20.2.2 Natural Environment

1) Groundwater

New market-Stadium road is proposed to pass through the protected and sanitary zones of UB City water sources for centralised water supplies. As the stated in the Mongolian Law on Water, "Sanitary zones shall be set not less than 100 meters from the water sources for centralised water supplies" (Article 13, item 3 and 4). "Regime in protected and sanitary zones of water sources for water supply" (Directive of the Ministries of the Nature and Environment, Infrastructure and Health, 1995, 167/335(a)/171) sets main rules for establishment of protected zones boundary and regime in the specified zones. The protected zone boundaries of the area are set 500 meters due to underground water sources for centralised water supplies. Sanitary zone is strictly set 50 meters with fences. To construct and to locate any construction, moving and other equipment, facilities except for water supply purpose are prohibited as the Directive.

Proposed New market-Stadium road also will cross the special road to Ikhtenger. Government and Special service authorities regulate any construction in area of this special road. Special agreement with Environmental Department, UB City and Special service authorities will be required so as to construct New market-Stadium road.

It is necessary to consider the following items:

- to establish the proper drainage along the new road in order to avoid negative impacts of rain water with oil and grease by automobiles
- to establish net fences along the new road in order for service facilities and gets not to encroach the restricted area.
- to establish a proper intersection
- to execute environmental monitoring of groundwater periodically

2) Hydrological situation

West Naran-Ard Ayush new road will pass through dry beds of the catchment area. These areas have catchment areas for rain flood and flood from snow melting in the spring season. Maximum flood discharge may reach 9.8-14.8 m^3/sec. Also it may have flash floods. Roads and bridges in this area should be designed and constructed to prevent flood damage. It is necessary for road planning in this area to cope with those floods.

3) Landscape

It is necessary for improving the environment of UB to consider greenery and individuality. The function of greenery in road planning is to improve the scenery, conserve the natural environment, enhance traffic safety, provide shade and prevent disasters. It is necessary for promoting greening activities to select an arrangement and facility types keeping in mind the

functions applied to the road and the region. It is important when aiming to improve the scenery to express the individuality of the area.

20.2.3 Environmental pollution

1) Air pollution

During Construction Period

Primary impacts on air quality will reflect on high dust loading of ambient air spreading towards the prevailing wind direction. There will be deposits of dust on all objects on surface, such as soil, water, plants and other man-made objects along the alignment route. Therefore, countermeasures during construction and transport of earth should be provided such as establishment of dust proofing fences and sprinkling water to control dispersion of dust when necessary.

During Operation Phase

The prediction of pollutant concentration of Nox (Nitrogen Oxides) and CO (Carbon Monoxide) caused by vehicle transportation in the future is calculated using the following process. A 1-hour concentration in the case of transverse wind and parallel wind by Plume model is used as the prediction method. The prediction formula is as follows:

a. In case of transverse wind (as line source model)

$$C(x) = (2/\pi)^{1/2} \cdot (Q_L/U\sigma_z) \cdot \exp(-He^2/2\sigma_z^2)$$

where, U : Average wind speed (m/sec)
Q_L : Emission intensity of pollutant (mg/m·s)
He : Effective emission source height (m)
σ_z : Width of diffusion in vertical direction

b. In case of parallel wind

$$C(y)=Q/(\pi U \sigma_y \sigma_z) \cdot \exp(-y^2/2\sigma_y^2) \cdot \exp(-He^2/2\sigma_z)$$

where, Q : Emission intensity of pollutant (mg/m) $Q = \Delta x \cdot Q_L$
$\sigma_y(x)$: Width of diffusion in horizontal direction $x = \Delta x \cdot i$
$\sigma_z(x)$: Width of diffusion in vertical direction $x = \Delta x \cdot i$

$$C(y)= \Sigma Q/(\pi U \sigma_y(\Delta xi)\sigma_z(\Delta xi)) \cdot \exp(-y^2/2\sigma_y(\Delta xi)^2) \cdot \exp(-He^2/2\sigma_z(\Delta xi)^2)$$

where, i : i =1,n (n=50)
Δx : Δx =10m

The concentration of vehicle exhaust gas in 2010 is thought to be higher than that of Japan, and it is assumed that the near future condition of Ulaanbaatar will be close to the former one of Japan. Therefore, Japanese emission rates in 2000 are used as Ulaanbaatar rates in 2010 and those in 2010 are used as in 2020. Using the Pasquill-Gilfford Chart of width of diffusion, the air stability percentage B,D,E were calculated. The wind speed is taken as 1.5 m/s which is the average wind speed for Ulaanbaatar, and height of emission source is assumed as 1 m in consideration of

predicting safely as the roads are low embankment. Hourly traffic volume, classification of vehicle type and speed are specified as follows:

i) Hourly traffic volume: peak hourly traffic volume is assumed to be the daily traffic on the future network multiplied by 0.08 as a peak hourly coefficient.

ii) Classification of vehicle type: vehicle types are classified as large and small. However motorcycles may be disregarded because of their small volume of emission.

iii) Speed: speeds are assumed to match practical speeds based on design speeds.

The above calculation conditions are shown in Table 20.2.1.

Table 20.2.1 Calculation Conditions

	2010		2020	
	Car	Truck + Bus	Car	Truck + Bus
Teeverchid Rd				
Running Speed (km/h)	50		50	
Hourly Traffic Volume	419	191	559	261
Emission Coefficient NOx	0.175	2.832	0.168	2.040
(g/km/unit) CO	1.173	1.370	1.155	1.370
Emission Intensity NOx	0.020	0.150	0.026	0.148
(mg/m/sec) CO	0.137	0.073	0.179	0.099
Total. Emission Int. NOx	0.170		0.174	
(mg/m/sec) CO	0.210		0.278	
South Tolgoit Rd				
Running Speed (km/h)	40		40	
Hourly Traffic Volume	796	351	1041	452
Emission Coefficient NOx	0.165	3.093	0.159	2.228
(g/km/unit) CO	1.288	1.549	1.269	1.549
Emission Intensity NOx	0.036	0.302	0.046	0.280
(mg/m/sec) CO	0.285	0.151	0.367	0.194
Total. Emission Int. NOx	0.338		0.326	
(mg/m/sec) CO	0.436		0.561	

The future concentrations are caused by the roads and background concentrations. The calculation results are as shown in Table 20.2.2 and the distribution of pollutant level of Teeverchid Rd is shown in Figure 20.2.1. Beyond the border which is 40 m far from the centre of the road, concentration of NOx is in the range 0.08 – 1.05 mg/m^3 and that of CO is in the range 0.167 - 0.229 mg/m^3.

The future concentration of CO is nearly equal to the standard on account of high background concentrations, however, contributions from vehicle emission to the air is small. The concentration of NOx (NO_2+NO: composition ratio is about 50 % each) near the border may exceed the Standard in case of its air stability D(neutral), E(stable) in transversal winds. As concentration is affected by change of wind speed, wind direction and air stability, high concentrations are anticipated in a short term and especially in the winter. However, it is difficult to diffuse the air effectually because of the low embankment road. Therefore, if settlement exists

along the proposed road, adequate afforestation planning of road sides will be required to promote the air diffusion function.

Table 20.2.2 Calculation Results at Border

Terms		Substances	Concentration in the future (mg/m^3)		Background Concentration (mg/m^3)	Standard (mg/m^3)
			Trans. Wind	Parallel. Wind		
Teeverchi hd Road	2010	NOx	0.055-0.072	0.038-0.063	0.017	NO_2:Max. 0.50 Daily Ave. 0.03
		CO	1.417-1.437	1.395-1.426	1.37	
	2020	NOx	0.056-0.073	0.038-0.064	0.017	
		CO	1.433-1.459	1.404-1.445	1.37	
NW Tolgoit Road	2010	NOx	0.054-0.071	0.035-0.062	0.017	CO: Max. 8.0 Daily Ave. 3.0
		CO	2.052-2.075	2.028-2.063	2.0	
	2020	NOx	0.052-0.069	0.034-0.060	0.017	
		CO	2.068-2.096	2.063-2.081	2.0	

(Teeverchid Rd.)

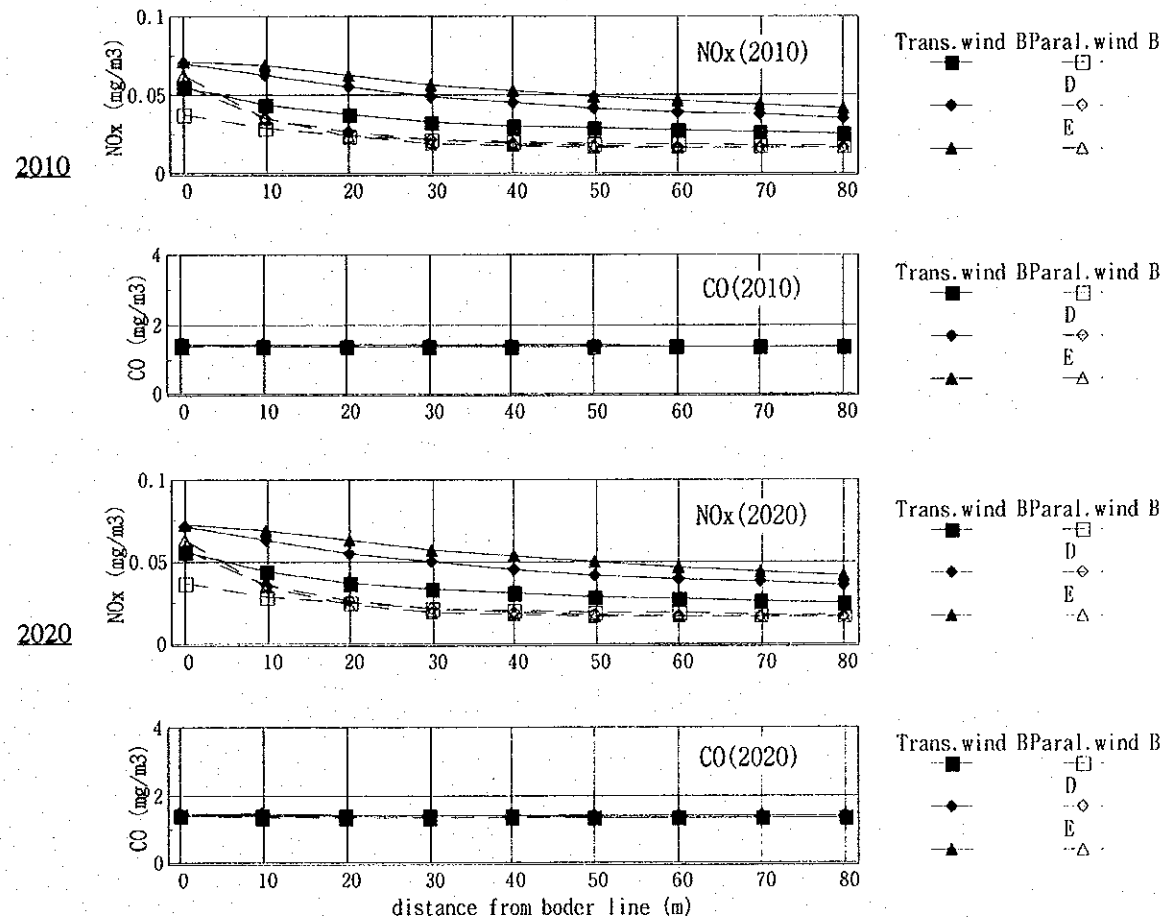


Figure 20.2.1 Distribution of Pollutant Level

Test Calculation for the Environmental Effect of Proposed Future Road Network

The environmental effect of proposed future road network is predicted for 2010 and 2020 with the following calculation conditions:

1. Emission rates of UB City in 2010,2020 used are those of Tokyo Government in 2000, 2010 respectively.
2. Items – NOx, CO (pollutants) and CO_2 (global warming effect)
3. Result of analysis on road network in 2010 and 2020 – daily traffic volume
4. Road length of road network section, analysed running speed and 3 types of traffic volumes
5. Traffic volumes of "No trolleys and Buses + Trolleys" are tabulated by finding that current trolleys on their running sections are 20% of the total of buses + trolleys. If trolleys are replaced by buses, the 20% is used for the additional air pollution caused by buses on the trolley operation sections.
6. The case with the proposed future road network, and the without case of no improvement on the road network are studied.

Results of test calculation in 2010 and 2020 reach the following conclusion as shown in Table 20.2.3 and Figure 20.2.2 respectively:

1. The traffic flow will be improved because of implementation of proposed future road network, as a result volume of air pollutants such as NOx, CO, CO_2 will decrease by 40 % compared to the case of no read improvement. Therefore, the proposed future road network will contribute to improvement of air conditions in UB City.
2. NOx: 3411/5916=0.58, CO: 4337/7169=0.60, CO_2: 875379/1556637=0.56
3. Because running distance of buses is one-tenth compared with that of other vehicles, air pollutant volume emitted from buses can hardly contribute to the whole volume.
4. Even if trolley buses are abolished or remain, their effect is no more than 1% of the total daily emission.

