

# **APPENDICES**



## AP1-1 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN PILOT PROJECT

### AP1-1-1 Pilot Project Environmental Screening

“Environmental Screening” is the first step of the environmental and social consideration study and means of deciding whether the proposed pilot project is likely to have any impacts on the environment.

As the proposed pilot project includes rehabilitation works of existing road without upgrading, the environmental impacts are expected to be of small scale and limited within short term. According to the Article 24 in the environment code of Burundi, any maintenance and rehabilitation works does not require to prepare an EIA study. The result of the screening is shown in the following table. The environmental impacts which will occur in the construction phase are noise, vibration, dust, construction waste and traffic congestion.

**Table AP1.1.1, Matrix for Pilot Project Environmental Scope**

Name of Cooperation Project: The Emergency Study on Urban Transport in Bujumbura, Pilot Project (Urgent rehabilitation works)														
		Likely Impacts	Overall Rating	Planning Phase		Construction Phase					Operation Phase			
				Land acquisition	Change of land use plan, Control of various activities by regulations for the construction	Reclamation of wetland, etc.	Deforestation	Alteration to ground by cut land, filling, drilling, tunnel, etc.	Operation of construction equipments and vehicles	Construction of roads, tollgates, parking lots, access roads for bridges and other related facilities	Traffic restriction in construction area	Increase of through traffic	Appearance/ Occupancy of toads and related building structures	Increasing influx of settlers
Social Environment *	No 1	Involuntary Resettlement												
	2	Local economy such as employment and livelihood, etc.									B			
	3	Land use and utilization of local resources												
	4	Social institutions such as social infrastructure and local decision-making institutions												
	5	Existing social infrastructures and services									C			

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	6	The poor, indigenous and ethnic people											
	7	Misdistribution of benefit and damage											
	8	Cultural heritage											
	9	Local conflict of interests											
	10	Water Usage or Water Rights and Rights of Common											
	11	Sanitation											
	12	Hazards (Risk) Infectious diseases such as HIV/AIDS											
Natural Environment	13	Topography and Geographical features											
	14	Soil Erosion											
	15	Groundwater											
	16	Hydrological Situation											
	17	Coastal Zone											
	18	Flora, Fauna and Biodiversity											
	19	Meteorology											
		Landscape											
21	Global Warming												
Pollution	22	Air Pollution							B				
	23	Water Pollution											
	24	Soil Contamination											
	25	Waste							B				
	26	Noise and Vibration							B	B			
	27	Ground Subsidence											
	28	Offensive Odor								B			
	29	Bottom sediment											
	30	Accidents								B	B		C

Rating: A: Serious impact is expected.  
 B: Some impact is expected.  
 C: Extent of impact is unknown (Examination is needed. Impacts may become clear as the study progresses.)  
 No Mark: No impact is expected. IEE/EIA is not necessary.

\*: Regarding the impacts on "Gender" and "Children's Right" might be related to all criteria of Social Environment.

## Reference:

- 1) Japan International Cooperation Agency (1992) "III Roads: Environmental Guidelines for Infrastructure Projects", Tokyo, Japan.
- 2) Norman Lee and Clive George (2002) "Environmental Assessment in Developing and Transitional Countries", JOHN WILEY & SONS, LTD., London, England.

**AP1-1-2 Initial Environmental Examination of Pilot Project**

## (1) Project Description

The proposed pilot project is summarized in the following table.

**Table AP1.1.2, Project Description**

Item	Description
Name of Cooperation Project	THE EMERGENCY STUDY ON URBAN TRANSPORT IN BUJUMBURA Pilot Project (Urgent rehabilitation works)
Project Proponent	Ministry of Transport, Posts and Telecommunications Ministry of Public Works and Equipment, Road Department
Background	Bujumbura with estimated population of 550,000, the capital city, is the political and economic center of Burundi. However, the basic infrastructures, and road conditions in particular, are extremely poor, and so reconstruction is essential before the living conditions of the people can be improved. Although the demand for transportation in Bujumbura is expected to increase in future due to the increasing economic activity during the rehabilitation period, road volume and the road network are inadequate, and existing structures and traffic control are so poor that traffic congestion in the city center is becoming a major concern.
Objectives	The implementation of this project will provide an immediate rehabilitation of the collapsed national trunk road 7 to improve the road traffic.
Location	Musaga Commune, Bujumbura City, Burundi Residential Area
Beneficiaries Population	Directly: 95,000 or more people (Living in Rohero and Musaga Commune along the road) Indirectly: 350,000 people (living in Morobe Province)
Project Components	Overlay works of existing road (National Trunk Road 7)
Type of Project	Construction / Rehabilitation
Type of Roads	Highway/ Ordinary, Urban/ Rural Area, Plain/ Mountainous Area
Target Year/ Traffic Volume	In year 2007, 5,000 cars/ 12 hours
Extension/ Width/ Lanes	Ext 1.7 km, Width 9.0~9.8 m, No. of Lanes 2
Road Structure	Bridge
Supplemental Facilities	Interchanges: 0 points, Toll Gates: 0 points
Others	The rehabilitation works are limited in the existing right of way and include paving work in bus stops.

## Reference:

- 1) Japan International Cooperation Agency (1992) "III Roads: Environmental Guidelines for Infrastructure Projects", Tokyo, Japan.

## (2) Site Condition

The pilot project section of National Trunk Road 7 is located in the southeastern part of Bujumbura and passes through residential areas. The important public facilities along the roadside are an army camp, a school, three public water stations and a bus parking. Water pipe is laid underground along the western roadside.

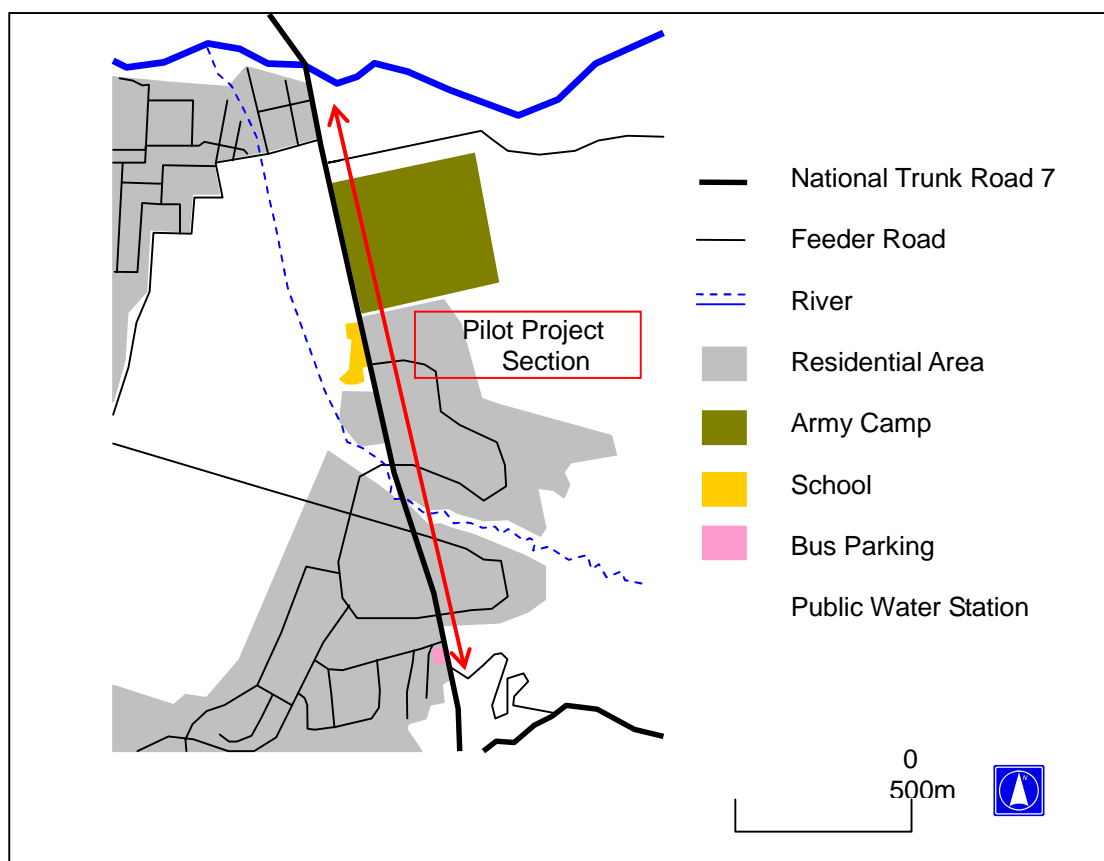


Figure AP1.1.1, Pilot Project Site

### (3) Environmental Impact and Mitigation

#### A. Construction Phase

##### Air Pollution and Offensive Odor:

Convey of construction materials, heavy equipment operation and earthworks will generate harmful dust. Operation of heavy equipment and asphalt plant will generate exhaust gas. These dust and exhaust gas caused by construction works are unavoidable to some degree.

