual electric horn	

No.	Items	Requirement	Remarks
B. Specification of body			
1. Seating capacity		Number of seat: minimum 30 seats	
2. Body structure			
(1)	Construction	Rear or middle engine body, left hand drive	
(2)	Exterior panels	1.2 – 1.5 mm thickness steel panel	
(3)	Ceiling inner panels	Not less than 0.8 mm thickness steel panel or 4 mm plywood (compressed wood) panel	
(4)	Side inner panels	0.8 mm thickness steel panel or 4 – 5 mm plywood (compressed wood) panel	
(5)	Fascia and front inner panels	Fascia panel: steel or plastic plate. Front inner panel: 1.0 – 1.2 mm thickness steel panel or 2.5 mm plywood (compressed wood) panel.	
(6)	Step	Non-slip steel treads and risers	
(7)	Battery storage	Steel compartment with drawer under the floorboard for easy maintenance	
(8)	Thermal insulation	To meet with the interior temperature requirements	
3. Doors			
(1)	General	The current position of all doors shall be indicated at the driver's seat. The doors must be locked when the bus is moving. The door edges to be covered with rubber profile. The doors can be opened from inside and outside the bus in case of emergency. Front door shall be locked from outside. Rear and middle doors shall be locked from inside or outside.	
(2)	No. of doors	3 doors on right hand side for passengers	
(3)	Type	Electro-pneumatic inward swinging doors glazed with safety glass	
(4)	Dimension of door width	2 double wing doors: min. 1200mm 1 single wing door: min. 650mm	
(5)	Door control mechanism	Operation by driver from driver's seat	
4. Windows			
(1)	General	The bus must be equipped with emergency windows (minimum 30% of total windows). Windows and their moldings must be vandalism-proof. Safety glass and tinted (sunshine protected)	
(2)	Front windshield	One part(non-divided) laminated windshield	
(3)	Side windows	Upper area opening type to be equipped	
(4)	Driver's window	Sliding opening type to be equipped	
(5)	Rear window	To be protected with bars (interior) on location	

No.	Items	Requirement	Remarks
5. Floor			
(1)	Flooring	16 - 25 mm thickness water glued proof plywood or hard wood. Noise protection shall be considered.	
(2)	Floor coating	Non-slip cover (PVC resinous sheet with thickness minimum 3 mm)	
6. Seats			
(1)	Driver's seat		
1)	Type	Seat adjustable to height, back and forth	
(2)	Passenger's seat		
1)	Type	Heavy duty vinyl leather with seat cushion, without arm-rest	
2)	Arrangement	Seats must be mounted in transverse position, arranged 2x2, 2x1 and 1x1 format	
7. Electrical equipment			
(1)	Head lamps	2 - 4 lamps	
(2)	Fog lamps	2 yellow fog lamps on both sides of front bumper	
(3)	Front combination lamps	2 lamps on both sides of front panel. Amber (turn), white (parking)	
(4)	Rear combination lamps	2 lamps on both sides of rear panel. Amber (turn), red (stop, parking)	
(5)	Marker lamps	4 lamps on both corners of front and rear roof. Amber	
(6)	Back lamps	2 white lamp under the rear bumper	
(7)	Room lamps	20W fluorescent lamps on the ceiling over aisle, 2 integral switches on the instrument panel. 100 lux measured at 1m above the floor required.	
(8)	Step lamps	Both side of step	
(9)	Buzzer	Reverse warning buzzer	
(10)	Windshield washer	Electric washer with 2 nozzles under both sides of front windshield	
(11)	Windshield wiper	2 speeds wiper	
(12)	Electric outlet	An outlet for inspection lamp	
8. Ventilation			
(1)	Front ventilator	Hatch type inlet under front windshield	
(2)	Roof ventilator	3 hatches 2 turbo ventilators in the front side roof 2 turbo ventilators in the rear side roof	
9. Exterior equipment			
(1)	Bumpers	Painted steel or PVC bumpers on front and rear	
(2)	Rear view mirrors	2 pieces of mirror on both ends of front	
(3)	Towing hooks	2 pieces (front and rear)	
(4)	Mud guards	Synthetic rubber behind each tire	
(5)	Destination sign box	Electrical display, one at the front and one at the side	