   NOx: (369-328)/3411=0.012, CO: (169-151)/4377=0.004,

   CO_2: (45874-40794)/875379=0.006

Table 20.2.3 Calculation Results (Unit: kg/day)

Items			Condition	Car	Truck	Bus	Total
2010	NOx	With	Bus+Trol	315	2,219	281	2,815
	CO	With	Bus+Trol	2,082	1,307	132	3,521
	CO2	With	Bus+Trol	394,145	294,353	34,838	723,336
2020	NOx	With	All Bus	380	2,703	369	3,452
			Bus+Trol			328	3,411
		Without	All Bus	767	4,742	455	5,964
			Bus+Trol			406	5,916
	CO	With	All Bus	2,650	1,536	169	4,355
			Bus+Trol			151	4,337
		Without	All Bus	3,664	3,292	238	7,194
			Bus+Trol			213	7,169
	CO2	With	All Bus	472,194	362,390	45,874	880,458
			Bus+Trol			40,794	875,379
		Without	All Bus	910,844	596,135	55,665	1,562,644
			Bus+Trol			49,658	1,556,637

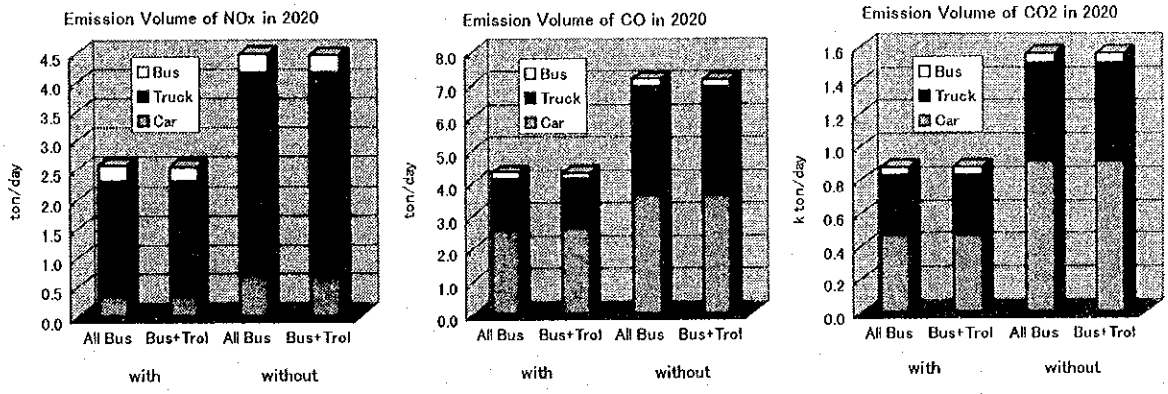


Figure 20.2.2 Comparison between With and Without Future Road Network

2) Water pollution

During Construction Period

As regards plans to rebuild a bridge over the Selbe River, muddy waters will be caused during construction of foundations. Therefore, it is necessary to consider time of construction such as a period of water shortage and plan the proper execution.

During Operation Phase

No effect on water quality is anticipated during operational phase except for certain amounts of runoff containing suspended solids from road surface into the natural drainage channels or onto open surface during the rainy seasons. The impact due to the runoff will be negligible, however, to be sure, provision will have to be made for drains of adequate volume preventing direct discharge of any oil/grease contaminated waters into the water supply area.

3) Noise

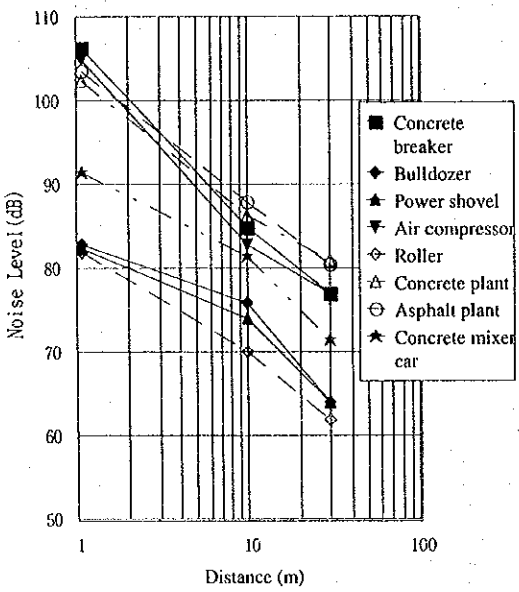
During Construction Period

Noise levels in the vicinity of any construction activity increases due to running of heavy earth moving equipment such as bull-dozers, excavators, transport vehicles, portable generators, etc. Noise and vibration of the existing construction equipment in Mongolia were measured. Regarding these construction works which will affect the environs, noise produced by construction equipment is predicted. The prediction point is at the edge of the site. The relationship between main construction equipment and distance are shown in Figure 20.2.3. As a prediction method, construction equipment is properly allocated and each noise level is synthesised as follows.

$$L = 10\log_{10}(10^{L1/10} + 10^{L2/10} + \cdots + 10^{Ln/10})$$

Calculation conditions and results are shown in Table 20.2.4. Although the Standard for construction is still not enacted, high noise levels caused by construction equipment will be anticipated. Where housing developments or dwellings are localised close to the site, therefore, it is necessary to establish a noise barrier along the borderline of the site, to reduce impact.

Table 20.2.4 Calculation Condition and Result



Name	Noise Level (dB)	Distance (m)
Concrete breaker	77	30
Bulldozer	78	5
Power shovel	74	10
Air compressor	77	30
Roller	70	5
(Concrete plant)	81	30
Asphalt plant	81	30
(Concrete mixer car)	82	10
Total Noise Level	85	

Regulatory Standards for construction in Japan

85 dB at borderline of the site

Prohibition Items: Night time, Holiday

Figure 20.2.3 Noise Level of Construction Equipment

During Operation Phase

The prediction of noise impact caused by vehicle transportation in the future is performed by the following process. For the noise calculations, the noise level L50 based on the prediction method of the Acoustical Society of Japan (AJS) is used. The prediction method of the ASJ is as follows:

$$L_{50} = Lw - 8 - 20 \log_{10} l + 10 \log_{10}(\pi l/d \tanh 2 \pi l/d) + \alpha d + \alpha i$$

where:

L_{50}	Median of traffic noise level (dBA)
Lw	Average noise power level of vehicles (dBA)
l	Distance from sound source (m)
d	Average interval between vehicle (m) d = 1000 V/N
V	Average running speed (km/hour)
N	Traffic volume (Vehicle/hour)
α d	Adjustment factor of diffraction
α i	Adjustment factor of various causes

The formula of noise power level in 2010 used is based on the calculation results by this power level survey. Noise power levels in 2020 are expected to be reduced from the present level due to the regulatory standards for vehicle noise and improvement of vehicle efficiency. Today, the vehicle noise is assumed to be slightly higher than that in Japan, however it is assumed that the future conditions in Ulaanbaatar will be close to the present ones in Japan.

$$Lw_{2010} = 68.9 + 20 \log_{10} V + 10 \log_{10} (a1 + 3.7\ a2)$$
$$Lw_{2020} = 65.1 + 20 \log_{10} V + 10 \log_{10} (a1 + 4.4\ a2)$$

Using the above power level formula, the distribution of noise level in 2010 and 2020 were calculated. Hourly traffic volumes, vehicle type proportions and speed were assumed to be the same as in the case of the air pollution calculations. Using these data, the results of calculation predicted using the ASJ are shown in Figure 20.2.4. Leq is about L50 plus 2–3 dB.

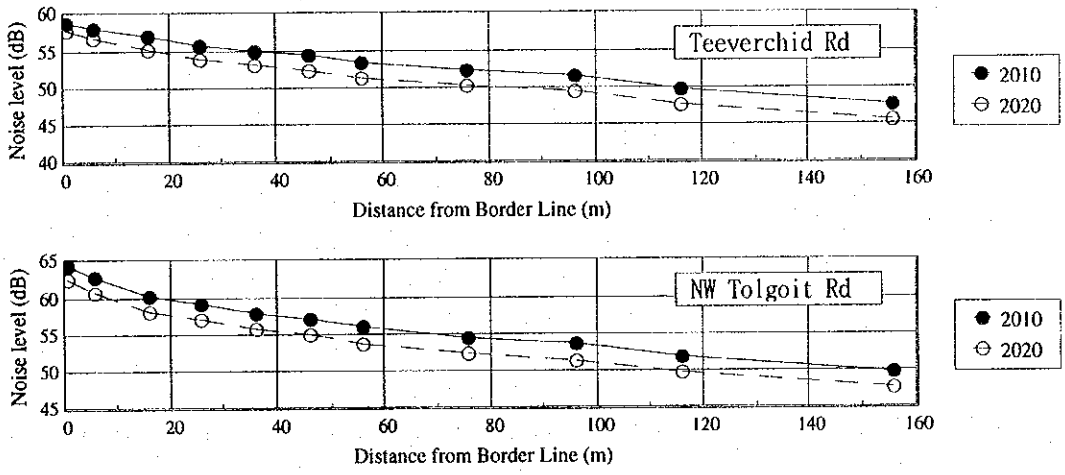


Figure 20.2.4 Distribution of Noise Level

In the above figures, the noise norm in residential areas is 55 dB in daytime, therefore noise level from proposed roads meets the standard narrowly in the area far from 20-40 m. With continued traffic growth after 2010, the noise levels will not decrease even though power level is reduced. Therefore, if conservation objects such as residences and schools exist along the routes,countermeasures will be needed to reduce the noise level. To achieve this, sound barriers with shrubs for landscaping on the edge of embankment is recommended, with a height in proportion to the traffic volumes. The effects of barrier height (in case of receiving height 1.2m) are shown in figure 20.2.5. 1m-barrier height produces a decrease effect of 2-3 dB.

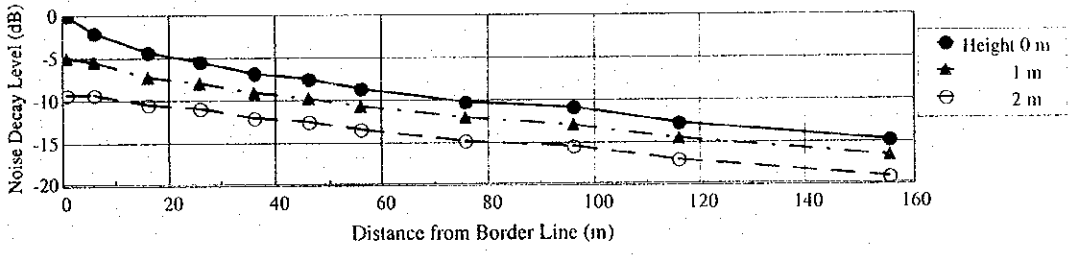


Figure 20.2.5 Effects of Noise Barrier

Regarding high rise residences such as apartments, a low barrier produces little effect in higher receiver positions, as shown in Figure 20.2.6. However, it is difficult to cope with sound

insulation in the case of low embankment roads, because a high barrier, which is effective, has a negative effect on road function and scenery. Most apartments have double-paned windows, so the transmission loss is very high. Therefore, a low barrier together with shrubs, which reduces noise levels by 2-3dB in lower receiver position, is recommended.

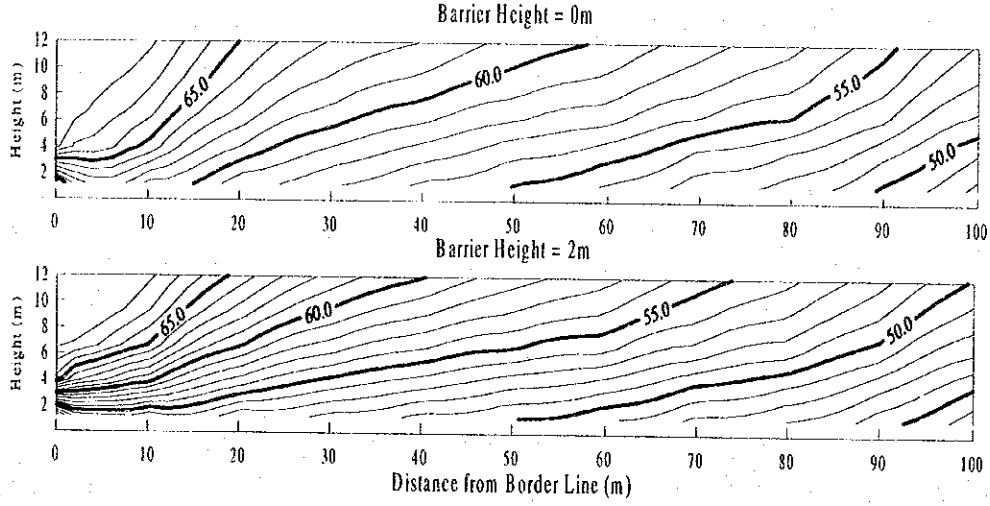


Figure 20.2.6 Comparison between Without Barrier and With 2m-height Barrier (NW Tolgoit Rd. in 2020)

4) Vibration

During Construction Period

Regarding earthworks and foundation works which will affect the environs, vibration produced by construction equipment is predicted. The prediction point is the border of the site. The relationship between main construction equipment and distance are shown in Figure 20.2.7. In relation to a prediction method, construction equipment is properly allocated and each vibration level is synthesised as follows.

$$L = 10\log_{10}(10^{L1/10} + 10^{L2/10} + \cdots + 10^{Ln/10})$$

Calculation conditions and results are shown in Table 20.2.5. Although the Mongolian Standard for construction is still not enacted, the vibration level caused by construction equipment will meet the Japanese Standard.

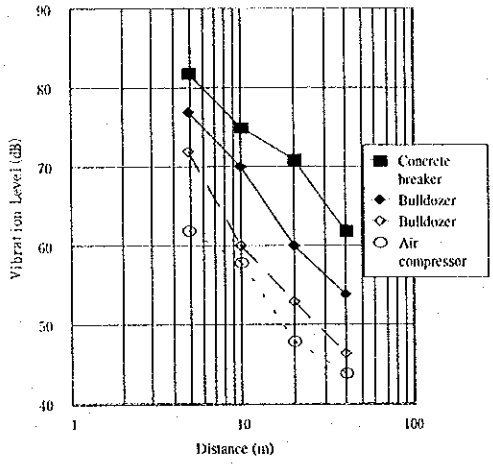


Table 20.2.5 Calculation Condition and Result

Name	Vibration Level(dB)	Distance (m)
Concrete breaker	71	20
Roller	70	10
Bulldozer	60	10
Air compressor	44	30
Total Vibration level	74 dB	

Regulatory Standards for construction in Japan
75dB at borderline of the site
Prohibition Items: Night time, Holiday and etc.