The contractor should keep their construction equipments and asphalt plant in proper condition to avoid the imperfect combustion. If the residents and pedestrians complain about the dust, the preventive measures such as water spraying to reduce the dust should be carried.

##### Noise and Vibration:

Heavy equipment operation and asphalt plant will generate noise and vibration. However, these noise and vibration caused by construction works is unavoidable to some degree.

To mitigate the nuisance by noise and vibration, the construction planning Consultant should consider the proper execution scheme. Because the pilot project site is located in residential areas, night time construction works should be avoided. The Contractor should keep their construction equipments and asphalt plant in proper condition. If the residents complain about noise and vibration, the Supervision Engineers and the Contractors should reconsider the construction method.

##### Waste:

The overlay works of the existing paved road will be conducted after tearing up of the old pavement. The torn up pavement will basically be reused as the road bed material. However, some part of old pavement may become the construction waste depending on the construction condition. Other construction waste such as fragments of construction materials and garbage from construction workers will be generated.

The contractor should consider proper disposal plan and manage the construction wastes. The Consultants' supervision team should monitor the waste disposal.

##### Existing Infrastructures and Facilities:

The Consultants' supervision team and the Contractor should study carefully the buried facilities such as water pipe to avoid the accidental destructions.

#### Accident and Traffic Conjunction:

As traffic restrictions will be required in the construction site, temporary traffic conjunction will occur during the construction period. Accidents may be provoked by the traffic restriction. The pavement works in the bus parking area, where many buses and passengers are utilizing, will disturb the service.

To mitigate the traffic conjunction and disturbance, the construction planning Consultant should consider the proper execution scheme and the Contractor should install the sign that explains the construction components and period at the bus parking area well in advance of the construction works. If the drivers or passengers complain about the traffic conjunction and disturbance, the Supervising Engineers and the Contractors should reconsider the construction method.

#### B. Operation Phase

##### Accident and Non-Motorized Transport:

The road accident will be reduced with the improved road condition. On the other hand, as the traffic speed is expected to increase, the accidents may increase.

There are many pedestrians passing through the pilot project section. The traffic volumes are: vehicles about 5,000/12hours, pedestrians about 7,000/12hours, and bicycles about 2,000/12hours, respectively. The road design Consultant should consider the movement of non-motorized transports and incorporate the considerations into the design.

#### (4) Environmental Management Plan

##### Construction Materials:

To prevent illegal exploitation of construction materials such as soil, gravel, etc., a sentence that the construction materials must be procured officially should be added in the conditions of the Contract to be signed by the Contractor. The Consultants' supervising team should monitor the procurement.

##### Construction Waste:

To prevent illegal dumping of construction wastes, the conditions of the Contract to be signed by the Contractor should be added with a sentence that the construction wastes must be disposed officially. The Consultants' supervision team should monitor the waste disposal.



### Environmental Monitoring:

To immediately identify the environmental and social issues, the Consultants' supervision team should monitor the following items throughout the construction period.

- Noise, vibration, dust, odor and exhaust gas caused by operation of heavy equipments and asphalt plant
- Traffic congestion and accident
- Opinions and complaints from the drivers, residents, pedestrians and passengers.

### A-1-2 Public Consultation on Pilot Project

The public consultation on the emergency work as pilot project was held at the Ministry of Finance on 19th June, 2007. Attended organizations were as follows:

- Ministry of Transport, Posts and Telecommunications
- Ministry of Public Works and Equipment
- OTRACO
- Administrative Office of Musaga Commune
- The 2nd Battalion (Camp Muha)
- Musaga Parking Lot Office
- Office of Gitaramuka Quarter
- Office of Kinanira I Quarter
- Office of Kinanira II Quarter
- Office of Kamesa Quarter
- Local Council of Musaga
- Committee of Parents of Musaga I School

### Contents of discussions:

JICA study team made the following presentation:

1. Explanation of Outline of the Project
  - Project Section
  - Anticipated Project Period
  - Design Policy
  - Design Contents
  - Civil Work Sequence
2. Facilities for consideration to local people
  - Number and Installation Point of Road Humps
  - Installation Point and Length of Caps on Side Ditch
3. Undertakings by Burundian Side

- Arrangement of Temporary Removal of Shops and Container in the Right of Way
- Clarify Boundary between Official and Private Land in Bus Bay Area

Main opinions and questions from participants were as follows:

- Regarding traffic safety, besides installation of safety facilities, regulations of traffic safety are important.
- Regarding road safety in Bujumbura, separation of traffic lanes among vehicles, bicycles and pedestrians is important.
- Thirteen accidents occurred in last year near Musaga I School where 2,500 students commute. The humps and pedestrian crosswalks are expected to reduce traffic accidents.
- The administrative office will hold a meeting with the local people on this project and order the owners of the illegal shops and container in the right of way to remove them in advance of the commencement of construction works.
- District office will enlighten this project to the local people to get their cooperation in the construction works.
- The cooperation of Japanese side to the minimal requests from the local residence in the construction period is expected for the success of this project.
- Q1: How to decide on the construction company, by tender? A1: By JICA's system including tender.
- Q2: Are signs, street lamps and bus shelters included in this project? A2: These facilities are not included in this project.
- Q3: How were the three installation points of side ditch caps selected? There were four official bus stops along the section in the past. A3: According to site survey, the points where many buses are stopping were selected.
- Q4: Is bridge rehabilitation included in this project? A4: Bank protection works to one river and one channel are included in this project.

## AP1-2 ENVIRONMENTAL SCOPE OF EACH PROJECT

### AP1-2-1 Road Improvement Plan

#### (1) Development of North-South Axis

**Table AP1.2.1, Result of Environmental Scope**

Project Description			
Location: Rohero, Kinindo, Musaga, Kanyosha			
Project Type: Upgrade construction including addition of new lanes			
Length: 7.0 km Road Structure: Including two bridges Remark: -			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	B or C	Pollution by exhaust gas from construction machines and increased vehicles.
2. Water pollution	B	D	Pollution of river and lake water by turbid water and spilling oil in construction phase.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste, surplus soil and other waste in construction phase.
5. Noise and vibration	B	C or D	Generation of noise and vibration from construction machines and increased vehicle.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	B	D	Generation of exhaust gas and bad smell substance from construction machines.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	C or D	D	Impacts on roadside trees.
11. Water usage	D	D	No impacts on water usage.
12. Accident	B	C	Increase of possibility of traffic accident by construction works and speeded vehicles.
13. Global warming	D	C	Potential increase of greenhouse gas by increased vehicles.
14. Involuntary resettlement	B	D	Resettlement for occupation of right of way.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	A or B	D	Loss of own land and facilities for occupation of right of way.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	B	D	Moving of existing water pipe, electric cable, or telephone line in construction phase.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	C	Impacts of change of commercial zone.
21. Local conflict of interests	D	C	Conflict on future land use in road side during operation phase.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	C	D	Spread of HIV/AIDS by construction worker

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.

D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

## APPENDIX 1 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN PILOT PROJECT

## (2) Development of Ring Road

Table AP1.2.2, Result of Environmental Scope

<u>Project Description</u>			
Location: Ngagara, Gihosha, Buyenzi, Bwiza, Rohero			
Project Type: Upgrade construction including addition of new lanes			
Length: Total 9.3 km Road Structure: Including one bridge Remark: Consisting of 3 road projects			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	B or C	Pollution by exhaust gas from construction machines and increased vehicles.
2. Water pollution	B	D	Pollution of river and lake water by turbid water and spilling oil in construction phase.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste, surplus soil and other waste in construction phase.
5. Noise and vibration	B	C or D	Generation of noise and vibration from construction machines and increased vehicle.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	B	D	Generation of exhaust gas and bad smell substance from construction machines.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	C or D	D	Impacts on roadside trees.
11. Water usage	D	D	No impacts on water usage.
12. Accident	B	C	Increase of possibility of traffic accident by construction works and speeded vehicles.
13. Global warming	D	C	Potential increase of greenhouse gas by increased vehicles.
14. Involuntary resettlement	B	D	Resettlement for occupation of right of way.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	B	D	Loss of own land and facilities for occupation of right of way.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	B	D	Moving of existing water pipe, electric cable, or telephone line in construction phase.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	C	Impacts of change of commercial zone.
21. Local conflict of interests	D	C	Conflict on future land use in road side during operation phase.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	C	D	Spread of HIV/AIDS by construction worker

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.

