8. ENVIROMENTAL STUDY

8.1. INTRODUCTION

8.1.1. OBJECTIVES

The objectives of this environmental study are to carry out relevant environmental studies for the proposed busway project, and support appropriate ToR development of the EIA study required for the official environmental license application process based on both Peruvian EIA Law and JICA guidelines for environmental and social considerations (hereinafter referred to as JICA Guidelines.

Another key objective of this environmental study is also to identify potential environmental concerns at a sufficiently early stage within the project development cycle, so that appropriate mitigation measures can be incorporated into the scheme selection, planning and design to ensure that it is environmentally sound, abiding by both Peruvian environmental laws/or regulations and JICA Guidelines. This allows the designers to address environmental issues in a cost effective fashion after all possible scheme and design alternatives are considered.

Three stakeholder meetings, based on JICA Guidelines are to be held throughout this Feasibility Study in order to enhance the public involvement and establish common understanding of this proposed project among various stakeholders. The entire framework of this series of stakeholder meetings and summaries of minutes of meeting of each stakeholder meeting are described in Chapter 8.12 in this section.

8.1.2. OUTLINE

This report summarizes the results of the environmental study which assesses the potential impacts associated with the proposed metropolitan transport project.

Section 8.2 describes brief summaries of current baseline environmental conditions across the study area. Site specific environmental information related with the two busway routes of (i) Av. Venezuela (L = 9.23 km) and (ii) Av. Carretera Central (L = 9.03 km), chosen within the proposed Lima and Callao Metropolitan Transport Project, is summarized. In Section 8.3, results of the screening and the scoping of the proposed project, based on JICA Guideline, are summarized. Section 8.4 summarizes the result of Environmental Impact Assessment. In the section 8.5, the results of the environmental field survey are shown. Section 8.6 describes the expropriation estimation study on the part of Av. Venezuela. 8.7 describe the mitigation of the negative impact. 8.8 explain the environmental impact prediction study. Section 8.9 explains environmental management for the implementation of EMP. Section 8.10 introduces the Environmental Monitoring. Recommendations are shown in section 8.11 and section 8.12 explains the stakeholder meeting held during the F/S.

8.1.3. ENGINEERING OPTIONS

Typical cross sections to be implemented for the proposed busway projects are summarized in Table 8.1-1. The exact configuration of road sections within this proposed busway project is to be figured out, depending on the RoW of each section between Av. Venezuela, Av.Arica, Av. Nicoras Ayllón, and Carretera Central.

Bus terminals are to be constructed at the end of each East-West trunk busway, i.e., Santa Anita in Lima and near the Ovalo Saloom in Callao, respectively. The project routes are to be connected to the Central Bus Station of COSAC project. More detailed descriptions of the East-West trunk busway proposed project are summarized in the chapter 7 in this report and the drawings of the preliminary engineering are presented in Appendix ”Drawings”.

Table 8.1-1 Typical Cross Sections of proposed Busway Project

	Section	RoW	Total Number of Lanes
1	Exclusive Trunk Bus Way (Type-A)	RoW > 52.0 m	(2 + 2 + 1) x 2 = 10-lane
2	Exclusive Trunk Bus Way (Type-B)	52.0 > RoW > 42.0	(3 + 1) x 2 = 8-lane
3	Exclusive Trunk Bus Way (Type-C)	42.0 > RoW > 36.0	(2 + 1) x 2 = 6-lane
4	Exclusive Trunk Bus Lane (Type-D)	36.0 > RoW > 32.0	(2 + 1) x 2 = 6-lane
5	Priority Trunk Bus Lane (Type-E)	32.0 > RoW > 25.0	(2 + 1) x 2 = 6-lane

8.2. BRIEF SUMMARY OF BASELINE ENVIRONMENT

8.2.1. BIO-PHYSICAL ENVIRONMENT

(1) Topography and Geology

Lima is located in the coastal desert plain and its climate is highly arid throughout the year. The surrounding high mountainous area rises rapidly from the coastline within a relatively short distance. Both project routes are located between Santa Anita and Callao Municipalities, and run through the central part of Lima-Callao Metropolitan Area, almost in parallel with the Rimac River. It is reported that several active fault lines exist around the Lima-Callao Metropolitan area and some epicenters of past severe earthquakes are located around those fault lines. So, it can be said that most of the study area is prone to earthquake events, and the possibility of the occurrence of a severe future earthquake is not small.