Figure 20.2.7 Vibration Level of Construction Equipment

During Operation Phase

Regarding the improved roads, road traffic vibration levels are predicted in addition as noise levels. As a prediction model, the following formula is defined by the Ministry of Construction in Japan for embankment road is used.

$$L_{10} = a \cdot \log(\log Q^*) + b \cdot \log V + c \cdot \log M + d + \alpha\sigma + \alpha f - \alpha l$$

where, L_{10} : Vibration level which is upper value of 80% range (dB)
Q^* : Equivalent traffic per one lane during 500sec (unit/500sec/lane)
$Q^* = 500/3600 \cdot 1/M \cdot (Q_1 + 13Q_2)$
Q_1 : Hourly traffic volume of small vehicle (unit/hour)
Q_2 : Hourly traffic volume of large vehicle (unit/hour)
V : Average running speed (km/h)
M : Number of whole lanes
$\alpha\sigma$: Adjustment factor for flat characteristics of pavement (dB)
$\alpha\sigma = 14\log\sigma$ (asphalt pavement σ =5mm)
αf : Adjustment factor of soil proper vibration (dB)
$f = 8.4N^{1/3}$ f : soil proper frequency (Hz), N : Average N value (surface-10m)
$f \geqq 8Hz$: $\alpha f = -20\log f$, $8Hz > f \geqq 4Hz$: $\alpha f = -18$, $4Hz > f$: $10\log f - 24$
αs: Adjustment factor for height of structure αs : 1.4H-1.3 (H : Height(m))
αr : Value of decay by distance (dB) $\alpha r = \beta \cdot \log(r/5+1)/\log 2$
$\beta = 0.077(L_{10}' + \alpha s) - 1.8$
a, b, c, d : Constant a = 65, b = 6, c = 4, d = 35

The establishment of traffic condition is the same as that for noise. Calculation results of the vibration level at the border between roads and housing sites are shown in Table 20.2.6 and Figure 20.2.8. These values are below the threshold of vibration sensation ($0.01 m/s^2$=60dB).

Table 20.2.6 Calculation Results at Border between Roads and Housing Site

Locations		Hourly traffic conditions			Vib. Level (dB)
		Small vehicle volume(U)	Large vehicle volume(U)	Av. Speed(km/h)	
Teeverchid Rd.	2010	419	191	50	45
	2020	559	261	50	47
NW Tolgoit Rd.	2010	796	351	40	48
	2020	1041	452	40	50

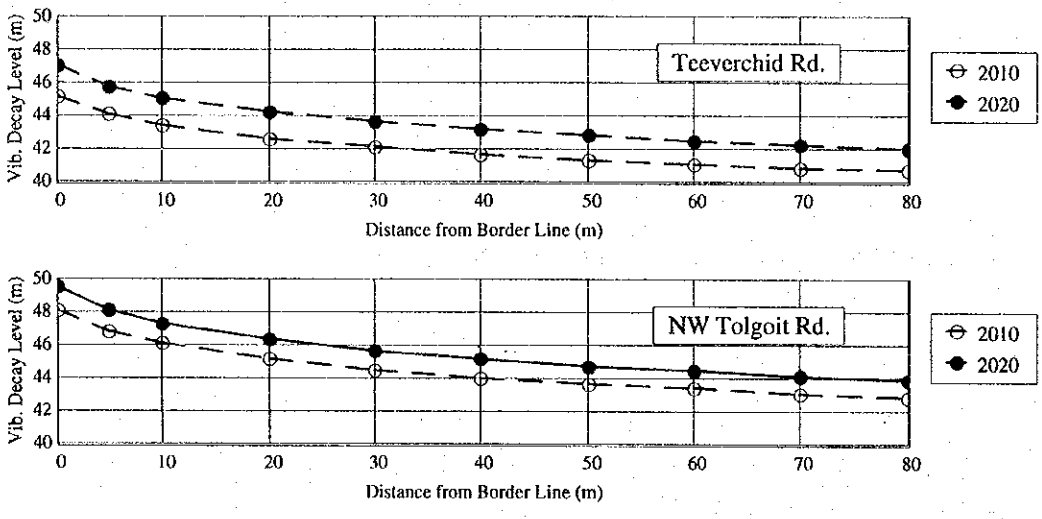


Figure 20.2.8 Distribution of Vibration Level

20.3 Environmental Management Program

20.3.1 Mitigation Measures

1) Air pollution

During Construction Period

In order to prevent the fugitive dust emission and its dispersal, it is proposed to provide a water sprinkling system at the construction site, particularly for intersection at Geser temple and for residential areas along NW Tolgoit Road. Dust covers may be required over the beds of trucks, which will be used for transportation of materials. Low emission construction equipment must be used wherever feasible.

During Operation Phase

Due to the basic reason that the present traffic will be divided in two parts and the speed of the vehicles will be higher and smoother on rehabilitated roads, the air pollution levels will be reduced considerably in comparison with the present level in the inner city. Even though specific environmental control measures cannot be implemented, efforts will be made to mitigate the impact by the following means.

Improvement of automobiles: Improvement of automobiles involves emission gas regulations applied to both new models and vehicles in use. It is important to strengthen regulations in the future. As for countermeasures for gasoline engines, the use of catalysts is effective for reduction of CO, HC, NOx. In addition, the use of electric controlled carburetors will reduce the volume of emission gas. In Thailand the installation of catalysts on new cars of over 1,600cc has been required from Jan.1993. In addition, the promotion of the use of gasoline without lead and diesel oil with little sulfur by means of price incentive has contributed to reduce the environmental load caused by increased fuel consumption.

Improvement of road structures: The concentration of automotive emissions decreases by diffusion as the distance from the road increases. Therefore, it is important to maintain distance between roads and dwellings by the establishment of buffer zones and greenbelts. Comparison of air pollutants' concentration decay by distance under same traffic conditions applied to basic types of road structure are shown in Figure 20.3.1 (receiver height 1.5m, wind direction transversal). In case where the height of the emission source is low, such as grade level, concentration on the roadside is high. Therefore, when the height of the emission source increases, diffusion is more effective. Use of barriers as countermeasures against noise and street trees will theoretically increase the emission height, and they are effective for the diffusion of pollutants.

On the other hand, some plants are able to absorb and fix air pollutants. For instance, a 7m-wide greenbelt with trees on both sides has the capability to absorb 5% of NOx emitted from a traffic volume of 30,000 vehicles per day. Figure 20.3.2 shows that a row of trees along a roadway has the effect of promoting diffusion by disturbing the airflow.

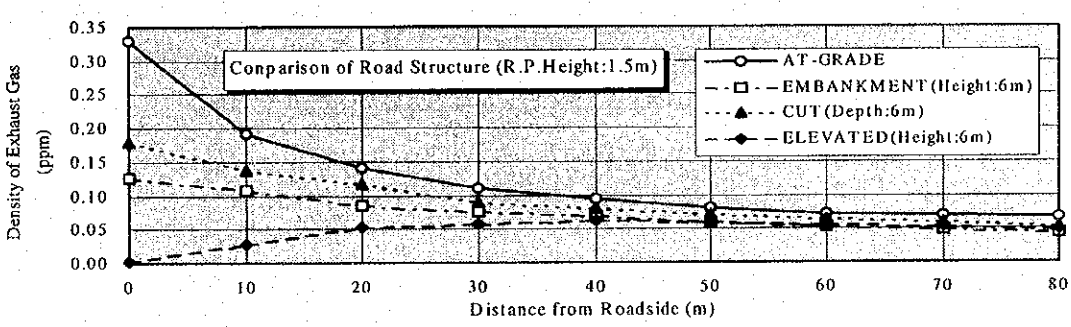


Figure 20.3.1 Air Pollutants Concentration Decay by Distance

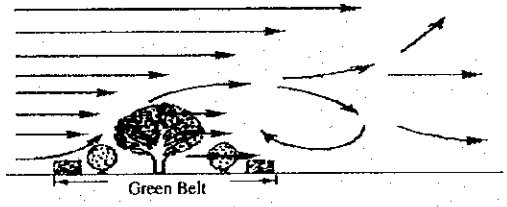


Figure 20.3.2 Function of Diffusion Concerning Greenbelt with Trees

Improvement of traffic flow: It is particularly important for achieving air pollutant reduction to plan and maintain smooth and safe traffic flow. The relation between vehicle velocity and emission volume is shown in Figure 20.3.3. As a result of the master plan, the combination of improvement of speed and control of starting and stopping is expected to reduce the concentration of exhaust gas from vehicles. This will be especially effective for large diesel-engine vehicles. However, the growth of traffic volume in the future will counter this effect unless suitable measures are taken. Therefore, as mentioned above, it is necessary to promote such measures as exhaust gas regulations and traffic demand management.

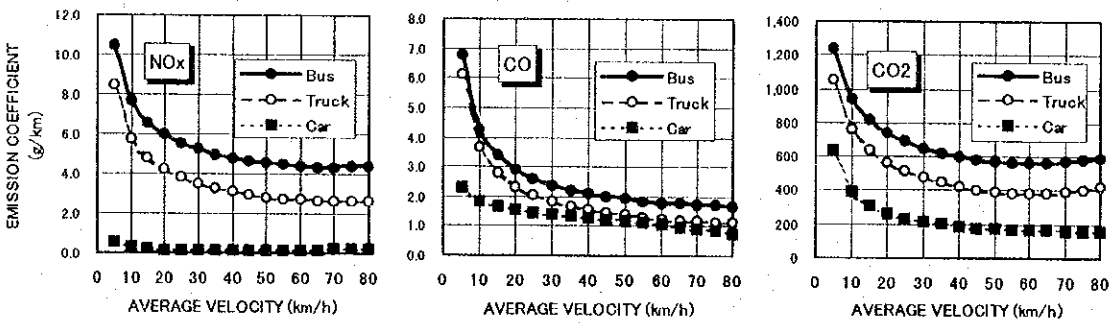


Figure 20.3.3 Emission Coefficient of Bureau of Environmental Protection, Tokyo Metropolitan Government in 2000

2) Noise and vibration

During Construction Period

The plant and machinery to be used during the construction period will be properly maintained. Low noise producing equipment such as vibrator driver (instead of pile driver) will be used. Engine and generator with cover will be used. With regard to use of equipment emitting high noise and vibration such as concrete breakers, it is necessary to reduce the effect on inhabitants in consideration of controlling daily operation hours.

During Operation Phase

The following measures will be adopted for the prevention of noise propagation.

- Plantation of trees along both sides of the roads,
- Construction of noise barriers along the roadways particularly where the road passes through the settlement or habitat areas.
- Regulating the smooth flow of traffic, thereby preventing the traffic jams and the subsequent use of horns.

Strength of regulations: Traffic noise will rise because of increasing traffic volumes in the future. Therefore, there is a need to strengthen the regulations and controls over the noise level from all vehicles contributing to road traffic noise.

Basic measures: Various measures should be promoted include:

- Controls of total traffic volume by improving efficiency of physical distribution systems as well as by controlling the number of vehicles used privately.
- Controlling large vehicles driving into the center of the city by placing distribution facilities in appropriate locations.
- Appropriate use of the roadside land.
- Controls of passing-by traffic driving through the center of the city by improving roads with consideration to the preservation of the roadside environment.

Traffic controls: Establishing and maintaining safe and smooth traffic flow is critical in reducing the levels of air pollution, noise, and vibration caused by road traffic. The following are the measures which should be taken to prevent road traffic pollution:

- On urban roads, measures such as improvement of traffic signal control technologies, and inspection and review of traffic rules, should be taken to reduce the frequency of starts and stops at intersections. These measures are part of the effort to reduce levels of nitrogen oxides and carbon dioxide, which is causing global warming, noise, and vibration.
- Establishment of bus lanes and priority lanes for other public transportation means should be promoted in order to encourage switching from private cars to public transportation to help reduce the overall traffic volume. Buses should be kept in good condition to minimize pollution and noise.
- To eliminate illegal parking which hinders smooth traffic flow in urban areas. Parking areas should be improved.

3) Plantation program

It is recommended to plant at least a 5-m wide green belt on both sides of the roads in residential areas. The green belt also creates turbulence in the airflow across it hence enhancing the diffusion. The total stretch of the proposed roads in residential areas will be covered under the plantation scheme.

Areas in Ulaanbaatar City are characterized by thin soil cover not exceeding 10-20 cm depth. Biological activity in such soils is very low and structure is poor. Nutritional status, moisture reaction and base exchange capacity are generally poor.

According to the general rule followed at UB city Greening company, the total area under the plantation, the number of required trees and budgets are calculated as shown in Table 20.3.1. Tariff used at Greening Company is given in Table 20.3.2.

Table 20.3.1 Plantation Area and Required Plants

Road	Green belt size			Plantation		
	Length m	Width m	Area m_2	Trees	Bushes	small bushes
Tolgoit	4,300	10	43,000	614	717	21,500
TV-	450	5	2,250	64	75	2,250
Teeverchid	2,450	5	12,250	350	408	12,250
Total	-	-	57,500	1,029	1,200	36,000

Table 20.3.2 Budget for Plantation

Road	Cost for total plants 1000 Tug.			Total 1000 Tug.	Total US$
	Trees	Bushes	Small bushes		
Tolgoit	1,843	136	5,375	7,354	8,453
TV-	193	14	563	770	885
Teeverchid	1,050	78	3,063	4,191	4,817
Total	3,086	228	9,000	12,315	14,156

The selection of trees to be planted has to be done judiciously keeping in mind the adaptability of trees to the climate of the region. As already mentioned, the trees, which are found in relative abundance as compared to the other species as well as species with proven survival rate should be preferred. Consultation with experts in the field will further help to identify the exact species to be planted and these can be obtained from the nurseries in the nearby areas. The trees and bushes suitable for the plantation are pine, larch and wild oats, thorny currant and yellow acacia. Plantation along the road should be done with the permission of UB City Environment Monitoring Department.

20.3.2 Implementation and Monitoring

Success of any environmental management program depends upon the efficiency of the organisational set-up responsible for the implementation of the program. Regular monitoring of the various environmental parameters is also necessary to evaluate the effectiveness of the management program so that necessary corrective measures could be taken in case there are some drawbacks in the proposed program. A specially made Environmental Management team will be responsible for:

i. Collecting and analysing air samples.
ii. Monitoring noise level.
iii. Implementing control and protective measures.
iv. Co-ordinating the environment related activities within the project as well as with outside agencies.
v. Collecting statistics of health of workers and population of the surrounding villages.
vi. Carrying out avenue plantation and its monitoring.
vii. Monitoring the progress of implementation of environmental management program.

1) Monitoring Schedule and Parameters

To evaluate the effectiveness of environmental management program regular monitoring of the important environmental parameters will be taken up by an outside agency. The schedule of duration and parameters to be monitored by environment cell are summarised in Table 20.3.3.

