(9) Sand Storms

Despite the dry weather with little rainfall throughout the year, no sand storms occur due to the weak wind in the range of several meters per second.

2-3-2-2 Transport Conditions in Ulaan Baatar

(1) Number of Registered Vehicles

The number of registered vehicles in Ulaan Baatar as of the end of 1993 is shown in Table 2-3-3. The number of private cars is 8,187 and the car ownership ratio is 1/77 persons which is quite low by present-day standards, making it necessary for most citizens to depend on buses as their means of transport. Taxi operators must obtain a licence issued by the Transport Department of the Metropolitan Authority and some 1,000 taxis are licenced as of September, 1994.

Table 2-3-3 Vehicle Registration (as of end of 1993)

Type	Number	Ratio (%)
Motorbikes	27,038	57.8
Official Cars	1,721	3.7
Private Cars	8,187	17.5
Buses	805	1.7
Trucks	6,802	14.5
Special Vehicles	2,217	4.7
Total	46,770	100.0

Source: Mongolia Transport Research Institute

(2) Number of Trips by Transport Mode

Table 2-3-4 shows the annual number of trips by transport mode in Ulaan Baatar except walking. The share of public transport was as high as 98.2% in 1992. Public buses and trolley buses had a combined share of 88%, indicating the importance of bus services for public life in Ulaan Baatar.

Table 2-3-4 Number of Trips by Transport Mode

(Unit: 1,000)

Type	1985		1990		1991		1992	
	No. of Trips	(%)	No. of Trips	(%)	No. of Trips	(%)	No. of Trips	(%)
Public Passenger Cars	6,360.0	4.1	5,447.5	2.8	4,740.0	2.3	3,872.5	1.7
Private Passenger Cars	1,671.0	1.1	121.8	0.1	136.8	0.1	245.7	0.1
(Passenger Car Sub-Total)	8,031.0	5.1	5,569.3	2.9	4,876.8	2.3	4,118.2	1.8
Public Buses	139,211.7	88.9	123,777.5	64.0	137,000.6	65.4	149,612.2	64.5
Company Buses	8,537.4	5.4	10,740.6	5.6	9,868.5	4.7	8,625.0	3.7
Trolley Buses	0	0.0	46,124.1	23.9	49,980.6	23.9	54,537.9	23.5
(Bus Sub-Total)	147,749.1	94.3	180,642.2	93.4	196,849.7	94.0	212,775.1	91.7
Taxis	872.5	0.6	7,121.6	3.7	7,740.6	3.7	15,030.0	6.5
(Public Transport Total)	148,621.6	94.9	187,763.8	97.1	204,590.3	97.7	227,805.1	98.2
Total	156,652.6	100.0	193,333.1	100.0	209,467.1	100.0	231,923.3	100.0

Source: Mongolia Transport Research Institute

(3) Road Conditions

The asphalt-paved wide roads running north-south and east-west in Ulaan Baatar create a tidy trunk road network which has been constructed in accordance with an urban development programme since the 1950's with the assistance of the Soviet Union and China. The key road is Enkhtayvan Avenue which runs in the east-west direction to the south of the city centre (Sukhbaatar Square). On both sides of the median, 3 lanes are accompanied by a wide pavement. Most trunk roads linking with this Avenue have 2 - 3 lanes on one side and present no real obstacle to bus operation except for minor surface undulations.

(4) Current Bus Routes

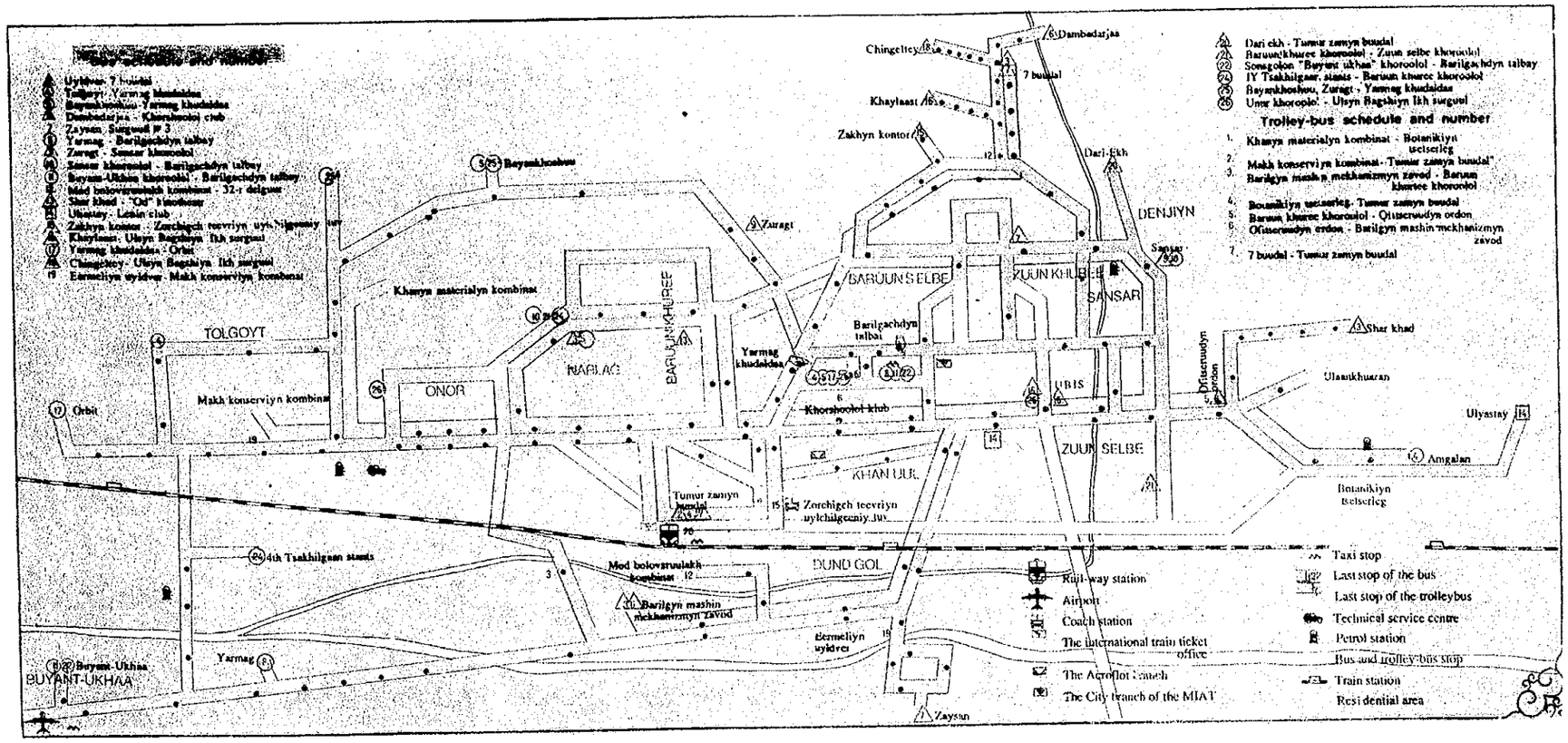
Fig. 2-3-2 shows the current bus routes in Ulaan Baatar. There are currently 30 routes and 290 buses are scheduled to provide 2,962 trips/day as shown in Table 2-3-5. In reality, however, the number of actual trips is slightly lower than the scheduled figure because of unexpected vehicle breakdowns and/or accidents.

Table 2-3-5 Current Bus Routes

Bus Company	Route No.	No. of Buses in Operation	Trips (trips/day)	Route Length (km)	Operation Mileage (km/bus)	Average Head (mins.)	Peak Head (mins)	Peak Transportat-ion Capacity (persons/hr)	Travell-ing Time (mins)	Average Speed (km/hr)
Bus - 1 Company	3	14	156	27.0	300.9	6.2	5.0	1,066	70	23.1
	6	7	91	25.0	325.0	10.5	8.6	620	60	25.0
	7	6	106	18.5	326.8	9.1	7.3	730	44	25.2
	9	8	142	17.0	301.8	6.8	5.5	969	44	23.2
	13	18	234	25.0	325.0	4.1	3.3	1,615	60	25.0
	15	8	142	13.0	230.8	6.8	6.0	888	48	16.3
	16	8	130	20.0	325.0	7.4	6.0	888	48	25.0
	18	8	104	25.0	325.0	9.2	7.5	710	60	25.0
	20	7	114	12.5	203.6	8.4	6.8	784	48	15.6
	21	6	106	17.0	300.3	9.1	7.3	730	44	23.2
	Sub-Total	90	1,325	200.0	294.4	7.8	6.3	853	53	22.7
Bus - 2 Company	4	14	152	29.0	314.9	6.3	5.1	1,018	72	24.2
	5	8	156	17.0	331.5	6.2	5.0	1,038	40	25.5
	8	14	182	26.0	338.0	5.3	4.3	1,207	60	26.0
	10	8	142	16.0	284.0	6.8	5.5	944	44	21.8
	11	8	78	35.5	346.1	12.3	10.0	519	80	26.6
	17	4	44	28.0	308.0	21.8	17.5	297	70	24.0
	22	6	58	39.0	377.0	16.6	13.3	390	80	29.3
	24	5	55	28.0	308.0	17.5	14.0	371	70	24.0
	25	7	114	22.0	358.3	8.4	6.8	763	48	27.5
	26	16	260	18.0	292.5	3.7	3.0	1,730	48	22.5
	Sub-Total	90	1,241	258.5	356.4	10.5	8.4	639	61	25.1
Bus - 3 Company	14	5	78	22.0	343.2	12.3	10.0	480	60	22.0
	23	5	97	21.0	407.4	9.9	8.0	600	48	26.3
	Sub-Total	10	175	43.0	376.3	11.1	9.0	540	54	22.3
Trolley Bus Company	1	16	227	26.0	368.9	4.2	2.6	2,043	55	28.4
	2	14	176	19.0	238.9	5.5	3.4	1,584	62	18.4
	3	16	204	17.9	228.2	4.7	2.9	1,836	61	17.6
	4	16	192	20.9	250.8	5.0	3.1	1,728	65	19.3
	5	16	183	22.0	251.6	5.2	3.3	1,647	68	19.4
	6	8	120	17.5	262.5	8.0	5.0	1,080	52	20.2
	7	10	137	16.6	227.4	7.0	4.4	1,233	57	17.5
	8	4	44	16.0	176.0	21.8	13.6	396	40	24.0
	Sub-Total	100	221	19.5	344.5	7.7	4.8	1,443	58	20.6
Total		290	2,962	521.0	317.9	9.3	7.1	869	56	22.7

Source: Ulaan Baatar Transport Department

The average mileage/vehicle/day is 317.9km which is relatively higher than the average mileage of 260km for standard urban public buses in developing countries. This high daily mileage may be caused by the heavy work load due to the relatively small number of available buses, implying much wearing of the parts of the vehicles and hard work on the part of drivers and conductors. Assuming that the desirable daily mileage is 260km/vehicle, 354 buses, 1.22 times more than the size of the present fleet, will be required.



Bus Company	Number	Bus Route Number	Departure Point	→ Final Destination	First Bus	Last Bus	No. of Buses in Use	No. of Daily Trips	Route Length (km)	Travelling Time (mins)	No. of Stations
Bus-1 Company	(1)	1	7 buudal	→ Industrual Park	6.30	22.30	14	156	27	70	30
	(2)	6	Dambadarjaa	→ Khorshoolol	6.30	22.30	7	91	25	60	26
	(3)	7	Zayaan	→ No 3 School	6.30	22.30	6	106	18.5	44	17
	(4)	9	TV station	→ District 12	6.30	22.30	8	142	17	44	18
	(5)	13	Shar khad	→ Od theater	6.30	22.30	18	234	25	60	26
	(6)	15	Market Office	→ U.B. Station	6.30	22.30	8	142	13	48	18
	(7)	16	Khaylaast	→ Nat. Ed. Univ.	6.30	22.30	8	130	20	48	23
	(8)	18	Chingeltey	→ Nat. Ed. Univ.	6.30	22.30	8	104	25	60	29
	(9)	20	Dari ekh	→ U.B. Station	6.30	22.30	7	114	12.5	48	23
	(10)	21	District 12, 13	→ District 3, 4	6.30	22.30	6	106	17	44	19
	Total						90	1,325	200	526	229
	Average						9	13	20	53	23
Bus-2 Company	(1)	4	Tolgoyto Dist.	→ Y. khudaldaa	6.30	22.30	14	152	29	72	31
	(2)	5	Bayanknoshuu	→ Y. khudaldaa	6.30	22.30	8	156	17	40	21
	(3)	8	Yarmag	→ Barilgachdyn Sq.	6.30	22.30	14	182	26	60	23
	(4)	10	Sansar	→ District 3, 4	6.30	22.30	8	142	16	44	19
	(5)	11	Airport	→ Barilgachdyn Sq.	6.30	22.30	8	78	35.5	80	28
	(6)	17	Orbit	→ Barilgachdyn Sq.	6.30	22.30	4	44	28	70	22
	(7)	23	Airport	→ Sonsgolon	6.30	22.30	6	58	39	80	16
	(8)	24	No. 4 Thermal	→ Baruun khuree	6.30	22.30	5	55	28	70	23
	(9)	25	Bayankhoshuu	→ Yarmag khudaldaa	6.30	22.30	7	114	22	48	13
	(10)	26	District 1	→ Nat. Ed. Univ.	6.30	22.30	16	260	18	48	24
	Total						90	1,241	258.5	612	220
	Average						9	12	26	61	22
Bus-3 Company	(1)	14	Ulyastay	→ District 13, 14	6.30	22.30	5	78	22	60	17
	(2)	22	Sufbaad Sq.	→ Tawanshal	6.30	22.30	5	97	21	48	17
	Total						10	175	43	108	34
	Average						5	87	21	54	17

Bus Company	Number	Bus Route Number	Departure Point	→ Final Destination	First Bus	Last Bus	No. of Buses in Use	No. of Daily Trips	Route Length (km)	Travelling Time (mins)	No. of Stations
Trolley Bus Company	(1)	1	Wall factory	→ Ind. culture ctr.	6.30	22.30	16	227	26	55	28
	(2)	2	Meat packers	→ U.B. Station	6.30	22.30	14	176	19	62	26
	(3)	3	Machine factory	→ District 3, 4	6.30	22.30	16	204	17.9	61	22
	(4)	4	Garden	→ U.B. Station	6.30	22.30	16	192	20.9	65	29
	(5)	5	District 3, 4	→ Officer's hall	6.30	22.30	16	183	22	68	29
	(6)	6	Officer's hall	→ Machine factory	6.30	22.30	8	120	17.5	52	25
	(7)	7	Doron buudal	→ U.B. Station	6.30	22.30	10	137	16.6	57	22
	(8)	8	Sansal	→ District 3, 4	6.30	22.30	4	44	16	40	19
	Total						104	1,283	155.9	460	200
	Average						13	160	20	58	25

Fig. 2-3-2 Ulaan Baatar Bus Route Map and Operation Details (as of October, 1994)

(5) Passenger Demand by Route

Table 2-3-6 shows the supply and demand balance of bus passengers by route, estimated based on the Bus Passenger OD Table for 1993 in the Ulaan Baatar 2010 year plan prepared by Ulaan Baatar City and the Ministry of Infrastructure Development and the actual bus routes. The most heavily congested route is Route 17 of Bus - 2 Company with a congestion rate of 240%. Route 8 of the same Bus - 2 Company, which runs east-west direction connecting city centre with west zones, attracts the highest number of passengers. The peak demand of 20,000 persons/day is, however, dealt with by the high service frequency, resulting in the highest congestion rate of 184% which is much lower than in the case of Route 17.

(6) Bus Service Operators

Fig. 2-3-3 and Fig. 2-3-4 show changes of the bus service operators and the organization of Passenger Transport Bus - 1 Company as of 1993. A private company (URGAMAL) which was formerly involved in trucking commenced bus services in 1994, bringing the total number of bus operators in Ulaan Baatar to 5. The Transport Department of Ulaan Baatar City still have authority over permission on routes, service frequency and fares, etc. In the case of the 4 public companies, their operational deficit is compensated for by the central government and local authorities. As the Transport Department of Ulaan Baatar City has the right to appoint management staff, these public companies cannot be said to be truly independent business entities.