Some sites around the Callao Port were severely contaminated with lead. This is mainly due to past shipping of lead by the railroad, and no environmental remedial measures have been implemented yet. This railroad line is located far away from both project routes (i.e., 1 - 2 km away from the project route), so it can be said that the possibility of existence of any lead-contaminated sites around the project route is very small.

(2) Flora/fauna

In general, no rare flora/fauna exist around Lima-Callao Metropolitan Area except one environmental reserve, Villa wetland area, located around Chorillos, in the southern part of Lima. This wetland is one of the final destinations of the confined groundwater flow recharged at the highland area of the Andes Mountain Range, and several springs exist around this reserve. This environmental reserve is located far away from both project routes. So it can be said that negative biological impacts to be caused by the proposed project on both entire roadside biological environment and the environmental reserve, mentioned above, are negligible.

(3) Hydrology

As mentioned earlier, the study area is an extremely dry region along the Pacific coast, and only two tributaries, the Rimac and the Chillon Rivers, run through Lima-Callao Metropolitan Area. Flow rates of those two rivers are not so abundant. In every rainy season, relatively heavy rainfall occurs in the Andes highland area, and the run-off water collected within the upstream basins of each river sometime causes severe flood events at the downstream sites with poor river bank systems.

No tributary and/or channel exist around either of the project routes, and the nearest one is the Rimac River, located about 1-2 km away from the two project routes. Groundwater level around the project route is deep, and sometime more than 70 meters below the ground surface. So, it can be said that negative hydrological impacts to be caused by the proposed project are negligible.

(4) Air Quality

Air quality of Lima and Callao Metropolitan Area is not good. Most prevalent wind directions are SE, S and SW (i.e., the wind blows from the sea toward the land), so the regional air quality around the coastline is relatively good, but the same cannot be said of the mountainous area such as Independencia and San Juan de Lurigancho, where most portions of emitted pollutants tend to be trapped due to the thermal inversion phenomenon.

Within the Master Plan Study of this proposed project [JICA, 2005], a preliminary roadside air quality survey was carried out, and it was found that there is a strong

correlation between the current traffic condition and the spatial variation of PM-10 concentration.

In Peru, a comprehensive vehicle inspection and maintenance program has not yet been established, and most of the vehicles circulating across the metropolitan area are imported, used vehicles. In general, the exhaust systems of those vehicles are not well-maintained, so, as mentioned earlier, the amounts of pollutants emitted from those poorly maintained vehicles are abundant and worsen the current roadside air quality environment. Moreover, the clean fuel policy that bans the use of leaded gasoline has not been fully implemented, and that also contributes, to some extent, to the city-wide air quality deterioration problem.

(5) Noise and Vibration

Within the Master Plan Study of this proposed project [JICA, 2005], a preliminary roadside noise survey was carried out, and it was found that most of Leq values measured at all roadside points exceed current Peruvian noise standards. So it can be said that the current daytime roadside environment is noisy and might cause some disruptions in human health such as hearing changes, losses, interference with speech communication and/or annoyance. Many parks, schools, churches and hospitals that require a calm environment exist within 500 meters of both sides of most of the urban expressway project routes. It is also reported that damage to some historical facilities due to the nearby roadside vibration was reported around the Historic City Center Zone.

8.2.2. SOCIO-CULTURAL ENVIRONMENT

(1) Land Use and Population

Central Lima has a total population of approximately two million in 2004. Basically, the population growth across Central Lima is low, stagnant or decreasing. Most major business and commercial activities are densely located along the Paseo de la República between Cercado de Lima and Miraflores [JICA, 2005].

In East Lima, through which the proposed Carretera Central busway route would run, unprecedented population growth occurred during the 1970s and 1980s. This area is categorized as a mixture of residential and industrial areas, and most residents live in marginal settlements [JICA, 2005].

Callao is regarded as the most important transport hub in the country. Recent population growth of this area, except for Ventanilla, seems to be stable. Most residents are categorized as low and/or middle income classes [JICA, 2005].