D: No impact is expected.

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## (3) Forming Road Network

Table AP1.2.3, Result of Environmental Scope

<u>Project Description</u>			
Location: Ngagara, Buyenzi, Gihosha, Nyakabiga, Rohero, Musaga			
Project Type: New road construction Length: 0.5km, 0.3km, 0.6km			
Road Structure: Including three bridges Remark: Consisting of 3 road projects in different sites			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	D	Pollution by exhaust gas and dust from construction machines and works.
2. Water pollution	B	D	Pollution of river and lake water by turbid water and spilling oil in construction phase.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste, surplus soil and other waste in construction phase.
5. Noise and vibration	B	D	Generation of noise and vibration from construction machines.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	B	D	Generation of exhaust gas and bad smell substance from construction machines.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	D	D	Little impacts on biota and ecosystem.
11. Water usage	D	D	No impacts on water usage.
12. Accident	B	C	Increase of possibility of traffic accident by construction works and increased vehicles.
13. Global warming	D	D	Little impacts on global warming.
14. Involuntary resettlement	B	D	Resettlement for occupation of right of way.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	B	D	Loss of own land and facilities for occupation of right of way.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	C	D	Impact of existing water pipe, electric cable, or telephone line in construction phase.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	C	Impacts of change of access to public transportation.
21. Local conflict of interests	D	C	Conflict on future land use in road side during operation phase.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	C	D	Spread of HIV/AIDS by construction worker

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.

D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

## APPENDIX 1 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN PILOT PROJECT

## (4) Development of City Plan Roads in Northern Area

Table AP1.2.4, Result of Environmental Scoping

Project Description			
Location:	Buterere, Kinama, Ngagara, Cibitoke, Kamenge, Gihosha		
Project Type:	New road and upgrade construction	Length:	Total 19.9 km
Road Structure:	Including one bridge	Remark:	Consisting of 8 road projects
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	D	Pollution by exhaust gas and dust from construction machines and works.
2. Water pollution	B	D	Pollution of river and lake water by turbid water and spilling oil in construction phase.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste, surplus soil and other waste in construction phase.
5. Noise and vibration	B	D	Generation of noise and vibration from construction machines.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	B	D	Generation of exhaust gas and bad smell substance from construction machines.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	D	D	Little impacts on biota and ecosystem.
11. Water usage	D	D	No impacts on water usage.
12. Accident	C	C	Increase of possibility of traffic accident by construction works and speeded vehicles.
13. Global warming	D	D	Little impacts on global warming.
14. Involuntary resettlement	B	D	Resettlement for occupation of right of way.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	B	D	Loss of agricultural land and own facilities for occupation of right of way.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	C	D	Impact of existing water pipe, electric cable, or telephone line in construction phase.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	B	Impacts of change of commercial zone and access to public transportation.
21. Local conflict of interests	D	C	Conflict on future land use in road side during operation phase.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	C	D	Spread of HIV/AIDS by construction worker

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.

D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

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## (5) Development of City Plan Roads in Southern Area

Table AP1.2.5, Result of Environmental Scope

<u>Project Description</u>			
Location: Kinindo, Musaga, Kanyosha		Length: Total 27 km	
Project Type: New road and upgrade construction		Remark: Consisting of 12 road projects	
Road Structure: Including four bridges			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	D	Pollution by exhaust gas and dust from construction machines and works.
2. Water pollution	B	D	Pollution of river and lake water by turbid water and spilling oil in construction phase.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste, surplus soil and other waste in construction phase.
5. Noise and vibration	B	D	Generation of noise and vibration from construction machines.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	B	D	Generation of exhaust gas and bad smell substance from construction machines.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	C or D	C or D	Loss of grove and impacts on lakeside ecosystem.
11. Water usage	D	D	No impacts on water usage.
12. Accident	C	C	Increase of possibility of traffic accident by construction works and speeded vehicles.
13. Global warming	D	D	Little impacts on global warming.
14. Involuntary resettlement	B	D	Resettlement for occupation of right of way.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	B	D	Loss of agricultural land and own facilities for occupation of right of way.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	C	D	Impact of existing water pipe, electric cable, or telephone line in construction phase.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	B	Impacts of change of commercial zone and access to public transportation.
21. Local conflict of interests	D	C	Conflict on future land use in road side during operation phase.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	C	D	Spread of HIV/AIDS by construction worker

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.  
D: No impact is expected.

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## (6) Stone Pavement Project to Improve Living Environment

Table AP1.2.6, Result of Environmental Scope

<u>Project Description</u>			
Location: All of city	Project Type: Stone pavement	Length: Total 101.4 km	
Road Structure: -	Remark: -		
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	D	Dust from construction works.
2. Water pollution	D	D	No impacts on water pollution.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste in construction phase.
5. Noise and vibration	D	C or D	Generation of noise and vibration from increased vehicle.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	D	D	No impacts on odors.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	D	D	Little impacts on biota and ecosystem.
11. Water usage	D	D	No impacts on water usage.
12. Accident	C	C	Increase of possibility of traffic accident by construction works and increased vehicles.
13. Global warming	D	D	Little impacts on global warming.
14. Involuntary resettlement	D	D	No impacts on resettlement.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	D	D	No impacts on land use.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	D	D	No impacts on infrastructures.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	B	Uneven distribution of improved road condition.
21. Local conflict of interests	D	D	No impacts on local conflict.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	D	D	No impacts on infectious disperses.

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.  
D: No impact is expected.

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## (7) Intersection Improvement

Table AP1.2.7, Result of Environmental Scope

<u>Project Description</u>			
Location: Ngagara, Buyenzi, Bwiza, Rohero			
Project Type: Intersections improvement and traffic restriction		Length : -	Road Structure: -
Remark: Consisting of 4 intersection off-set projects and signal phasing in one intersection			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	D	Pollution by exhaust gas and dust from construction machines and works.
2. Water pollution	D	D	No impacts on water pollution.
3. Soil pollution	D	D	No impacts on soil.
4. Waste	B	D	Generation of construction waste in construction phase.
5. Noise and vibration	B	D	Generation of noise and vibration from construction machines.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	D	D	No impacts on odors.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	D	D	No impacts on biota and ecosystem.
11. Water usage	D	D	No impacts on water usage.
12. Accident	C	B or C	Increase of possibility of traffic accident by construction works and improved traffic system.
13. Global warming	D	D	Little impacts on global warming.
14. Involuntary resettlement	D	D	No impacts on resettlement.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	D	D	No impacts on land use.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	No impacts on social institution.
18. Existing social infrastructures and services	D	D	No impacts on infrastructures.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	D	No impacts on misdistribution.
21. Local conflict of interests	D	D	No impacts on local conflict.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	D	D	No impacts on infectious disperses.

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.  
D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

## (8) Traffic Flow Control

Table AP1.2.8, Result of Environmental Scope

<u>Project Description</u>			
Location: Kinama, Cibitoke, Ngagara, Gihosha, Buyenzi, Bwiza, Rohero, Kinindo, Musaga			
Project Type: Signalization and traffic restriction Length: - Road Structure: -			
Remark: Consisting of signalization in 36 intersections and one-way traffic restrictions in city center			
Environmental Item 1)	Assessment		Remarks
	Constructio Phase	Operation Phase	
1. Air pollution	D	D	No impacts on air pollution.
2. Water pollution	D	D	No impacts on water pollution.
3. Soil pollution	D	D	No impacts on soil.
4. Waste	B	D	Generation of construction waste in construction phase.
5. Noise and vibration	D	D	No impacts on noise and vibration.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	D	D	No impacts on odors.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	B	D	Impacts on roadside trees.
11. Water usage	D	D	No impacts on water usage.
12. Accident	D	B or C	Increase of possibility of traffic accident by improved traffic system.
13. Global warming	D	D	No impacts on global warming.
14. Involuntary resettlement	D	D	No impacts on resettlement.
15. Local economy such as employment and livelihood etc.	D	D	No impacts on local economy.
16. Land use and utilization of local resources	D	D	No impacts on land use.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	No impacts on social institution.
18. Existing social infrastructures and services	D	D	No impacts on infrastructures.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	D	No impacts on misdistribution.
21. Local conflict of interests	D	D	No impacts on local conflict.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	D	D	No impacts on infectious disperses.