No.	Items	Requirement	Remarks
10. Interior equipment			
(1)	Sun visors	2 acryl resinous sun visors above front windshield	
(2)	Driver's compartment	Window side: Roll up screen Behind of driver: Plastic panel	
(3)	Step mirror	Around mirror on ceiling above the rear step	
(4)	Room mirrors	2 interior rear view mirrors on ceiling above front windshield	
(5)	Fire extinguisher	A fire extinguisher near the driver's seat (Based on the regulation M.N5.504	
(6)	First-aid kit	Near the driver's seat (box only)	
(7)	Safety wheel blocks	2 equipped, made by steel	
(8)	Labels	Written in Serbian language	
(9)	Announce system	Three speakers and one microphone for the driver	
(10)	Clock	One clock at the front	
(11)	Exit signal	Three push buttons near the doors	
(12)	Grab rail	Steel pipes covered by PVC	
(13)	Power supply for ticket machine	To provide the power cable pipings only (near the all doors)	
11. Coating			
(1)	Corrosion protection	Anti-corrosion protection. Salt protection is needed (the use of salt on the road in winter season). Chassis shall be anti-corrosion coated inside and outside of chassis.	
12. Other requirement			
(1)	Standard tool for emergency	Manufacturer's standard	
(2)	Triangle reflector	Provide	
13. Painting			
(1)	Exterior	Two coats of Melamine Plastic Paint	
(2)	Interior	Manufacturer's standard	
(3)	Finish color of exterior and interior	Based on requirement by the Client	

2) Spare Parts

The spare parts for the articulated buses and those for the standard buses to be procured under the Project have been finalised through discussions with GSP Belgrade, surveys and examinations and are shown in Table 2-2-7 and Table 2-2-8 respectively.

Table 2-2-7 Spare Parts for Articulated Bus

No.	Parts name	Quantity	Remakes
1	Oil filter element (cartridge)	10	
2	Element (cartridge) for oil-water separator	10	
3	Air cleaner	5	
4	Fuel filter	20	
5	Filter for hydrostatic ventilator drive	2	
6	Filter for automatic gearbox	4	
7	Air dryer element (cartridge)	4	
8	Oil pressure indicator	1	
9	Water temperature indicator	1	
10	Instrument temperature indicator	1	
11	Water pump repair set	1	
12	Brake drum	4	
13	Brake drum lining with rivets	12	
14	Wheel bolt	20	
15	Shock absorber	4	
16	Air bellow	8	
17	Instrument board switch (first door)	2	
18	Instrument board switch (heater)	2	
19	Instrument board switch (window wash)	2	
20	Instrument board switch (two positions)	2	
21	Instrument board switch (wipers)	2	
22	Instrument board switch (engine brake)	2	
23	Instrument board switch (automatic clutch)	2	
24	Signal lamp (yellow)	4	
25	Signal lamp (white)	4	
26	Signal lamp (red)	4	
27	Fuel level indicator	2	
28	Relay	12	
29	Cylinder for doors (door mechanism)	6	
30	Electromagnetic valve for doors	2	
31	Brake pedal set	2	
32	Tire	6	
33	Glass for doors	4	with seal rubber or equivalent
34	Side glass for passenger compartment	4	with seal rubber or equivalent
35	Windshield	0.5	with seal rubber or equivalent
36	All belt for engine	2 set	
37	Light bowl	2 set	
38	All hoses for cooling and braking system	2 set	
39	Bearing for door holder	2	
40	Wiper	4	
41	Fuse 15A	20	
42	Fuse 16A	20	
43	Fuse 20A	20	
44	Fuse 50A	20	
45	Joint rubber or shaft joint for ventilator	10	