(2) Traffic Accidents

Within the Master Plan Study of this proposed project [JICA, 2005], the traffic safety study was carried out, and it was found that the total number of both nation-wide traffic accidents and fatalities due to traffic accidents tends to decrease gradually after 1998. Similarly, the number of fatalities per 1,000 registered vehicles has decreased by about 57 % to 0.8 within the Lima metropolitan area. However, compared with other countries, it can be said that this value is comparatively high.

The detailed traffic accident study is conducted in the Study as the component II (Traffic Management Plan). The results of the traffic accident study are presented in chapter 11 of this report.

(3) Infectious Diseases

Outbreak of insect-borne diseases such as Malaria and Dengue are rampant in the tropical Amazon Region of Peru, but not in Lima-Callao Metropolitan Area Recently, the spreading of Cholera (believed to be transmitted from the bilge water of a Chinese freighter in 1991) became one of the major public health-related issues in Lima-Callao

Metropolitan Area. As discussed earlier, most of the areas adjacent to the Rimac River, in particular, lowland areas around Callao, are inundated for about one month during El-Nino, and, sometimes, the outbreak of water borne disease is reported. Both project routes are located far away from the Rimac River, and no large-scale inundation events occurred around the project route in the past. So, it can be said that the negative health impact to be caused by the proposed project is negligible.

(4) Cultural/historical and archaeological sites

As discussed in Masterplan study of this project, some areas around downtown Lima are conserved as Lima Historic Center Zone by Lima Municipality and UNESCO World Heritage Zone [JICA, 2005]. Neither of the project routes will run through this Historic Central Zone, but originate from some points of the perimeter of those areas.

Several minor pre-Inca ruins exist across the whole of Lima, and some of them are located within 500 meters of both sides of the road from the centerline of both Av. Venezuela and Carretera Central.

(5) Roadside Health

Some people such as transit police officers and various street vendors work at the roadside of major roads for relatively long hours everyday. In other words, they are directly exposed to the vehicular emission throughout their daily work longer than people of other occupations, such as office workers. So, the risk of their health deterioration caused by inhaling the pollutants originated from the vehicular emissions seems to be high compared with other people.

In the past, roadside health surveys were carried out in several major cities in Peru. A roadside health survey, carried out in Arequipa [IADB, 2002], found that most of the respondents started their businesses and/or careers (i.e., street vendors) less than one year prior to the survey and had several health problems such as sore throat, congestion and itching eyes. The health damage of street vendor seems to be much more serious than that of transit police officers.

8.3. ENVIRONMENTAL SCOPING AND SCREENING

8.3.1. INTRODUCTION

Preliminary environmental site inspection was carried out during both May and June of 2006. Based on major findings obtained from this preliminary environmental field inspection, literature reviews, and the outline of the proposed engineering option described earlier, the initial environmental examination of each route is carried out separately, and potential environmental issues associated with the rehabilitation works to be carried out at each route are summarized. Basically, the examination is carried out for the following two scenarios: i.e., (i) Do-Nothing scenario, and (ii) Do-scenario. Under Do-scenario, possible negative environmental impacts to be caused during and/after busway construction work are identified, and those orders of the magnitude are evaluated qualitatively.

8.3.2. INITIAL ENVIRONMENTAL EXAMINATION

(1) Av. Venezuela and Av. Arica

Project route of the trunk busway on Av. Venezuela is located between Plaza Bolognesi, Lima Centro, and Ovalo Saloon, in Callao City, via Av. Arica. Av. Venezuela is one of the major inter-city roads connecting both Lima Centro and Callao City, and runs through mixed residential /commercial and industrial areas. Several schools and hospitals that require calm environment are located in these areas. The closer to Lima Centro, the more conspicuous activities of numerous street vendors tend to be along this road.

Several ruins exist within 500 meters of both sides of the road, and, in particular, Maranga Ruins Complex (i.e., Aramburu Pyramid, Mateo Salado and Huaca Palomino, see Figure 8.3-1 and Figure 8.3-2) exits contiguous to this road. It is believed that Av. Venezuela was initially constructed without knowing the archeological importance of this ruin. As a result, current Av. Venezuela runs directly through this ruin complex, and, consequently, the original, unified ruin complex was divided into two conserved areas [Flores, 2006]. Due to this odd situation of the Maranga Ruin Complex, the current road width of Av. Venezuela around San Martin University is restricted to a width of around 20 meters (i.e., bottlenecked due to the existence of those two ruins). Besides, several small-scale garages and a kiosk exist within the current bottlenecked RoW around this ruin complex.