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.  
D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

## APPENDIX 1 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN PILOT PROJECT

## A-2-1 Public Transport Plan

## (1) Bus Network Improvement Plan

Table AP1.2.9, Result of Environmental Scope

<u>Project Description</u>			
Location: All of city			
Project Type: Improvement of exiting bus route			
Remark: Consisting of extension of bus network and strengthening of capacity in North-South Axis			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	-	D	Little impacts on air pollution.
2. Water pollution	-	D	No impacts on water pollution.
3. Soil pollution	-	D	No impacts on soil.
4. Waste	-	D	No impacts on waste.
5. Noise and vibration	-	D	Little impacts on noise and vibration.
6. Ground subsidence and soil erosion	-	D	No impacts on subsidence and erosion.
7. Offensive odors	-	D	No impacts on odors.
8. Geographical features	-	D	No impacts on geographical features.
9. Bottom sediment	-	D	No impacts on bottom sediment.
10. Biota and ecosystem	-	D	No impacts on biota and ecosystem.
11. Water usage	-	D	No impacts on water usage.
12. Accident	-	B or C	Increase of possibility of traffic accident by improved bus network system.
13. Global warming	-	D	Little impacts on global warming.
14. Involuntary resettlement	-	D	No impacts on resettlement.
15. Local economy such as employment and livelihood etc.	-	B or C	Decrease of opportunity for employment as private transporter.
16. Land use and utilization of local resources	-	D	No impacts on land use.
17. Social institutions such as social infrastructure and local decision-making institutions	-	D	No impacts on social institution.
18. Existing social infrastructures and services	-	D	No impacts on infrastructures.
19. The poor, indigenous of ethnic people	-	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	-	B	Uneven distribution of benefit and damage between OTORACO and private transporters.
21. Local conflict of interests	-	B	Conflict on bus route between OTORACO and private transporters.
22. Gender	-	D	No impacts on gender.
23. Children's rights	-	D	No impacts on children's rights.
24. Cultural heritage	-	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	-	D	No impacts on infectious disperses.

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.

D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

## (2) Bus Terminal development Plan

Table AP1.2.10, Result of Environmental Scope

Project Description			
Location: Kinama, Rohero, Kanyosha			
Project Type: Construction of bus terminal.			
Remark: Consisting of a bus centre construction and two bus terminal constructions.			
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	B	B or C	Pollution by exhaust gas from construction machines and increased bus near new bus terminals.
2. Water pollution	B	D	Pollution of river and lake water by turbid water and spilling oil in construction phase.
3. Soil pollution	D	D	Little impacts on soil.
4. Waste	B	D	Generation of construction waste, surplus soil and other waste in construction phase.
5. Noise and vibration	B	C or D	Generation of noise and vibration from construction machines and increased bus.
6. Ground subsidence and soil erosion	D	D	No impacts on subsidence and erosion.
7. Offensive odors	B	D	Generation of exhaust gas and bad smell substance from construction machines.
8. Geographical features	D	D	No impacts on geographical features.
9. Bottom sediment	D	D	No impacts on bottom sediment.
10. Biota and ecosystem	C or D	D	Impacts on trees in construction site.
11. Water usage	D	D	No impacts on water usage.
12. Accident	B	B or C	Increase of possibility of traffic accident near new bus terminals.
13. Global warming	D	D	Little impacts on global warming.
14. Involuntary resettlement	C or D	D	Little impacts on resettlement.
15. Local economy such as employment and livelihood etc.	B	D	Increase of opportunity for employment as construction worker.
16. Land use and utilization of local resources	A or B	D	Loss of sports stadium and own land for occupation of bus terminals.
17. Social institutions such as social infrastructure and local decision-making institutions	D	D	Little impacts on social institution.
18. Existing social infrastructures and services	B	D	Moving of existing water pipe, electric cable or telephone line in construction phase.
19. The poor, indigenous of ethnic people	D	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	D	B	Impacts of change of commercial zone.
21. Local conflict of interests	D	C	Conflict on future land use near new bus terminals during operation phase.
22. Gender	D	D	No impacts on gender.
23. Children's rights	D	D	No impacts on children's rights.
24. Cultural heritage	D	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	C	D	Spread of HIV/AIDS by construction worker

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.  
D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"

## APPENDIX 1 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN PILOT PROJECT

## (3) Other Public Transport Plan

Table AP1.2.11, Result of Environmental Scope

Project Description			
Location:		All of city	
Project Type:		Public transport management except for bus	
Remark:		Control and restriction of taxi, bike taxi and bicycle taxi	
Environmental Item 1)	Assessment		Remarks
	Construction Phase	Operation Phase	
1. Air pollution	-	D	Little impacts on air pollution.
2. Water pollution	-	D	No impacts on water pollution.
3. Soil pollution	-	D	No impacts on soil.
4. Waste	-	D	No impacts on waste.
5. Noise and vibration	-	D	Little impacts on noise and vibration.
6. Ground subsidence and soil erosion	-	D	No impacts on subsidence and erosion.
7. Offensive odors	-	D	No impacts on odors.
8. Geographical features	-	D	No impacts on geographical features.
9. Bottom sediment	-	D	No impacts on bottom sediment.
10. Biota and ecosystem	-	D	No impacts on biota and ecosystem.
11. Water usage	-	D	No impacts on water usage.
12. Accident	-	B or C	Increase of possibility of traffic accident by improved transport system.
13. Global warming	-	D	Little impacts on global warming.
14. Involuntary resettlement	-	D	No impacts on resettlement.
15. Local economy such as employment and livelihood etc.	-	A or B	Decrease of opportunity for employment as taxi transporters.
16. Land use and utilization of local resources	-	D	No impacts on land use.
17. Social institutions such as social infrastructure and local decision-making institutions	-	D	No impacts on social institution.
18. Existing social infrastructures and services	-	D	No impacts on infrastructures.
19. The poor, indigenous of ethnic people	-	D	No impacts on ethnic people.
20. Misdistribution of benefit and damage	-	B	Uneven distribution of benefit and damage between bus and taxi transporters.
21. Local conflict of interests	-	B	Conflict on route for passenger transport between bus and taxi transporters.
22. Gender	-	D	No impacts on gender.
23. Children's rights	-	D	No impacts on children's rights.
24. Cultural heritage	-	D	No impacts on cultural heritage.
25. Infectious diseases such as HIV/AIDS etc.	-	D	No impacts on infectious disperses.

Rating: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown.  
D: No impact is expected.

Reference: Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (April 2004) "Appendix 3. Screening Format, Check Items"