Table 2-2-8 Spare Parts for Standard Bus

No.	Parts name	Quantity	Remakes
1	Oil filter element (cartridge)	10	
2	Element (cartridge) for oil-water separator	10	
3	Air cleaner	5	
4	Fuel filter	20	
5	Filter for hydrostatic ventilator drive	2	
6	Filter for automatic gearbox	4	
7	Air dryer element (cartridge)	4	
8	Oil pressure indicator	1	
9	Water temperature indicator	1	
10	Instrument temperature indicator	1	
11	Water pump repair set	1	
12	Brake drum	2	
13	Brake drum lining with rivets	8	
14	Wheel bolt	20	
15	Shock absorber	2	
16	Air bellow	4	
17	Instrument board switch (first door)	2	
18	Instrument board switch (heater)	2	
19	Instrument board switch (window wash)	2	
20	Instrument board switch (two positions)	2	
21	Instrument board switch (wipers)	2	
22	Instrument board switch (engine brake)	2	
23	Instrument board switch (automatic clutch)	2	
24	Signal lamp (yellow)	4	
25	Signal lamp (white)	4	
26	Signal lamp (red)	4	
27	Fuel level indicator	2	
28	Relay	12	
29	Cylinder for doors (door mechanism)	4	
30	Electromagnetic valve for doors	2	
31	Brake pedal set	2	
32	Tire	4	
33	Glass for doors	2	with seal rubber or equivalent
34	Side glass for passenger compartment	2	with seal rubber or equivalent
35	Windshield	0.5	with seal rubber or equivalent
36	All belt for engine	2 set	
37	Light bowl	2 set	
38	All hoses for cooling and braking system	2 set	
39	Bearing for door holder	2	
40	Wiper	4	
41	Fuse 15A	16	
42	Fuse 16A	16	
43	Fuse 20A	16	
44	Fuse 50A	16	
45	Joint rubber or shaft joint for ventilator	6	

3) Repair Equipment

The specifications for the repair equipment for the buses to be procured under the Project have been finalised through discussions with GSP Belgrade, surveys and examinations and are shown in Table 2-2-9.

Table 2-2-9 Repair Equipment

No.	Description	Quantity		Remarks
1	Hot Water High Pressure Washer Capacity : 900 Liter/hour Pressure : 100 kgf/cm ² G Voltage: 3-phase 380V	1	unit	
2	Jet Parts Washer Max. Washable : 1370 x 850 mm Max. Washable Weight : 1000 kg Water discharge: 500 liter/min. Voltage: 3-phase 380V	1	unit	
3	Diesel Smoke Meter Type: Optical with stand and printer Voltage: Single-phase 220V or DC12V	1	set	
4	Flexible Fiber Scope with light unit Diameter: Approx. 8 mm Effective length: 2 m Bending angle: up/down and right/left: 90deg. Voltage: Single-phase 220V	2	sets	
5	Battery Tester Applicable:12V/18-200Ah	2	pieces	
6	Screw Compressor Electric voltage: 3-ph 380V Motor output: 22kW Air pressure: 13.7 kgf/cm ² G Discharge volume: 2.0m ³ /min Voltage: 3-phase 380V	2	units	
7	Brake Drum Lathe Capacity dia.: 250-600mm, Width: 350mm Grinding drum dia.: 100mm, Length: 270mm Voltage: 3-phase 380V	2	units	
8	Brake Lining Riveter Capacity: 5 ton at 10kgf/cm ² G Operation: By air hydraulic	2	units	