Table 20.3.3 Monitoring Program during Operation Phase

No	Description of parameters	Schedule and duration of monitoring	Implementing organization	Budget 1000 US$
1	Ambient air quality (SPM, S O_2, CO and NOx) at roads: W/N Tolgoit, Naran-Ard Ayush, Teeverchid, Ajilchin-Chinggis, South PS4, Old market, New market-Stadium	24 hourly sample once a season	UB city Municipality Central Laboratory for Environmental Monitoring Auto road Department Laboratory of Hygiene Institute of Social Health	5.0
2	Ambient noise levels, power level	Twice a year	UB city Municipality Institute of Social Health Auto road Department	2.0
3	Traffic volume	Once a year	Auto road Department	2.0
4	Green belt maintenance	Throughout year	UB city Municipality City Greening Company Forestry Institue	25.0
5	Soil contamination along the road corridor, near to water sources (Lead, Heavy metals, 4 Ethyl Lead, etc.)	Twice a year	Ministry for Nature and Environment Ministry of Health and Social Care UB city Municipality	8.0
Total				42.0

Note: Based on the results of improvement in the environmental parameters further monitoring will be structured after consulting Ministry of Nature and Environment.

2) Cost for Environmental Monitoring/Management

The investment for implementation of the environmental management plan is given in Table 20.3.4.

Table 20.3.4 Cost for Environmental Mitigation / Management

Particulars	Cost in Tug. Thousand
Avenue plantation[1]	12,315
Net-fence[2]	96,000
Monitoring program[3]	36,540
Total	144,855

Note 1. See Table 20.3.2
2. Net-fence along New market-Stadium Rd.: 1,600m*2*30,000=96,000,000
3. See Table 20.3.3

The recurring cost for environmental monitoring viz. ambient air quality, noise level, etc. will depend upon the number of locations, samples and times to be analysed by an outside agency assigned for the purpose.

Chapter 21 Maintenance and Repair of Roads and Bridges

21.1 Existing Condition of Ulaanbaatar city

21.1.1 Organization

Organization for the maintenance and repair of roads in UB city is shown in Fig 21.1.1.

Only one staff is now engaged at the road section in the supervision division for the maintenance and repair.

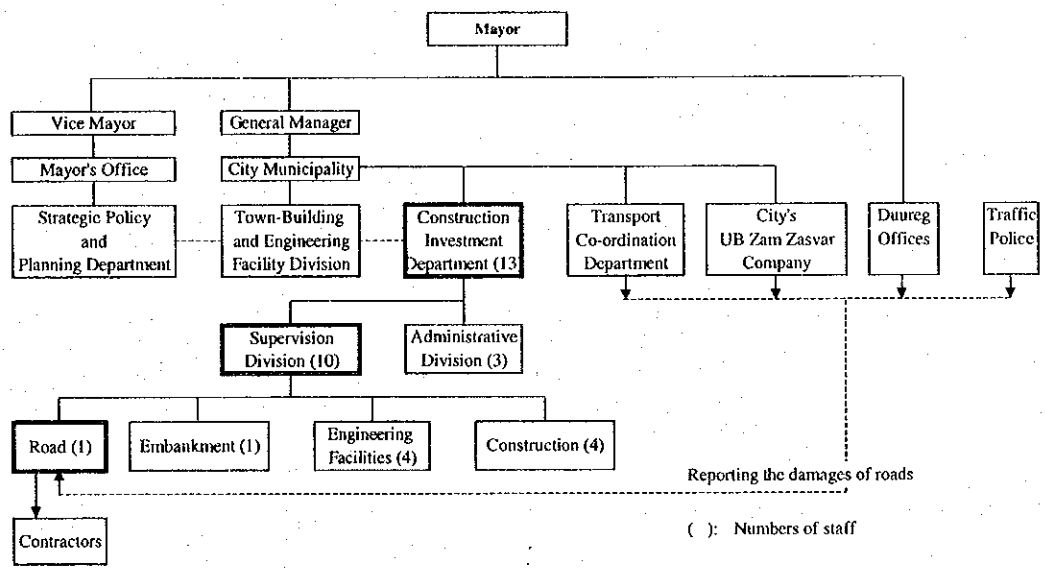


Fig. 21.1.1 Organization Related to Maintenance and Repair of Roads of UB City

UB city budget for roads is formed mainly from the allocation made by Road Department, but that is not enough for not only maintenance but also for new construction of roads. After 1990, the budget of UB city became very tight and the budget for the maintenance and repair was reduced. The budget in 1998 is none as shown in Table 21.1.1.

Table 21.1.1 Budget Related to Roads of UB City in 1998 (million Tg)

		Requested	Actual
New construction and Improvement	1.2km roads and underground pipes at13th,14th Khoroolol	491	200
	18.6m Gachuurt Bridge widening	37	0
	Berkh road 2.5km	200	0
Maintenance and Repair		**272**	**0**
	Total	1,000	200

Source: Ulaanbaatar city

There is a shortage of pavement repair equipment as well as of materials procured from abroad. Under such situation, the function and serviceability of roads, structures, etc are gradually decreasing. The road maintenance and management could not be observed during the study period. New cracks, pot holes are occurring. The life expectancy of road pavement, structures, etc is obviously shortened due to complicated intertwining of unfavorable conditions as weather and poor performance in road administration.

Urgent repair works and periodical maintenance works should be conducted to save the future extraordinary costs.

21.1.2 Activity for Maintenance and Repair

1) Inspection

In UB city the budget for the maintenance and repair of following year is decided as follows:

a) The joint committee of 5 organizations, inspects each road of "Duureg" of the city every October

The traffic police office	the city transport co ordination department	"Duureg"offices of the city	City construction company	Supervision division

b) Report to the supervision division for preparing the next budget planning.

2) Maintenance and repair works

The maintenance and repair work is mainly ordered to the registered 5 construction companies shown in Table 21.1.2, out of which "UB ZAM ZASVAR" is the UB city's own company.

Table 21.1.2 Construction Company for Maintenance and Repair of Roads and Bridges in Ulaanbaatar City

No	Company name	Established	Engineers	Workers	Others	Total	Main works
1	ASBI	1991	9	88	13	110	Road construction /repair
2	BAT ZAM	1991	6	15	14	35	Road construction /repair
3	GAN GUUR	1992	8	58	34	100	Bridge construction/repair
4	KHUCHIT ZAM	1991	6	38	14	58	Road construction /repair
5	UB-ZAM ZASVAR (Old name :TOKHIJILT)	1998	5	100	30	135	Road maintenance /repair

Source: UB city

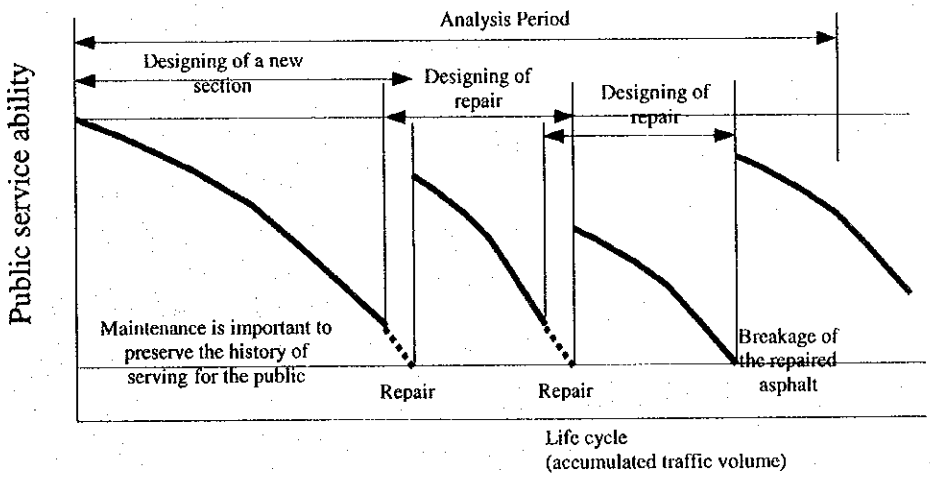
21.2 Maintenance and Repair of Roads for the Medium and Long Term Periods

This chapter shows important concept of maintenance and repair, and the recommendation of necessary equipment and selection of maintenance and repair works.

21.2.1 Life Cycle of Pavement

The concept of the life cycle of pavements is shown in Figure 21.2.1. The serviceability of pavement will gradually reduce year by year. However it will be recovered by suitable repairing.

Figure 21.2.1 Concept of Life Cycle of Pavement



21.2.2 Inspection

Inspection of roads and bridges is important to repair them quickly for keeping their serviceability and for making the repairing costs less.

Examples of inspection sheet is shown in Appendix 4.1-4.3 which were used for the inventory survey in this project with Mongolian companies.

21.2.3 Execution Procedure of Maintenance and Repair of Roads

The flow chart is shown in Figure 21.2.2 for roads, Figure 21.2.3.for bridges.

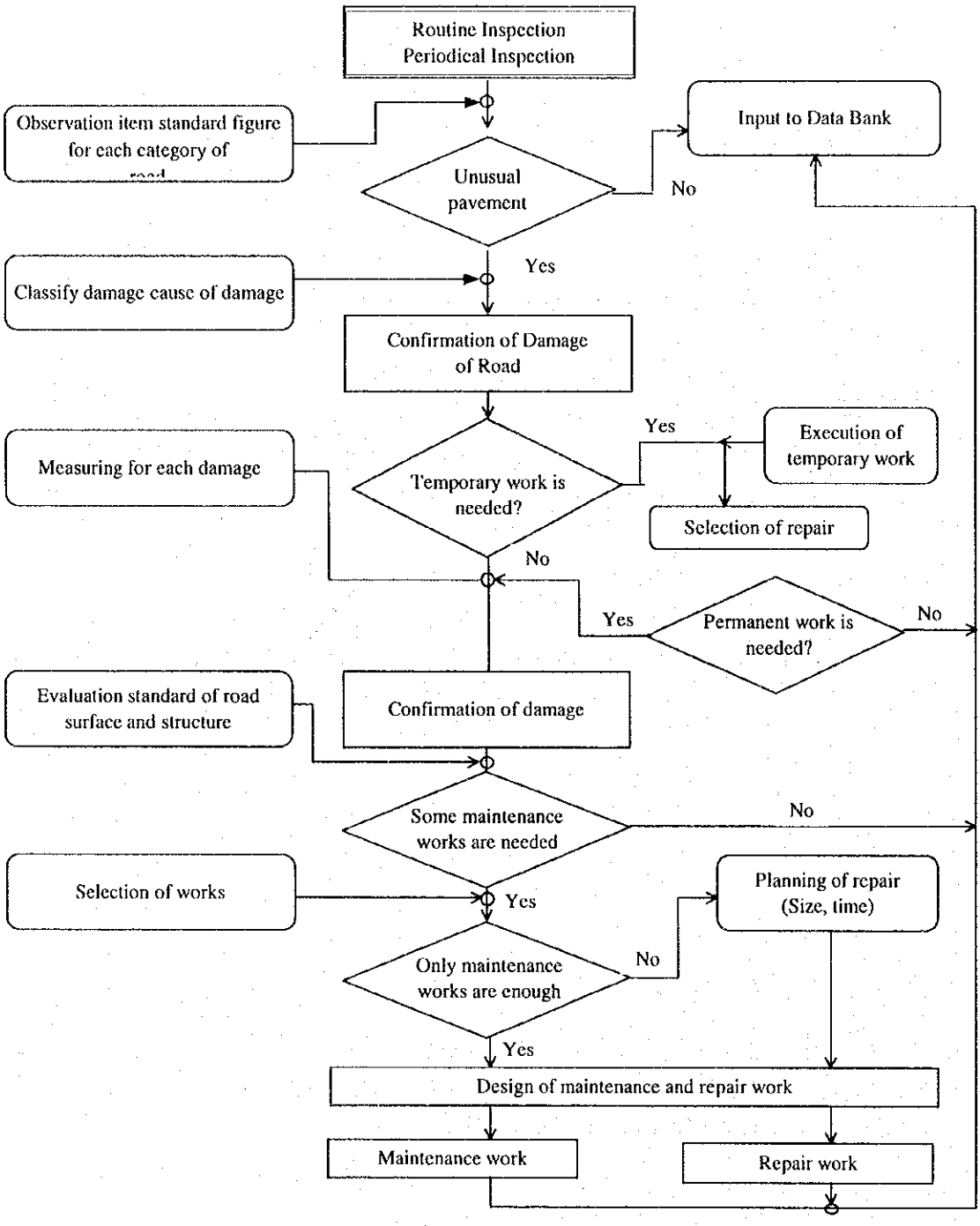


Figure 21.2.2 Flow Chart of Maintenance and Repair for Roads

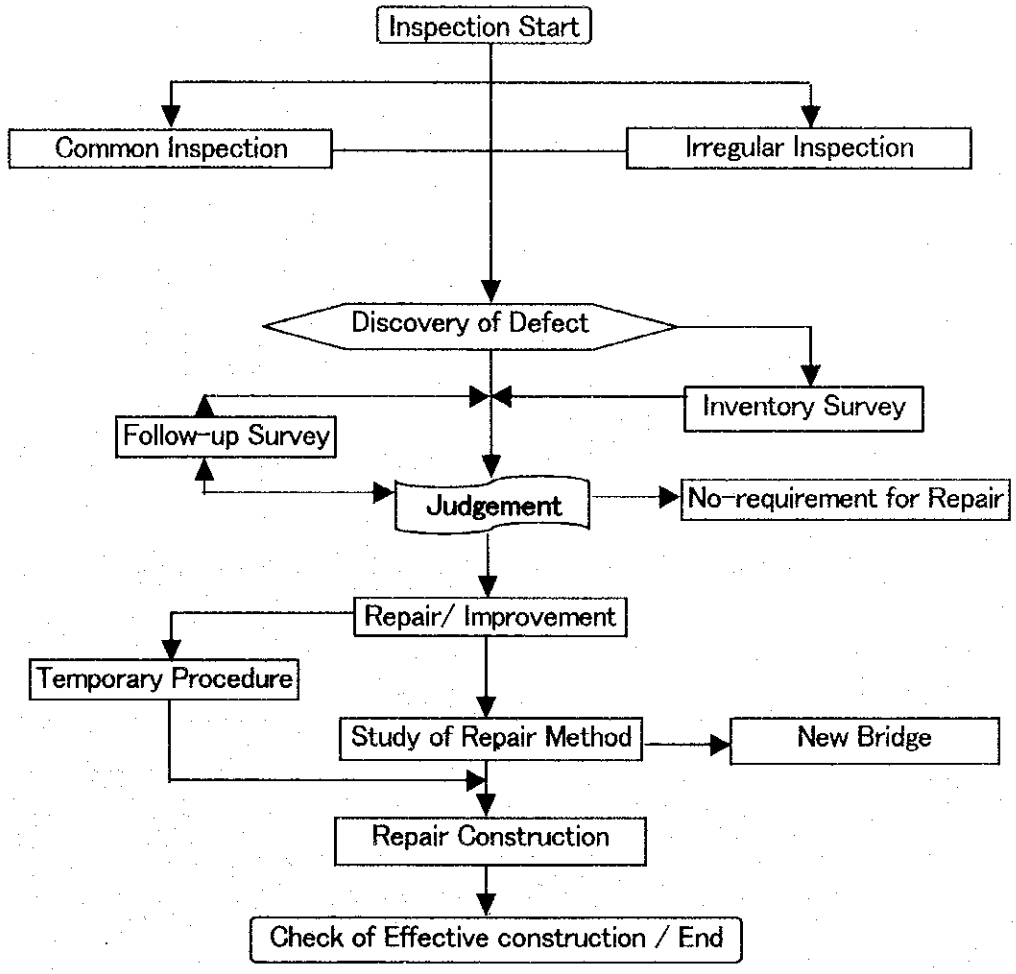


Figure 21.2.3 Flow Chart of Maintenance and Repair for Bridges

21.2.4 Selection of Maintenance and Repair Works

1) Roads

Figure 21.4.4 shows the classification of repair works by the ratios of cracks and Figure 21.4.5 shows the stage of maintenance and repair works of asphalt pavement.