Table 2-3-6 Bus Operation Data for 1993 (Estimate)

Bus Company	Route Number	Daily Service Frequency (trips/day)	Peak Service Frequency (trips/hr)	Maximum No. of Passengers (persons/day)	Daily No. of Passengers (persons/day)	Maximum Congestion Rate	Route Length (km)	Transport Efficiency (persons/km/bus)
Bus - 1 Company	3	156	13	2,820	13,502	0.29	27.0	3.21
	6	91	8	9,796	23,668	1.63	25.0	10.40
	7	106	9	5,049	7,596	0.75	18.5	3.87
	9	142	12	12,755	21,736	1.42	17.0	9.00
	13	234	19	4,980	13,029	0.35	25.0	2.23
	15	142	12	6,035	6,855	0.67	13.0	3.71
	16	130	11	4,244	7,785	0.51	20.0	2.99
	18	104	9	6,509	22,790	0.96	25.0	8.77
	20	114	10	4,885	16,410	0.65	12.5	11.52
	21	106	9	5,729	13,822	0.85	17.0	7.67
Bus - 2 Company	4	152	13	18,621	37,527	1.91	29.0	8.51
	5	156	13	6,067	18,536	0.62	17.0	6.99
	8	182	15	20,665	43,044	1.84	26.0	9.10
	10	142	12	8,263	29,677	0.92	16.0	13.06
	11	78	7	3,319	8,203	0.63	35.5	2.96
	17	44	4	7,226	14,287	2.41	28.0	11.60
	22	58	5	7,573	18,557	2.02	39.0	8.20
	24	55	5	5,041	11,971	1.34	28.0	7.77
	25	114	10	4,585	10,780	0.61	22.0	4.30
	26	260	21	13,065	23,751	0.83	18.0	5.08
Bus - 3 Company	14	78	7	7,087	14,704	1.35	22.0	8.57
	23	97	8	4,420	17,046	0.74	21.0	8.37
Trolley Bus Company	1T	227	19	16,462	27,238	1.16	26.0	4.62
	2T	176	15	5,440	12,570	0.48	19.0	3.76
	3T	204	17	7,583	19,445	0.59	17.9	5.33
	4T	192	16	11,849	34,935	0.99	20.9	8.71
	5T	183	15	3,122	8,244	0.28	22.0	2.05
	6T	120	10	5,653	12,557	0.75	17.5	5.98
	7T	137	11	14,478	51,153	1.75	16.6	22.49
	8T	88	8	8,245	27,299	1.37	16.0	19.39
Total		4,068	343		588,717	1.02	657.4	6.60

Source: Study Team Estimate

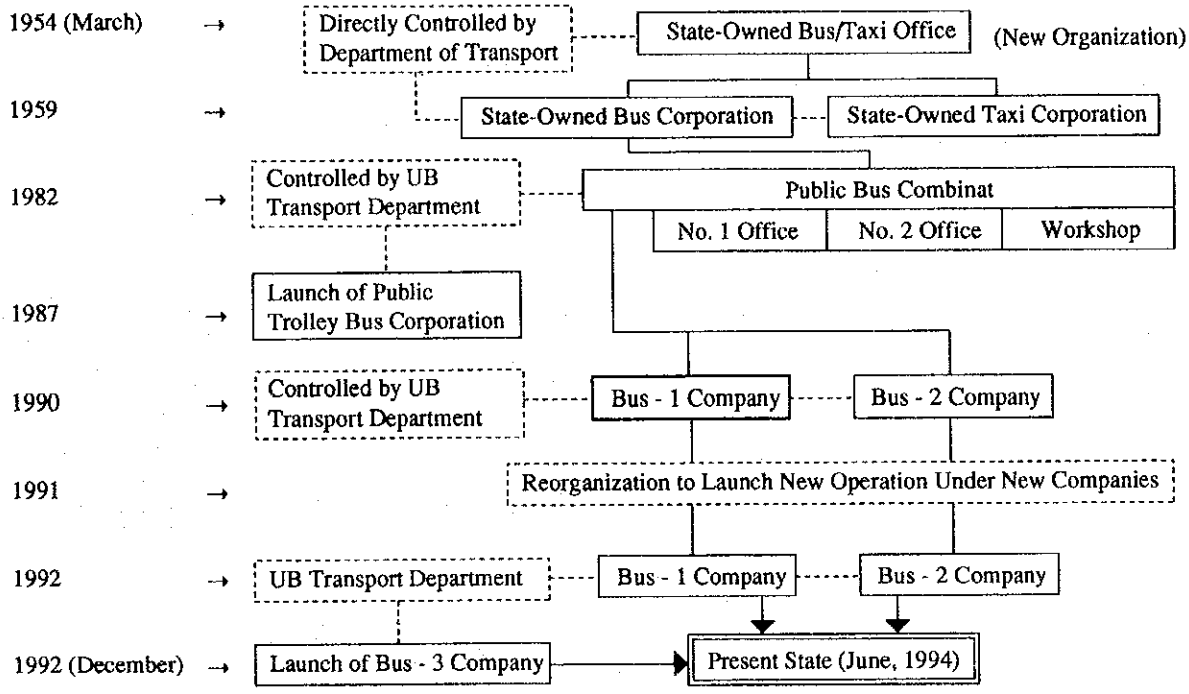
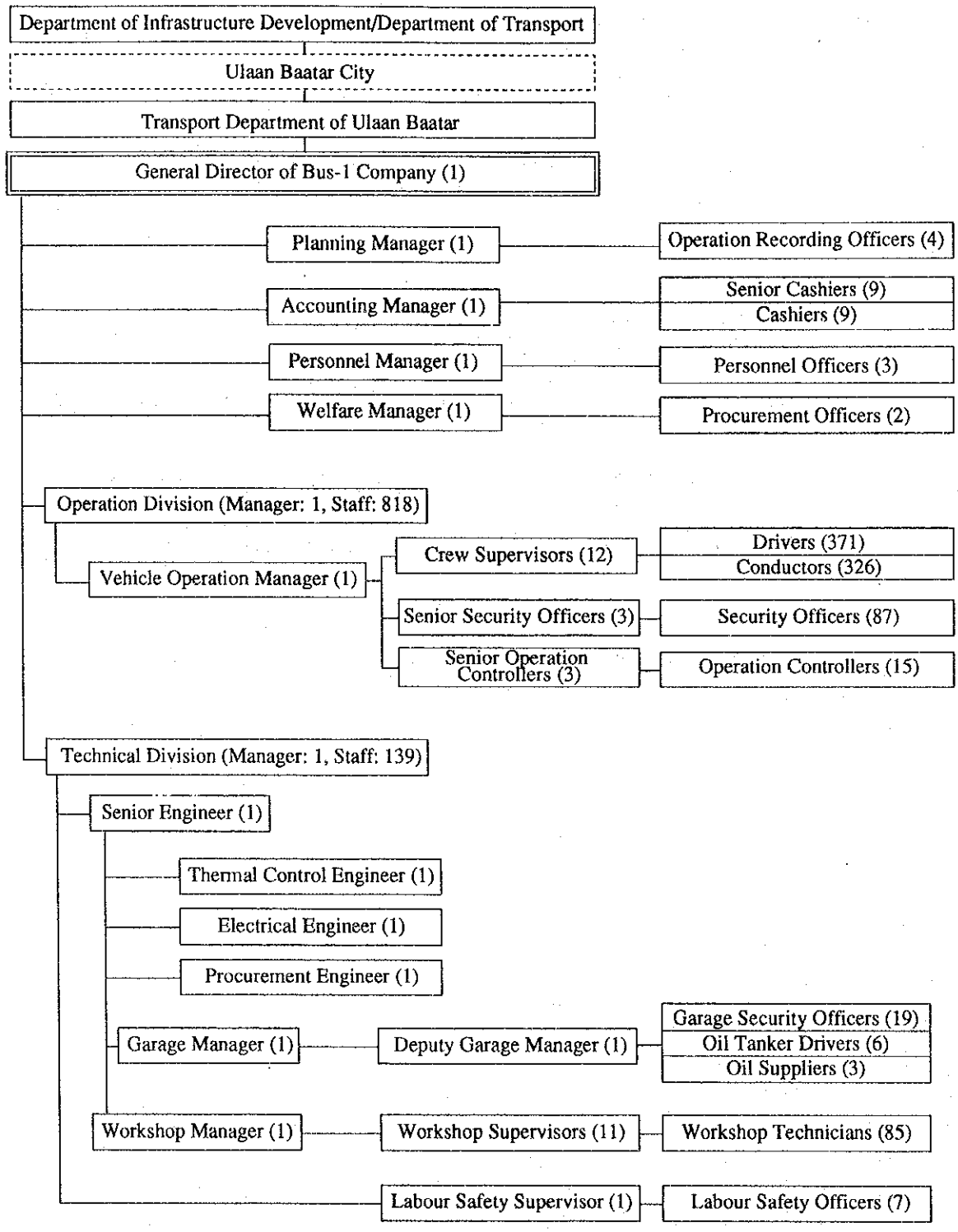


Fig. 2-3-3 Historical Changes of Bus Operation System in Ulaan Baatar Since 1954



Notes : 1) The figures in brackets are the number of staff under a specific job description.
2) The workforce total is 991.
Source : Passenger Transport Bus - 1 Company of Ulaan Baatar

Fig. 2-3-4 Organizational Chart of Passenger Transport Bus - 1 Company of Ulaan Baatar (as of June, 1994)

The number of employees of the bus companies as of June, 1994 is shown in Table 2-3-7. The number of employees per number of buses owned is 7.0 which is not particularly high. However, the average number of employees per operable vehicle of 10.3 is rather high vis-a-vis the normal figure of 6.0-7.0 per operable vehicle and may be caused by the high number of vehicles which are out of order and the operation system under which workers are assigned to specific vehicles. The number of drivers and conductors is approximately double the number of vehicles, underlining the assumption that 2 shifts provide the services.

Table 2-3-7 Current Manpower Strength

(Unit: persons)

Job Type	Bus - 1 Company	Bus - 2 Company	Bus - 3 Company	Trolley Bus Company	Total	Ratio (%)
Management	10	12	5	17	44	1.4
Engineers	29	25	24	10	88	2.8
Drivers	371	358	60	270	1,059	33.4
Conductors	326	338	38	275	977	30.8
Mechanics	97	106	14	255	472	14.9
Clerical Staff	105	106	19	121	351	11.1
Assistants	53	38	10	77	178	5.6
Total	991	983	170	1,025	3,169	100.0
Number of Buses Owned	122	130	46	154	452	-
Number of Employees/Bus	8.1	7.6	3.7	6.7	7.0	-
Number of Operable Buses	90	90	32	96	308	-
Number of Employees/Operable Bus	11.0	10.9	5.3	10.7	10.3	-

Source: Ulaan Baatar Transport Department

(7) Revenue and Expenditure of Bus Business

The revenue and expenditure of each bus company for 1993 and the first half of 1994 are given in Table 2-3-8. The number of passengers reported by each company is roughly 79.2% of the estimated annual bus passenger figure issued by the Transport Research Institute and seems to have been calculated on the basis of the fare revenue. The fare collection rate, which is a percentage of the actual revenue in the estimated revenue based on the estimated number of passengers and the actual fare, is 61.2%. The revenue deficit is compensated for by the central government and local authorities and the total deficit of all the bus companies in 1993 stood at 1,095 million Tg, accounting for some 2% of the national budget. The break even level for the bus fare is calculated to have been 10Tg in 1993 (the actual fare was 3Tg until June, 1993) and 23Tg at the

beginning of 1994. The necessity for such a steep increase of the bus fare to break even can be explained by the annual inflation rate of approximately 100%, making it essential to almost double the fare every year. The fare stands at 30Tg as of October, 1994.

The balance of both Bus - 1 Company and Bus - 2 Company shows that the fuel cost accounts for some 50-60% of the total expenditure. In fact, the fuel cost alone exceeds the revenue from bus fares. The depreciation cost is appropriated at a level of approximately 3-6% of the total expenditure. The depreciation level appears to have been determined based on the vehicle procurement cost deriving from the pre-1989 fixed rate of 20Tg to 1 US$ and the pre-1990 fixed rate of 40Tg to 1 US$. Procurement since the currency liberalisation in June, 1993 must use an exchange rate of 400Tg to 1 US$ and the resulting depreciation cost level must be some 10-20 times higher than the present depreciation cost level and the bus fare should be increased quadrupled in August, 1994. The fare increased could have remained in the range of 2-3 times if the fare collection rate had been improved to nearly 100%.

Table 2-3-8 Balance Sheet of Bus Companies

Bus Company	Bus - 1	Bus - 2	Bus - 3	Trolley Bus	Total
January-December, 1993					
Passengers (1,000)	74,792.2	54,341.7	1,263.9	40,906.1	171,303.9
Revenue (1,000Tg)	308,950.2	275,502.9	20,453.0	255,209.8	860,115.9
Expenditure (1,000Tg)	781,052.0	686,930.9	47,012.9	440,190.4	1,955,186.2
Balance (1,000Tg)	-472,101.8	-411,428.0	-26,559.9	-184,980.6	-1,095,070.3
Average Fare Collected (Tg/person)	4.1	5.1	16.2	6.2	5.0
Fare Break Even Level (Tg)	10.4	12.6	37.2	10.8	11.4
January-May, 1994					
Passengers (1,000)	25,010.0	21,479.5	3,936.6	21,445.0	71,871.1
Revenue (1,000Tg)	215,242.4	209,390.6	33,010.4	209,299.8	666,943.2
Expenditure (1,000Tg)	579,519.6	584,339.2	90,561.9	434,952.2	1,689,373.9
Balance (1,000Tg)	-364,277.2	-374,948.6	-57,551.5	-225,652.4	-1,022,429.7
Average Fare Collected (Tg/person)	8.6	9.7	8.4	9.8	9.3
Fare Break Even Level (Tg)	23.2	27.2	23.0	20.3	23.5
Year on Year Performance in 1994 on 1993					
Passengers	0.80	0.95	7.48	1.26	1.01
Revenue	1.67	1.82	3.87	1.97	1.86
Expenditure	1.78	2.04	4.62	2.37	2.07
Balance	1.85	2.19	5.20	2.93	2.24
Average Fare Collected	2.08	1.92	0.52	1.56	1.85
Fare Break Even Level	2.22	2.15	0.62	1.88	2.06

Source: Ulaan Baatar Passenger Transport Bus Companies

Table 2-3-9 Balance Sheet of Passenger Transport Bus - 1 Company

Item	January-December, 1993		January-June, 1994		Performance in 1994 on 1993
	Cost (10^3Tg)	Percentage of total expenditure	Cost (10^3Tg)	Percentage of total expenditure	
Expenditure					
Operating Expenditure					
Wages	100,359.2	12.85	104,439.4	18.02	2.08
Allowances	13,548.4	1.73	14,537.1	2.51	2.15
Fuel	418,400.0	53.57	283,539.0	48.92	1.36
Lubricant	64,088.8	8.21	32,658.1	5.63	1.02
Spare Parts	62,317.8	7.98	47,168.1	8.14	1.51
Tyres	12,078.0	1.55	6,490.6	1.12	1.07
Repairs	38,852.1	4.97	36,982.0	6.38	1.90
Miscellaneous	50,131.0	6.42	34,891.8	6.02	1.39
Sub-Total	759,775.3	97.28	560,706.1	96.73	1.48
Non-Operating Expenditure					
General Administration	179.7	0.02	615.8	0.11	6.85
Food	13,719.3	1.76	18,315.0	3.16	2.67
Coal and Firewood	367.3	0.05		0.00	
Welfare	1,508.0	0.19		0.00	
Housing	2,300.0	0.29		0.00	
Liability	3,202.4	0.41		0.00	
Sub-Total	21,276.7	2.72	18,930.8	3.27	1.78
Total	781,052.0	100.00	579,636.9	100.00	1.48
Revenue					
Operating Revenue	308,950.2	39.56	217,512.1	37.53	1.41
Subsidy	418,814.3	53.62	299,299.8	51.64	1.43
Total	727,764.5	93.18	516,811.9	89.16	1.42
Balance	-53,287.5	-6.82	-62,825.0	-10.84	2.36

Source: Passenger Transport Bus - 1 Company

(8) Current Bus Fleet

Public buses operating in Ulaan Baatar mainly consist of 4 types, i.e., gasoline engine LIAZ677 and 695 made in Russia, diesel engine KAROSA B732 made in Czechoslovakia and the Russian trolley bus ZIU682G. In addition, Bus - 3 Company operates microbuses made in China and others for charter purposes. URGAMAL, a private bus operator, has been using South Korean diesel buses for its services since September, 1994.

The age and average mileage of the buses owned by the bus companies, excepting those owned by URGAMAL, as of October, 1994 are compiled in

Table 2-3-10. The average age is 5.3 years and the average mileage is 312,000km. By company, the low mileage and low annual mileage of the fleet owned by the Trolley Bus Company are particularly noticeable. As Bus - 3 Company only uses 10 buses for its regular route services with other buses being used for charter and other purposes, the data differs from that for other companies.

Table 2-3-10 Bus Fleet as of October, 1994

Item		Bus - 1 company	Bus - 2 company	Bus - 3 company	Trolley Bus company	Total
Fleet Size		122	130	46	154	452
	Number of Operable Buses	85	81	32	83	281
	Ratio	0.70	0.62	0.69	0.54	0.62
Age	Average	4.9	5.0	5.8	5.6	5.3
	90% Value	6.9	6.9	10.1	7.2	7.3
Average Mileage (1,000km)		343	361	219	274	312
	90% Value	558	633	410	392	508
Annual Mileage (1,000km)		70.0	72.2	37.8	48.9	60.2
	90% Value	80.9	91.7	40.6	54.4	70.2

Source: Passenger Transport Bus Companies of Ulaan Baatar

As pointed out earlier, the current daily average mileage target of 317.9km/vehicle is somewhat higher than the ordinary figure. Assuming 330 working days/year, the annual mileage based on this daily mileage target is approximately 100,000km. Due to the high ratio of inoperable vehicles, however, the actual performance level is an average of some 60,000km/vehicle/year. In the case of Bus - 1 and Bus - 2 Companies, the figure is slightly better at 70,000km. The figure for the Trolley Bus Company is 50,000km, possibly because of power failures and other reasons.

The average ratio of operable vehicles of 62% is very low, mainly because of suspension and transmission failures, in turn caused by an excessive passenger load of more than 200% throughout the year. As a safety factor of 2.5-3.0 is adopted for bus design in Japan, Japanese buses would not face such serious mechanical failures after only 5 years even under a severe passenger load of 200%. Although the spare parts supply shortage is often pointed out to explain the low ratio of operable vehicles, the adoption of incorrectly calculated specifications, design mistakes of the buses purchased and/or inferiority of the

materials used are suspected. In short, it appears indisputable that the buses currently operating in Ulaan Baatar lack sufficient structural strength.

(9) Actual Operation of Existing Bus Fleet

1) Purpose of Use

Bus service in Ulaan Baatar.

2) Operating Conditions

① Load: mainly passengers with maximum hand luggage weight of some 60kg

② Loading Passengers

- Design Capacity	Russian Buses	: 80
	Czechoslovakian Buses	: 94
- Maximam Loading	Russian Buses	: 120
	Czechoslovakian Buses	: 150

3) Mileage

Annual: 70,000-90,000km

4) Expected Life

	New	After Overhaul
Russian Buses	6-7 years approximately 500,000km	approximately 350,000km
Czechoslovakian Buses	4-5 years approximately 400,000km	approximately 300,000km

5) Driving Performance

① Gear Shift/Transmission : Solenoid valve switch-over type with torque converter; single dry plate clutch; 3 forward gears and a reverse gear

② Speed : Maximum 50km/hr

③ Acceleration : No sudden start or acceleration due to the use of a torque converter.

④ Turning : Smooth turning assisted by the good driving skills of the drivers and wide road width in Ulaan Baatar.

⑤ Braking : Sudden braking seldom occurs.

6) Road Conditions

① Topographical Background: The operating area is located on a plateau of 1,325m above sea level and is generally flat.

② Road Types: Wide urban roads with no sharp bends

③ Road Surface: Concrete paved; some undulations but no special bus structure is required vis-a-vis the road surface conditions.

7) Garage

① Most of the buses are left outdoors from April 15th to October 15th.

② The buses are kept in heated garages from October 16th to April 14th.

8) Conditions and Problems of Current Bus Fleet

① Russian Buses:

V8 cab-over type gasoline engine located at the front. The body work is solid but the chassis suspension is weak. These buses have 2 passenger doors which are insufficient to deal with heavy boarding and unboarding of passenger. Consequently, they are ill reputed among bus users. The passenger space is rather small compared to the body weight. In short, they are unsuitable for city bus services to transport a large number of passengers. The front-mounted engine frequently breaks down, causing a headache for maintenance staff.

② Czechoslovakian Buses:

Horizontal straight V6 diesel engine with a turbo charger. The drive-train is similar to that of the Russian buses and is rather vulnerable in view of the large output. The clutch and transmission tend to breakdown as they are unable to cope with the excess load. Most of those buses not in operation have transmission failures. The adoption of a semi-frame and square pipes (100mm × 50mm × t3.5mm) to form the main structure does not produce a solid structure, presenting many problems, including cracks in the rear-mounted engine area, for all buses. The existence of 3 doors which are wider than those of the

Russian buses makes it easier for passengers to get on and off and are well reputed among bus users. The larger floor space as well as passenger capacity compared to the Russian buses have made the Czechoslovakian buses the mainstay of public bus services in Ulaan Baatar. The rear-mounted engine is less of a noise nuisance to both the drivers and passengers.