Several portions of the public road space (i.e., RoW) are occupied by illegal invasions of private properties such as factories. So, the continuity of entire vehicle lanes of this Av. Venezuela is not in good condition (see Figure 8.3-3 and Figure 8.3-4). Several barracks of illegal squatters exist around Maranga Ruins Complex, and obnoxious roadside smells (e.g., the mixture of vehicular exhaust gas and household compost smell) can be sensed at several places, with high walls and/or large building on both sides along this road. No ethnic minority and/or tribe of indigenous people exist around Av. Venezuela. No important visual resources, such as major scenic places and/or townscape, exist.

No major tributaries exist and/or intersect with Av. Venezuela. No rare flora/fauna occur along this project route although sparse roadside vegetation exists in several places along the Av. Venezuela. Basically, the cutting/pruning/or relocation of those trees and/or flower beds without official permission are prohibited, and the compensation of those trees will be prepared in accordance with consultation with relevant agencies, such as environmental police and/or environmental section of municipal governments. Table 8.3-1 summarize the environmental evaluation of Av. Venezuela Busway Project.

Table 8.3-1 Initial Environmental Examination (Av. Venezuela)

Environmental Factor	Descriptions of Impact	Do nothing	Do project
1. Air quality	Increased roadside air pollution.	B	C
2. Water Quality	Risk of pollution to major tributaries.	D	D
3. Soil and sedimentation	Potential for soil erosion.	D	D
	Occurrence of new sedimentation at downstream site.	D	D
4. Waste Disposal	Generation of large amounts of construction waste.	D	C
5. Noise/Vibration	Increased roadside noise and vibration	B	C
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork	D	D
7. Bad smell	Existence of obnoxious roadside smell	C	D
	Potential of creation of new bad smell.	C	D
8. Topography and Geology	Cutting of hill or mountainside/ use of embankment.	D	D
9. River bed	Disturbance to river bed condition.	D	D
10. Fauna/flora	Destruction/or relocation of roadside vegetation.	D	C
	Disturbance to roadside habitats.	D	D
11. Water Resources	Disturbance to regional groundwater flow.	D	D
12. Accidents	Potential of increased traffic accidents after construction.	B	C
	Potential of worsened traffic conditions during construction.	D	C
	Risk of increased traffic accident due to the discontinuity of vehicle lanes.	B	D
13. Global warming	Increased CO_2 emission.	B	D
14. Involuntary Resettlement	Land expropriation due to construction yard	D	D
	Demolition of roadside houses.	D	D
	Demolition of illegal squatters' lots.	D	D
	Demolition of illegal commercial and/or industrial facilities.	D	B
15. Local Economy	Possible impact on local employment and livelihood	D	D
	Possible impact on roadside street vendors	D	D
	Possible impact on moto-taxi	D	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan	D	D
	Conflict with local development plans	D	D
17. Social Institutions	Possible Impact on social infrastructure and local decision-making institutions	D	D
18. Existing social infrastructures and services	Conflict with current local transport system	B	D
	Conflict with current local energy/communication/ water supply system.	D	D
19. The poor, indigenous or ethnic group	Existence of ethnic minority around the site.	D	D
20. Misdistribution of benefit and damage	Risk of possible damages/or negative impacts concentration/or localization.	D	D
21. Local Conflicts of interest	Conflicts between regional environmental conservation and development.	D	D
22. Gender	Risk of WID-related issues	C	C
23. Children's right	Risk of illegal child labors (e.g., street vender).	C	C
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.	D	D
	Visual conflict with surrounding community.	D	D
	Loss of visual continuity of townscape.	D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases.	D	D
	Risk of HIV/AIDS	D	D

Note A: significant, B: major, C: minor, D: less significant, E: Unknown.

Figure 8.3-1 Maranga Ruins Complex (part 1): San-Marcos University Side

Note that the ruin complex on this side is well-protected and no invasion has occurred.