No.	Description	Quantity		Remarks
9	Fork Lift Capacity: 1,500kg Lifting High: minimum 2,000mm Engine: Diesel, 50 PS Mission: Torque Control Type	2	units	
10	Mechanic Tool Set Floor mounted cabinet type	10	sets	
11	MIG/MAG Welding Machine with wire feeder, torch Welding current: 40 - 350A Duty cycle: 60% Voltage: 3-phase 380V	2	units	
12	DC Arc Welder Welding Current : 20-300A Duty Cycle : 40% Voltage: 3-phase 380V	2	units	
13	Hydraulic Garage Jack Capacity : 15 Ton Min. Saddle Height: 200 mm Max. Saddle Height: 600 mm	10	units	
14	Air Angle Grinder Wheel Size: 100mm Air consumption: Approx. 0.6 m3/min. at 6 kg/cm2	8	pieces	
15	Air Drill Drilling capacity: Min. 13mm Air consumption: Approx. 1.0 m3/min. at 6 kg/cm2	10	pieces	
16	Air Impact Wrench Wrench size: 1 "sq. Capacity (bolt dia.): 36mm Air consumption: Approx. 0.3 m3/min. at 6 kg/cm2	8	pieces	
17	Oil Drain with caster and handle Overall height : Min. 200mm Receiver capacity: Min. 75 liters Pump: Air operated	2	units	
18	Impact Wrench Holder with casters Working height: 200 - 850mm	8	units	
19	Battery Quick Charger AC Input: 6.0 kVA DC Output: 12 - 24V/140A Voltage: 3-phase 380V	2	units	

No.	Description	Quantity		Remarks
20	Hand Tool Set Handy tool box type	30	sets	
21	Electrician Tool Set Handy tool box type	10	sets	
22	Body & Fender Tool Set Handy tool box type	4	sets	
23	Alternator Test Bench Indicator: Volt meter, RPM meter, Ampere meter and Alternator scope Motor: 11 kW Max. load test: 4 kW Voltage: 3-phase 380V	1	unit	
24	Bench Drill Press Capacity (Steel): 23 mm Power Output: 400 W Spindle revolution: Approx. 400-2,400 rpm Voltage: Single-phase 220V	2	units	
25	Waste Parts and Material Container Steel mesh type Size: 1200x1000x900mm	10	Pieces	
26	High Speed Abrasive Cut-off Machine Wheel dia.: Min. 300mm Cutting capacity: 100x100mm (angle bar) Voltage: Single-phase 220V	2	Pieces	
27	Air Impact Wrench Wrench size: 1/2"sq. Capacity: 16mm (bolt dia.) Air consumption: Approx. 0.1 m ³ /min. at 6 kg/cm ²	8	Pieces	
28	Vacuum Cleaner Electric Motor Type Motor: 3kW Tank capacity: Min. 60 liters Voltage: 3-phase 380V	2	units	
29	Wheel Dolly Applicable tire size: 7.50 - 11.00 Max. tire weight: Min. 500 kg Lift: Min. 125mm	4	sets	
30	Portable Lubricator for Grease with hose and gun Delivery Pressure : 240 kgf/cm ² G Delivery Lubricant: 700 g/min.	2	units	

No.	Description	Quantity		Remarks
31	Hydraulic Shop Press with Hydraulic Hand Pump Capacity: Min. 50 ton Stroke: Min. 150mm Working space: 914(W) x 1118(H) mm	1	set	
32	Pit Lift Capacity: 10,000kg Lift: Approx. 450mm Required air pressure: Approx. 14 kgf/cm ² G Applicable pit width: 750 - 1000mm	10	units	
33	Tools for Tire Change on the road 1 set of 2.5 tons floor crane 1 set of engine compressor (250 liters, 14kgf/cm ² G) 1 set of 10 tons Garage jack 4 sets of rigid rack 2 sets of service creeper 2 set of air impact wrench (for 3/4" and 1" sq)	2	units	
34	Bus Lift Capacity: Min. 30 ton Lifting height: Min. 1500 mm Voltage: 3-phase 380V	2	sets	
35	Brake Tester with indicator stand Max. axle load: 10 ton (wheel: 5ton x 2) Measuring range per wheel: 50 - 3,000kg Roller size: 120mm dia. Voltage: 3-phase 380V	1	unit	