9) Special Specifications

① Because of their use in a cold area, the Russian buses have 2 internal heaters using the engine cooling water while the Czechoslovakian buses have 3 separate heaters (capacity: 15,000kcal/hr each) to warm the passenger area.

② Each driver carries repair tools on the bus and is responsible for the repair of any mechanical problem.

③ Hand rails are mounted on the inside of the windows to protect the glass and to ensure passenger safety (to avoid accidents due to sudden starting or stopping).

④ As the buses are garaged during the winter, no such special specifications as oil heaters are required to start the engine. Some of the Czechoslovakian buses are equipped with a hot air blowing device which is not used any more. The battery capacity is large to counter the lowering capacity in winter. Similarly, the generator capacity is large.

⑤ Radial tires (10.00R20) with a good road holding performance are used without chains for the various road surface conditions, including ice and snow.

(10) Present Conditions of Existing Workshops

The current conditions of the workshops operated by the Passenger Transport Bus Companies are outlined below together with a description of privately-run workshop in Ulaan Baatar. Tables 2-3-11~14 give an outline of the existing buildings at the depots of each Passenger Transport Bus Company.

1) Passenger Transport Bus - 1 Company

The workshop of Passenger Transport Bus - 1 Company has ample floor space for each section (engine shop; engine test room; washing yard; transmission and differentials shop; body shop; oiling shop; machining

shop; etc.) indicating that it was an advanced and fully equipped workshop when it was constructed in 1968. In the subsequently period of about 30 years, all the buildings and equipment have generally deteriorated to the point that the floor is stained with oil and rainwater leaks and standing water on the floor are not exceptional. Some of the inspection pits in particular are no longer in use as they are filled with oil and/or water.

Most of the existing repair equipment was originally purchased from the Soviet Union and Czechoslovakia between 1954 and 1982 and some equipment was added between 1989 and 1992. At present, 20 pieces of equipment out of 36 (approximately 55%) are not functioning properly. Hardly any tools for overhauling are provided. Consequently, the tools kept by the drivers (in their buses) are used to overhaul certain components. As these tools are the minimum tools necessary to barely restart a bus which has broken down, the urgent implementation of measures to establish preventive maintenance is necessary to ensure safe operation.

2) Passenger Transport Bus - 2 Company

The workshop of Passenger Transport Bus - 2 Company is larger than that of Bus - 1 Company. Repair equipment was installed in 1987 and the recent termination of Russian aid means that it is now difficult to replenish the shortage of equipment, accessories and spare parts. Consequently, 44 pieces of equipment out of some 80 (approximately 55%) are not functioning properly.

3) Passenger Transport Bus - 3 Company

This company has virtually no repair equipment.

4) Private Workshop

The workshop of the Mongol Machine Corporation, the largest private car maintenance company in Mongolia, is located in Ulaan Baatar. The Corporation was established in 1966 as a state-owned company with some 1,000 employees to maintain and repair Russian trucks (some 5 tons) and automobiles. After the shift to a market economy, the Corporation has been operated as a private company. As assistance from Russia is no longer available, the Corporation is finding it very difficult to repair or replenish its repair equipment and only some 20% of its existing equipment is operable. Accordingly, the workforce has diminished to 280. The workshop

can only conduct the simple assembly and processing of private cars and is incapable of conducting overhauls or other major work.

The workshop also has tire retrieving facilities for passenger cars. While it is not actually produced retrieved tires due to the increased operation cost and sluggish market situation for retrieved tires, it does manufacture simple rubber products. Given these conditions, it is impossible to use the workshop of the Mongol Machine Corporation to maintain and repair public transport buses.

5) Privately-Owned Tire Retreading Factory

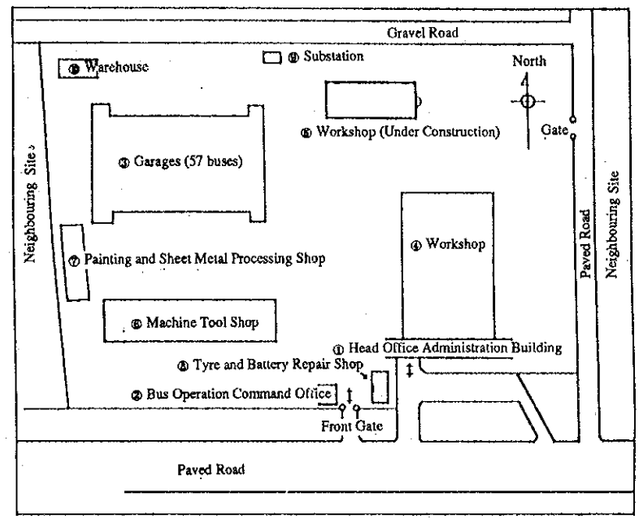
Mongol-Czech Metal Company, a joint venture between the Governments of Mongolia and Czechoslovakia, is located in Ulaan Baatar and produces retreaded tires for passenger cars as well as for large buses (10.00R20 which meets the tire specifications for the buses to be provided under the Project). At present, the bus companies do not place tire retreading orders with this factory on the grounds that their old tires have passed the stage of retreading. They are, however, willing to use tires remoulded by this factory when new buses are introduced in the future.

Table 2-3-11 Outline of Buildings of Main Depot of Passenger Transport Bus-1 Company

Category	Structure	Qty.	No. of Floors	Total Floor Area (m^2)	Year of Completion	Funding Source	Construction Cost (1,000 Tg)	Age	Current Conditions
① Head Office Administration Building	RC	1	3	1,620	1968	own capital	2,406.7	26	Houses offices, meeting rooms, canteen, rest room (for short naps) and other welfare facilities.
② Bus Operation Control Office	brick masonry	1	1	75	1968	own capital	(N.A.)	26	Monitors entry and departure of buses to and from the depot; issues work instructions to workers, receives notification of work hours, etc. from workers.
③ Garages (57 buses)	RC/ST	3 adjoining	1	3,800	1968	own capital	(N.A.)	26	Accommodates 57 buses; currently being used to house buses awaiting repair.
④ Workshop	RC/ST	1	1	2,900	1968	own capital	2,761.2	26	Same structure as garage; leakage of rainwater through the roof in several places due to deterioration.
⑤ Workshop (Under Construction)	RC/SC	1	4 (including basement)	1,100	1995 (planned)	own capital	about 30 million Tg	under const.	Work started in 1990 to construct a gymnasium but was later suspended due to a change of circumstances. The work resumed in May, 1994 to construct a new bus workshop and is planned to be completed at the end of 1994.
⑥ Machine Tool Shop	RC/WT	1	1	1,600	1968	own capital	16,000	26	The building is highly deteriorated. It houses several rooms, including a machining shop with old Soviet-made (1954 - 1979) lathes and drilling machines, etc., small machining shop to overhaul and repair small machine tools and storage room for tools and spare parts, etc. The deterioration of the interior is further stressed by dirty walls, etc. caused by smoke from coal stoves formerly used for heating
⑦ Painting and Sheet Metal Processing Shop	brick walls/RC roof	1	1	430	1976	own capital	(N.A.)	18	The building is relatively new and is designed in the Soviet style. Inside, the sheet metal processing shop is separated from the painting shop.
⑧ Tyre and Battery Repair Shop	brick masonry	1	1	100	1968	own capital	(N.A.)	26	The original purpose of use was later changed for the present purposes.
⑨ Substation	brick masonry	1	1	50	1968	own capital	(N.A.)	26	Receives commercial high voltage power and drops it to distribute low voltage power to all the facilities on the premises.
⑩ Warehouse	brick masonry	1	1	200	1968	own capital	(N.A.)	26	Constructed in 1968, the purpose of use was later changed and the building is now used as a ware-house for new tyres and other items.

Location and Rough Layout

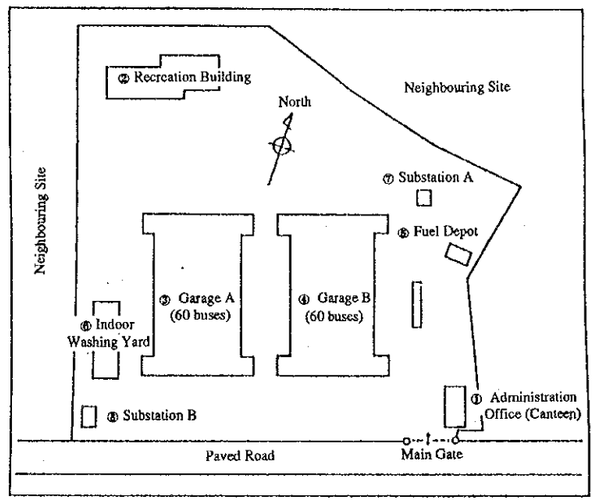
Located on the north side of Teeverchid Street, a trunk road along the railway track. The site area is approximately 4.1 ha. (All systems, i.e. road access, electricity, water, hot water for heating, telephone are sewerage, are functioning well.



Note: RC - reinforced concrete; ST - light steel roof truss; WT - wooden roof truss

Table 2-3-12 Outline of Buildings of Sub-Depot (Garage) of Passenger Transport Bus-1 Company

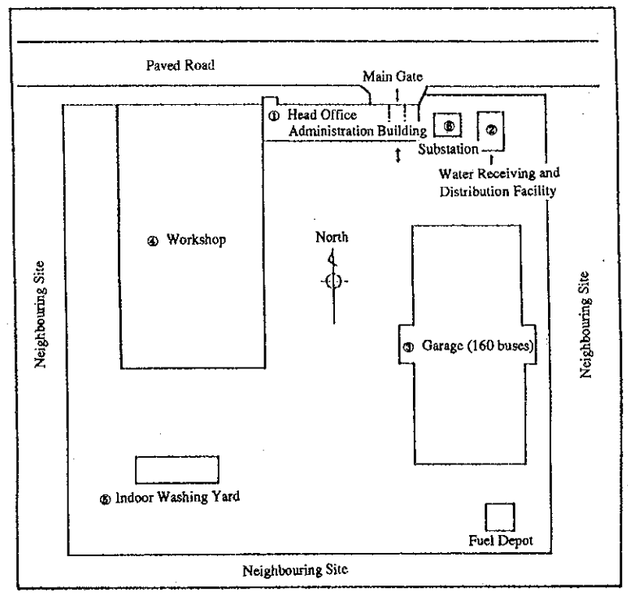
Category	Structure	Qty.	No. of Floors	Total Floor Area (m^2)	Year of Completion	Funding Source	Construction Cost (1,000 Tg)	Age	Current Conditions	Location and Rough Layout
① Administration Office (Canteen)	brick masonry	1	1	150	1985	own capital	133.6	9	Single storey building constructed in 1972.	The sub-depot is located to the south of the main depot across the railway track and Selbe River. It has a land area of some 4.0 ha. While the roads around it are unpaved, its ample width (4 lanes of 10m in width) allows smooth bus operation.
② Recreation Building	RC/ST	1	2	2,000	1985	own capital	(N.A.)	9	Constructed in 1985, this building is currently let.	
③ Garage A (60 buses)	RC/ST	1	1	3,850	1977	own capital	6,009.1 for 3) & 4)	17	The construction of Garage A and Garage B commenced in 1972 and 1973 respectively and both buildings were completed in 1977 (17 years old). Each houses 60 buses and maintains an internal temperature of 5°C in winter (from September to May).	
④ Garage B (60 buses)	RC/ST	1	1	3,850	1977	own capital		17		
⑤ Fuel Depot	brick masonry	1	1	50	1977	own capital	301.0	17	Acceptance of fuel oil from tank lorries and fuel supply to buses are remotely controlled and metered by an indoor system.	
⑥ Car Washing Yard (Indoor)	RC/ST	1	1	550	1977	own capital	1,456.0	17	This facility permits indoor bus buses during the long winter.	
⑦ Substation A	brick masonry	1	1	30	1977	own capital	(N.A.)	17		
⑧ Substation B	brick masonry	1	1	50	1977	own capital	(N.A.)	17		



Note: RC - reinforced concrete; ST - light steel roof truss; WT - wooden roof truss

Table 2-3-13 Outline of Buildings of Sub-Depot (Garage) of Passenger Transport Bus-1 Company

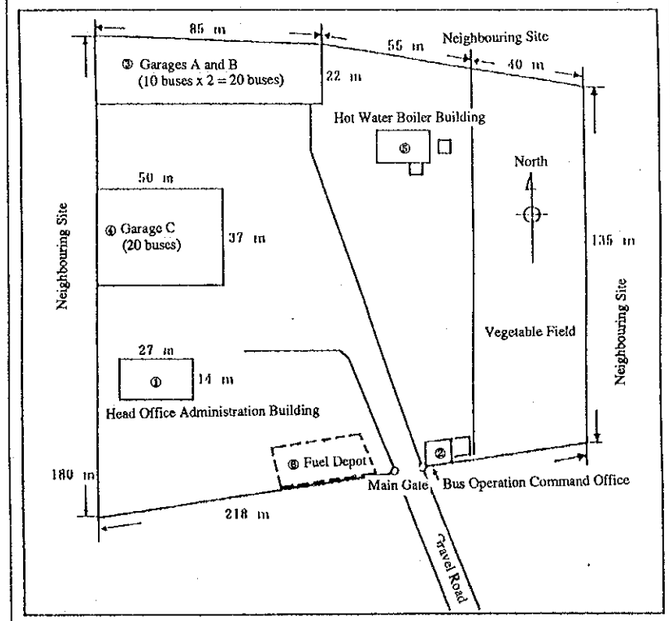
Category	Structure	Qty.	No. of Floors	Total Floor Area (m^2)	Year of Completion	Funding Source	Construction Cost (1,000 Tg)	Age	Current Conditions	Location and Rough Layout
① Head Office Administration Building	RC	1	3	3,650	1987	central governt. building	5,460.6	7	Houses offices, meeting rooms, operation control room, canteen and overnight accommodation, etc.	Located in an industrial park 8 km west on Enkhtayuan Avenue and some 1.5 km beyond the railway track. It has a land area of approximately 5.2 ha and was constructed using a Soviet loan between 1986 and 1987. In 1990, the company separated from the group of public bus corporations and became the independent Bus-2 Company. This is why it has the latest buildings and workshop among the public bus companies.
② Water Receiving and Distribution Facility	RC	1	1	190	1987	central governt. building	500.0	7	Constructed in 1986 and commenced service in 1987. Capable of serving 160 buses.	
③ Garage (160 buses)	RC/ST	1	1	8,700	1979	central governt. building	5,839.1	15	The garage can house upto 160 buses and is equipped with heating, ventilation, lighting and fire prevention facilities.	
④ Workshop	RC/ST	1	1	9,300	1987	central governt. building	17,006.9	7	Has 9 pit-style repair bays, out of which 5 are used for the repair of rotating sections. Due to the shortage of spare parts for repair equipment, half of the bays are not functioning properly.	
⑤ Car Washing Yard (Indoor)	RC/ST	1	1	600	1987	central governt. building	2,765.4 for 5) & 6)	7	Capable of relatively strong washing and the drainage is functioning well.	
⑥ Substation	RC	1	1	140	1987	central governt. building		7		



Note: RC - reinforced concrete; ST - light steel truss roof; WT - wooden truss room

Table 2-3-14 Outline of Buildings of Depot of Passenger Transport Bus-3 Company

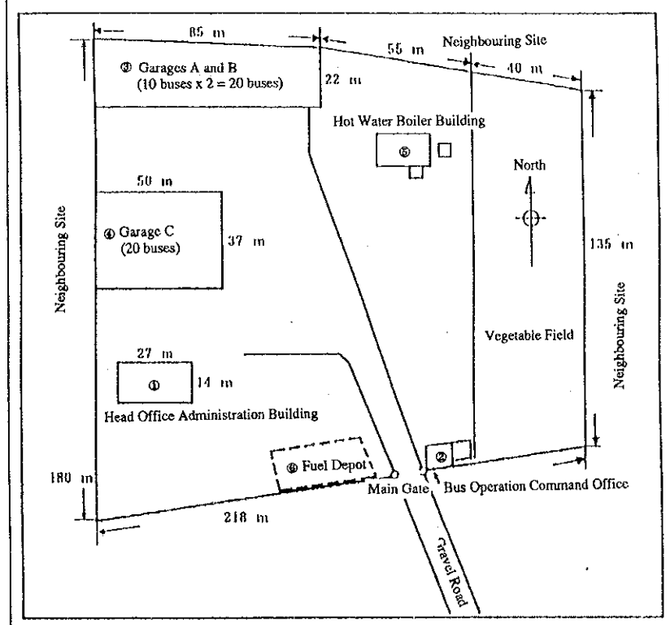
Category	Structure	Qty.	No. of Floors	Total Floor Area (m^2)	Year of Completion	Funding Source	Construction Cost (1,000 Tg)	Age	Current Conditions	Location and Rough Layout
① Head Office Administration Building	RC	1	2	380	1993	own capital	1,031.3	1	Houses offices, meeting rooms and storage rooms, etc.	Located on north side of the state road some 6 km east on Teeverchid Street. It has a land area of approximately 3 ha. While electricity and telephone services are available, no water, sewerage or heating hot water facilities are provided. Drinking water is supplied by tank lorry and heating is provided by its own boiler. The depot started life as a garage constructed in the 1960's and additional buildings were added in the 1980's. After being used as a depot for official cars and suburban buses, etc. and with extension of the building, it became the depot of Bus-3 Company in December, 1993.
② Bus Operation Command Office	brick masonry	1	1	35	1980	own capital	(N.A.)	14		
③ Garages A and B (10 buses × 2 = 20 buses)	RC/WT	1	1	1,870	1963	own capital	536.6	31	Although these adjoining garages are 31 years old, they can still house a total of 20 buses.	
④ Garage C (20 buses)	RC	1	1	1,850	1980	own capital	3,440.0	14	This garage was first used in 1980 and can house 20 buses. At present, Bus-3 Company has 46 buses, 10 of which are used for 2 routes in the city while 36 are used exclusively as charter buses.	
⑤ Hot Water Boiler Building	RC	1	1	230	1980	own capital	(N.A.)	14	After 14 years of use, the boiler facilities were completely overhauled and repaired in 1993 to rejuvenate the boiler function.	
⑥ Fuel Depot	brick masonry	1	1	35	1980	own capital	(N.A.)	14		



Note: RC - reinforced concrete; ST - light steel truss roof; WT - wooden truss roof

Table 2-3-14 Outline of Buildings of Depot of Passenger Transport Bus-3 Company

Category	Structure	Qty.	No. of Floors	Total Floor Area (m^2)	Year of Completion	Funding Source	Construction Cost (1,000 Tg)	Age	Current Conditions	Location and Rough Layout
① Head Office Administration Building	RC	1	2	380	1993	own capital	1,031.3	1	Houses offices, meeting rooms and storage rooms, etc.	Located on north side of the state road some 6 km east on Teeverchid Street. It has a land area of approximately 3 ha. While electricity and telephone services are available, no water, sewerage or heating hot water facilities are provided. Drinking water is supplied by tank lorry and heating is provided by its own boiler. The depot started life as a garage constructed in the 1960's and additional buildings were added in the 1980's. After being used as a depot for official cars and suburban buses, etc. and with extension of the building, it became the depot of Bus-3 Company in December, 1993.
② Bus Operation Command Office	brick masonry	1	1	35	1980	own capital	(N.A.)	14		
③ Garages A and B (10 buses × 2 = 20 buses)	RC/WT	1	1	1,870	1963	own capital	536.6	31	Although these adjoining garages are 31 years old, they can still house a total of 20 buses.	
④ Garage C (20 buses)	RC	1	1	1,850	1980	own capital	3,440.0	14	This garage was first used in 1980 and can house 20 buses. At present, Bus-3 Company has 46 buses, 10 of which are used for 2 routes in the city while 36 are used exclusively as charter buses.	
⑤ Hot Water Boiler Building	RC	1	1	230	1980	own capital	(N.A.)	14	After 14 years of use, the boiler facilities were completely overhauled and repaired in 1993 to rejuvenate the boiler function.	
⑥ Fuel Depot	brick masonry	1	1	35	1980	own capital	(N.A.)	14		



Note: RC - reinforced concrete; ST - light steel truss roof; WT - wooden truss roof

2-3-2-3 Conditions of Social Infrastructure

(1) Electricity

Electricity in Ulaan Baatar is supplied from the 4 coal-fired thermal power stations in the city. However, the No. 1 Power Station (commissioned in 1934) has not been in use since 1984 when its operation was suspended while the No. 2 Power Station (commissioned in 1956) currently only generates some 18MW as of 1994. Consequently, the No. 3 Power Station (commissioned in 1986 with a current output of some 125MW as of 1994) and the No. 4 Power Station (commissioned in 1981 with a current output of some 540MW as of 1994) are the main sources of electricity supply in Ulaan Baatar. All the stations are run on a self-accounting basis since the adoption of a market economy.