Figure 8.3-2 Maranga Ruins Complex (part 2)

Note that this site used to be parts of one continuous ruin complex. Currently, several illegal squatters' houses are built within this complex. Besides, several small-scale garages and kiosks exist within the current bottlenecked RoW around this ruin complex.

Figure 8.3-3 Vehicle lane discontinuity due to the illegal settlement of factory (Av. Venezuela)

Note that this site is located 1 block away from the crossroad of Av Venezuela and Av Haya de la Torre, Callao City. Some portions of COGORNO S.A. invaded RoW of Av. Venezuela.

Figure 8.3-4 Vehicle lane discontinuity due to the illegal settlement of factory (Av. Venezuela)

Note that this site is located at the crossroad of Av Venezuela and Av Insurgentes, Callao City. Some portions of ALMACENES MUNDO S.A. invaded Row of Av. Venezuela.

(2) Av. Ayllón and Carretera Central

The project route of East-West trunk busway on the Av. Ayllón and Carretera Central is located between Av. Grau and 22 de Julio via Av. Nicolas Ayllón. Carretera Central is one of the major national roads connecting both Lima Centro and Chillon City, approximately 40 km away from Lima Centro, and runs through mixed residential/commercial and industrial areas. Currently, road improvement works are under way between Avenidas Grau and Riva Aguero and severe traffic congestion of the surrounding feeder roads occur due to the diversion caused by these construction activities (as of August 2006).

In general, the roadside environment of Carretera Central is dusty and disorganized. The road environment between Ate and Evitamiento seems to be more organized than other parts of this road (i.e., the road section between Av. Grau and Evitamiento). This is due to the fact that the urban development around Santa Anita was carried out recently, which is not the case of the communities around the remaining portion of Carretera Central, in particular, areas close to Av. Grau. Many factories exist along Carretera Central around Santa Anita, and large cargo trucks or convoys circulate frequently.

Three small mountains, such as Cerro El Pino (E.L. 289 m), Cerro El Agustino (E.L. 482 m) and Cerro San Cosme (E.L. 195 m) exist along this road and most of the mountainsides are completely exploited in a disorderly fashion and are crowded with housing of low-income class people (see Figure 8.3-5).

The current RoW of the Carretera Central is wide enough (i.e., 3 vehicle lanes x 2) and no major illegal settlement and/or invasion, similar to those found along Av. Venezuela, is to be found along this road. Mercado de Frutas (i.e., fruit market) is easily accessible from this road. Activities of many street vendors are conspicuous at any cross roads with major feeder roads and/or along this road. A large market, known as "Tacora", that is illegally set up within the current RoW, is established at the median around Santa Clara (see Figure 8.3-6), and obnoxious roadside smells (e.g., the mixture of vehicular exhaust gas and household compost smell) can be sensed at several places along this road. Several hospitals and churches that require a calm environment are located in this area.

Ruins exist within 500 meters of both sides of the road. Some portions of Carretera Central run through the archaeological conservation zone, located around Ate and La Molina. Several religious sites, so-called “Grutas”, exist within the current road space. It is recognized that community-level festivals such as processions are held around those sites. No ethnic minority and/or tribe of indigenous people exists around Carretera Central. No important visual resources such as major scenic places and/or townscape exist.

No major tributaries exist and/or intersect along the Av.Ayllón and Carretera Central. No rare flora/fauna exist along this project route. Several areas of roadside vegetation exist along the Carretera Central. As mentioned in the previous section, the cutting of those trees and/or destruction of flower beds within any construction activities are prohibited, and the compensation of those trees shall be prepared in accordance with the consultation with relevant agencies such as environmental police and/or environmental section of municipal governments. Table 8.3-2 summarize the environmental evaluation of Carretera Central and Av. Nicolas Ayllón.