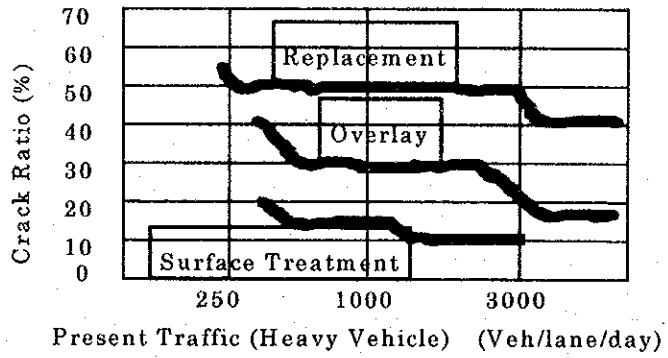


Figure 21.2.4 Crack Ratio, Preset Traffic and Repair Work

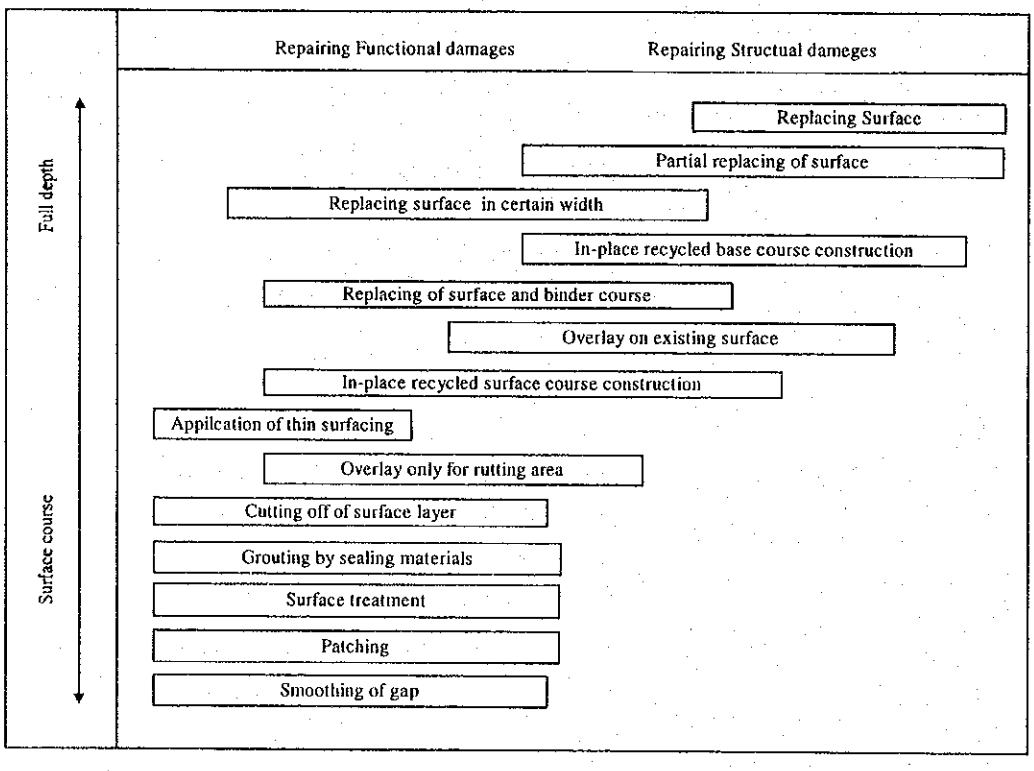


Figure 21.2.5 Selection of Repair Works for Asphalt Pavement

2) Bridges

The selected maintenance and repair works are shown in Figure 21.2.6.

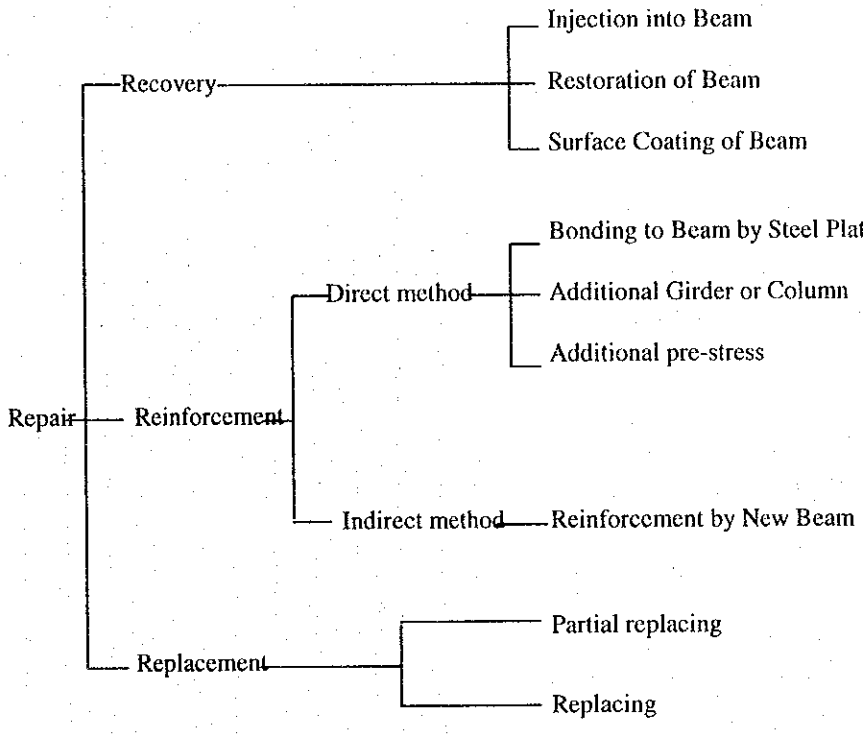


Figure 21.2.6 Repairing Works for Bridges

21.2.5 Equipment for Maintenance and Repair

Many kinds of equipment are needed against various kinds of maintenance and repair works. The list of necessary equipment is shown in Table 21.2.3. "◎" shows the important ones among them.

Table 21.2.3 Equipment for Maintenance and Repair of Roads

Model	Inspection	Gravel road	Concrete pavement	Asphalt pavement	Shoulder	Structure	Guard rail	Sign board	Weeding	Road cleaning	Snow removal	Management
Patrol car	○											○
Road service car	◎	○	○	◎	○	◎	○	○	○	○	○	
Dump truck		◎	○	◎	○				○	○	○	
Water lorry		○							○	○	○	
Motor grader		◎									○	
Road stabilizer		○	○	○								
Back hoe		○			○	○						
Wheel loader		◎			○	○					○	
Belt conveyer		○	○	○	○	○						
Roller		◎	○	◎								
Rammer, compactor		○	○	◎	○	○						
Distributor		○	○	○								
Joint cleaner			◎									
Asphalt finisher				◎								
Road maintenance vehicle			○	◎								
Concrete breaker			○									
Pavement breaker			○	◎								
Compressor			○			○	○	○				
Generator						○	○	○				
Welder						○	○	○				
Bridge inspector						○						
Truck crane						○	○	○				
Line marker												
Motor grader with snow plow											○	
Radio communication equipment												◎
Vehicle weight measuring equipment												○

21.2.6 Problems on Maintenance and Repair

1) Lack of budget

The budget for maintenance and repair of roads of UB city is small or actually none.

UB city is proposing the Mongolian Government to utilize the revenue from the vehicles at the gates of UB city as their own resource according to new regulation of city road fund.

2) Lack of staff in the city road department

The staff of road maintenance is only one. UB city have a plan to increase the staff to 5 for proper maintenance and repair of roads considering the long term road maintenance and repair plan. Latest regulation defined the road owner responsibility system for the traffic accidents.

The maintenance and repair work shall be divided into two categories. One is routine or urgent work and the other one is comparatively large sized work such as periodical improvement works. The latter one is desirable to be ordered to the construction companies in each contract base from the view point of efficiency. However the former one is better to be conducted by the UB city directly.

Categories	Work to be done	be executed by
Routine and urgent works	Inspection, small scale repairing	City own organization
Comparatively large sized works	Overlay, improvement, widening	Commit to construction companies on contract base

3) Capability of the construction companies

Quality control and work efficiency are important factors of the construction companies. 5 registered companies have 120 units of construction equipment and trucks. (Table 21.1.4 in Appendix shows the equipment of these companies.) They have been used for more than 10 years and became superannuated. Their work availability is 20-40%, and their performances have decreased 50% and less. Actual available number of the equipment are only 12-25 units for urgent and qualified works. It means 0.04- 0.08 units per km to consider 300km of main road length in UB city. It is much smaller comparing the case of Japan, where there are more than 0.2 units per km were owned for routine repair and urgent works.

21.2.7 Organization for Routine and Urgent Repair Works

UB city has some working parties in their organization for routine and urgent requirements. Generally speaking, the number of the necessary party are considered as one per 400-800 thousand m2 of pavement area. UB city has a 600km length of roads as shown in Table 4.1.1. If assumed total area of the pavement is 6 million m2, it will need 10 parties. However UB roads need less maintenance in winter and the necessary numbers may be reduced to 5parties. Numbers of the crews and equipment in a party are shown as an example in Table 21.2.4.

Table 21.2.4 Example of Numbers of the Crews and the Equipment in the Party for Repairing of Roads

<Staff>	Nos.	
Foreman	1	
Driver	2	Staff transport, materials transport
Operator	1	Roller
Shoveler	2	Unloading materials
Raker	2	Raking
Painter	1	Tack coating
Sweeper	1	Cleaning up damaged place
Flagman	1	traffic control
Total	11	
<Equipment>		
Cargo truck	1	Doule cab, 2-4 ton,
Dumptruck	1	4 ton
Car	1	Van type, 4WD
Vibration Roller	1	0.5 ton
Sprayer	1	25liters/min.
Hand heater	1	
Small instrument	1	Rake, shovel and etc.
Radio comunication	3	each vehicles

21.2.8 Repairing Works

The following show the illustration of repairing works.

Figure 21.2.7 shows the patching method for road and bridge surface.

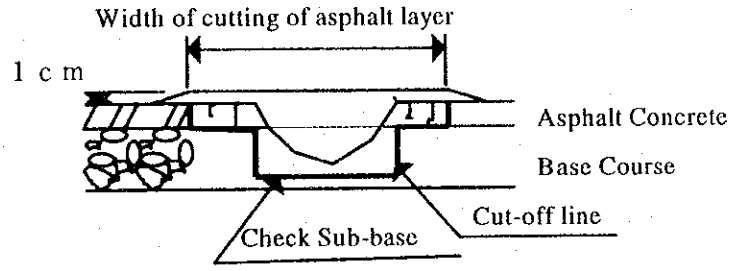


Figure 21.2.7 Patching Method

Figure 21.2.8 shows the partially replace method

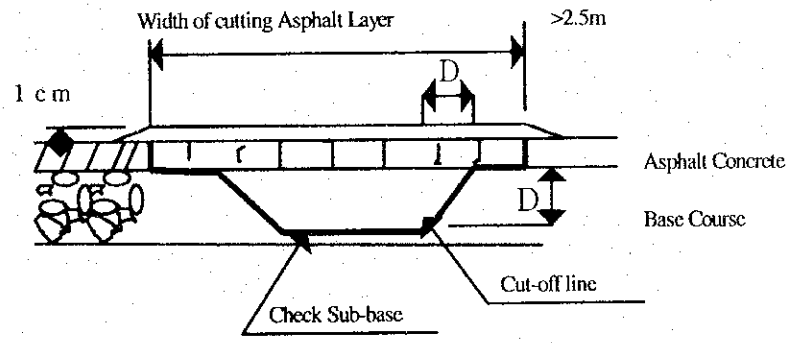


Figure 21.2.8 Partial Replacement Method

Repairing method for the pavement at approach section of bridge is shown in Figure 21.2.9.