The power grid in Ulaan Baatar is controlled by the Department of Electricity Supply of Ulaan Baatar and the electricity is supplied to users via a 3-phase, 50Hz, 35kV transmission network and a 6.3kV distribution network (10.5kV distribution network in some areas).

The Project site is situated in the 6.3kV distribution network area and a distribution substation controlled by the Department of Electricity Supply of Ulaan Baatar is located within the Project site. This substation drops the 6.3kV to 3-phase, 4 wires, 50Hz, 220/380V and supplies lower voltage electricity to such facilities as the garage and car washing house in the site and to neighbouring areas.

The substation's existing transformer lacks surplus capacity to supply electricity to the new workshop planned under the Project. It will, therefore, be necessary to install a transformer in the workshop to ensure the proper functioning of electrical equipment.

According to the Department of Architect, Urban Development and Housing Public Service of Ministry of Infrastructure Development, Ulaan Baatar's distribution network experiences power failures once or twice a week in winter (from October to May) which last upto 4 hours although power failures seldom occur in summer. This will inevitably disrupt the operation of the new workshop.

The electricity charge is based on the combined system of a fixed charge and a meter charge and is shown in Table 2-3-15.

Table 2-3-15 Electricity Charge in Mongolia (as of October, 1994)

Category	Charge
Industrial	13Tg/kWh
Household	10Tg/kWh

Source: Ulaan Baatar City

(2) Water

There are 4 sites along Tuul River where shallow groundwater is extracted to supply Ulaan Baatar with clean water. These 4 sites are called the Central Water Source, the Industrial Water Source, the Substation Water Source and the Meat Plant Water Source. The actual supply performance under normal conditions is 234,000m^3/day although it declines to 154,000m^3/day in winter. The Planned supply volume is 244,700m^3/day.

The groundwater extracted at these sites is first pumped to a reservoir located at each site. Part of the stored water is then again pumped to a distribution basin on high ground for gravity distribution. Part of the water is directly supplied to users from the distribution basin. The Water Supply and Exploitation Board of Ulaan Baatar City is responsible for the operation and maintenance of water supply facilities in the city and the operation cost is covered by the water charge.

In principle, the water charge is based on the meter reading. Due to the lack of meters in ordinary households, however, the charge is based on the head count. Some factories are equipped with a water meter. The water charge for household users is 24Tg/person/month (as of October, 1994).

The Project site is near the Central and Industrial Water Sources. The water quality is generally good except for a high colour vis-a-vis Mongolia's and the WHO's drinking water criteria (60-70 color unit compared to the Mongolian criterion of 20 color unit).

A branch water pipe extends to the Project site to supply the facilities on the premises with both drinking and industrial water with a supply pressure of

2kg/cm^2. Because of the lack of a water meter, exact data on the present water consumption is unavailable.

(3) Sewerage

Ulaan Baatar has a well established sewer system and waste water is centrally treated at a treatment plant (maximum treatment capacity: approximately 230,000m^3/day) located some 14km northwest of the city centre. A branch sewer is buried on the Project site which links to the sewer main leading to the treatment plant. As in the case of water supply, the sewerage service in Ulaan Baatar is operated and maintained by the Water Supply and Exploitation Board of Ulaan Baatar. The waste water standard set by the Department are shown in Table 2-3-16.

Table 2-3-16 Sewerage and Industrial Waste Water Standard in Mongolia

Item	Unit	Reference Value
1. COD	mg/litre	500 or less
2. BOD	mg/litre	389 or less
3. SS	mg/litre	407 or less
4. pH	-	6.5-3.5
5. Petrochemical Products (Oil, etc.)	mg/litre	0.07 or less
6. Washing Agents	mg/litre	0.75 or less
7. Temperature	°C	15-40

Source: Water Supply and Exploitation Board of Ulaan Baatar

(4) Hot Water for Heating Purposes

Ulaan Baatar has a local hot water heating system which supplies hot water from the power stations to users as a heat source via the distribution network controlled by the Department of District Heating system of Ulaan Baatar. In the case of the Project site, hot water is supplied from the No. 3 Power Station. The original water temperature is 150°C when the outdoor temperature is -39°C and the system is designed to return water of some 70°C to the stations after heat exchange at users.

When an outside temperature of -32°C was recorded in 1994, the total heat output of the power stations was 790 × 10^{6}kcal/hr which fell short of the city's required heat value of 1,441 × 10^{6}kcal/hr by 651 × 10^{6}kcal/hr (45%).

During the field survey, the Heating Department was asked to confirm the future availability of heat supply for the new workshop. The Department agreed to supply hot water for heating to the workshop while expressing the difficulty of meeting all demands of potential users under the present tight supply situation.

Hot water heating pipes (125mm in diameter) have already been laid at the Project site. According to the Heating Department, these pipes will require replacing by larger diameter pipes (200mm) in order to supply the new workshop with hot water.

The heating charge is based on the required heating space and is 19Tg/m^2 (as of October, 1994). The Department encourages users to install a calorie meter (kWh display) and is considering offering a 20% discount and other incentives for users installing such a meter.

(5) Communications

Ulaan Baatar has a well established telephone network and direct international call and facsimile communication with Japan is possible at some hotels. A local telephone line is provided at the existing guard house on the Project site. The telephone subscription charge for ordinary households is fixed at 420Tg/month (as of October, 1994).

(6) Gas

Ulaan Baatar has neither city gas supply nor propane gas supply. Electricity is used for cooking purposes.

2-3-2-4 Environmental Problems

(1) Bus Emission Control

Emissions regulations for large size buses were set in Mongolia in November 1st, 1992 (No. YCT 175.1.20-92). However, the test method used to set this regulation was mode 4, and inferior in accuracy and contents to the mode 13 test method now commonly used throughout the world.

The World Bank project currently in progress in Mongolia adopts the emission controls of European countries, etc., and these must be heeded by the Project. Table 2-3-17 shows the European emission controls.

Table 2-3-17 European Emission Controls Adopted by World Bank Project

(Unit: g/kW•hr)

Item	CO	HC	NOx	Particulate	Test Mode
ECE R49/01	11.2	2.4	14.4	-	13

(2) Bus Noise Control

The Mongolian control of noise caused by buses mounted with large engines was enforced on September 10th, 1992 (No. YCT-175.1.21-92), limiting the maximum noise of acceleration to 88 dB (A). The World Bank project currently in progress adopts 85 dB (A) as the maximum noise level. A similar regulation introduced in Japan in 1988 sets the maximum acceleration noise level at 83 dB (A) and the adoption of the Japanese regulation for the Project will not cause any practical problems.

(3) Other Environmental Regulations

Apart from emission gas control described in (1) above, the implementation of the Project may infringe environmental regulations relating to waste oil, waste water and construction noise.

1) Waste Oil and Wastewater

The wastewater standard introduced by the City Water and Sewerage Department are applicable to the Project. Due consideration should be given at the Project design stage to including suitable waste oil and wastewater treatment facilities to meet the regulations.

2) Construction Noise

The Project site is located in an area which is designated as an industrial zone and no housing or office buildings exist in the vicinity. The construction of a workshop on the site will not, therefore, create any noise pollutions.

2-3-3 Outline of Facilities and Equipment

Outline of facilities and equipment to be provided under the Project are summarized in the following Table.

Table 2-3-18 Outline of Facilities and Equipment of the Project

	Phase I	Phase II	Phase III
Equipment Procure-ment Plan	Procurement of 50 large buses (Main Specifications) • 90 passengers • Large bus for urban route bus service • Gross vehicle weight: minimum15 tons • Engine: diesel engine direct injection water-cooling 4 cycle 9,800 cc (minimum) 185 HP (minimum) • Transmission: mechanical type, 5 speed direct drive • Suspension: semi-elliptical alloy steel leaf spring or air suspension • Tire: 10.00R20 (-40°C operation) • Fuel tank: 200 liter (min) • Chassis/frame: semi-frame • Steering: power assisted steering • Handle position: left-hand drive • Doors: 3 doors • Battery (180AH × 2 sets) • Heater (15,000kcal/hr)	—	Procurement of 40 large buses (Main Specifications) • 90 passengers • Large bus for urban route bus service • Gross vehicle weight: minimum15 tons • Engine: diesel engine direct injection water-cooling 4 cycle 9,800 cc (minimum) 185 HP (minimum) • Transmission: mechanical type, 5 speed direct drive • Suspension: semi-elliptical alloy steel leaf spring or air suspension • Tire: 10.00R20 (-40°C operation) • Fuel tank: 200 liter (min) • Chassis/frame: semi-frame • Steering: power assisted steering • Handle position: left-hand drive • Doors: 3 doors • Battery (180AH × 2 sets) • Heater (15,000kcal/hr)
Facilities Construc-tion Plan		Construction of the following facilities and procurement of necessary equipment ① Construction of Workshop (Main Building Specifications) • Structure: steel-frame and partial 2-storey single building • Floor area: total 2,340m^2	

	Phase I	Phase II	Phase III
Facilities Construc-tion Plan	—	• Main Rooms Maintenance-Repair Section (1st Floor) Maintenance bays; machine shop; inspection and fablication area; engine repair room; engine test room; injection pump test room; battery room; tool storage; spare parts storage; electrical room, etc. Administration Section (1st Floor) Administration office; worker's office; locker room, etc. Administration Section (2nd Floor) Director room; administration room; expert's room; meeting and practice room, etc. (Maintenance equipment to be installed in workshop) Large bus maintenance and repair equipment for the following purposes: • Parts machining • Chassis maintenance • Measuring, diagnose and lubricating • Engine/chassis repair • Body repair • Electric parts repair • Parts warehouse • Administrative operation • Seat repairing • Education and training ② Renovation of Washing Facilities (Work Outline) • Renovation of floor of existing washing yard • Construction of water treatment room to recycle washing water • Installation of washing equipment ③ Other • Asphalt paving of outdoor car park	—

2-3-4 Operation and Maintenance Plan

(1) Bus Operation Budget

Currently, revenue from bus fares only covers 50% of operating costs with the remainder being publicly subsidized. If the policy of holding public utility charges down is to be continued, such a system is unavoidable. However, starting from October 1994, the bus fare has been tripled from 10Tg to 30Tg, at which point assuming a fare collection rate of 100%, bus operating costs are more or less fully covered by revenue from fares. Prospective income and expenditure are subject to variation due to numerous factors such as price rises and the covering capacity of passenger fares, however it may be possible to cover operating costs with revenue from fares alone.

(2) Workshop Running Budget

Unlike bus operation costs, the costs of running the workshop, if excluding the cost of purchasing spare parts, mainly consist of heating, lighting and water charges and have a little affect on the Company's accounts. In consideration of that present spare parts cost shares merely 8% of the total operation cost, it can be judged that the cost for spare parts will be obtained, if the fare collection rate would be increased, and the fare would be kept in the appropriate level to meet with actual price escalation. The Project includes the provision of a three-year supply of spare parts, so that no additional burden is expected in these periods. Moreover, the existing staff of Bus - 1 Company will be reassigned as new workshop staff, there will be no additional costs.

(3) Maintenance of Provided Buses

Table 2-3-19 indicates the estimated annual operating and maintenance cost of a bus to be provided under the Project. These figures include depreciation cost and capital opportunity cost. Total costs can just about be covered with the present bus fare (30Tg). It is thus possible to cover operating and maintenance costs except for the initial investment with revenue from fares so long as fares are kept in line with consumer price increases. If the operation and maintenance costs would be obtained from the present bus fare system (30Tg), the fare collection rate should be reached to 100% as much as possible. Each Bus Company should make the necessary effort to achieve this goal.

Table 2-3-19 Bus Operation Income and Expenditure Forecast

Item	Amount (Tg)	Ratio (%)	Remarks
Expenditure			
Personnel costs	920,000	6.1	230,000Tg × 4
Fuel costs	3,523,333	23.5	151Tg × 23,333ℓ
Lubricant costs	704,667	4.7	20% of fuel costs
Spare parts costs	508,619	3.4	
Tire costs	192,500	1.3	80,000km, retreated two times
Depreciation costs	5,100,000	34.0	85%, 10 years fixed rate depreciation
Capital opportunity costs	3,528,000	23.5	85%, with a 12% interest rate
Other costs	381,464	2.5	
(Subtotal)	14,858,583	99.2	
Management costs	127,155	0.8	
(Total)	14,985,738	100.0	
Income (if fare is 30Tg)	13,500,000	90.0	1,500 passengers per bus per day
Income (if fare is 40Tg)	18,000,000	120.1	1,500 passengers per bus per day

Remarks:

1) Fuel consumption: 70,000km/(3ℓ/km) = 23,333ℓ/year
2) Spar parts cost: 8% of total cost except depreciation and capital opportunity costs.
3) Depreciation cost and capital opportunity cost: Average cost per 1 fleet, it the number of buses to be provided allocated equally for 10 years.
4) Management cost: Cost and interest which are not directly concerned with the operation of buses, e.g. administration cost, etc.

(4) Maintenance Organization

The workshop to be constructed and rehabilitated under the Project shall, as mentioned earlier (see Section 2-2 (3)), possess preventive maintenance based periodic inspection and maintenance functions and be responsible for the maintenance and repair of those buses to be newly provided.

As was mentioned earlier (see Section 2-3-1 (2)), the subject workshop shall require a staff of 59 and is to consist of the six departments of ordinary maintenance, mechnical, engine maintenance, vehicle inspection, engine testing and administration.

(5) Maintenance and Repair Work Contents

Bus maintenance in Japan is based upon legal inspection and maintenance guidelines laid down by the Ministry of Transport. These guidelines indicate the required contents for one, three and six month periodic inspections.

The same guidelines are to be applied to the buses provided under the Project, however because the public buses in Ulaan Baatar run over longer daily

distances than the Japanese ones (around 260km compared to 200km), there is a danger that following the same inspection intervals may lead to the occurrence of bus breakdowns. Consequently, the inspection and maintenance of buses in the Project is to be carried out according to the set mileage intervals indicated in Table 2-3-20.

Table 2-3-20 Required Bus Maintenance and Repair Contents

No.	Item	Mileage	Maintenance and Repair Contents
1	Minor maintenance.	Roughly every 3,000km	Inspection and maintenance of power line system, hydraulic system, electrical equipment and wheel section system functions by use of diagnostic equipment and tools. Due to the harsh natural and operating conditions in Mongolia, preventive inspection and maintenance is a particularly important factor.
2	Intermediate maintenance	Roughly every 12,000km	Although the extent of abrasion, deformation, cracks and damage differs according to operating conditions, intermediate inspection and maintenance of buses is to be carried out roughly every 12,000km. This entails adjustment and tuning of bus engines, power transmission systems, wheel section systems and hydraulic systems, and also parts replacement where necessary. Due to the nature of equipment required for such work, buses will need to be inspected inside the workshop. It will also be necessary to carry out partial body plating and coating work at the same time.
3	Major maintenance	Roughly every 36,000km	Essentially the same contents as intermediate maintenance with special attention paid to brakes, clutch lining and wheel section systems (springs in particular).
4	Overhaul	Roughly every 300,000km	Overhaul involves the total dismantling of engine, power shift transmission, travel clutch, final deceleration and wheel equipment and after the complete inspection and maintenance of engine, fuel system and electrical equipment, a check of overall performance is made in a bench test chamber. Concerning wheel section abrasion, regeneration through build up welding is necessary.
5	Other inspection and maintenance	According to necessity	① Spot repairs (breakdowns, etc.). ② Part machine work and regeneration. In order to augment spare part shortages, equipment for machine working and plating is required to make simple parts and carry out parts regeneration. ③ Bus seat repair and refitting.

(6) Spare Parts Purchasing Plan

Spare parts can be roughly divided into standard attachment items for replacement after certain travelling distances and replacement parts needed in emergency cases such as breakdown. The Mongolian side thus needs to

purchase the necessary spare parts in accordance with the repair and maintenance intervals mentioned above (see Table 2-3-20).

The Project includes the provision of a three-year supply of spare parts for the new buses and Fig. 2-3-5 indicates the purchasing plan for spare parts for around the first five years after the commencement of the initial spare parts provision.

Fig. 2-3-5 also shows that it will be necessary for the Mongolian side to prepare funds to cover the purchase cost of standard attachment parts (around 10% of the whole bus costs) within three years and replacement parts and overhaul parts (each accounting for around 5% of whole bus costs) within 4.5 years.