Table 8.3-2 Initial Environmental Examination (Av. Ayllón and Carretera Central)

Environmental Factor	Descriptions of Impact	Do nothing	Do project
1. Air quality	Increased roadside air pollution.	B	C
2. Water Quality	Risk of pollution to major tributaries.	D	D
3. Soil and sedimentation	Potential for soil erosion.	D	D
	Occurrence of new sedimentation at downstream site.	D	D
4. Waste Disposal	Generation of large amounts of construction waste.	D	B
5. Noise/Vibration	Increased roadside noise and vibration	B	C
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork	D	D
7. Bad smell	Existence of obnoxious roadside smell	C	D
	Potential of creation of new bad smell.	B	D
8. Topography and Geology	Cutting of hill or mountainside/ use of embankment.	D	D
9. River bed	Disturbance to river bed condition.	D	D
10. Fauna/flora	Destruction/or relocation of roadside vegetation.	D	C
	Disturbance to roadside habitats.	D	D
11. Water Resources	Disturbance to regional groundwater flow.	D	D
12. Accidents	Potential of increased traffic accidents after construction.	B	C
	Potential of worsened traffic conditions during construction.	D	B
	Risk of increased traffic accident due to the discontinuity of vehicle lanes.	D	D
13. Global warming	Increased CO_2 emission.	B	D
14. Involuntary Resettlement	Land expropriation due to construction yard	D	D
	Demolition of roadside houses.	D	D
	Demolition of illegal squatters' lots.	D	D
	Demolition of illegal commercial and/or industrial facilities.	D	D
15. Local Economy	Possible impact on local employment and livelihood	D	D
	Possible impact on roadside street vendors	D	D
	Possible impact on moto-taxi	D	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan	D	D
	Conflict with local development plans	D	D
17. Social Institutions	Possible Impact on social infrastructure and local decision-making institutions	D	D
18. Existing social infrastructures and services	Conflict with current local transport system	B	C
	Conflict with current local energy/communication/ water supply system.	D	D
19. The poor, indigenous or ethnic group	Existence of ethnic minority around the site.	D	D
20. Misdistribution of benefit and damage	Risk of possible damages/or negative impacts concentration/or localization.	D	D
21. Local Conflicts of interest	Conflicts between regional environmental conservation and development.	D	D
22. Gender	Risk of WID-related issues	C	C
23. Children's right	Risk of illegal child labors (e.g., street vender).	C	C
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.	D	D
	Visual conflict with surrounding community.	D	D
	Loss of visual continuity of townscape.	D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases.	D	D
	Risk of HIV/AIDS	D	D

Note A: significant, B: major, C: minor, D: less significant, E: Unknown

Figure 8.3-5 Mountain side of Cerro El Pino (view from Av. C-Central)

Note that entire mountainside of Cerro El Pino is completely exploited and is crowded with housing of low-income people.

Figure 8.3-6 "Tacora" Market

Note that this market was forced to be vacated in the past, but eventually set up within the Row of Carretera-Central

8.3.3. SUMMARY OF IEE

Here, based on IEE results of the proposed urban transport project, possible environmental impacts, commonly identified for two project routes, are summarized in Table 8.3-3. It is noted that most of the identified negative impacts to be caused by the proposed metropolitan transport project are evaluated as either B or C. Also, most of the B

evaluations are related with construction activities, so it can be said those negative impacts are temporary ones. Table 8.3-4 summarize more detailed descriptions of each potential negative impact for both "Do-Nothing" and "Do-Project" scenarios, identified for the two proposed project routes.

Table 8.3-3 Summary of Potential Negative Impacts

	Bridge Name	Potential Negative Impacts							
		Do Nothing				Do Project			
		A	B	C	D	A	B	C	D
1	Avenida Venezuela	0	6	4	30	0	5	6	29
2	Avenida Carretera Central	0	6	3	31	0	2	7	31

Note: 40 environmental evaluation factors are developed for this IEE.