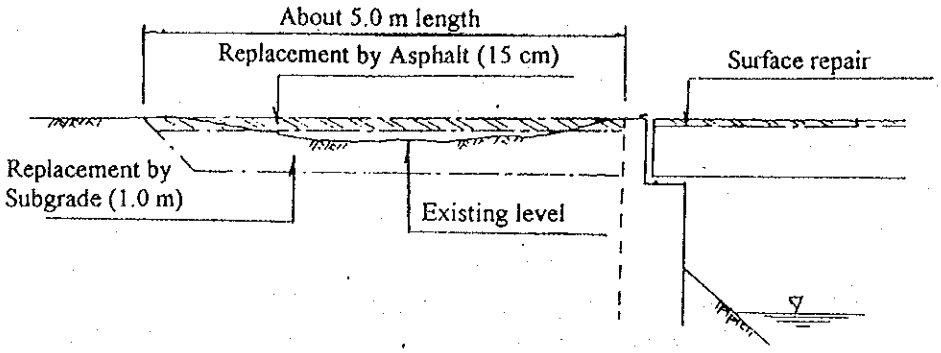


Figure 21.2.9 Repair at Approach to Bridge

Applying cross beam and repairing slab method for the superstructure is shown in Figure 21.2.10.

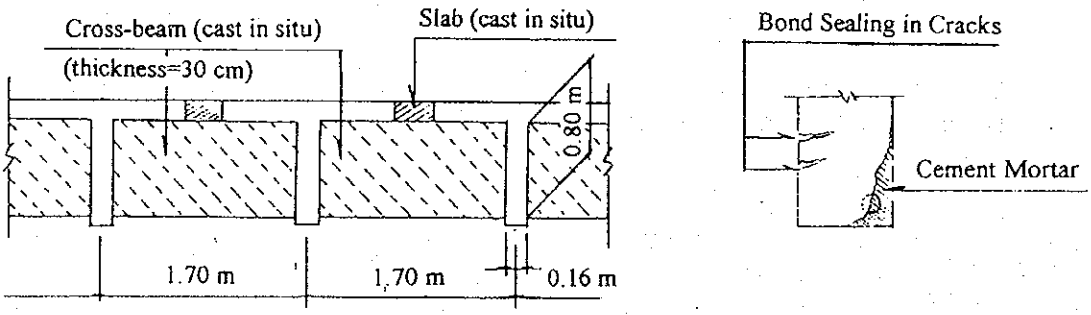


Figure 21.2.10 Applying Cross Beam & Reforming Beam

Repairing and reinforcing method for the substructure is shown in Figure 21.2.11.

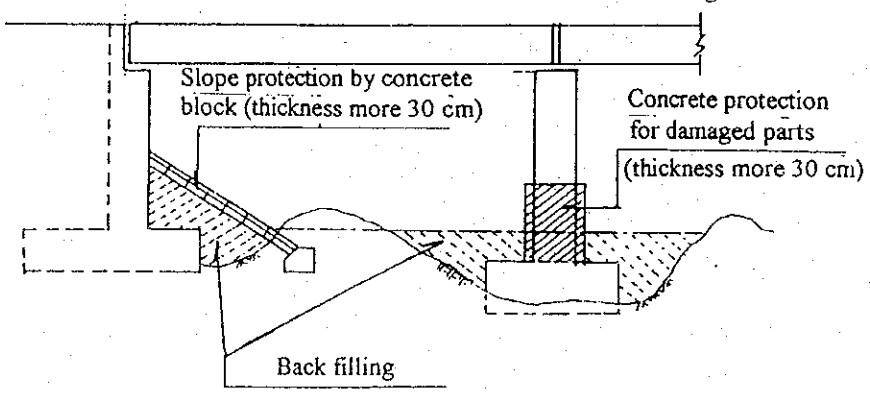


Figure 21.2.11 Repairing & Reinforcing of Substructures

21.3. Cost Estimation for Maintenance and Repair

The annual cost for maintenance and repair of main existing paved roads is assumed to be one tenth of the cost for the construction of these roads as shown in Table 21.3.1. The annual cost for maintenance and repair of F/S project is also assumed to be one tenth of the cost of construction as shown in Table 21.3.2.

Table 21.3.1 Maintenance and Repair Cost for Existing Pavement Roads

Evaluation of road	*Total area of each roads m^2	Estimated unit cost (yearly) $ / m^2 / year	Estimated cost (yearly) $ / year	**Estimated cost by ADB $ / m^2 / year
4	570,960	0.15	85,644	
3	1,284,880	0.73	937,962	1.16
2	70,050	3.33	233,267	x
1	93,500	6.50	607,750	186000
Total:	1,860,000		**1,864,623**	=2,160,000

Source: JICA study team.

*: based on the Road inventory sheet

**: Second Roads development Project(F/S), August 1998

Table 21.3.2 Maintenance and Repairs Cost for Roads in F/S projects

Group (Route)	UB Rd No.	Road name	Road Length (km)	Pave Width (m)	Pave area (m2)	Estimated unit cost (Financial) ($/m2.year)	Estimated unit cost (Financial) (1000$/year)	Cost of Group (Financial) (1000$/year)
Central	new	Tolgoit~Sonsgolon cross	0.413	18	7434		41	240
Route	new	South Tolgoit Rd	0.346	18	6228	5.59	34	
	82	South Tolgoit Rd	1.671	18	30078		165	
Northern	3	Tolgoit~Sonsgolon cross	0.413	18	7434		41	747
Route	84,85	N/W Tolgoit	3.627	18	65286	5.49	359	
	New	WestNaran~ArdAyush	3.006	18	54108		297	
	new	South of TV~N/Rd.88	0.391	11.5	4496.5		25	
	88	N/Rd.88~IS 11	0.454	10.5	4767		26	
	41	Teeverhid Rd.	8.368	18	150624		827	1,584
Southern	new	Teeverchid SW Ext.	0.71	18	12780	5.49	70	
Route	117	Dund Gol River Side Rd	1.00	18	18000		99	
	39	South of PS4	5.942	18	106956		587	
Middle Ring Route	new	Stadium~New Market	3.12	18	56160		308	308
							Total	2,880

Chapter 22 Implementation Program for F/S Projects

22.1 Projects to be Implemented at the First Stage

For the realization of the whole of projects selected for feasibility study in Chapter 15, it needs a huge amount of the cost. Implementation schedule of the projects shall be studied under the consideration of the following items:

1) Execution of high priority projects in early occasion, which are selected from the most appropriate long-term road network for 2020.
2) Maintenance and repair works for existing and future road networks.
3) Measures to sustain current public transportation systems in future.

22.1.1 Execution of High Priority Road Development Projects

Current road network will become congested in 2020 as mentioned in Chapter 8. Traffic congestion is forecasted especially on "the west part of Enkh Taivan Avenue", "the roads to the satellite towns" including "road to airport (Nadamchin Rd)" and "access road to northern ger villages".

The current "access road to northern ger villages" shall be maintained, however without new road development, from engineering and environment points as mentioned in Chapter 3 and 7.

"Access road to satellite towns" shall be developed in parallel with the regional development. It will not be effective to put large amounts of investment to the roads only. As the scope of this FS study is limited within urbanized UB, actual execution plan for these access roads is expected to be studied in detail by another project.

The role of Enkh Taivan road will become more important as the transverse trunk road between east and west of UUB. As mentioned in Chapter 8, the development of alternative routes of east-west transverse road will contribute to the solution of the congestion by dispersing the traffic rather than the widening of the Enkh Taivan alone. Three alternative routes were studied in Chapter 10. The result of economic evaluation shows that, for all routes together, the B/C is 0.94 and EIRR of is 9.3%, which is close to the values required for project to be economically viable.

From the view point of cost and benefit, the improvement of the West End of the Central route has the best cost-efficiency followed by the southern route. The economic performance of Northern Route is low at B/C of 0.71 and IRR of 6.4%. This is because of its high cost. This route passes through mountainous terrain and there are 6 bridges on this route. Middle ring route is economically viable at B/C of 1.03 and IRR of 10.5%.

Total construction periods are assumed to be about 8 years as mentioned in 17.4 of Chapter 17 of Main Text. While the total cost of FS projects is about US$ 116 million. Whole of the projects would be divided into 3 implementation stages and average expenditure for one stage should be about US$ 30 to 40 million.

Considering the above budgetary implementation constraint, current developing conditions of the lands along the expected project roads and the urgency, especially against the opening of new central market, following 3 projects are selected as the most high priority projects to be implemented at first stage.

Projects	Cost/Term	Reasons	Remarks
Improvement of irregular Cross section with railway at western part of Enkh Taivan and development of road for the access to northern route.	US$ 5.6 million 3years	The largest efficiency is ensured by small cost. It will contribute to solve the forecasted traffic congestion in the Central route and to prevent accidents with railway.	The efficiency may become larger after the completion of the northern route in future. EIRR=14.7%
Widening of Teeverchid Road (Length:8.4km)	US$ 17.0 million 4years	First, this widening is effective for the solution of traffic congestion immediately due to the opening of new central market in 1999. Second, this project has a position as the part 1 of Southern route, which should be completed as the alternative route of the congested central route in 2020.	Recently the development of the land along the road is in good progress and the acquisition of land is becoming difficult. EIRR=11.3%
Fly-over on East cross intersection	US$ 2.4 million 3years	This is a part of Middle Ring Road and the flyover will contribute to the solution of traffic congestion due to the opening of new central market.	Although the B/C of Middle Ring Road reaches minimum requirement, the East Cross intersection is considered in urgent need of improvement for reducing the future traffic congestion in city center area. EIRR=10.5%
Total Cost	US$ 25.0 million		

Simultaneously the development of the following facilities is expected in early occasion from the view point of safety of which cost were included in future road network study of Chapter 12, but not in Feasibilty Study of Chapter 18 . Any of them shall be implemented, if budgetary allocation is available.

- Improvement of 2 intersections US$ 0.7 million
- Development of Traffic Signal US$ 4.4 million
- Traffic Sign and Road Marking US$ 1.0 million
- Improvement of Existing Bus Stops US$ 0.7 million

- Development of Drainage system in UUB US$ 12.0 million

22.1.2 Maintenance and Repair Works for Existing and Future Road Network.

There is a general tendency of making a political decision in favor of new roads but not of maintenance during the planning of road network within very limited budget. However in the long term, it means to waste the precious budget if new roads are left without maintenance. While there is an international tendency to seek the responsibility of road management / maintenance of government, if accidents occurr.

The roads in UB are under rapid destruction even at this moment. They need urgent repair work.

The following idea is proposed as the priority for the maintenance and repair

Priory		Length of road	Expected yearly maintenance cost (Assumed: $5/ m2-year:width 10m)
1.	The roads for public bus routes	158km	1,580,000*5= US$7.9 million
2.	Busy roads	About 60km	600,000*5= US$3.0 million
3.	Political important roads	About 20km	200,000*5= US$1.5 million
4.	District roads	95km	950,000*5= US$4.7 million

Note : Total length of UB road is about 450km as mentioned in Chapter 4. While the above figures of road length has double counting.

22.1.3 Measures to Sustain Public Transportation System for the Future

As discussed in Chapter 5 and 9, the existing 4 bus companies were separated from the city organization into self-supported ones in 1996. Their total annual income is TG 7 billion (US$8.4 million), and expenditure is TG 9.2 billion (US$11.0 million) in the first half of 1998. Therefore the annual loss would be US$ 2.6 million.

School children receive a discount of a half of the passenger tariff. And Tug570 million (US$0.68 million) comes as a subsidy from city office in 1997 for the discount of university students (approximately 8% of the total revenue). While free bus service is provided for aged or handicapped persons without any subsidy. The loss in revenue should be compensated by City Government. These lost revenues correspond to 10 % - 20% of the total income. Also it is now a serious issue that about 10 % of passengers do not pay their fare, which should be reduced by strict actions of dirvers. Appendix 22.1 discusses the forecast revenues and costs with thosed measures.

They need US$23.3 million for the renewal of buses during 4 years from 1999 to 2002 in order to sustain the service level of public transportation as mentioned in Chapter 9. It corresponds US$6 million per annum.

It is usual to receive government assistance for public transport organization in other countries, however current expenditure of the city is TG28 billion (US$36 million : 1997) only. It is difficult to increase the subsidy from the city. Also it is necessary that the bus companies should prepare US$ 6 million per annum by themselves.

Income $8.4 milllion, '98	$0.7 subsidy for students	10-20% compensation for aged etc.	10% for non qualified free pass.

Expenditure $11 milllion, '98	$6.mil for the use of renewal per annum

If subsidy from the city is not expectable, some measures to fill in the renewal fund are required. They were described in Chapter 9 and again repeated as follows:

1. Re-organization between companies and within each company.
2. Raising of fare from 100Tg to 150Tg in 2000, and 150Tg to 200 Tg in 2006. Reduction of the scope of people applicable to free bus service should be necessary. Actions by conductors to delete the nonqualified passengers should be enforced by legislative authorization as discussed in Chapter 9. These actions would increase the revenues during the years up to 2010, and can accumulate the funds for vehicle renewal. (see again Appendix 22.1)
3. Introduction of new ticket system for allowing free transfer among routes and, unlimited use of multi-ride ticket within a stipulated time.
4. Sale of the existing and new bus routes to private sectors should be considered, if the revenue shortages continue. This would require a number of preparatory arrangements, the scale of four bus corporations should be reduced; legal arrangements to privatization are necessary. (Staff of bus companies shall receive some advantages in bidding for obtaining the route operation), regulation and control of the operation by TCD should be prepared and so on.
5. Government and city office should take measures to increase the efficiency of bus operation. (e.g. bus exclusive lane, improvement of bus stop, re-arrangement of bus routes, etc.)

22.2 Premises for Implementation

22.2.1 Financial backup by self effort

Total amount of three projects to be implemented is US$ 25.0 million. or about US$ 6 million per annum for 4 years mentioned in 22.1.1. While the maintenance cost is US$ 10 million per annum as mentioned in 21.1.2. 30% of the budget of UB city (US$11 million) is not only enough for new development but also for maintenance. Income from the entrance fare to the city area by the new roads fund comes to only Tg 110 million (US$0.13 million) .

Mongolian government is requested to establish the system in early chance to procure the necessary budget for the development of roads with effort themselves. The principle here is that the road development costs should be paid by road users. For example, registered vehicles in UB city are now at 36,000. Funds can be raised from several kind of sources such as fuel tax, registration fee and sales tax (for purchasing of vehicles), etc.