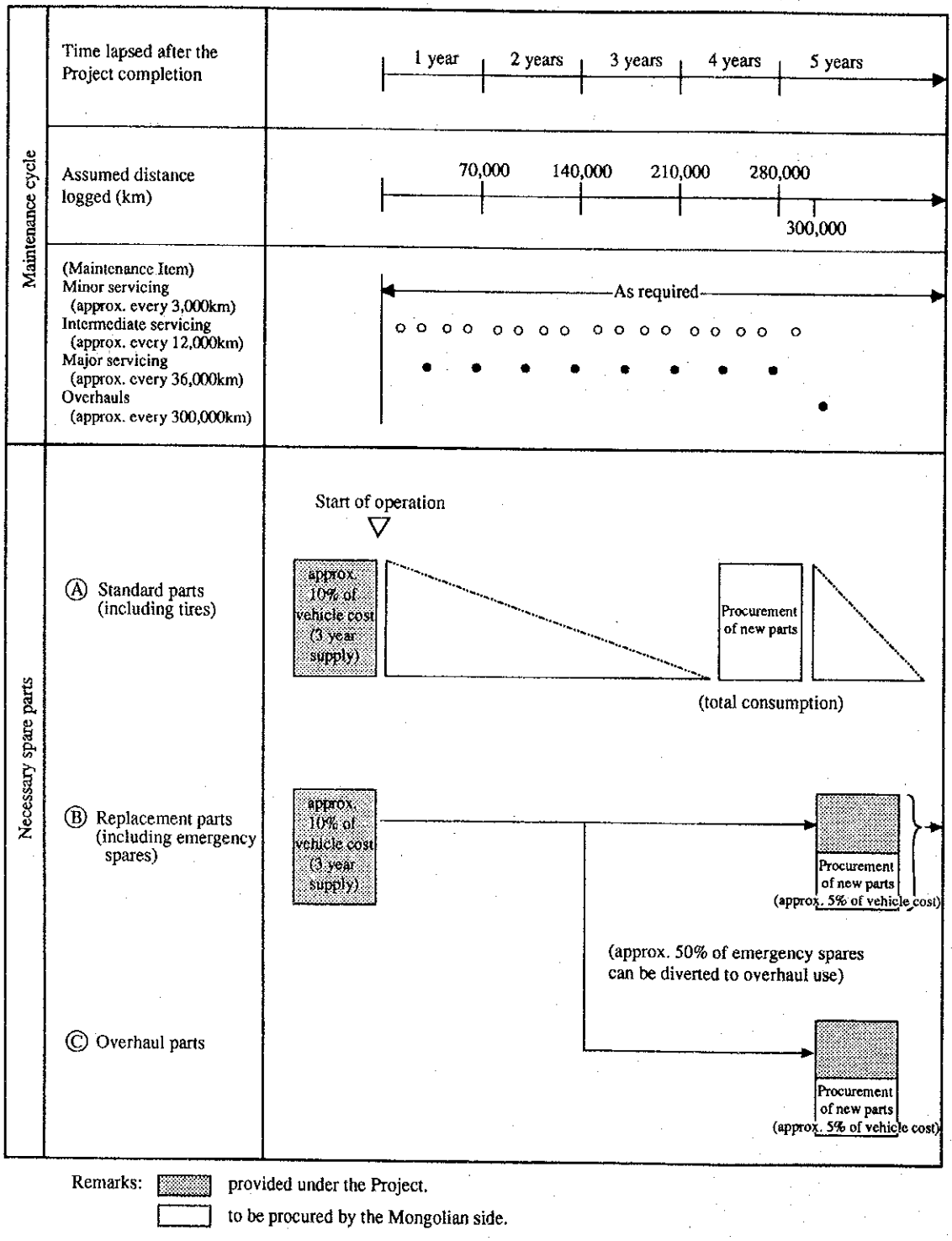


Fig. 2-3-5 Spare Parts Procurement Plan

2-4 Technical Cooperation

Recongizing the fact that appropriate maintenance and management is essential for improving the critical transportation situation and providing a reliable public bus operation, the government of Mongolia has requested the following technical cooperation.

- The dispatch of Japanese experts and/or Japan Overseas Cooperation Volunteers to help with the appropriate opperation and maintenance of the materials and equipment provided in the Project.

For the long term success of the Project in increasing the public transportation capacities, it is necessary to transfer the technology and management system which will enable Mongolian technitians to properly operate and maintain the equipment provided in the Project. Therefore the dispatch of the aforementioned experts at the time of completion of the Project will be effective and is considered necessary.

CHAPTER 3
BASIC DESIGN

CHAPTER 3 BASIC DESIGN

3-1 Design Policy

3-1-1 Design Policy on Natural Conditions

Ulaan Baatar is situated in a basin at an elevation of 1,325m above sea-level and surrounded by mountains. The city is located along the north bank of the Tora River which runs from west to east south of the city.

The average monthly temperature of Ulaan Baatar is as indicated in Appendix 5, with a seven month winter from October 15 to May 15 during which heating is necessary. And as the average temperature during the three months from December to February falls below -20°C, it is imperative to note this when considering bus specifications and when making facility plans it is necessary to secure a supply of hot water from the local heating network. Summer temperatures average around 20°C, therefore there is no need for air conditioning.

The humidity ranges from 50 to 70 percent throughout the year and with an annual average of 65 percent. It being dry, there is no need to pay special attention to humidity in the construction plans.

Both annual rainfall at approximately 200mm, and snowfall at approximately 30cm are minimal and no special building measures need be taken.

Winds are light throughout the year, with no typhoons or strong gusts, therefore wind may be disregarded as a factor in the structural design of the buildings.

Furthermore, the vicinity of Ulaan Baatar is not volcanic nor prone to earth tremours. There have been no records of significant earthquakes in the past and there is no fear of earthquakes in the future.

With regard to the effects which various natural phenomena have on construction, and policies to deal with these, it has been agreed through consultations with the Mongolian side that Japanese building standards will be adopted for the building design to ensure sufficient strength and safety with considerations of earthquakes and strong winds.

3-1-2 Design Policy on Social Conditions

Mongolians are a nomadic people, living in tent structues called *Ger*, famous for their equestrian skills.

The residents of the cities of Ulaan Baatar, Darhan and Erdenet have urban lifestyles, working for government offices and private companies. The national religion is a form of Tibetan Buddhism, and the people are curtious and polite. For about 70 years following the Russian Revolution, as the country was under Soviet influence, the urban lifestyle has a European and Russian flavor. The design of the planned facilities should take the local manners and customs into consideration, however, there are no major differences in lifestyle which need to be accommodated in the building plans.

3-1-3 Design Policy on Local Construction Conditions

(1) Permits and Authorisation for Project Implementation

In the first stage, it is necessary to submit a summary of the building plans to the Town Planning Department of Ulaan Baatar city including building use, allong with estimations of electricity, water, and hot water so that a guarantee of their supply can be obtained. During the detailed design stage, it will be necessary to hold discussions with the responsible technical experts in the Department of Architect, Urban Development and Housing, Public Service of the Ministry of Infrastructure Development concerning the detailed plans for construction, structure, facilities, and electricity. However, as a Grant Aid Project of the Japanese Government, guarantee that a submitted plan will be accepted will have been attained from both aforementioned government offices.

(2) Related Laws and Regulations

Mongolia does not have an independent building code and construction is based on former Soviet building standards. Building codes for earthquakes, wind, snow and other loading factors, steel framed structures and reinforced concrete structures are all written in Russian. It is understood that only earthquake, wind and snow loading factors will be decided upon discussion with technical experts from the Mongolian side, and all other building standards will be based on those of the Architectural Institute of Japan (AIJ).

In the case construction is to be commenced, there is a need for clerical workers, technitians, drivers, construction workers and other laborers to be hired locally by the Japanese contractor. It is necessary at this point to discuss labor contracts, wages and other related maters with the Ministry of Labor, in relation to the Labor Law and Employment of Foreign Workers Law.

(3) Technical Level of Local Construction Companies

Due to the shift to a market economy started in 1990 and the privitization policy there are private construction offices in Mongolia. As a Japanese consulting company will be in charge of the detailed design and surpervision, there is no forseen need to contract local engineering companies within the scope of work to be done by the Japanese side. However, during construction, when the Japanese contractor subcontracts work to local companies, the following points will have to be considered.

Major construction activities within Ulaan Baatar are office buildings, hotels and factories being built by Russian and former Yugoslavian contractors with Mongolian subcontractors working on most of the sites. Among the local companies there is one with 120 engineers and technitians and 700 employees and experience working under Japanese companies in project such as the new Embassy building to be completed in March 1996, and the steel plant in Darhan.

At the construction sites visited by the Study Team during the field survey, all the companies were found to be capable of producing good results (in terms of a precise finish to the specifications) using local construction methods. With regard to the building construction and equipment installation for the Project, these companies should be able to satisfy the quality standards and other requirements with the provision of some technical guidance by the Japanese general construction company. Schedule control is one weak point of the local construction industry and the provision of technical guidance by Japanese engineers will be essential to complete the Project-related work within the comparatively short period required by the Japan's grant aid system.

(4) Worker Capability and Availability

The majority of the technicians and workers observed at construction sites in Ulaan Baatar were young Mongolian males and females. However, among the workers, people of Russian, Ugoslavian, and Chinese origin were observed. Due to a recent large infulx of Chinese Laborers, the Mongolian Ministry of

Labor has, based on a law for the employment of foreigners, put a limit on the number of working visas issued. As Mongolians are generally hard working and courteous, no problems of worker capability and availability are anticipated in relation to the implementaion of the Project.

(5) Quality and Availability of Local Construction Materials

There should be a ready local supply of such construction materials as cement, sand, gravel, bricks, concrete blocks, reinforcing bars and mould materials, etc. As far as finishing materials are concerned, raw materials are imported to locally process and assemble doors, window frames and board, etc. While the quality is reasonable, the supply is generally short of the demand. Steel products, such as structural frames, can be locally procured, however there is some concern regarding both punctual delivery and manufacturing precision. Since their raw materials are imported, as in the case of doors and window frames, etc., therefore, the planned procurement of doors, window frames, board and structural steel, etc., from Japan is appropriate.

(6) Transportation Routes

Being a landlocked country, direct transport via ocean and waterways is impossible, and the routes for transporting the buses and construction materials from Japan and third countries in to Mongolia are by rail via the Chinese Port of Tienjing and via the Siberian Railway around from the Russian port of Nakhodka. This second route is not viable because safety, delivery time, and freight rates cannot be guaranteed due to the turbulent political situation and the large drop in the value of the Rubble following the collaps of the Soviet Union. Moreover, a renovation of the station building and freight facilities at Zameen - Uud on the Chinese-Mongolian border are being conducted with Japan's Grant Aid and will be completed around the time the materials and products are scheduled to be procured, greatly increasing the efficiency of the China route. Therefore it has been judged that the most appropriate route to procure materials and products for this Project is by rail via the Chinese port of Tienjing.

The roads within Ulaan Baatar are in good condition and there are no problems with transportation from Ulaan Baatar station to the construction site.

(7) Infrastructure

The Project site is within central Ulaan Baatar. Here, basic infrastructure such as electricity, water, sewers, hot water heating system are well maintained and

there is no hinderence to the implementation of the Project. There will, however, be a need for an emergency generator set capable of supplying the minimum necessary power for operations at the Project site, as days with up to four hours of electric stoppages are common in the winter.

3-1-4 Design Policy on Use of Local Companies, Equipment and Materials

(1) Use of Local Companies

As stated in the paragraph, Technical Level of Local Construction Companies in the section Design Policy on Local Construction Conditions the local company already has experience as a sub-contractor for Japanese construction companies. Therefore the use of such a local company (or companies) as subcontractor(s) of the Japanese general construction company for the Project will be very significant in terms of the transfer of technology to the Mongolian construction industry, and also in terms of the desirable economic impact of the Project.

(2) Local Availability of Construction Machinery

The largest construction machinery required for the Project will be a 20 ton truck crane to hoist the roof truss and an overhead crane. It was confirmed during the field survey that the local leasing of this machinery is possible.

In short, most construction machinery and equipment, except surveying equipment and concrete testing instruments, etc., can be either procured or leased locally.

(3) Local Availability of Construction Materials

In view of the local delivery reliability, product quality and manufacturing precision, etc., of construction equipment and materials, the steel-frame roof truss, steel doors, calcium silicate boards and building service equipment, including electrical equipment, etc., will be procured in Japan. In comparison, all basic materials, including concrete, reinforcing bars, cement and concrete blocks will be procured locally. The maintenance and repair tools and equipment for the buses will be procured in Japan as procurement in Mongolia would prove difficult.

3-1-5 Design Policy on Operation and Maintenance Capability of Project Implementation Body

As earlier stated in section 2-3-1, the Passenger Transport Bus - 1 Company has 991 employees (June 1994), of which 28% or 278 (including drivers) have over 6 years of experience. From this, it has been judged that the management and maintenance of the buses to be provided is possible with the current work force and technical ability.

Yet the current maintenence system is focussed on treating what has already broken down and for the smooth operation of buses, there is a need to establish a regular preventative maintenance system.

Consequently, the workshop in the Project will be equiped with both equipment and tools for regular testing, and repair tools and equipment to deal with breakdowns.

3-1-6 Design Policy on Scope and Level of Facilities and Equipment

Considering the above conditions, the scope of the construction of facilities and procurement of materials and products shall be based of the following.

(1) Design Policy on Scope of Facilities and Equipment

The Project aims at quickly increasing the public transportation capability of the city of Ulaan Baatar by ① procuring large size buses and ② constructing a workshop. Moreover, the specifications and number of buses, and the construction, type of materials, number of workers and specification of the workshops shall be selected to ensure that proper operations are possible.

(2) Policy on Technical Level

Precautions shall be taken so that bus specifications and workshop instruments will be selected so as not to deviate from the technical level of vehicles and instruments already familiar to Mongolian technitians.

In particular, passenger capacity, the number of entrance/exits, tire size, and other such specifications shall be approximately the same or the same as those of the existing buses with which the drivers and conductors are familiar, to allow for easier operation and maintenance.

3-1-7 Design Policy on Construction Schedule

In principle, both the construction contract and the actual work will be completed in the same fiscal year in accordance with Japan's grant aid system. Considering the urgent requirement for buses it is deemed appropriate that the buses be procured in the first phase of the Project (Phase I), and workshops be constructed in the second phase (Phase II). A further procurement of buses will occur in the third stage of the Project (Phase III) on confirmation of the maintenance and management system and its implementation by the Mongolian side after the supply of equipment and facilities in the first and second stages of the Project.

To complete the construction of the facilities and the procurement and installation of equipment in the Phase II within a fiscal year, this should be considered a Facility Construction Plan. The construction schedule is as indicated in section 3-4-5, with the construction period being 12 months from the signing of the contract with the companies to commence construction.

3-2 Study and Examination on Design Criteria

3-2-1 Study on the Bus Specifications

(1) Passenger Capacity

The current passenger capacity of buses is 90 passengers, and the buses to be supplied should also have roughly the same specification.

(2) Gross Vehicle Weight (GVW)

The weight per person shall be set at 70kg per person according to Mongolian standards. The maximum load will be 6,300kg (90 × 70kg), and the vehicle weight will be 8,500kg. Therefore, the GVW should be minimum 15,000kg. Moreover the consideration shall be made on the excess load approximately 200% at peak for the structure of buses.

(3) Size

The length and width of the body shall be set to ensure that passenger can be transported. However, due to the clearance of the entrance to the existing garage, the height limit is 3,250mm.

(4) Engine

A direct injection diesel engine similar to the Czechoslovakian engines which the technicians are familiar with is desirable. Also, in view of fuel economy, maximum floor area, ease of access, and reduction of noise for the passengers, the engine will be rear-mounted.

(5) Emissions Regulations

Emissions Regulations for the World Bank project shall be adopted.

(6) Chassis and Frame

The Czechoslovakian made frames (semi-frames structures) are composed of 100mm × 50mm × t3.5mm square pipes, and the rear engine mounts of most buses have cracks. However, if the frames are made sufficiently strong (sufficient reinforcement), they will withstand local conditions. As the semi-frame structure will allow a lighter body weight and lower floor facilitating passenger access, this structure shall be used in the Project buses as well.

(7) Suspension

Both Russian and Czechoslovakian suspensions are too weak to handle overloading and resultingly, there are many accidents due to breakage. It is necessary to increase spring strength to handle overloading.

(8) Tires

Both Russian and Czechoslovakian tires are radial (10.00R20), and to simplify and lighten the maintenance load for the Mongolian side, the use of similar tires for the Project is recommended. Further, as the tires must be able to withstand use in artic conditions, type 10.00R20 radials (–40°C specification) shall be used.

(9) Batteries

The cold weather specifications require two batteries of over 180AH, and the generator must be 24V with over 60A capacity.

(10) Doors

To allow efficient boarding and alighting there shall be 3 sets of doors on the front, mid and rear sections of the right side of the bus, and they shall be activated by a button on the driver's control panel.

(11) Clutch and Transmission

The transmissions on the Russian and Czechoslovakian buses use a push button electromagnetic/hydraulic clutch system which is prone to malfunction and difficult to use.

Most trucks and cars in Mongolia have foot operated direct drive position clutches, and drivers in the country are familiar with this system. Therefore, the clutches used in the Project shall be of the easily inspected and maintained foot operated direct drive position clutches.

3-2-2 Study on Bus Spare Parts

Spare parts are divided into standard parts required to maintain the regular operation of buses and replacement parts for break downs. The major items are as follows.

(1) Standard Parts

A three year supply of expendable parts, based upon 240,000 to 270,000km logged, will be supplied. The major expendable parts needed to guarantee three years of safe operation are as follows.

1) Tires (The number of spare tires to be supplied will be decided on the basis that local private retreading facilities will be used.)
2) Oil filter elements
3) Air filter elements
4) Fuel filter elements

All major motor oil brands are available in Mongolia, and local lubricant suppliers stock a wide selection of motor oil types. The Russian motor oil (A.P.I. of CD class) currently used in the Czechoslovakian buses is decided sufficient to for buses in the Project. This oil should be procured by the Mongolian side.

(2) Replacement parts (including emergency spares)

Spare parts for break downs are divided into parts for, engine, clutch, transmission, electrical system, steering wheel, brakes, chassis, suspension, body, and window glass. The following parts are required.

1) Engine Parts

Consist of main moving parts, including spare engines, cooling system parts, fuel injection pumps, nozzles, etc.

2) Clutch and Transmission Parts

Consist of spare transmissions, clutch parts, transmission gears, bearings, clutch disks, etc.

3) Electrical System Parts

Consist of starters, dynamos, and batteries capable of withstanding cold weather, and wiper blades, lights and fuses capable of withstanding breakage during operations.

4) Steering Parts

Include power steering parts.

5) Break Parts

Brake shoes, air chambers, drums, brake linings, etc.

6) Chassis and Suspension Parts

Front and rear hub bearing parts, shock absorbers and other suspensions parts with specifications able to withstand overloading.

7) Body and Glass Parts: Front windshield glass, window glass.