Table 8.3-4 Breakdown of Each Potential Impact

	Environmental Factors	Remarks of Possible Impacts
1	Air Quality	1. Increased roadside air quality degradation
2	Water Quality	Less significant
3	Soil and Sedimentation	Less significant
4	Waste Disposal	1. Preparation of excavated soil dump site. 2. Proper treatment of industrial wastes to be generated during construction period.
5	Noise/Vibration	1. Noise and vibration during construction period. 2. Future roadside noise and vibration after construction.
6	Subsidence	Less significant
7	Bad Smell	Less significant
8	Topography/ Geology	Less significant
9	River Bed	Less significant
10	Flora/Fauna	1. Destruction/or relocation of roadside vegetation.
11	Water Resources	Less significant
12	Accidents	1. Potential of increased traffic accidents during construction period.
13	Global Warming	Less significant. CO_2 emission loading may be reduced.
14	Involuntary Resettlement	1. Demolition of illegal commercial and/or industrial facilities. 2. Demolition of illegal squatters' lots.
15	Local Economy	Less significant
16	Land use and Utilization of local Resources	Less significant
17	Social Institutions	Less significant
18	Existing social infrastructures and services	Less significant
19	Poor, indigenous or ethnic group	Less significant
20	Misdistribution of benefit and damage	Less significant
21	Local Conflicts of interest	Less significant
22	Gender	Less significant
23	Children's right	Less significant
24	Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.
25	Infectious Disease	Less significant

8.4. ENVIRONMENTAL IMPACT ASSESSMENT

8.4.1. SCOPING FOR EIA STUDY

Environmental Impact Assessment (hereinafter referred to as EIA) is concerned with potential natural and social environmental impacts to be caused by the proposed bus lane project. Those potential negative impacts are identified throughout the IEE study of this report, summarized in the previous section. Based on those IEE results, the EIA study is carried out in accordance with the Peruvian EIA Law, JICA Guidelines and relevant international EIA standards/guidelines. The main purpose of this EIA study is to evaluate the potential impacts of the proposed projects at three different phases (i.e., pre-construction, construction, and operation phases), and establish appropriate environmental mitigation and management programs. However, as previously mentioned, the activities required to obtain the environmental license for the East-West trunk bus way project are not included in this study.

8.4.2. TOR FOR EIA STUDY

Relevant environmental field surveys such as the roadside noise survey are carried out within this EIA study. Then, based on more detailed evaluation of potential environmental impacts to be caused by the proposed project, the environmental management program including both environmental mitigation measures and the environmental monitoring program during both construction and operation phases are summarized.

Basically, the ToR for EIA study is developed based on Peruvian EIA law and JICA Guidelines as well as relevant international environmental guidelines for large-scale infrastructure development projects. Also, several remarks, suggestions/or comments obtained through a series of discussion/or consultation processes with PROTRANSPORTE, CONAM and other relevant agencies/or organizations are incorporated within this ToR development.

8.4.3. IMPACT ASSESSMENT

Possible environmental impacts regarding environmental factors, listed in Table 8.3-4, are summarized separately. Basically, more detailed studies are to be carried out for some of the identified "Category-A" and "Category-B" environmental factors, whereas simple analysis is provided for those of "Category-C" and "Category-D" within this EIA study. More specific ToR descriptions for each of "Category-A" and "Category-B" factor-related studies are to be delineated in the following section.

(1) Air Quality

1) Dust during the construction period

There is likely to be a temporary dust problem during the construction period. In general, construction activities of the proposed project will comprise large-scale earthworks but are scheduled to be done within a relatively short period. So, the magnitude of the dust level will not be major during this period. It is recommended that stock piles of sand and soil be well screened from residential areas. Frequent usage of sprinklers would be appropriate in Lima due to the fine soil characteristics. Multi-directional fall-out buckets should be used to monitor dust levels during the construction period.

2) Local Air quality degradation around new road and bus system

Some local feeder roads connecting to the project routes run through residential area in which current traffic volumes are not so large. The roadside air quality of some local feeder roads may be deteriorated due to the increased traffic volume after the construction. It would be better to carry out an air quality-related study in order to evaluate the air quality impacts on some residential areas.

(2) Water Quality

Most of the project route and its bus system facilities will be constructed within the current plain RoW space. There is the Surco river, coming from a ramification of Rímac river along the San Martin de Porres University, where is canalized crossing Carretera Central close to the intersection with Los Frutales Avenue. Also there is an irrigation channel crossing Carretera Central close to Av. Separadora Industrial in Santa Anita. Said waters are used for green area irrigation in the districts of La Molina, San Borja, Surco, Miraflores, Barranco, etc. So, no major water quality-related impact is expected.

(3) Soils and sedimentation

Most of the project route and its bus system facilities will be constructed within the current plain RoW space. Besides, there are no steep hillsides along the entire project routes, and annual rainfall that would cause major run-off and resultant erosion/sedimentation is very low across the entire Lima coastal region. So, no major impact on the soil and the sedimentation is expected.