The research for increase of the tax revenue is now under implementation by the JICA assistance. Revolutionary changes in tax system and organization is required in Mongolia based on the principle that the cost should be borne by the beneficiaries. As an example, following methods could be proposed:

	Consumption	Fuel tax increase from 33Tg/L to 100TG/L	Annual increasing cost ratio for the vehicles (US$10,000)
Fuel Tax	30,000veh x4,000 lit = 120 million Litter	120 x 77/840tg = US$11 million	11 %
		Reg. Fee increase from Tg 30,000 to 100,000	
Registrati on Fee		30,000 x 70,000/840= US$ 2.5 million	2.5 %
		Total tax increase US$13.5 million	13.5 %

Forecast of revenue and expenditures by the above assumptions are in Appendix 22.2. The influence for the social prices will occur due to the increased cost of vehicles of 13 %. However, this type of macro economic analysis was not conducted in this study.

22.2.2 Maintenance system

New road construction is the investment for the future. Their maintenance and repair should be conducted to sustain the investment of the past and the present at adequate conditions. The Ulaanbaatar city's budget for road maintenance is formed from the allocations made by the Road Department, which is decided by Government under the approval of Parliament. But that is not enough for maintenance of the city roads. On the other hand, there is a shortage of pavement repair equipment as well as of materials procured from abroad. Under such a situation,

roads, structures, etc. are now rapidly deteriorating, not gradual process as in the past. The road maintenance and management could not be observed during the study period, while cracks, pot-holes have appeared on the surface. The life expectancy of road pavement, structures, etc. is obviously shortened due to unfavorable conditions. Weather conditions and poor administration would affect unfavorably.

The urgent repair works and periodical maintenance works should be conducted to save high costs in future.

22.2.3 Recognition of Quality Control of Project

There is an example of bad quality control in UB. The officially admitted durability of repair of potholes is only one year. And the same places are repaired every year.

There is a system of one-year guarantee for the road works, but this is not adhered strictly. The staff of the government and the company had come from the same government organization under the socialist system. They are too good friends to point out the defaults of the works. Review of contract documents for clear definition of the guarantee system and of organization responsible for the guarantee system in necessary strict execution of the contracts should be ensured. Otherwise the desirable quality control could not be achieved.

22.2.4 Strengthening of Organization for Management and Supervision

Current city organization for road maintenance does not function due to the lack of budget as mentioned in Chapter 21. The new efficient and reasonable organization should be re-established to meet with the above new large works. It should be avoided that the budget of a state organization is just the same to the total salary of the officers engaged.

22.2.5 Contractors and their Equipment

There are five registered contractors in UB city and they have about 120 pieces of construction equipment. However, most of them are old and not useful as mentioned in 21.2.6 of Chapter 21.

Policy for upgrading the contractors to the international level shall be adopted. At the same time competitions among national or foreign contractors should be introduced through fair bidding to ensure the above 5 contractors are not exclusive contractors for the city projects.

22.2.6 Road Inventory Data

Roads and streets have no kilometer posts. The inventory sheets of roads and bridges in UB City are not edited satisfactorily. The records for overlay, presence of improvement and date of the works are not clear. Bridges and structures on the roads in UB City have no as-built drawings and construction records. A development of database of inventory data in UB City is strongly recommended for ensuring proper maintenance work.

22.2.7 Improvement of the Organization of Bus Companies and Bus Fare

It is essential for the public transportation organization to get the official financial assistance. However it is absolutely difficult now for the UB city government. It is expected to solve the situation for the time being by raising the fare step by step, improvement of their organization and sell out of the right of some bus routes to the outside.

22.2.8 Advisers to TCD

The transport situation of the city is changing as the city develops in various aspects, to which TCD should respond in planning, regulation and implementation. Problems are –1 demand from New Central Market, -2 participation and competition of private buses (an issue of privatization), -3 periodic revision of route and trips, -4 restructure financial positions and so on.

It is recommended to have urgently one or two advising experts of survey and planning for 2 years in Network Planning Division in TCD of Ulaanbaatar City in order to strengthen capabilities of the staff. The employment fund may be requested to the technical assistance program of ADB, World Bank, or JICA

22.3 Proposals

22.3.1 Establishment of Long Term Policy and Regulations

In the planning and implementation cycle of projects for the development of transport sector, a conceptual long term plan is determined at first. This long term plan should not be changed easily. It should be followed by the present and every succeeding cabinets for a long- term period as the base of national policy. New governor or mayor should not revise the basic plan for the implementation of his political idea. During the years of implementation, a need may arise to revise the conceptual long term plan because of changes in development forecast. The revision should be decided after careful re-study of the basic plan and the spirit of the original plan should be respected as much as possible.

Right of way should be ensured within long years period under the city master plan law and land acquisition law. The land for the future road network should not be allowed for any new construction or improvement of building even if it is standing now.

22.3.2 Establishment of Regulation for the Use of the Empty Private Lands

The drainage system in UUB has many problems as mentioned in 4.4 of Chapter 4. It is difficult to design an appropriate drainage system with enough capacity for floods caused by the rain water flowing from the upper side of the city. Financially it is not reasonable to construct a huge drainage system to meet with all occasions. However, we may recommend to utilize empty

land as the emergency pond. Now there are still many empty lands inside of the city area. Some of them are kept for future construction of buildings. These open lands should be excavated as a pond until their actual development. Tax for land should be exempted during the utilization of land as an emergency pond. This idea should be backed up by the new regulations.

22.3.3 Decision of Priority of Projects

We should recognize that all selected projects above are studied in the scope of infrastructure development of UB road network. Mongolian government is expected to decide the priority of projects among all Mongolian projects irrespective of whether they will develop the project by their own budget or by the assistance of foreign organizations. It is expected relevant authorities may discuss, decide and move for realization of the selected ones at an earlier occasion.

Table 23.1.1 List of Members Concerned

JICA Headquarters, Advisory Committee and Study Team

JICA Headquaters

1) Takao KAIBARA	: Director, First Development Study Division, Social Development Study Department
2) Eri HONDA	: Deputy Director, First Development Study Division, Social Development Study Department
3) Mutsumi NARAWA	: Staff, First Development Study Division, Social Development Study Department

JICA Advisory Committtee

1) Katustuyoshi NISHIKAWA	: Chairman, Deputy Director, Kagoshima National Highway Work Office, Kyushyu Regional Construction Bureau, Ministry of Construction
2) Kusumu NAGAE	: Assistant Manager, Maintenance Division 2, Engineering Department, Tokyo Second Operation Bureau, Japan Highway Public Corporation
3) Eiichiro MITAKE	: Deputy Director, 1st Division, Operations Department 2, The Overseas Economic Cooperation Fund

JICA Study Team

1) Koki KANEDA	: Team Leader / Road Planner
2) Kanao ITOH	: Regional Planner
3) Teruhiko HORIE	: Public Transportation Planner
4) Yoshiki TAKAI	: Road & Structural Engineer
5) Hajime KINUGAWA	: Pavement Specialist
6) Ravinder KATIYAR	: Traffic Demand / Economic Analysis
7) Yukio URANO	: Traffic Survey Specialist
8) Akira ISHIDO	: Road Administration Specialist
9) Fumiaki SHINO	: Environmental specialist
10) Yukio KOUSAKA	: Construction Planner / Cost Estimator
11) Morichika TAKAHASHI	: Topographic Geographical Surveyor

Steering Committee and Counter Parts

Steering Committee

1) Mr. Ts. Damiran	: Chairman, State Secretary, Ministry of Infrastructure Development
2) Mr. Ts. Oyunbileg	: Secretary, Officer, Strategic Planning and Overall Policy Department, MID
3) Mr. R. Bud	: Director, Information, Control, Analysis and Evaluation Department, MID
4) Mr. B. Batjav	: Director, Policy Implementation and Coordination Department, MID
5) Mr. Ts. Sukhbaatar	: Deputy Director, Policy Implementation and Coordination Department, MID
6) Mr. B. Byambajav	: Officer, Government of Mongolia
7) Mr. B. Manduul	: Officer, Policy Implementation and Coordination Department, MID
8) Mr. E. Gombojav	: General Manager, UB City
9) Mr. Ch. Bat	: Director, Strategic Policy and Planning Department, UB City
10) Mr. L. Nyamsuren	: Chief Architect, UB City
11) Mr. Ch. Gankhuu	: City Chief Engineer and Director of Building and Capital Investment Department
12) Mr. N. Nyamdavaa	: Director, Public Transport Department
13) Mr. L. Battsooj	: Officer, Strategic Policy and Planning Department, UB City
14) Mr. S. Ochirbat	: General Director, Road Department (Government Agency)
15) Mr. L. Dashdorj	: Director, Budget Policy Department, Ministry of Finances
16) Mr. L. Davaadorj	: Deputy Director, Foreign Trade and Cooperation Department, Ministry of External Relations
17) Mrs. Dolgormaa	: Officer, Cooperation Division, Ministry of Nature and Environment
18) Mr. S. Pioner	: Deputy Chief, Traffic Police Department
19) Ms. Sarandulam	: Project Coordinator, Road Department (Government Agency)

Counterparts

1) Mr. L. Battsooj	: Officer, Strategic Policy and Planning Department, UB City
2) Ms. Sarandulam	: Project Coordinator, Road Department (Government Agency)

APPENDIX

Appendix Survey Sheet 4.1.1 Road Inventory Sheet (Sheet No. 1)

1 Road Inventory Sheet (Sheet No.1 —)

Inventory Date		Surveyor Name	

<1>	Street Name	
<2>	Street No.	
<3>	Kind of Street	
<4>	Length of St.	
<5>	Origin	
<6>	Destination	
7	Design Traffic Volume	
8	Design Load	

Notes:Inventory items for No.19,21,24,26,28 and 30 shall be inspected by examination or technical/visual evaluation refering supplemental evaluation list.
The marks of < > specified JICA's items.

Evaluation Point List

	Point	4	3	2	1
13	Terrain	DID	other urban	Flat	Mountain
17	Improved/not	Good	not good	bad	Not yet
18	Pavement Type	Concrete	asphalt	surface treatment	Gravel
19	Thick of pave.	Enough	Medium	Poor	Bad
21	Flat/Roughness	Smooth	Medium/Rough	Poor	Bad
22	Cracks	Non	10% or more	30% or more	50% or more
23	Wheeltrack/Rut	Non	10mm or more	30mm or more	50mm or more
25	Gaps	Non	10mm or more	20mm or more	30mm or more
27	Damage of BC	Non	A few	1 point/10m2	many
29	General Point	Good		Bad	Dangerous
31	Shoulder	2m or more	1m or more	1m or less	None
32	Sidewalk	5m or more	3m or more	1m or more	1m or less

Point	4	3	2	1
33 Barrier	good	partially	many damage	non
34 Slope	non	good	partially	many damage
35 Retaining wall	non	good	partially	many damage
36 Drainage	good	partially	many damage	non
37 Culvert	non	good	partially	many damage
38 Manhole	non	good	partially	many damage
39 Road Sign	good	partially	many damage	non
40 Traffic Sign	good	partial	many damage	non
41 Signal	good	partially	many damage	non
42 Facility/snowice	good	partially	many damage	non
43 Tree	good	partially	many damage	non
44 Illumination	good	partially	many damage	non
45 Dangerous Place	non	afew	many	urgent

<9>	Km Post																
<10>	Point Code																
<11>	Length of Survey Area																
12	No. of Survey Area																
<13>	Terrain																
<14>	Width																
<15>	Traffic Lane Number																
16	Visual Traffic Volume																
<17>	Improved or not																
<18>	Type of pavement																
19	Thickness of Pavement																
20	Date of Construction																
21	Flatness/Roughness																
<22>	Cracks																
<23>	Wheeltrack/Rut																
24	PSI																
<25>	Gaps																
26	Thickness of basecourse																
<27>	Damage at basecourse																
28	Subgrade CBR																
<29>	General Visual Degree																
30	Structural Number																
<31>	Shoulder Width																
<32>	Sidewalk width																
<33>	Barrier																
<34>	Slope																
<35>	Retaining Wall																
<36>	Drainage																
<37>	Culvert																
<38>	Manhole																
<39>	Traffic Sign																
<40>	Road Sign																
<41>	Signal																
<42>	facilities for Snow/Ice																
43	Tree																
<44>	Illumination																
<45>	Dangerous place																

2. Bridge Inventory Sheet (Sheet No.2 -)

*NAME OF BRIDGE		*CLASS OF ROAD	*CROSSING: NAME OF RIVER OR ROAD			*DATE OF INVENTORY		*INVENTORY BY		
*Km post			Construction By			Date of Construction		Maintenance by		
*Type of Bridge	*Superstructure				Design Loading			Load limitation	No	Yes
	*Substructure	*Abutment			Design Standard	BS AASHTO RUSSIA OTHERS( )				
		*Pier			*Skew of Bridge	Square Skew Curve (deg.R=)				
*Length of Bridge	* m	*Span m			*Condition of Crossing	*Road	Width m	Clearance m	Skew deg.	
*Width of Bridge	*Overall m	*Carriageway m	*Pedestrianway m			*River	Width of River m	Depth m	Free Board m	Design Quantity m3/sec
Affixed Articles	Kind	Number								
Traffic Volume	(year)	Ratio of Heavy Vehicle (year)			Others					
Final Record of Repair	Pavement	Deck Slab	Main Beam	Painting	Expansion Joint	Bearing	Drainage	Railing	Curb	Affixed Articles
	Others				Substructure					

	* Component	* Conditions Of Damage	*Rating
Surface	Pavement (Type)	Good , Wave , Rut , Crack , Pothole , Others	
	Curb (Type)	Good , Scale , Crack , Spall , Rebar-exposed , Others	
	Railing (Type)	Good , Scale , Crack , Spall , Rebar-exposed , Others	
Super-Str	Deck slab (Type)	Good , Honeycombs , Crack , Deformation , Rebar-exposed , Other	
	Main Beam (Type)	Good , Honeycombs , Crack , Deformation , Rebar-exposed , Other	
	Cross Beam (Type)	Good , Crack , Deformation , Rebar-exposed , Others	
	Painting	Condition	
Accessory	Exp.Joint (Type)	Good , Abnormal Sound , Deformation , Gap , Broken , Others	
	Shoe (Type)	Good , Abnormal Sound , Deformation , Gap , Broken , Others	
	Drainage (Type)	Good , Clogged Leakage, Broken , Others	

	* Component	*Conditions of Damage	*Rating
Sub-Str.	Abutment (Type)	Good , Crack , Spall , Deformation , Rebar-exposed , Broken , Settlement , Scouring , Others	
	Abutment (Type)	Good , Crack , Spall , Deformation , Rebar-exposed , Broken , Settlement , Scouring , Others	
	Pier (Type)	Good , Crack , Spall , Deformation , Rebar-exposed , Broken , Settlement , Scouring , Others	
	Pier (Type)	Good , Crack , Spall , Deformation , Rebar-exposed , Broken , Settlement , Scouring , Others	
	*Road/Traffic sign	Good , Partial, Many damaged, None	
	*Comment		

*OVERALL EVALUATION RATING

1. No damage detected on the basis of the inspection results.
2. Damage has been detected and a follow-up survey is required.
3. There is significant damage and a detailed survey needs to be carried out to establish whether repair work is to be carried out or not.
4. There is significant damage and urgent repair is required or the bridge has to be closed to traffic or restriction on vehicle weight to be imposed. (or to be re-constructed new bridge)

* Final rating

*<Plan / Profile>

*<Section>

Note: The marks of * specified JICA's items.