After 300,000km have been logged (approx. 4.5 years), the buses will require overhauls. Some of the above mentioned replacement parts may be used, however, overhaul parts (same items as breakdown parts) which will be lacking must be supplied by the Mongolian side.

3-2-3 Facility Construction Plan

(1) Number of Maintenance Bays

The size of the workshop to be provided in the Project is determined by the number of maintenance bays required, and was calculated as follows based on a total procurement of 90 buses—50 being provided in the Project's first stage (Phase I) and 40 in the Project's third stage (Phase III).

1) Calculation Parameters

① Bus Related Parameters

– Number to be serviced:	90 buses
– Estimated daily distance logged	260 km/day
– Days in operation per month	25 days
– Days in operation per fleet per year	300 days

② Service Facility Related Parameters

– Daily working hours per employee	8 hours/person
– Working days per month	23 days/month
– Working days per year	276 days/year

③ Servicing Frequency and Time Required for Servicing

The following are standard servicing times (buses not being serviced or waiting for service will be parked in the parking area)

– Minor servicing (approx. every 3,000km)	9 hours·person/service
– Intermediate servicing (approx. every 12,000km)	14 hours·person/ "
– Major servicing (approx. every 36,000km)	28 hours·person/ "
– Standard bay time required for Overhauls (approx. every 300,000km)	
Engine	8 hours·person/ "
Transmission	8 hours·person/ "
Differential	8 hours·person/ "
Others	32 hours·person/ "

④ Breakdown frequency and time required for services

6 cases/bus/year	6 hours/service

⑤ Accident frequency (assumption) and time required for services

0.2 cases/bus/year 150 hours/service

⑥ Vehicle servicing space (no. of bays); equation (as normally used in Japan)

$$\text{No. of bays} = \frac{\text{standard servicing time (h)} \times \text{no. of buses} \times \text{servicings required within a set time span (time)}}{\text{total servicing time within a set time span (h)}}$$

Notes: • Servicings required within a set time span (times) = assumed daily distance logged per bus (km/day) × operational days per year (days/year) /servicing cycle for each service item (servicing/km)

• Total servicing time within a set time span (hours) = annual working days (days) × aily working hours (hours/day) × workers (person)

2) Calculation for Maintenance Space (no. of bays) Required

The following is the determination of the number of bays required based on the above parameters. The number of workers is set at 2 in Japan, but considering the need for training based on the technical level of Mongolian technicians, this number was set at 2.25 for these calculations.

– Minor servicing bays $= \frac{9\text{h} \times 90 \text{ buses} \times 26 \text{ times}}{276 \text{ days} \times 8\text{h} \times 2.25 \text{ persons}} = 4.24$ bays

– Intermediate servicing bays $= \frac{14\text{h} \times 90 \text{ buses} \times 6.5 \text{ times}}{276 \text{ days} \times 8\text{h} \times 2.25 \text{ persons}} = 1.6$ bays

– Major servicing bays $= \frac{28\text{h} \times 90 \text{ buses} \times 2.17 \text{ times}}{276 \text{ days} \times 8\text{h} \times 2.25 \text{ persons}} = 1.1$ bays

– Overhauls bays $= \frac{56\text{h} \times 90 \text{ buses} \times 0.26 \text{ times}}{276 \text{ days} \times 8\text{h} \times 2.25 \text{ persons}} = 0.26$ bays

– Breakdowns bays $= \frac{6\text{h} \times 90 \text{ buses} \times 6 \text{ times}}{276 \text{ days} \times 8\text{h} \times 2.25 \text{ persons}} = 0.65$ bays

– Accidents bays $= \frac{150\text{h} \times 90 \text{ buses} \times 0.2 \text{ times}}{276 \text{ days} \times 8\text{h} \times 2.25 \text{ persons}} = 0.54$ bays

* total bays required 8.39 bays

From the above the total number of bays required is 9.

(2) Height and Floor Area of Each Room

The standards for floor space of each room set as follows when calculating and planning the building size. The following standards were arrived at by referring Japanese standards, the conditions in Mongolia and the contents of discussion with Mongolian side.

Maintenance bays (9 bays)	dimensions necessary for disassembly and assembly (5.0m × 15.0 m / 1 bay)
Engine repair room	determined based on space necessary for servicing equipment and engine hoists
Engine test room (including control room)	ditto
Machine shop	ditto
Injection pump test room	ditto
Battery, electrical room	ditto
Tool storage	Floor area sufficient for tools
Spare parts storage	Especially for receiving frequently used parts
Office, reception	4.5-5.5m^2/person
Director's room	20-25m^2/person (including reception space)
Experts room	10-15m^2/person (including meeting space)
Meeting and practice room	1.2-1.5m^2/person
Locker room	1.2-1.5m^2/person
Toilet	4

(3) Consideration of Maneuver

The maintenance bays are placed in the front of the building so that large buses could directly enter the repair shop. Other servicing and repair rooms are placed in the rear of the building, with the engine repair, machine shop, and generator rooms place away from the administrative areas for noise considerations.

The administrative area is two stories with rooms such as the director's room, meeting and practice room, which have relatively independent functions, placed on the second floor.

(4) Necessary Auxiliary Attachments

Within the repair facility, 2 manually operated overhead cranes will be placed over the nine maintenance bays. Each room will have chain blocks and jib cranes installed as necessary.

Compressed air and electrical outlets will be provided at one place at each bay.

3-2-4 Procurement Plant of Equipment for Maintenance and Repair of Buses

The Project should provide a complete array of standard tools and workshop equipment to allow total servicing from preventative maintenance to overhaul, and these equipments shall be placed in the appropriate specialized rooms within the workshop. Table 3-2-1 indicates the main function and equipment of each room.

When selecting tools and equipment, the tools and equipment of the existing facility which can be used in the Project shall be used to the greatest possible extent, and the following facilities are not provided in the Project.

(1) Tire retreating facility (a local private facility will be used)

(2) Wheel dolly (in the Main Depot of Passenger Transport Bus - 1 Company will be used)

(3) Parts rack (to be procured by the Mongolian side)

As for the computerized total vehicle testing equipment (for overall tests of engine power, brakes, speed, tire alignment and electrical systems) requested to be included in the Project by the Mongolian side, it has not been included in order to preserve the practicability of the present vehicle inspection facilities and the basic analytical skills which future Mongolian technicians can gain from performing the tests separately without aid of computers.

Table 3-2-1 Workshop Divisions, and Functions and Equipment

Room Name	Workshop Function and Equipment
Maintenance Bay	- A 3 ton overhead crane for the efficient removal and replacement of heavy bus parts - Hydraulic chassis jacks and supports
Engine Repair Room	- One two ton jib crane for engine use to facilitate engine rebuilding and movement of parts - One hydraulic engine platform to increase the safety of engine rebuilding - To conduct cylinder boring, honing and valve polishing, correction, cylinder head polishing.
Engine Test Room	- Repaired and rebuilt engines will be transferred here and tested for overall performance. - One two tone monorail crane - The air compressor to supply air to the whole facility will be placed in the engine test room
Electrical Room	- General test equipment for all electrical parts such as electric starters, AC generators, etc.
Injection Pump Test Room	- A Both type test equipment will be set up to service bus fuel injection pumps
Machine Shop	- For retreating and fabrication of the parts, crankshaft grinder Lath machine, etc., will be placed.
Battery Room	- Tools and materials necessary for servicing batteries including a water purifier..
Bus Washing House	- The current dilapidated washing facility will be renovated. - Automatic vehicle washer, and high pressure water spray will be installed to wash buses and bus parts

3-3 Basic Plan

3-3-1 Procurement Plan of Buses

Table 3-3-1 Basic Specifications for Bus to be Procured Under the Project

I. Specifications for Chassis

Item	Requirement	Remarks
1. Major Specification		
(1) Type of Vehicle	Heavy duty bus for city' operation	
(2) Driving Position	Left hand drive front	
(3) Engine Location	Rear engine	
(4) Chassis Frame	Semi-Frame type	
(5) Driving Wheel	4 × 2 rear drive	
(6) Loading Capacity	Seating 26 + 1 (Driver) + Standing 63, Total 90 (Minimum)	
(7) Gross Vehicle Weight (GVW)	15,000kg (Minimum)	Vehicle weight approx.8,500kg Passenger (90) 6,300kg (70kg × 90) Total 14,800kg
(8) Design Site Condition		
1) Ambient Temperature	-25°C	
2) Altitude	Max. 1,500m above sea level	
(9) Heating System	Heater with 15,000kcal/hr (minimum)	
(10) Steering	Power Steering	
2. General Dimensions		
(1) Wheel Base	4,900~6,000mm	
(2) Overall Length	10,500~11,500mm	
(3) Overall Width	2,400~2,500mm	
(4) Overall Height	3,250mm (Maximum)	
(5) Front Tread	1,980mm (Approx.)	
(6) Rear Tread	1,800mm (Approx.)	
(7) Road Clearance	200mm (Minimum)	
3. Performance		
(1) Max. Speed	80~95km/h	for operating in mountain area
(2) Max. Gradeability	22% (Minimum)	
(3) Min. Turning Radius (in Tread)	11m (Maximum)	
4. Engine		
(1) Type	Direct injection type	
(2) Used Fuel	Diesel	
(3) Cycle	4 cycle	
(4) No. of Cylinders	6 cylinders in line	
(5) Cooling	Water cooled	
(6) Displacement	9,800cc (Minimum)	

(7) Output	185ps (Minimum)	
(8) Torque	65kgm (Minimum)	
(9) Minimum Fuel Consumption	185g/ps-h (Maximum)	
(10) Emissions	ECE R49/01	
5. Injection Pump		
(1) Type	In line plunger with limit speed governor	
6. Main Oil Filter		
(1) Type	Full-flow paper	
(2) Capacity	1.5 litter (Minimum)	
7. Air Cleaner		
(1) Type	Paper element replaceable type	
8. Clutch		
(1) Type	Dry single plate	
(2) Size	dia. 368mm (14.5 inch) (Minimum)	
9. Transmission (T/M)		
(1) Type	Mechanical type, 5 speed direct drive 1st & Rev: Constant mesh 2nd to 5th: Synchro mesh	
10. Rear Axle		
(1) Type	Banjo, fully floating type	
(2) Axle Load	9,200kg (Minimum)	
11. Brake		
(1) Service Brake		
1) Type	Full air type with drum dual circuit system	
(2) Parking Brake		
Type and Location	Mechanical expanded at the rear of T/M or spring brake acting on rear wheels	
(3) Other brake	Exhaust brake	
12. Suspension		
(1) Front		
1) Type	Semi-elliptical alloy steel leaf spring or piston bellow type air bag suspension for heavy duty bus	
2) Dimension (for steel leaf spring)		
- Span	1,450mm (Minimum)	
- Width	80mm (Minimum)	
- Thickness	12mm (Minimum)	10mm (minimum) when the number of leaf spring is equal or more than 12 pcs.
- Number	9 pcs (Minimum)	

(2) Rear		
1) Type	Semi-elliptical alloy steel leaf spring or piston bellow type air bag suspension for heavy duty bus	
2) Dimension (for steel leaf spring)		
- Span	1,650mm (Minimum)	
- Width	80mm (Minimum)	
- Thickness	12mm (Minimum)	
- Number	12 pcs (Minimum)	
13. Shock Absorber		
(1) Type	Hydraulic double acting telescopic for front and rear	
14. Wheels		
(1) Tire Size	10.00R20 Radial	(-40°C operation)
(2) Rim and Wheel	7.50V-20 (Minimum)	
(3) Type	8~12 studs	
15. Fuel System		
(1) Fuel Tank Capacity	200 litter (Minimum)	
(2) Fuel Cleaning System	Water sedimenter with dual fuel filter or Water Separator	
16. Electrical Equipments		
(1) Battery	12V 180AH (Minimum) × 2 in series connection	
(2) Alternator	24V-60A (Minimum)	
(3) Horn	Dual electric horn	

II. Specifications for Body

Item	Requirement
1. Seating Capacity	Passengers (26)
2. Body Structure	
(1) Construction	Rear engine body with ladder type channel section frame. Left-hand drive.
(2) Exterior panels	1.0~1.2mm thick steel sheet.
(3) Ceiling inner panels	0.8mm thick painted steel sheet
(4) Side inner panels	0.8mm thick painted steel sheet
(5) Fascia and front inner panels	1.0~1.2mm thick painted steel sheet
(6) Step	Non-slip steel treads and risers
(7) Battery storage	Steel compartment with a drawer under the floorboard for easy maintenance
(8) Thermal insulation	to meet with the interior temperature requirements
3. Doors	
(1) Passenger's doors	Center door sliding type, Front and rear 2 section inward-folding doors glazed with 5mm thick tempered safety glass and with cylinder locks Door control: Air operation Dimension (width), Front door 800mm, Center door 1000~1200mm, Rear door 800~1000mm
4. Windows	
(1) Front windshield	2 section windshield glazed with 6mm thick laminated safety glass
(2) Side windows	Lower fixed window and upper side sliding windows with aluminum sash glazed with 5mm thick tempered safety glass. One hand rail shall be provided to protect windows from the passengers.
(3) Driver's window	Sliding aluminum sash glazed with 5mm thick tempered safety glass.
(4) Rear window	5mm thick tempered safety glass
5. Floor	
(1) Flooring	10~25mm thick water proof plywood
(2) Floor covering	PVC. resinous sheet, "Linoleum" with thickness 3mm (minimum) with nonskid ribbed materials
6. Seats	
(1) Driver's seat	
1) Type	Seat adjustable to height, back and forth
2) 、Seat belt	2-point type safety belt with an ELR
(2) Passenger's seats	Heavy duty vinyl leather with seat cushion, without arm-rest
7. Electrical Equipments	
(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 × 12w lamps on both corners of front and rear roof. Amber
(6) Back up lamp	A white lamp under the rear bumper

(7) Room lamps	4 × 20w fluorescent lamps on the ceiling over aisle. 2 integral switches on the instrument panel
(8) Step lamps	12w lamp on each step riser
(9) Buzzer	Reverse warning buzzer
(10) Windshield wiper	2 speed wipers
(11) Windshield washer	Electric washer with 2 nozzles under both sides of front windshield
(12) Electric outlet	An outlet for inspection lamp
8. Ventilation	
(1) Front ventilator	Hatch type inlet under front windshield
(2) Roof ventilators	3 inlet and 1 outlet, 1 hatch type inlet for driver
9. Exterior Equipments	
(1) Bumpers	Painted steel bumpers on front and rear
(2) Rear view mirrors	2 pieces of mirror on both ends of front
(3) Towing hooks	2 pieces on front and rear
(4) Mud guards	Synthetic rubber behind each tire
(5) Spare tire carrier	Lift-up type carrier and carrier handle
(6) Destination sign box	Manual driving, one at the front and one at the side window
10. Interior Equipments	
(1) Sun visors	2 acryl resinous sun visors above front windshield
(2) Driver's blind	Roll-up screen for driver's partition behind
(3) Room mirrors	2 interior rear view mirrors on ceiling above front windshield
(4) Step mirror	Around mirror on the ceiling above the rear step
(5) Fire extinguisher	A fire extinguisher near the driver's seat
(6) Parcel box	Steel parcel box near driver's seat
(7) Safety wheel blocks	2 equipped, hard plastic
(8) Labels	Written in English and/or Mongolian
(9) Announce system	Three speakers and one microphone for the driver with AM/FM radio tuner
(10) Clock	one clock at the front
(11) Exit signal	Three push buttons at near the doors
(12) Strap	
11. Coating	
(1) Corrosion protection	Anti-corrosion coating
12. Other Requirements	
(1) Standard tools for emergency	for Driver's instrument
(2) Triangle reflector	
(3) Smoke candle	
13. Painting	
(1) Exterior	Two coats of Melamine Plastic Paint
(2) Interior	manufacture's standard

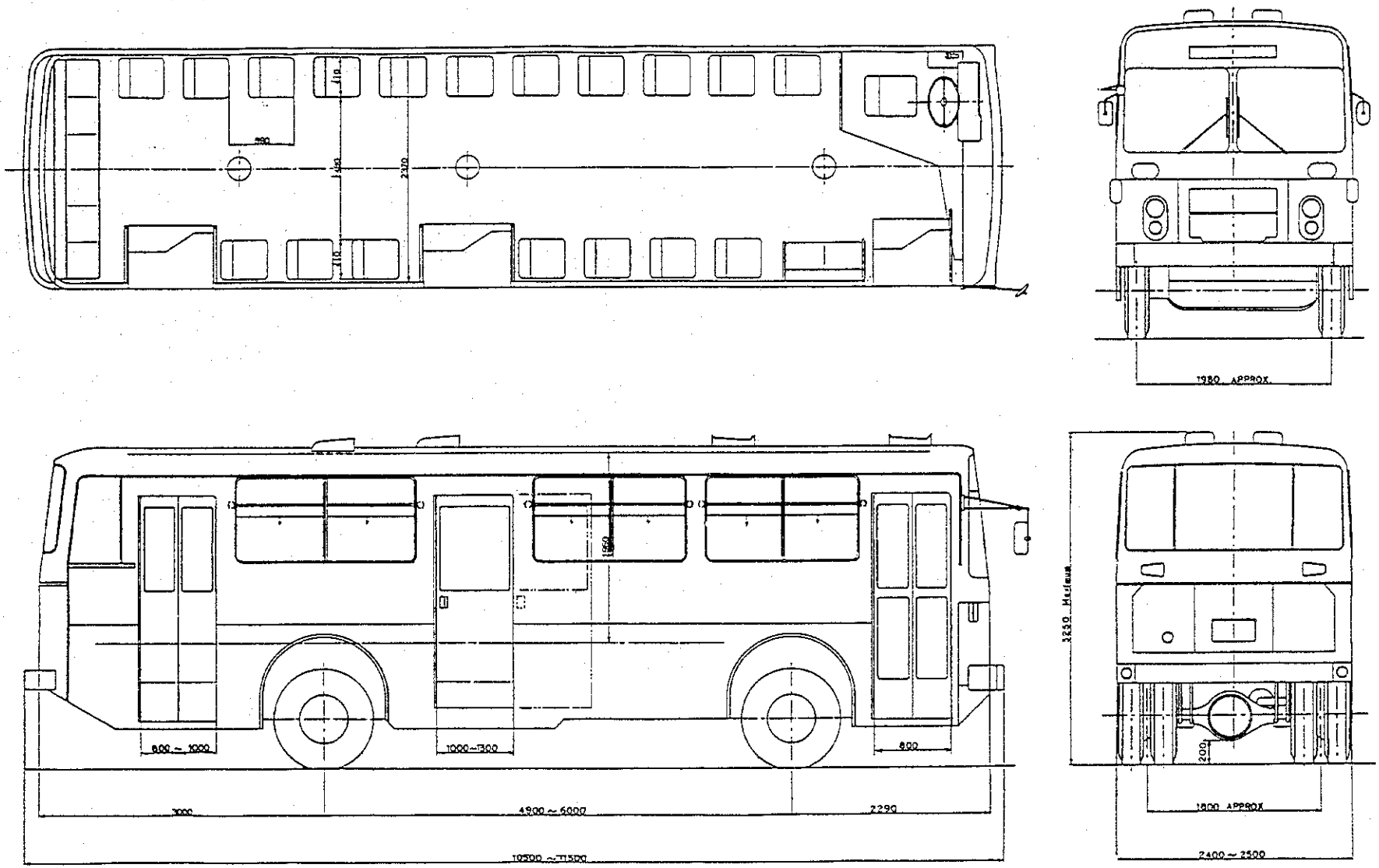


Fig. 3-3-1 Outline of Buses for the Project

3-3-2 Facility Construction Plan

(1) Location of Building

The facility where new workshop will be constructed under the Project is the sub-depot of Passenger Transport Bus - 1 Company located in the industrial area between the Serbe River and the Gengis Khan Road.