APPENDIX 2 VEHICLE LIST AND CONDITION

OTRACO Bus condition 2007 September

No.	Condition	Bus No.	Req.No.	Manuf.	Model	Chas. No.	Year	Capacity
1	Operation	B 04	98151	ISUZU	JCR500ZZ	3436594	1983	60
2	Operation	B 59	98214	ISUZU	JCR500ZZ	3474611	1983	60
3	Operation	A 08	98202	ISUZU	CHR-680	1435563	1984	100
4	Operation	A 12	98206	ISUZU	CHR-680	1435567	1984	100
5	Operation	A 14	98280	ISUZU	CHR-680	3000002	1989	100
6	Operation	A 15	98281	ISUZU	CHR-680	3000001	1989	100
7	Operation	B 46	98314	ISUZU	MT112LL	3000075	1989	60
8	Operation	B 52	98320	ISUZU	MT112LL	3000082	1989	60
9	Operation	C 38	98458	ISUZU	NPR66PY	7102308	1989	40
10	Operation	C 40	98460	ISUZU	NPR66PY	7102307	2000	40
11	Operation	C 41	98468	ISUZU	NPR66PY	7102285	2000	40
12	Operation	C 43	98472	ISUZU	NPR66PY	7100301	2000	40
13	Operation	C 45	98474	ISUZU	NPR67PY	7100303	2000	40
14	Operation	C 47	98476	ISUZU	NPR66PY	7100305	2000	40
15	Operation	C 48	98477	ISUZU	NPR66PY	7100306	2000	40
16	Operation	-	98489	ISUZU	MV-118	3000034	2002	100
17	Operation	C 50	98483	ISUZU	NPR66PY	7100589	2002	40
18	Operation	C 52	98485	ISUZU	NPR66PY	7100601	2002	40
19	Operation	C 53	98486	ISUZU	NPR66PY	7100602	2002	40
20	Operation	C 55	98488	ISUZU	NPR66PY	7100703	2002	40
21	Operation	-	98498	ISUZU	MV-123	13000125	2003	100
22	Operation	-	98499	ISUZU	MV-123	13000169	2003	100
23	Operation	-	98501	ISUZU	NPR66P3	7100397	2003	40
24	Operation	C 58	98502	ISUZU	NPR66P3	7100388	2003	40
25	Operation	C 57	98503	ISUZU	NPR66P3	7100399	2003	40
26	Operation	-	98505	ISUZU	NPR66P	7100401	2003	40
27	Operation	-	98506	ISUZU	NPR66P	7100402	2003	40
28	Operation	C 59	98507	ISUZU	NPR66P	7100403	2003	40
29	Operation	-	98561	ISUZU	MV-123	R47000164	2005	100
30	Operation	C 60	98528	ISUZU	NPR66P4	7101900	2005	40
31	Operation	C 61	98529	ISUZU	NPR66P4	7102045	2005	40
32	Operation	C 62	98530	ISUZU	NPR66P4	7102046	2005	40
33	Operation	C 63	98531	ISUZU	NPR66P4	7102085	2005	40
34	Operation	-	98532	ISUZU	NPR66P4	7102087	2005	40
35	Operation	-	98533	ISUZU	NPR66P4	7102150	2005	40
36	Operation	-	98534	ISUZU	NPR66P4	7102152	2005	40
37	Operation	-	98535	ISUZU	NPR66P4	7102154	2005	40
38	Operation	-	98568	ISUZU	NPR66P5	7102255	2006	40
39	Operation	-	98589	ISUZU	NPR66P5	7102257	2006	40
40	Operation	-	98590	ISUZU	NPR66P5	7102284	2006	40
41	Operation	-	98591	ISUZU	NPR66P5	7102274	2006	40
42	Operation	-	98592	ISUZU	NPR66P5	7102272	2006	40

No.	Condition	Bus No.	Req.No.	Manuf.	Model	Chas. No.	Year	Capacity
1	Scrapped	A 05	98189	ISUZU	CHR-680	1435563	1984	100
2	Scrapped	A 11	98205	ISUZU	CHR-680	1435568	1984	100
3	Scrapped	A 19	98285	ISUZU	CHR-680	3000006	1989	100
4	Scrapped	B 20	98288	ISUZU	MT112LL	3000050	1989	60
5	Scrapped	B 21	98289	ISUZU	MT112LL	3000051	1989	60
6	Scrapped	B 27	98295	ISUZU	MT112LL	3000057	1989	60
7	Scrapped	B 30	98298	ISUZU	MT112LL	3000060	1989	60
8	Scrapped	B 32	98300	ISUZU	MT112LL	3000062	1989	60
9	Scrapped	B 34	98302	ISUZU	MT112LL	3000076	1989	60
10	Scrapped	B 41	98309	ISUZU	MT112LL	3000070	1989	60
11	Scrapped	B 43	98311	ISUZU	MT112LL	3000072	1989	60
12	Scrapped	C 49	98482	ISUZU	NPR66PY	7100588	2002	40
13	Scrapped	C 54	98487	ISUZU	NPR66PY	7100307	2002	40
14	Scrapped	D 11	98337	ISUZU	BE22L	9200018	1989	25
15	Scrapped	B 28	98296	ISUZU	MT112LL	3000058	1989	60





## APPENDIX 3 CAPACITY ASSESSMENT QUESTIONNAIRE

### General information confirmation sheet for mechanics

#### General

1. Name and Surname:
2. Title:
3. Age:
4. The academic background:
5. Qualification (maintenance qualification etc.):
6. Experience of Vehicle (or equipment) maintenance (How many years?)

#### Technical questions

1. What is the duration of the periodical maintenance?
2. What measures do you take when overheating at site?
3. What are the causes of breakdown when there is white smoke coming out?
4. Write in few lines the causes of disappearance of power of vehicle.
5. What is the difference between the two-wheeled vehicle and four-wheeled vehicle.

**General information confirmation sheet for Management/Store keepers****General**

1. Name and Surname:
2. Title:
3. Age:
4. The Academic background:
5. Experience of Stock keeping (How many years?):

**On duty**

1. What is the inventory control?
  
2. What is important in the inventory control?
  
3. What (How to) delivery and stock management are you doing now?
  
4. How do you do when a record and an actual stock are different?
  
5. Do you know the difference of first moving parts and slow moving parts? If you know, what are these parts?

## **General information confirmation sheet for Management**

### **General**

- 1. Name and Surname:**
- 2. Title:**
- 3. Age:**
- 4. The Academic background:**
- 6. Experience of Workshop management (How many years?):**

### **Management**

- 1. What is important in the Materials/Equipment management?**
- 2. Current problem in equipment management (Technically)?**
- 3. What is the problem in the personnel arrangement?**
- 4. How to confirm a branch office bus condition?**
- 5. What are the points where there are a lot of occurrences of the breakdown and the cause?**

### General information confirmation sheet for Drivers

#### General

1. Name and Surname:
2. Title:
3. Age:
4. The Academic background:
5. Experience of Driving (How many years?):

#### Technical

1. Have you already driven a medium or large vehicle?
2. If yes, what kind of vehicle did you drive?
3. What are the causes of overheating and how do you do when it occurs?
4. How do you do when the traffic accident occurs?
5. Do you know the before and after driving check, if yes what kind of check do you do.

### General information confirmation sheet for Conductors

#### General

1. Name and Surname:
2. Title:
3. Age:
4. The Academic background:

#### Other

1. Do you think what relation exists between a driver and a conductor?
2. How much weight in kilograms is the regulated weight of the luggage room which is not supposed to be exceeded?
3. What is the passengers number are you authorized to take in your bus (two kinds)?
4. How do you do in case the passenger brought luggage when the luggage rack has reached the regulated weight (maximum weight)?
5. When the luggage room reaches a regulated amount (weight) at the same time, how do you do in case of you to whom a new passenger brought luggage?
6. How do you do when the traffic accident occurs?



APPENDIX 4 BREAKDOWN DETAIL & WORKING HOUR

Appendix 4 Breakdown Detail and Working Hour

Breakdown detail & Working hours		2004			2005			2006					
Type of Brake.	Year & Model	NPR	MT	CHR	MV	Total	(%)	NPR	MT	CHR	MV	Total	(%)
1 Engine	Work. Hour/ea NPR . MT : 32, CHR . MV : 56	32	64	112	0	208	12.9	96	0	56	0	152	7.7
2 Transmission	16	0	16	0	0	16	1.0	16	32	0	0	48	2.4
3 Differential	8	24	0	0	0	24	1.5	40	8	0	0	48	2.4
4 Brake	NPR . MT : 6,CHR . MV : 7	288	18	35	21	362	22.4	438	18	14	49	519	26.5
5 Clutch	NPR . MT : 6, CHR . MV : 10	24	6	10	0	40	2.5	24	0	10	0	34	1.7
6 Shock absorber FRT	2	0	4	0	0	4	0.2	6	2	0	0	8	0.4
7 Shock absorber RR	2	0	2	0	0	2	0.1	6	4	0	0	10	0.5
8 Spring	NPR . MT:4, CHR . MV : 8	40	8	48	8	104	6.4	60	24	32	40	156	8.0
Sub Total		408	118	205	29	760	47.1	686	88	112	89	975	49.7
9 Periodical Service	2	196	24	32	20	272	16.9	202	20	22	32	276	14.1
10 Electrical	NPR . MT:3, CHR . MV : 4	153	33	52	20	258	16.0	171	45	32	60	308	15.7
11 Tire	1	70	6	3	3	82	5.1	100	8	2	15	125	6.4
12 Body	NPR : 6,MT . CHR . MV : 4	186	36	20	0	242	15.0	222	32	24	0	278	14.2
Ratio (%)		1,013	217	312	72	1,614	100.0	1,381	193	192	196	1,962	100.0
		62.8	13.4	19.3	4.5	100.0		70.4	9.8	9.8	10.0	100.0	
		2004	2005	2006									
	Total working hours	1,614	1,962	2,118									
	Increasing rate(%)	100	121.561	131.227									