Appendix Survey Sheet 4.1.3 Intersection Inventory Sheet (Sheet No. 3)

3. Intersection Inventory Sheet (Sheet No.3—)

*Date of Inventory		*Inventory By		*Date of Inventory		*Inventory By	
*Location	*Street Name	*Street No.		*Location	*Street Name	*Street No.	
*Existing Shape (Plan & Section)				*Existing Shape (Plan & Section)			
*Current Condition	Traffic Flow			*Current Condition	Traffic Flow		
	Signal				Signal		
	Traffic Sign				Traffic Sign		
	Pavement				Pavement		
	Others				Others		
*Comment				*Comment			
Evaluation				Evaluation			

Table- Evaluation Rank for Existing Roads

Route No.108

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2.3	0.35	0.8	
	29	Visual Degree	2.8	0.15	0.4	
Life of Pavement	22	Cracks	2.6	0.25	0.7	
	23	Wheel Track/Rut	3.2	0.1	0.3	
	27	Damage of Basecourse	2.4	0.15	0.4	
Total					2.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.5

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2.7	0.35	0.9	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3.2	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3.2	0.15	0.5	
Total					3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.4

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.5	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.3

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2.5	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.1-1

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3.2	0.15	0.5	
Total					3.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.1-2

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	2.5	0.15	0.4	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	2.5	0.15	0.4	
Total					2.9	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.103

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3.6	0.35	1.3	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3.6	0.25	0.9	
	23	Wheel Track/Rut	3.4	0.1	0.3	
	27	Damage of Basecourse	3.8	0.15	0.6	
Total					3.7	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.82, 84, 85

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2.7	0.35	0.9	
	29	Visual Degree	2.5	0.15	0.4	
Life of Pavement	22	Cracks	2.7	0.25	0.7	
	23	Wheel Track/Rut	2.5	0.1	0.3	
	27	Damage of Basecourse	2.7	0.15	0.4	
Total					2.7	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.100,99,83

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2	0.35	0.7	
	29	Visual Degree	2	0.15	0.3	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2.3	0.1	0.2	
	27	Damage of Basecourse	2	0.15	0.3	
Total					2.3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.121

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2	0.35	0.7	
	29	Visual Degree	2.3	0.15	0.3	
Life of Pavement	22	Cracks	2	0.21	0.5	
	23	Wheel Track/Rut	2.3	0.1	0.2	
	27	Damage of Basecourse	1.3	0.15	0.2	
Total					1.9	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.8,9

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3.8	0.35	1.3	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3.5	0.25	0.9	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3.8	0.15	0.6	
Total					3.7	
		Evaluation Rank		3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.10

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.9	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.90

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.7	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.37,95

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3.7	0.1	0.4	
	27	Damage of Basecourse	4	0.15	0.6	
Total					4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.11

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.8	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.12

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3.5	0.25	0.9	
	23	Wheel Track/Rut	2.5	0.1	0.3	
	27	Damage of Basecourse	2.8	0.15	0.6	
Total					3.4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.97

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	4	0.1	0.4	
	27	Damage of Basecourse	4	0.15	0.6	
Total					4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.18

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.13

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.2	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.19

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.14

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3.3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.1	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.15

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	2.5	0.15	0.4	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.16

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	2.5	0.15	0.4	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.22

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3.5	0.25	0.9	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.32						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	2	0.25	0.5	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.2	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.6						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3.8	0.25	1	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3.8	0.15	0.6	
Total					3.9	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

7.8

Table- Evaluation Rank for Existing Roads

Route No.26						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3.5	0.25	0.9	
	23	Wheel Track/Rut	3.5	0.1	0.4	
	27	Damage of Basecourse	3.5	0.15	0.5	
Total					3.4	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.25						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.3	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.64						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3.3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.9	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.62						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.9	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.27						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	4	0.1	0.4	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.6	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.63						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	1.2	0.35	0.4	
	29	Visual Degree	1.5	0.15	0.2	
Life of Pavement	22	Cracks	1.5	0.25	0.4	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	1.5	0.15	0.2	
Total					1.4	
	Evaluation Rank		4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.61

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3.5	0.25	0.9	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.2	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.41

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	2.4	0.15	0.4	
Total					3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.86,115

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2.8	0.35	1	
	29	Visual Degree	2.9	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.4	
Total					3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.7

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.7	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.88,89

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3.3	0.35	1.2	
	29	Visual Degree	3.4	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2.9	0.1	0.3	
	27	Damage of Basecourse	2.9	0.15	0.4	
Total					3.2	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.114

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.51

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	2	0.15	0.3	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					2.9	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.112,52

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	1.5	0.35	0.5	
	29	Visual Degree	2.5	0.15	0.4	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	3	0.15	0.5	
Total					2.4	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.113,112

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.6,47

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	2.9	0.15	0.4	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3.1	0.1	0.3	
	27	Damage of Basecourse	3.1	0.15	0.5	
Total					3	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.53

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	2	0.15	0.3	
Life of Pavement	22	Cracks	3.4	0.25	0.9	
	23	Wheel Track/Rut	0.18	0.1	0.2	
	27	Damage of Basecourse	3.4	0.15	0.5	
Total					2.9	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.54,120

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2.3	0.35	0.8	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	3	0.15	0.5	
Total					2.8	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.58

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1.1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3.6	0.25	0.9	
	23	Wheel Track/Rut	3.4	0.1	0.5	
	27	Damage of Basecourse	3.9	0.15	0.6	
Total					3.6	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.109

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	1	0.35	0.4	
	29	Visual Degree	1	0.15	0.2	
Life of Pavement	22	Cracks	1	0.25	0.3	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	1	0.15	0.2	
Total					1.3	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.110

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.111

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.76

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3.8	0.25	1	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.3	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.2

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3.3	0.1	0.3	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.4	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.104.105

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3.6	0.35	1.3	
	29	Visual Degree	3.4	0.15	0.5	
Life of Pavement	22	Cracks	3.6	0.25	0.9	
	23	Wheel Track/Rut	3.3	0.1	0.3	
	27	Damage of Basecourse	3.7	0.15	0.6	
Total					3.6	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.50

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3.3	0.15	0.5	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	2.3	0.15	0.3	
Total					3.1	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.45

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3.7	0.1	0.4	
	27	Damage of Basecourse	4	0.15	0.6	
Total					3.6	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.39

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	1	0.35	0.4	
	29	Visual Degree	1.4	0.15	0.2	
Life of Pavement	22	Cracks	2.1	0.25	0.5	
	23	Wheel Track/Rut	2.1	0.1	0.2	
	27	Damage of Basecourse	1.1	0.15	0.2	
Total					1.5	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.71.72

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	2.5	0.35	0.9	
	29	Visual Degree	2.5	0.15	0.4	
Life of Pavement	22	Cracks	2.8	0.25	0.7	
	23	Wheel Track/Rut	2.5	0.1	0.3	
	27	Damage of Basecourse	2	0.15	0.3	
Total					2.6	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.69

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	2.7	0.15	0.4	
Life of Pavement	22	Cracks	3.7	0.25	0.9	
	23	Wheel Track/Rut	2.7	0.1	0.3	
	27	Damage of Basecourse	3.3	0.15	0.5	
Total					3.1	
Evaluation Rank			4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.68						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	1	0.15	0.2	
Total					3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.34,70						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	2.5	0.15	0.4	
Total					3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.117						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	1	0.35	0.4	
	29	Visual Degree	2	0.15	0.3	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	2	0.15	0.3	
Total					2.1	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.116						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.101,20						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	3	0.1	0.3	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.65						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	2	0.15	0.3	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2	0.1	0.2	
	27	Damage of Basecourse	2.3	0.15	0.3	
Total					2.6	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.118						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.102						
Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1	
	29	Visual Degree	3.3	0.15	0.5	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	2.3	0.1	0.2	
	27	Damage of Basecourse	3.7	0.15	0.6	
Total					3.1	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.119

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness		0.35		
	29	Visual Degree		0.15		
Life of Pavement	22	Cracks		0.25		
	23	Wheel Track/Rut		0.1		
	27	Damage of Basecourse		0.15		
Total						
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.33

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	4	0.35	1.4	
	29	Visual Degree	4	0.15	0.6	
Life of Pavement	22	Cracks	4	0.25	1	
	23	Wheel Track/Rut	4	0.1	0.4	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.9	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.60

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1.1	
	29	Visual Degree	3	0.15	0.5	
Life of Pavement	22	Cracks	33	0.25	0.8	
	23	Wheel Track/Rut	4	0.1	0.4	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.3	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

Table- Evaluation Rank for Existing Roads

Route No.59

Category			Average Point	Weight Factor	Evaluated Point	Remak
Trafficability	21	Flatness/Roughness	3	0.35	1.1	
	29	Visual Degree	2	0.15	0.3	
Life of Pavement	22	Cracks	3	0.25	0.8	
	23	Wheel Track/Rut	4	0.1	0.4	
	27	Damage of Basecourse	3	0.15	0.5	
Total					3.1	
		Evaluation Rank	4~3.5: Good	3.5~2.5: Fair	2.5~1.5: Poor	1.5~1.0: Bad

List of Overall Evaluation for Bridge No. 4

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe	good 1 2 3 4 bad	2		0.7	1.4
	Degree of substructure damage and defect	good 1 2 3 4 bad	3		0.3	0.9
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			C (3.6)
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 5

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe	good 1 2 3 4 bad	1		0.7	0.7
	Degree of substructure damage and defect	good 1 2 3 4 bad	1		0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.5)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 6

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe	good 1 2 3 4 bad	1	1	0.7	0.7
	Degree of substructure damage and defect	good 1 2 3 4 bad	1	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.3)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 7

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe	good 1 2 3 4 bad	1	1	0.7	0.7
	Degree of substructure damage and defect	good 1 2 3 4 bad	1	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.3)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 10

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.3)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 11

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.7)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 12

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.3)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 13

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.2)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 14

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 1	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad: 1	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.5)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 15

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 2	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad: 2	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			C (3.6)
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 16

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 1	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad: 1	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.1)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 17

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 2	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad: 2	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.3)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 18

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 3		0.7	2.1
	Degree of substructure damage and defect		good 1 2 3 4 bad: 1		0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.1)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 19

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 1		0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad: 2		0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (1.8)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 20

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 2		0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad: 2		0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.5)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 21

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 1		0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad: 3		0.3	0.9
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.3)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 22

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.6)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 23

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.0)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 24

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.5)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 27

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.1)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 28

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.0)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 29

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.0)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 32

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (1.5)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 33

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for brid (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.2)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 35

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (3.0)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 36

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	1	0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.8)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 37

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	1	0.7	0.7
	Degree of substructure damage and defect		good 1 2 3 4 bad	3	0.3	0.9
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.9)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 39

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad	2	0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad	2	0.3	0.6
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.5)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 40

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 2		0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad: 3		0.3	0.9
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			B (2.8)
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 45

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 2		0.7	1.4
	Degree of substructure damage and defect		good 1 2 3 4 bad: 1		0.3	0.3
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1	1	0.3	0.3
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3		0.3	
Function	Construction record	Constructed after 1977 (use less than 19 years)	1		0.1	
		Constructed before 1977 (use more than 19 years)	3	3	0.1	0.3
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	A (2.4)
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 48

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 3		0.7	2.1
	Degree of substructure damage and defect		good 1 2 3 4 bad: 3		0.3	0.9
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1	1	0.1	0.1
		Insufficient width for traffic capacity	3		0.1	
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			C (4.1)
		D: Danger	4.5~5.5		Max.point 5.5	

List of Overall Evaluation for Bridge No. 50

Evaluation Item			Rating point (R/P)	Br. (R/P)	Weight factor (W/F)	Point (R/F)*(W/F)
Durability	Degree of superstructure damage and defe		good 1 2 3 4 bad: 4		0.7	2.8
	Degree of substructure damage and defect		good 1 2 3 4 bad: 4		0.3	1.2
Load Capacity	Low traffic volume of heavy vehicle with axle load less than 7 ton		1		0.3	
	High traffic volume of heavy vehicle with axle load greater than 7 ton		3	3	0.3	0.9
Function	Construction record	Constructed after 1977 (use less than 19 years)	1	1	0.1	0.1
		Constructed before 1977 (use more than 19 years)	3		0.1	
	Effective widt of bridge	Sufficient width for traffic capacity	1		0.1	
		Insufficient width for traffic capacity	3	3	0.1	0.3
Overall evaluation for bric (range of point)		A: Sound	1.5~2.5		Min.point 1.5	
		B: Fairly sound	2.5~3.5			
		C: Unsound/ Lack of safety	3.5~4.5			
		D: Danger	4.5~5.5		Max.point 5.5	D (5.3)