The site is 220m (North–South) by 200m, with the Northeast border having an irregular shape, and covering an area of approximately 4ha. The pavement of the road leading to the site is in bad condition, however, it is 10 meters wide and there is no hindrance to traffic.

The plan calls for service/repair facilities, administration facilities, and auxiliary facilities for in the Project.

These facilities will be located as follows to maximize function and efficiency, and with consideration to natural conditions of the surrounding site.

1) New Workshop of the Project shall be located in the rear of the facility so as not to take operating space away from other buildings and in particular so that buses can enter the workshop without hindering the daily line of flow of buses (from the entrance to refuel supply stand to garage and to the exit again). For this purpose the width of the apron shall be one bus length.

2) By placing the bus workshop parallel to the existing road within the site, buses can be serviced without hindering the daily operations of the facility.

   The basic plan for the construction of the workshop is show in section 3-3-4.

(2) Layout

The functions and planned areas of each room is as follows.

Table 3-3-2 Planned Area of Rooms in the Workshop, etc.

Item		Room Name	Area Standard	Planned Area	Remarks
① Construction of Workshop	Service/ Repair Facility (1st Floor)	Maintenance bay	5.0 × 15.0m/bay	795.00m^2	
		Machine shop inspection and fabrication area	Determined based on the placement of equipment	125.00m^2	
		Engine repair room	(same as above)	41.25m^2	
		Engine test room (including control room)	(same as above)	70.00m^2	
		Injection pump test room	(same as above)	37.50m^2	
		Battery room	(same as above)	12.50m^2	
		Tool storage		22.50m^2	
		Spare parts storage		127.50m^2	
		Pathways		193.75m^2	
		Substation		62.50m^2	
		Electrical room		25.00m^2	
		Mechanical room		100.00m^2	
		(Total)		1,612.50m^2	
	Adminis-trativon Section (1st Floor)	Entrance hall, hallways, stairwell		112.00m^2	
		Administration / office	4.5–5.5m^2/person	82.50m^2	
		Worker's office	4.5–5.5m^2/person	32.50m^2	
		Locker room	1.2–1.5m^2/person	65.00m^2	
		Hot water corner		16.50m^2	
		Toilet		27.50m^2	
		Storage		16.50m^2	
		(Total)		352.50m^2	First floor area total 1,965.00m^2
	Adminis-tration Section (2nd Floor)	Hall, hallways, stairwell		64.50m^2	
		Type · photocopy room		15.00m^2	
		Director's room	20–25m^2/person	37.50m^2	
		Administration room		37.50m^2	
		Experts room	10–15m^2/person	33.75m^2	
		Meeting and Practice room	1.2–1.5m^2/person	112.00m^2	
		Hot water corner		27.50m^2	
		Toilet		24.75m^2	(1F total) 1,965.00m^2
		Storage		24.75m^2	(2F total) 375.00m^2
		(Total)		375.00m^2	Grand total 2,340.00m^2
② Renovation of Car Washing Facility		Renovation of the existing bus washing house	Floor renovation surface area	504.00m^2	
		Construction of a water treatment house		65.4 m^2	For the processing of wastewater from bus washing
③ Others		Open parking lot (spaces for 48 cars)	Asphalt surface with white lines	1,380.00m^2	

(3) Sectional Planning

1) The area where the overhead traveling crane will operate will be designated as the maintenance bay, and the floor height will be decided based on a crane hoisting height of 5m, the required clearance above the crane and the beam height.

2) The floor height of each shop will be decided based on the installation height of the jib crane and the beam height.

3) The floor height of the spare parts storage will be decided based on the parts rack height and the beam height.

4) A suspended ceiling will be used for the director's office, the administration office, the meeting and practice room, etc., with a ceiling height of 2.4-2.5m above floor level. The floor height will be decided taking the ceiling height, beam height and equipment installation space into consideration.

(4) Structural Planning

1) Basic Principles

The following basic principles will apply for the structural design of the buildings to be constructed under the Project.

① Where possible, the design will allow the use of a local construction method.

② The design will ensure safe, durable buildings.

③ The design will suit the local environmental conditions as well as the site conditions.

④ The design will allow the maximum use of local materials.

2) Foundation Design

The results of boring surveys in the vicinity show the soil bearing capacity of the planned site to be approximately 25tons/m^2 at 2.5m below the ground surface (see Appendix 7). The planned building is a two-story building with a maximum load per column of approximately 50 tons, necessitating the use of a spread foundation.

The ground water level is 2.8m below the surface during the winter according the geological survey described in section 2-3-2-1-(3). The depth of winter freezing is determined to be 2.7m below the surface. A freezing depth of 269cm was calculating from the average winter temperature, number of winter days in Ulaan Bataar and the ground condition, matching information attained in Mongolia. The foundation level of the Cashmere factory being constructed on west side of the Project site is 2.5m and it is

determined that the foundation of the Project building can be set deeper than 2.5m.

3) Design of Superstructure

Columns, beams and slabs in Mongolia usually have a reinforced concrete structure while walls are made of either concrete blocks or bricks.

The size of the planned buildings allows the use of local construction methods which will be economical. In principle, therefore, the use of a RC structure is preferable.

However, the tight construction schedule demands the use of a steel frame for the pillars and large and small beams. As the construction will take place in the second stage of the Project (Phase II), it is likely to coincide with the Mongolian winter, and actual construction will be from April of the year following the signing of the contract. Therefore it has been decided to construct the foundation and foundation beams using reinforced concrete, and to use a steel frame for the superstructure. This will allow the steel structure to be constructed and transported, making full use of the winter.

(5) Aseismic Design

The Project site is not located in an earthquake-prone area and, there is no history of a large earthquake occurring. Aseismic design standards are based on former Soviet ones which indicate a standard shear modules of 0.15 for buildings within Mongolia. The strength and safety of the building will be decided bearing this standard in mind. For reference, the minimum standard shear modules in Japan is 0.20.

(6) Dead Load

The weight of all the structural materials, finishing materials and fixed equipment will be calculated to obtain the dead load.

(7) Live Load

The live load used for the present structural design will be based on Japan's Building Standards Act as shown in Table 3-3-3.

Table 3-3-3 Standard Live Load for Structural Calculation

(Unit: kg/m^2)

Category	Floor/Small Beam	Main Beam/Column/Foundation	Aseismic Design
Office	300	180	80
Meeting Room Corridor Hallway	360	330	210
Storage	500	300	200

(8) Wind Load

The wind load factor is negligible, yet will be considered for the safety of the steel-frame superstructure.

The recorded maximum wind velocity in the area, i.e. 10m/sec, plus an additional safety margin of 10m/sec, 20m/sec, will be used to calculate the design wind pressure (load), pursuant to the corresponding regulation in the Japan's Building Standards Act as shown below.

Maximum Wind Velocity (V) : 20m/sec

Assumed Air Density (ρ): 0.125kg sec^2/m^4

q (design wind pressure) $= 1/2 \times \rho \times (V)^2$

$= 1/2 \times 0.125 \times 30^2 = 25 kg/m^2$

$= 25 kg/m^2$

(9) Electrical Facility Plan

1) Basic Principles

① The electric facility plan must take the local conditions, including the climate and customs, and the special conditions of the planned facilities into consideration.

② Electric facility must be easy to operate and maintain.

③ The electrical equipment, appliances and their components (parts) to be used for the Project should preferably be standard products in view of easy replacement.

④ The zoning for lighting should adopt small units for energy saving purposes.

2) Substation

From discussions with the Department of Electricity Supply of Ulaan Bataar city, 2 lines with the following specifications will be extended from the existing substation located at southwest corner of the Project site.

Workshop line:	6kV, 3 phase, 3 wire, 50Hz
Bus washing house line:	380/220V, 4 phase, 4 wire, 50Hz

A 400kVA stepdown transformer within the workshop will be used to change the voltage from 6kV to the following voltages.

Secondary Voltage:

- power equipment:	3 phases, 4 wires, 380/220V, 50Hz
- lighting and outlets:	single phase, 220V, 50Hz

3) Emergency Generator Set

An emergency diesel power generator will be installed in preparation for power failures which are expected to occur very frequently in winter. The load will consist of emergency lights, fire fighting pump and critical equipment which may pose a danger if power is unexpectedly cut off such as hoisting cranes, lathe machine, etc. The design power generation capacity shall be 100kVA.

The emergency generator shall be installed within the facility to withstand the severe winter and will have an automatic starter and cutoff to ensure immediate operation during power failure. The fuel tank will hold a 6 hour capacity to allow for the maximum daily blackout time during the winter, which is 4 hours, as mentioned in the previous section 2-3-2-3-(1).

4) Lighting and Outlets

Lighting will mainly be provided by fluorescent lamps and outlets will be installed in desirable positions in each shop/room. The expected average luminous intensity is given below for the main rooms.

① Offices	300-400lux
② Maintenance Bay	200-300lux

③ Locker room, toilet	100-200lux
④ Meeting room	300-400lux
⑤ Entrance hall	200-300lux
⑥ Hallway	100-200lux

For the security purpose, the exterior lighting facility will be installed on the wall of the workshop.

5) Telephone and Interphone

Four external telephone lines will be installed in the director's room, expert's room, and office respectively.

An interphone system will be installed in the workshop to allow quick and efficient internal communication.

6) Paging System

A speaker will be placed in each room of the workshop for convenience and to increase general work efficiency. The announcements will be made from the first floor office.

7) Fire Alarm System

A smoke detector will be placed in the highest point of the service bay and heat detectors will be placed in each room to improve response time and increase fire-fighting efficiency.

The detector indicator board will be located in the first floor office and along with the paging system for the safety of the entire workshop.

(10) Building Services Plan

1) Basic Principles

① The building services design must take the local climate and environmental conditions fully into consideration.

② Equipment which is easy to operate and maintain should be selected.

2) Heating and Ventilation

The conditions for installation of the heating system are as follows.

① Designed ambient temperature: –39°C

② Temperature of city heating system:

Supplied temperature	150°C (at ambient temp. –39°C)
Returned temperature	70°C (same as above)

③ Designed indoor temperature:

Offices, toilets, etc.	18°C
Other areas	16°C

When the workshop is not used at night, the temperature shall be set at 5°C to save energy.

④ Ventilation time:

Locker room, toilet, etc.	7 time/hr
Maintenance bay	3 time/hr
Engine repair room, mechanical room, electrical room	6 time/hr

Based on the above design conditions, the required heating value for the workshop will be about 1,700,000kcal/hr.

3) Water Supply

Water (100l/person + water for machinery) will be supplied to the necessary rooms by direct connection to a water main within the site.

The water necessary for the workshop is estimated at 6 cubic meters per day.

The water supply contract between the bus company and the City Water Works Department is for a maximum of 3,000 cubic meters per month, will recycle washing water to stay within this limit.

4) Sewerage

Wastewater will flow from the three drainage system shown in Fig. 3-3-1 into the public sewer system after passing through purification system, oil separator, etc. Wastewater standards will be fundamentally based on the discharge standards of the City of Ulaan Bataar. However, regarding oil products, the Japanese standard value for normal-hexane abstract matters, i.e. below 5mg/ℓ for mineral oils, will be adopted for the Project.

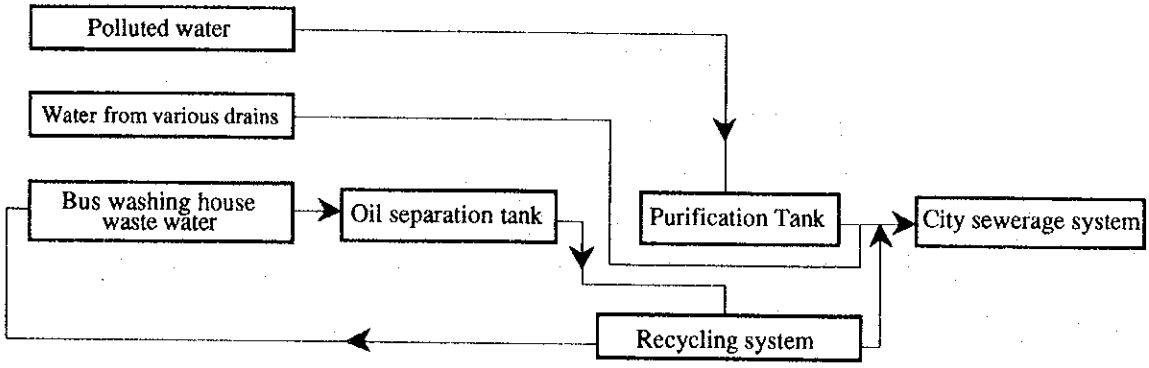


Fig. 3-3-2 Waste Water System Flow Diagram

5) Sanitary Fixtures

Sanitary fixtures will be installed in the toilets and other relevant places. Water closets for the staff will be western-style water closets.

6) Compressed Air Supply

Compressed air supply will be provided for necessary areas of the workshop building.

There will be two compressed air systems, one system at a pressure of 7kg/cm^2 for general air tools, and the other system at a pressure of 10kg/cm^2 for special equipment such as break testers, etc.

7) Fire-Fighting Facilities

- indoor fire plugs: service repair workshop (first floor) : 4
  offices, etc. (second floor) : 1

- fire extinguishers: ABC powder extinguisher (4kg), and carbon dioxide (CO_2) extinguishers (90kg) will be located where necessary.

One fire-fighting pump will be placed in the first floor mechanical room to supply the indoor fire plugs, and share the cooling water supply of the engine test room for practical purposes.

8) Bus Exhaust Ventilation System

In consideration of the effect of buses exhaust on worker health, exhaust hoses connected to a fan will be installed in the maintenance bay to expel exhaust from the building. 1 hose for 2 bays will be provided.

The main electrical and mechanical installations in each room are as follows. Lighting fixtures will also be installed in each room.

Table 3-3-4 Attached Installations for Each Room

	Ventilation	Water	Hot water	Compressed air	Interphone
Maintenance bay	O	O	O	O	O
Engine repair room	O	O	O	O	
Engine testing room	O			O	
Machine shop	O	O	O	O	
Injection pump test room	O	O	O	O	
Battery room	O	O	O	O	
Tool storage	(natural ventilation)				
Spare parts storage	(natural ventilation)				
Administration	(natural ventilation)				O
Director room	(natural ventilation)				
Experts' room	(natural ventilation)				
Practice room	(natural ventilation)				
Meeting room	O				
Locker room	O	O	O		
Toilet	O	O	O		

(11) Finish

In principle, the materials required for the finishing work for the planned buildings will be procured locally. However, regarding structural steels and

door/window frames which involve manufacture or processing jobs, corrugated steel roof sheets, concrete floor hardener and others which are unobtainable locally, the Study Team surveyed possibility on the supply from the third countries with local construction company and material procurement company. These companies replied that quality, supply capacity and delivery of the third country's products (Russian and China) are not efficient and not stable. Therefore, materials not procured in local shall be procured in Japan. The following points must be taken into consideration in the selection of materials.

1) high durability in view of easy maintenance
2) compatibility with Mongolian standards or equivalents in view of easy maintenance
3) wide availability and popular use locally to ensure high work quality and to shorten the construction period

The main materials to be used for exterior and interior finishing are listed below.

1) Exterior Finishing

Roof:	double corrugated steel sheets with insulation
External Walls:	insulation panels + insulation + concrete blocks.
Doors and Windows:	aluminium frames, aluminium doors, steel doors, aluminium oversliders (with insulation)
Apron:	trowel finish concrete
Gutter:	vinyl chloride

2) Interior Finishing

① Maintenance Bay and repair rooms and storage room

Floor:	trowel finish concrete
Walls:	mortar finish with emulsion paint coating
Ceiling:	exposed corrugated steel sheets with insulation materials and exposed structural steel with oil paint coating

② Entrance hall, Administration room, worker's room, rocker room

Floor local marble

Walls mortar finish with emulsion paint coating

Ceiling concrete with cement plastering + glass wool

③ Hot Water Corner/Toilets

Floor ceramic tiles

Walls ceramic tiles

Ceiling asbestos board + glass wool

④ Second Floor Administrative Section

Floor local marble

Walls mortar finish with emulsion paint coating

Ceiling acoustic asbestos board + gypsum board + glass wool

3-3-3 Procurement Plan of Equipment for Maintenance and Repair of Buses

Based on the study and examination result on the design condition (see 3-2-4), the facilities and equipment for the workshop are as follows.