## APPENDIX 5 TOOLS AND EQUIPMENT LIST

### Tools and Equipment list

No.	TOOL NAME	Q'ty	No.	TOOL NAME	Q'ty
1	Mechanic Tool set	3	34	Transmission jack	0
2	Adjustable wrench	7	35	Transmission bearing puller	0
3	Adjustable pipe wrench	1	36	Tube flaring and cutting tool	0
4	Adjustable reamer	0	37	Universal puller set	0
5	Air hydraulic garage juck	0	38	U-bolt nut wrench	0
6	Chisel Punch set	2	39	Valve lifter	0
7	Cutting grinder	1	40	Valve rubber cap	0
8	Diesel compression gauge	1	41	Valve compound	0
9	Dial indicator set	0	42	V-block	0
10	Diff jack	0	43	Wood mallet	0
11	Drilling machine	1	44	Vernier caliper	1
12	Ball peen hammer	5	45	Vertical lift	0
13	Bearing puller	6	46	Vice grip plier	0
14	Bearing grease packer	0	47	Vice	2
15	Blind bearing puller	0	48	Socket wrench set	0
16	Anchor pin puller	0	49	Straight shank twist drill	0
17	Bolt clipper	0	50	Stud remover	0
18	Drain plug wrench	0	51	Test hammer	4
19	Drain plug wrench set	0	52	Thread restorer	0
20	Drum pump	0	53	Thickness gauge	0
21	Drum carrier	3	54	Radiator cap tester	0
22	Double Sledge Hammer	0	55	Rigid Rack	10
23	Double offset box wrench set	0	56	Screw plate	0
24	Double-face Sledge hammer	0	57	Screw extractor	0
25	Engine brush	0	58	Screw pitch gauge	0
26	Files set	1	59	Scraper blade	1
27	Funnel	3	60	Service creeper	0
28	Garage lamp	0	61	Square	0
29	Gasket cutting punch set	0	62	Solder	0
30	Hand valve lapper	0	63	Straight edge	0
31	Hexagon socket set	0	64	Snapping plier	0
32	High Power Wrench	0	65	Piston filler gauge	0

## APPENDIX 5 TOOLS AND EQUIPMENT LIST

No.	TOOL NAME	Q'ty	No.	TOOL NAME	Q'ty
66	Piston ring tool	0	102	Pilot bearing puller	0
67	Wheel puller	1	103	Pitman arm puller	0
68	Wheel bearing puller	1	104	Plasti-gauge	0
69	Work Bench	5	105	Plastic hammer	2
70	Wire brushes	0	106	Portable electric grinder	1
71	Wire stripper	0	107	Portable hydraulic juck	10
72	Toe-in Gauge	2	108	Polyetylen can	0
73	Tie-rod end remover	0	109	Oil drain	0
74	Tie-rod end lifter	0	110	Oil bucket pump	0
75	Turningradius Gauge	0	111	Oil sylinge	0
76	Torque wrench	0	112	Oil measure	1
77	TORX socket wrench set	0	113	Oil filter wrench	1
78	Tool tray	0	114	Oiler	0
79	Tool and parts rack	0	115	Booster cable	0
80	Oil pressure gauge	0	116	Brake cylinder hone set	0
81	Oil stone	0	117	Brake booster tester	0
82	Oil seal puller	0	118	Brake spring plier	0
83	Outside micrometer set	1	119	Brake lining rivetter kit	0
84	Parts washing stand	0	120	Brake drum gauge	0
85	Piston ring compressor	0	121	Body puller set	0
86	Electric bench grinder	0	122	Body fender tool set	0
87	Electric drill	1	123	Porto power set	0
88	Electric disk sander	0	124	Gas cutting tool-regulator set	0
89	Electric shear	0	125	Hydraulic press	0
90	Grease gun	0	126	Cast iron anvil	0
91	Hack saw	1	127	Cast iron swage block	0
92	Hack saw blade	3	128	C-Clamp	0
93	Hand rivetter tool kit	0	129	Tire Inflator	0
94	Hand truck	0	130	Tire Pressure gauge	0
95	High pressoure grease pump	0	131	Tire Lever	2
96	High pressure car washer	0	132	Tire Service Tool Set	0
97	Hydraulic Garage Juck	0	133	Tire Spreder	1
98	Impact driver set	0	134	Tubeless tyre canger	0
99	Integral hand screw driver	0	135	Wheel Dolly	0
100	Iron bench level	1	136	Lubricator	0
101	Magnetic base	0	137	Magnetic finger	0

## APPENDIX 5 TOOLS AND EQUIPMENT LIST

No.	TOOL NAME	Q'ty	No.	TOOL NAME	Q'ty
138	Metal cutting snips	0	166	Milling machine	1
139	Needle file set	1	167	Lathe machine	1
140	Air blow gun	0			
141	Air compressor	0			
142	Air compressor oil	0			
144	Air Chuck	0			
145	Air Chuck Gauge	0			
146	Air rivetter	0			
147	Air rotary cutter	0			
148	Air Hose	0			
149	Air Hose band	0			
150	Air hose joint	0			
151	Air valve lapper	0			
152	Quick hose connecter	0			
153	Arc welder	0			
154	Battery charger	1			
155	Battery quick charger	1			
156	Battery tester	0			
157	Battery starter	0			
158	Battery-syringe	0			
159	Battery filler	0			
160	Battery hydrometer set	0			
161	Circuit tester	0			
162	Electric soldering iron	0			
163	Insulation tester	0			
164	Solderless terminal kit	0			
165	<b>If any</b>				







**How to Overhaul Brake system**

1. Use the rigid rack and wheel stopper
2. Remove the axle shaft and Rear hub
3. Cleaning method of Drum and Brake
4. Change the Bearing grease
5. Change the Hub seal
6. Change the Brake lining
7. Check the trouble of Brake system
8. Check the Vacuum booster
9. Change the wheel cylinder cup
10. Fix the shoe adjuster lock
11. Lubricate the Brake adjuster and Back plate
12. Install the Brake shoe
13. How to adjust the Bearing
14. How to bleed the Brake oil
15. How to adjust the Brake
16. Install the Axle shaft



- Rigid rack supporting point
- We cannot trust the support of rigid rack 100%.
- Rigid rack + Jack

**1. Using the rigid rack and wheel stopper**

- 1) Reason of using rigid rack and wheel stopper
  - Support the bus for safety.

2) What's difference?

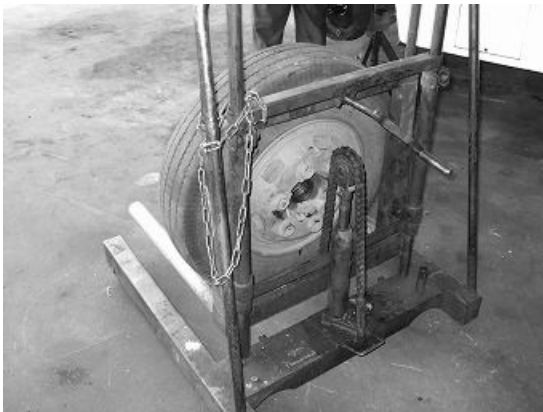


**2. Remove the axle shaft and Rear hub**

- 1) Hitting point of axle shaft
  - How to use 'Double hammer'
  - The role of corn and spring washer
  - Keep the bearing



- 2) How to use wheel hub remover
  - Attention for damaging the hub seal



3) How to keep wheel hub bearing and short parts



**3. Cleaning method of Brake drum and brake**

- Inside of the Brake drum
- Brake lining
- Back plate



**NOTICE!**

Dust of the Brake lining is harmful to the human body



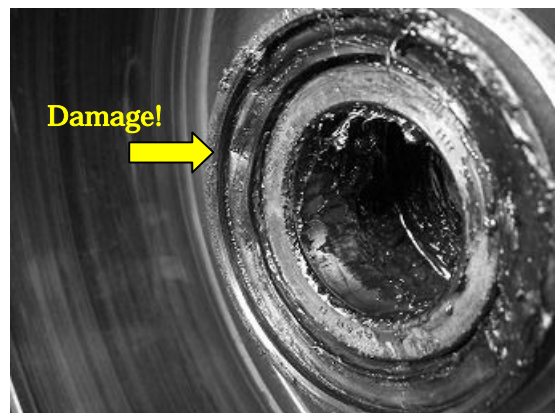
**4. Change the Bearing grease**

- How to change the Bearing grease.
- Arrangement / Safekeeping small parts



**5. Change the Hub seal**

- Replace carefully



- Lubricant of Oil seal.