Table 3-3-5 List of Workshop Equipment to be procured under the Project

1. Equipment for parts machining

Item	Description	Specifications	Q'ty	Remarks
1	Crankshaft grinder	Center distance: 1600mm Swing: 690mm	1 unit	with accessories
2	Bench drill press	Capacity: 23mm MT No. 2	2 units	
3	Bench grinder	Wheel: 205mm	3 units	with spare wheels
4	Tap and dies set	Each 46 pcs./set	1 set	
5	Lath machine	Center distance: 1,500mm Swing: 510mm	1 unit	with accessories
6	Arc welding machine	Current: 40-300A with electrode dryer	2 units	with accessories
7	High speed abrasive cut-off machine	Wheel: 455mm	1 units	
8	Spot welding machine	Input: 29kVA	1 units	
9	Gas welding set	Torch, cylinder etc.	1 set	with accessories
10	Universal milling machine	Table: 1,350 × 270mm	1 unit	with accessories
11	Hacksawig machine	Capacity: 310mm	1 unit	
12	Welding shield	Hand type	2 pcs.	
13	Safety holder	300A	2 pcs.	
14	Earth clip	300A	2 pcs.	
15	Igniter	Welding lighter	2 pcs.	
16	Welding glass		2 pcs.	
17	Straight shank twist drill set	1-13mm, 25 pcs./set	2 sets	
18	Taper shank twist drill set	14-32mm, 19 pcs./set	2 sets	
19	Drill press vise	width 83mm	1 pc.	
20	Drill chuck & handle	Capacity: 13mm No. 6 Jacob	2 sets	with arbor
21	Drill sleeve	MT1 × MT2	2 pcs.	
22	Tap holder	for 3-6mm tap	1 pc.	
23	Tap & remember wrench	for 5-12mm tap	1 pc.	
24	Tap & remember wrench	for 10-25mm tap	1 pc.	
25	Dies handle	for 25, 38, 50, 57mm dies,	each 1 pc.	
26	Tool bit set	for Lathe machine	1 set	
27	Cutting wheel	455 × 3 × 25.4mm	10 pcs.	
28	Tip for cutting		10 pcs.	
29	Tip for welding		10 pcs.	
30	Hacksaw blade	550 × 45 × 2.25mm, 10 pcs./set	5 sets	
31	Tap	PT1/8, PT1/4 each 1 PC./set	2 sets	
32	Dies	PT1/8, PT1/4 each 1 PC./set	2 sets	

2. Equipment for chassis maintenance

Item	Description	Specifications	Q'ty	Remarks
1	Air compressor	Pressure: 10kg/cm^2 motor: 15kw	1 unit	with additional tank
2	Garage jack	Capacity: 10 ton	4 units	
3	Garage lamp	with 100W lamp 5 pcs./set	10 sets	
4	Workbench	1,780 × 600 × 750mm with drawer	10 units	
5	Vice	width: 200mm	10 pcs.	
6	Electric cord reel	15A, 30m, 220V	4 pcs.	
7	Stud remover	19mm	2 pcs.	
8	Grip pliers	125mm & 178mm length opening 20~37mm	each 2 pcs.	
9	Nut cutter	9-12mm	1 pc.	
10	Snap ring pliers set	for stem and groove	1 sets	
11	Impact driver	with (-) & (+) bit 12.7mm	2 pcs.	
12	Torque wrench	3-33kg·m & 10-100kg·m	each 2 pcs.	
13	Gear puller set	Capacity: 5 ton	1 set	
14	Push puller set	Capacity: 10 ton	1 set	
15	Bearing puller set	Opening: 9.5-117.5mm	1 set	
16	Center punch set		1 set	
17	Slide hammer puller	Universal type	1 set	
18	Air impact wrench	12.7mm sq. socket & accessories	2 sets	
19	Screw extractor	5 pcs./set 6.5-16mm	1 set	
20	Tube cutter & flaring set	Pipe cutting: 3-30mm	1 set	
21	Overhead traveling crane	Single girder, 3 ton capacity with electric hoist	2 units	with accessories
22	Hydraulic shop press	Capacity: 55 ton 0.375kw	1 unit	
23	Parts washing stand	Tank: 90 liter 1250 × 650 × 1350mm	5 units	
24	Grease pump	250kg/cm^2, 16kg capacity	2 units	with wheel
25	Oil bucket pump	20 liter capacity	6 units	with wheel
26	Grease gun	with straight nozzle & micro hose	20 sets	
27	Air hose reel	10mm × 13m	10 pcs.	
28	Pit lift (Pit jack)	Capacity: 10 ton	6 units	
29	Tool set for vehicle		10 sets	
30	Sling chain & wire set	9 kinds/set	2 sets	
31	T-type wrench	14mm	2 pcs.	
32	T-type wrench	17mm	2 pcs.	
33	T-type wrench	19mm	2 pcs.	
34	T-type wrench	21mm	2 pcs.	
35	T-type wrench	22mm	2 pcs.	
36	T-type wrench	23mm	2 pcs.	
37	T-type wrench	24mm	2 pcs.	

38	T-type wrench	26mm	2 pcs.	
39	T-type wrench	27mm	2 pcs.	
40	Hexagon wrench set	10 pcs./set	2 pcs.	
41	Socket wrench set	19mm sq, socket (12pcs) & accessory	2 pcs.	
42	Socket wrench set	6.4mm sq, socket (8pcs) & accessory	2 pcs.	
43	Bolt clipper	16mm	2 pcs.	
44	Bolt clipper	8mm	2 pcs.	
45	Mechanic tool set for large vehicle		2 sets	
46	Magnetic finger	520mm	2 pcs.	
47	Pipe bender	Pipe dia. 8 & 10mm	1 pc.	
48	Disc grinder	Disc: 125mm × 22mm	2 pcs.	
49	Reversible air impact wrench	25.4mm × 36mm	2 pcs.	
50	Straight rules	300m	2 pcs.	
51	Straight rules	600m	2 pcs.	
52	Straight rules	1,000mm	1 pc.	
53	Cleaning gun	Bent type	1 pc.	
54	Adjustable hacksaw	250-300mm	4 pcs.	
55	Hacksaw blade	250mm	5 pcs.	
56	Hacksaw blade	300mm	5 pcs.	
57	Compact gas torch	Capacity: 200g	10 pcs.	
58	Tinner scissors	Capacity: 1.2mm straight	2 pcs.	
59	Tinner scissors	Capacity: 1.2mm curved (right)	2 pcs.	
60	Tinner scissors	Capacity: 1.2mm curved (left)	2 pcs.	
61	Torch lamp, gasoline	1 liter	1 pc.	
62	Iron anvil	50kg	2 pcs.	
63	Cast Iron swage block	300 × 300 × 38mm	1 pc.	
64	Thread type solder	2mm dia, 1kg	5 pcs.	
65	Thread type solder	1.2mm dia, 1kg	5 pcs.	
66	Double-face sledge hammer	3.6kg	1 pc.	
67	Double-face sledge hammer	4.5kg	1 pc.	
68	Cutting wheel	455mm dia,	10 pcs.	
69	Air compressor	7kg/cm^2, 1.5kW portable	2 units	
70	Sealants for pipe threads	10 pcs./set	20 sets	
71	Locking agent	200g	20 pcs.	
72	Liquid gasket	200g	20 pcs.	
73	Anti-seizing lubricant	480g aerosol	10 pcs.	
74	Anti-seizing lubricant	500g can	10 pcs.	
75	Rust-proofing agent and lubricant	340ml aerosol	20 pcs.	
76	Air transformer	0-10kg/cm^2	4 pcs.	
77	Copper hammer	450g	1 pc.	

78	Toor tray	415 × 250 × 90mm	5 pcs.	
79	Toor tray	600 × 450 × 150mm	5 pcs.	
80	Hand shear	Capacity: 2.9mm (steel) 335W	1 pc.	
81	Hand spring balancer	20kg	1 pc.	
82	Oil filter wrench	Capacity: 150mm dia.	4 pcs.	
83	Quick air hose connector		1 set	
84	Air cock	3/8PT × 3/8PF	25 pcs.	
85	Air cock	1/2PT × 1/2PF	5 pcs.	
86	Disc grinder wheel	125mm dia.	50 pcs.	
87	Scraper blade	190mm length	10 pcs.	
88	Wire brush	Brass 90mm	10 pcs.	
89	Parts cleaning brush	Long bristle 55mm	10 pcs.	
90	Oil stone	#80/#300, 150 × 25 × 13mm	5 pcs.	Combination type
91	Electric drill	Capacity: 6.5mm		
92	Electric drill	Capacity: 13mm	2 pcs.	
93	Hexagon wrench set	12 pcs./set	2 sets	
94	Engineer's file set	5 pcs./set	2 sets	
95	Abrasive cloth & paper	#50,#100,#320, each 50 pcs./set	1 set	
96	Jib crane, wall type	Capacity: 2 ton, Jib length: 4m electric chain block	1 unit	
97	Jib crane, wall type	Capacity: 1 ton, Jib length: 4m electric chain block	2 unit	

3. Equipment for measuring, diagnose and lubrication

Item	Description	Specifications	Q'ty	Remarks
1	Diesel timing tachotester	Range: 120-9990 rpm	1 pc.	
2	Diesel compression gauge	Range: 0-70kg/cm^2	1 pc.	
3	DC voltage meter	Voltage: 0-50V	2 pcs.	
4	Ammeter	Ampere: 0-75A	2 pcs.	
5	Vacuum gauge	1,000mmaq,	2 pcs.	
6	Valve sprig tester	120kg.	1 pc.	
7	Cylinder gauge	38-50 & 50-150mm	each 1 pc.	with dial indicator
8	Piston feeler gauge	8 leaves/set	1 set	
9	Con-rod aligner	Con-rod dia,: 50-150mm	1 pc.	
10	Plasti gauge	3kings/set	5 sets	
11	Fuel injection pump test stand	PGM 60cm^3	1 unit	with accessories
12	Nozzle tester	0-500kg/cm^2	2 pcs.	
13	To-in gauge	1,250-2,300mm	1 pc.	
14	Camber caster kingpin gauge		1 pc.	
15	Turning radius gauge		1 pc.	
16	Side slip tester	Axle weight: up to 10,000kg	1 unit	

17	Brake tester	Axle weight: up to 10,000kg	1 unit	
18	Armature tester		1 pc.	
19	Circuit tester		4 pcs.	
20	Battery hydrometer set	Hydrometer, thermometer, syringe	2 sets	
21	Battery tester	18-200Ah	2 pcs.	
22	Dye penetrate-metal crack detector	3kinds/set	5 sets	
23	Vernire caliper	300mm	4 pcs.	
24	Outside micrometer set	0-150mm	2 sets	
25	Dial indicator	with magnetic stand	2 sets	
26	Thickness gauge	25 leaves/set	5 sets	
27	Straight edge	1000mm	1 pc.	
28	Surface plate	1200 × 1200 × 150mm	1 pc.	
29	Headlight tester	Range: 0-80000cd	1 unit	
30	Alternator tester	Motor: 3.7kW 50V 100A	1 unit	
31	Fuel consumption meter	5-200 liter/h. for diesel	1 pc.	
32	Diesel smoke meter	Using filter paper and lamp	1 unit	
33	Battery coolant tester	Optical type	1 pc.	
34	Radiator cap and cooling system tester	0-2kg/cm^2 with adapter	1 pc.	
35	Vacuum pump	16.4 cm^3/stroke	2 pcs.	
36	Timing light		1 pc.	
37	Compression gauge	gauge: 25kg	1 pc.	
38	Cam angle tacho tester		1 pc.	
39	Spark plug cleaner and tester	10,000V	1 pc.	
40	Spark plug cleaning compound	2kg	1 pc.	
41	Measuring tape	10m	2 pcs.	
42	Screw pitch gauge	28 leaves/set	1 pc.	
43	Thermometer	-20-200°C (for oil and water temperature)	1 set	10pcs/set
44	Stop watch		1 pc.	
45	Standard file for scratch hardness test	4 pcs./set (HRC)	1 set	
46	Square	200 × 130mm, stand type	1 pc.	
47	Square	100 × 70mm, stand type	1 pc.	
48	V-block	150 × 60 × 80mm	2 pcs.	
49	V-block	50 × 19 × 24mm	2 pcs.	
50	Surface gauge	200mm	1 pc.	
51	Steel compass	0~175mm	1 pc.	
52	Firm joint caliper for inside	300mm	1 pc.	
53	Firm joint caliper for outside	300mm	1 pc.	
54	Scriber		2 pcs.	

55	Engine dynamometer	300PS with accessories	1 unit	
56	Mono-rail crane	Capacity: 1 ton, with geared trolley and chain block	1 unit	

4. Equipment for engine and chassis repair

Item	Description	Specifications	Q'ty	Remarks
1	Engine positioner	Capacity: 2 ton, 360 rotation	2 units	with bracket
2	Valve lifter and compressor	Capacity: 50-225mm	1 pc.	
3	Valve seat cutter (Valve seat refacer)	Capacity: 20-60mm	1 unit	
4	Hand valve lapper	30, 35mm 2pcs./set	4 sets	
5	Valve lapping compound	Fine & coarse each 200g can	4 pcs.	
6	Injection nozzle puller		1 pc.	
7	Cylinder liner puller	For wet type liner, 82-150mm	1 pc.	
8	Valve refacer	Capacity: 6-14.5mm valve: max 100mm	1 unit	
9	Piston ring tool	Capacity: 70-150mm	1 pc.	
10	Piston ring compressor	Capacity: 100-150mm	1 pc.	
11	Injection pump service tool set	For Bosch PE-A, P	1 set	
12	Injection nozzle cleaning kit		1 set	
13	Transmission jack	Capacity: 1500kg height: max 870mm	2 units	
14	Differential jack	Capacity: 500kg height: max 600mm	2 units	
15	Transmission bearing puller	Capacity: 75-170mm	1 pc.	
16	Universal hab puller	For large vehicle, front & rear	2 pcs.	
17	Wheel bearing puller	For large vehicle, 140-170mm	1 pc.	
18	Brake spring pliers	For large vehicle, 700mm length	4 pcs.	
19	Brake lining reveter	Capacity: 2 ton stroke: 45mm	1 pc.	
20	Brake drum lathe	Foe large vehicle drum dia: 180-850mm	1 unit	
21	Cold patch set for tube repair	For large vehicle, tube repair	100 sets	
22	Air valve lapper	Air type with 3 kinds of caps	1 pc.	
23	Red lead		1 pc.	
24	Tire bead braker (Tire charger)	Rim dia: 14-26"	2 units	
25	Wheel balancer	Rim dia: 13-24"	1 unit	with balance weight
26	Tire valcanizer (Thermopress)	Tire size: 7.50-16.00	2 units	with tools and consumable parts
27	Cylinder boring and surface grinding machine	Bed type, boring dia: 31-180mm distance table to hand: 1260-430mm	1 unit	
28	Micro hone	Dia: 152mm, grid: #180	10 pcs.	

29	Blocking tool	750 × 400 × 330mm	4 units	
30	Blocking tool	750 × 480 × 590mm	4 units	
31	Service creeper	With pillow, 430 × 910mm	4 pcs.	
32	Cross rim wrench	19 × 21 × 23 × 26mm	2 pcs.	
33	Cross rim wrench	19 × 22 × 24 × 27mm	2 pcs	
34	Truck wheel hub shock puller	For large vehicle, front & rear	1 pc.	
35	Truck wheel bearing	8 point: 4-120mm	1 set	
36	Lock nut wrench wheel inner bearing puller	6 point: 4-125mm	1 set	
37	Lock nut wrench wheel inner bearing puller	For large vehicle, capacity: 140-170mm	1 pc.	
38	Brake anchor pin remover	For medium & large vehicle	1 pc.	
39	Tie-rod end puller	130 × 65 × 45mm	2 pcs.	
40	Various wedges	23.8 × 406mm	2 pcs.	
41	Pitman arm puller	For large vehicle, max, 95mm	1 pc.	
42	Strut spring compressor	Mac Pherson type	1 pc.	
43	Tire pressure gauge	Max. 8kg/cm^2	5 pcs.	
44	Automatic tire inflator	Stand type, 0-10kg/cm^2	2 units	with hose and chuck
45	Air chuck		5 pcs.	
46	Tire service tool set	Tools with hanger board	2 sets	12 pcs/set
47	Concentrate lubricant system	Air pump and hose reel for gear, mission and engine oil	each 2 units	
48	Oil drain	Tank: 70 liter height: 1740mm	2 units	with accessories
49	Oil drain	Tank: 70 liter height: 190mm	2 units	with accessories
50	Drum can carrier	Capacity: 300kg	1 unit	
51	Drum can carrier	Capacity: 350kg with drum lift	1 unit	
52	Oil measure	2 liter, polyethylene made	5 pcs.	
53	Oil measure	5 liter, polyethylene made	5 pcs.	
54	Spray mask		4 pcs.	

5. Equipment for body repair

Item	Description	Specifications	Q'ty	Remarks
1	Hand riveter set	L-type, rivet: 2.4, 3.2, 4.8mm	2 sets	with spare rivet
2	Vacuum cleaner	Electric type, motor: 1.5kW	2 units	
3	Spray gun	Suction type, nozzle: 1.5mm	1 set	with container
4	Screw clamp	L-type, Opening: 250mm	4 pcs.	
5	Body & fender tool set	Pad, hammer, etc. 10 pcs./set	2 sets	
6	Air riveter	Rivet: 2.4, 3.2, 4.0, 4.8mm	2 sets	with spare rivet

6. Equipment for electric parts repair

Item	Description	Specifications	Q'ty	Remarks
1	Battery charger	Moving type, silicon quick and normal charge, output: 50A	2 units	input: 1.1kVA
2	Solderless terminal kit	For vehicle, pliers and terminals	2 sets	
3	Electric soldering iron	200W and 100W	each 1 pc.	with solder
4	Soldering iron	300g	2 pcs.	
5	Water purifier	Capacity: 10 liter/h	2 units.	for battery
6	Wire winding machine	Max. coil winding diameter: 130mm Speed: 0-150rpm	1 unit	with accessories
7	Battery charger	Moving type, silicon quick and normal charge, output: 140A	1 unit	input: 6.5kVA stationary type

7. Equipment for parts warehouse

Item	Description	Specifications	Q'ty	Remarks
1	Drum pump	Capacity: 20 liter/min. hand type	2 pcs.	
2	Hand truck	Capacity: 300kg 900 × 600mm	2 units	
3	Cardex cabinet	Drawer: 12pcs. 5 units/set	1 set	
4	Forklift	Capacity: 2 ton diesel engine	1 unit	
5	Pallet truck	Capacity: 2 ton fork height: 80mm	1 unit	

8. Cleaning equipment

Item	Description	Specifications	Q'ty	Remarks
1	Water hose reel	Spring type, 10m hose	4 pcs.	
2	Versatile vehicle washing machine	Washable dimensions: 2,500 (W) × 12,000 (L) × 3,800 (H)mm	2 units	Turning brash type
3	Hot water high pressure washer	700liter/h, 100kg/cm^2, 2.2kw	2 units	For washing of under carriage
4	Steam cleaner	800liter/h, 8-10kg/cm^2	1 unit	
5	Exhaust hose & blower	dia 75mm × 7.5m	4 units	

9. Equipment for Administration

Item	Description	Specifications	Q'ty	Remarks
1	Black board	1900 (L) × 600 (W) × 1700 (H)mm	2 units	with consumable parts
2	Photo copy machine	For B5-A3 paper size	1 unit	with consumable parts
3	Overhead projector	300W lamp	1 unit	with accessories
4	Personal computer	with accessories	2 units	
5	Printer for personal computer	with accessories	2 units	

10. Seat repair equipment

Item	Description	Specifications	Q'ty	Remarks
1	Sawing machine	repairing for seats	1 unit	

11. Educational equipment

Item	Description	Specifications	Q'ty	Remarks
1	Cutaway model for diesel engine assembly	Large vehicle engine	1 unit	
2	Cutaway model for transmission	Manual type, large vehicle	1 unit	
3	Cutaway model for differential	Large vehicle	1 unit	
4	Electrical system board	Pre-heater system	1 unit	
5	Brake system board	Large vehicle engine, air brake	1 unit	
6	Fuel system board		1 unit	

12. Others

Item	Description	Specifications	Q'ty	Remarks
1	Safety helmet		100 units	
2	Safety shoes		100 units	