**7. Check the Trouble of Brake system**

1) Inspector found the leaking of oil from Inside of Brake drum.

You must confirm the following matters carefully.

Brake oil

- Wheel cylinder cup

Grease

- Hub seal

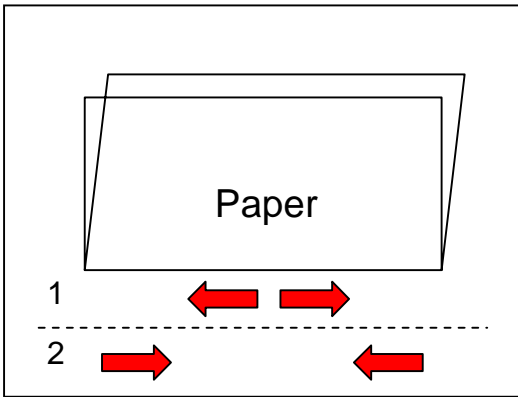
Diff oil + Grease

- Axle shaft seal



**6. Change the Brake lining**

1) How do you break paper properly? 1 or 2 ?



From inside to Outside to avoid the cockle.

2) Brake dragging



**NOTICE!**

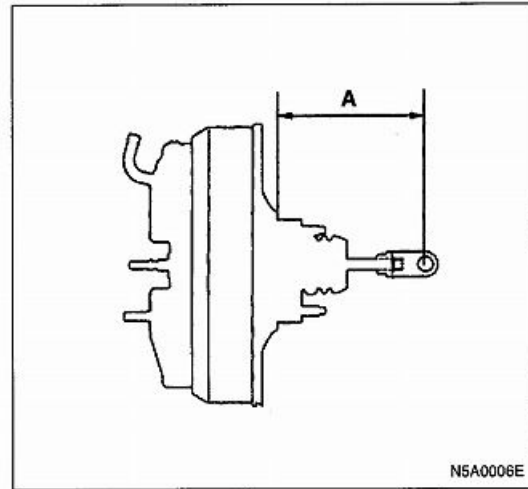
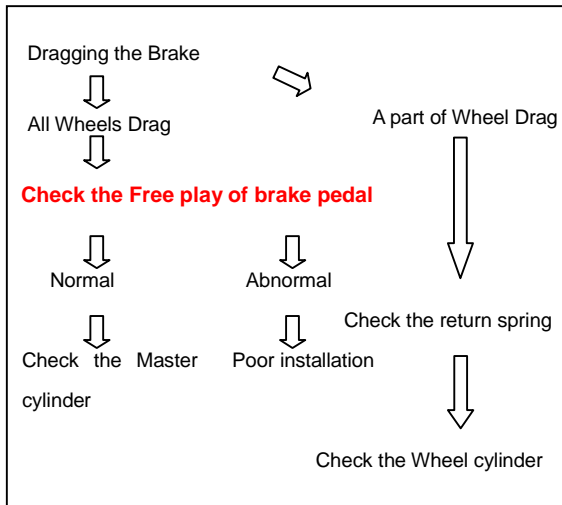
**First Check the Brake Switch!**

**Check the Free play of brake pedal! 4 - 7mm**

2) How do you rivet lining properly?



Flow chart of brake digging trouble shoots



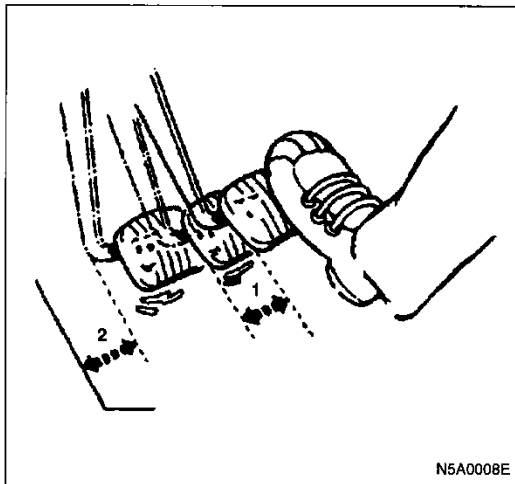
C

Check the push rod length

A=129mm (with apacer)

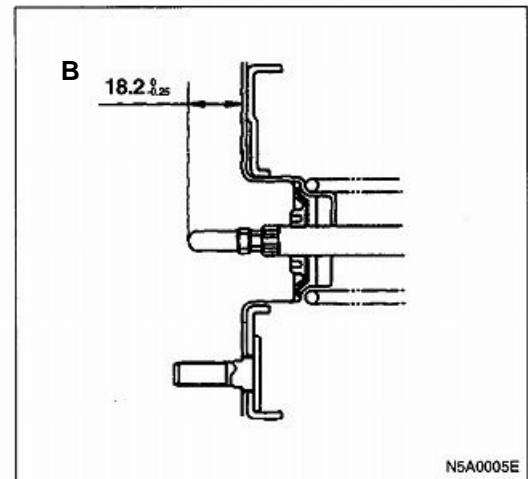
A=109mm (without spacer)

**8. Check the Vacuum booster**



N5A0008E

- 1) How to check the vacuum booster (on the car)
  1. Start with engine and stop the engine one or two minutes later.
  2. Step on several times brake pedals and check a change of the pedal height.
  3. If the vacuum booster is normal, the second, the third times stepped pedal height is higher than I stepped to the first.
  4. Engine shutdown. Pedal it several times till do not pedal height change.
  5. Start engine with having stepped a brake pedal.
  6. If a device operates normally, the pedal is slightly in the depths.
- 2) Check the vacuum booster (Unit)

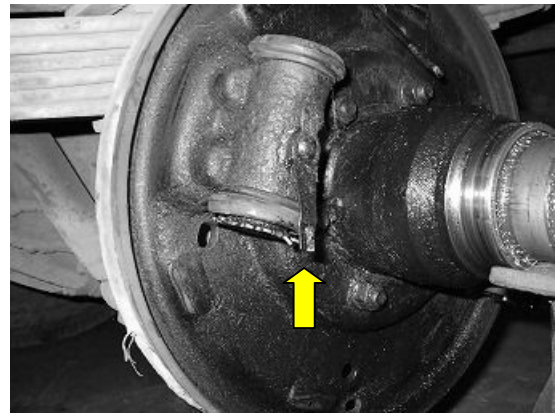
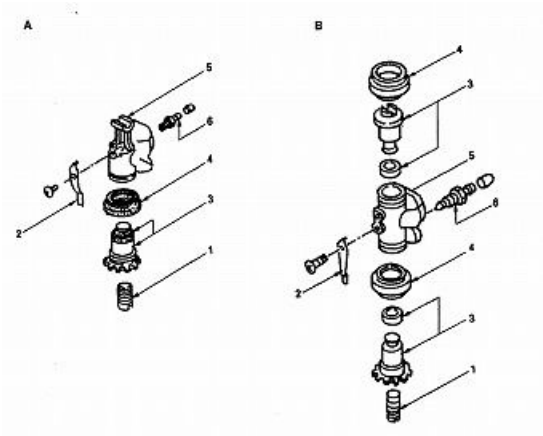


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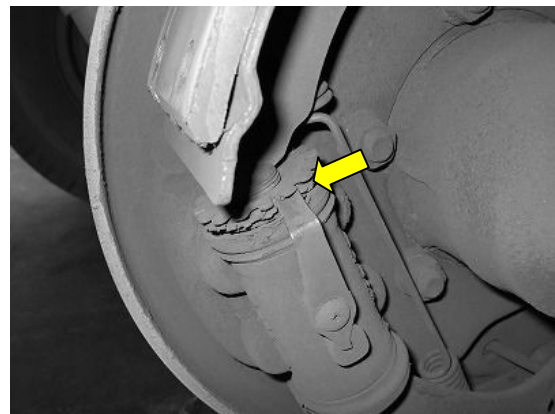
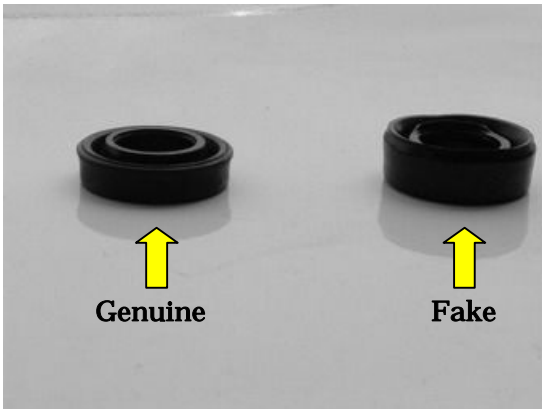
B=18.2mm

**9. Check the Wheel cylinder cup**

- 1) Direction of wheel cylinder cup



2) Check the genuine parts or not.

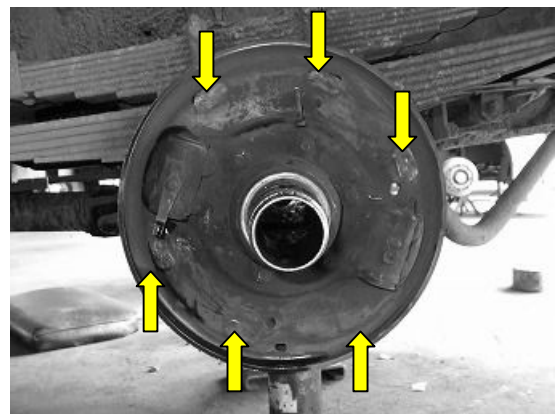


Make sure the lock plate fit the brake adjusting gear.

3) How to clean the inside of cylinder



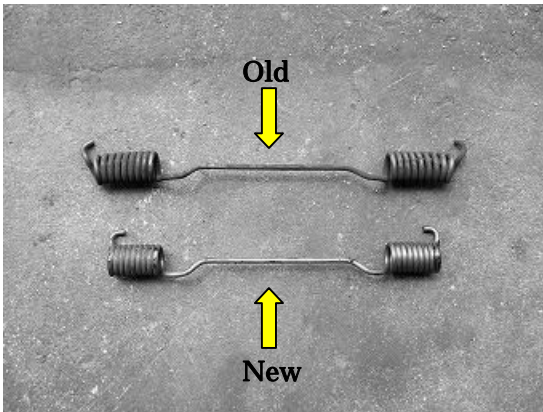
11. Lubricate the Brake adjuster and Back plate



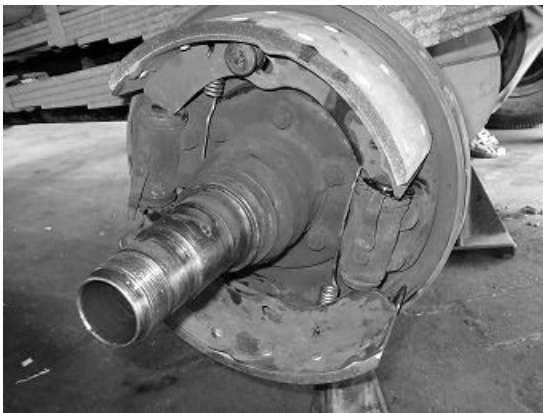
10. Fix the Shoe adjuster lock plate

12. Install the Brake shoe

1) The reason of damaging the return spring

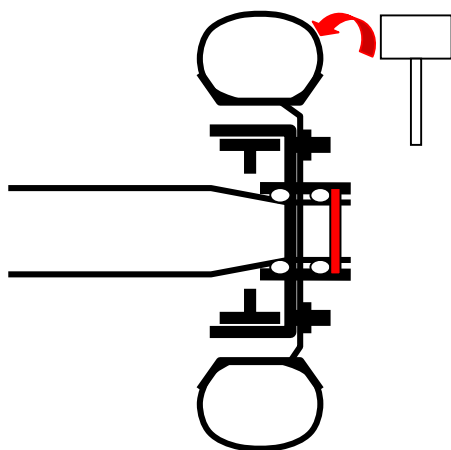


2) How to install the brake shoe



In stall brake shoe one by one. If you install both sides in same time, return spring stretches easily over the limit.

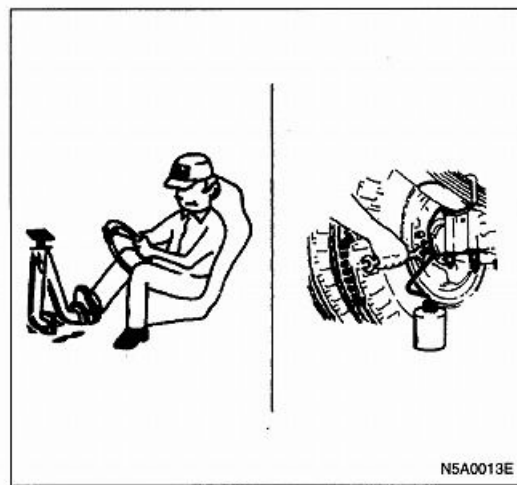
**13. How to adjust the hub bearing (Preload)**



1. Tighten the Adjust nut.

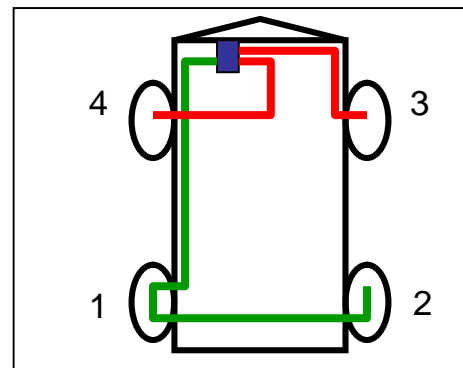
2. Turn a tire and worked bearing, then beat several times tire with a hammer.
3. Confirm that a tire does not have a play
4. loosen a Adjust nut 1 round for unclockwise
5. Beat several times tire again with a hammer and confirm the Free play of the tire.
6. Tighten the Adjust nut slowly till there is not the free play.
7. Install a lock washer.

**14. How to bleed the Brake oil**



1. Air in the brake hydraulic circuit will result in dangerous reduced braking efficiency.
2. Bleed the brake circuit In the following sequence.
3. Engine stop

Brake oil bleeding circuit



1. Left hand rear wheel
2. Right hand rear wheel
3. Right hand front wheel

4. Left hand front wheel

5.

\* If no bleeding nipple at left hand rear wheel, start the right hand rear wheel.

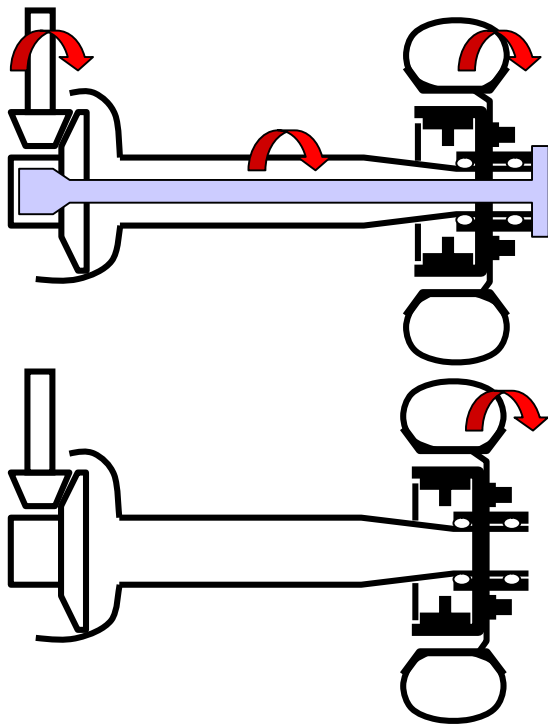
**15. How to adjust the Brake**

1) Without axle shaft



Before installing rear axle shaft you should adjust rear brake.

2) The reason



Axle shaft makes load of differential, propeller shaft, and another side of wheel. Therefore it is difficult to adjust gap of brake lining and brake drum.

**16. Install the Axle shaft**

Do not forget installing shaft cone, spring wash and nut. Without these small parts, it has damage the axle shaft stud bolts.