(4) Waste Disposal

1) Preparation of excavated soil dump site

All excavated soil and other construction wastes will not be used and has to be dumped at proper waste disposal sites. Appropriate industrial waste treatment sites should be prepared and be large enough for the treatment of this excavated soil and construction wastes. More specific amount and/or type of construction wastes will be available after the construction schedule of the proposed project is delineated.

(5) Noise/vibration

1) Noise and vibration during the construction period

Since construction activities will result in almost continuous noise from a mobile mechanical plant and others, the order of magnitude of the noise and the vibration level will be significant to some extent during this period. Entire construction activities may be planned to be initiated during the night time and applications of special mitigation measures such as noise barriers or silent construction machinery may be considered to alleviate the noise and the vibration impacts around the school or residential areas.

2) Noise and vibration transmitted from the new bus system

Due to the increased future traffic volume, the roadside noise environment of several major routes will become worse whether the proposed project is implemented or not. On the other hand, if the proposed project is implemented, all future traffic circulation will be smooth due to both the introduction of a more organized regional transport system and the implementation of the comprehensive traffic management program. So, the future roadside noise/vibration environment at some points may be improved to some extent.

Currently, several hospitals, schools and parks that require a calm environment, exist along those routes. So, it may be wise to prepare for the noise and/or vibration mitigation measures, such as the noise barrier installation, in order to lessen the noise and/or vibration impacts on some residential areas.

Both noise and vibration prediction studies are to be carried out for the quantitative evaluation of both those impacts within this study. More detailed discussions about the noise and the vibration impacts will be presented in the roadside noise and vibration study sections of this report, respectively.

(6) Subsidence

Most of the project route and its bus system facilities will be constructed within the current plain RoW space over dry sandy terrain. So, no major subsidence-related impact is expected.

(7) Bad Smell

Several rather obnoxious smells, presumably a mixture of vehicular emission, household compost and others, are sensed along the current roadside of the project route. It is likely that these points will be renovated and/or removed within the construction of the proposed project. So, it is expected that the entire amenity of the road space will be improved, in addition to which, no new major negative bad smell-related impact will be produced.

(8) Topography and Geology

Most of the project routes and their bus system facilities will be constructed within the current plain RoW space and no large-scale subterranean construction activity is to be implemented within the proposed project. So, no major impact on current regional topography and geology is expected.

(9) River Bed

As mentioned earlier, there is no major tributary around the study area. So, no major negative impact on the river bed is expected.

(10) Flora/Fauna.

There are neither important environmental reserves nor ecologically sensitive area around the study area. So, no major impact on the overall flora/fauna is expected. In Lima, cutting, pruning and/or relocation of the roadside vegetation need official permission from the competent environmental section of the local municipalities prior to the construction activity. So, special attention must be paid to the project-related handling of roadside trees, shrubs and lawns in public areas.

(11) Water Resources

Most of the drinking water for entire residential areas along the project route is delivered through the piped water-supply network system. Furthermore, there are no groundwater recharge areas. So, no major impact on the regional water resources is expected.

(12) Traffic Accidents

1) Increased traffic levels during the construction due to road material transport

Due to the delivery of a large amount of ready-mixed concrete and other road materials required for the entire construction, temporary traffic increases or traffic jams are expected to occur at several sites. Several material sources such as asphalt, concrete, and aggregate plants and quarries are located around Lima. If those deliveries are spread throughout the entire project period, this may not result in significant increases in road traffic. More detailed descriptions of the construction schedule are presented in chapter 10 “Implementation Plan” of the report.

2) Decrease in Traffic Accidents after Construction of the Project

After construction of the East-West trunk busway, the bus lane and private car lane are separated by a small concrete structure. So, traffic accidents will decrease.

(13) Global Warming (Possible CO_2 emission reduction after bus system operation starts).

As mentioned previously, the future traffic volume of the project route will be increased whether the proposed bus system project is introduced or not. The total amount of regional vehicular emissions (i.e., CO_2) under the “Do-Scenario” may be reduced due to the

implementation of a more organized bus system, compared with that of the "Do-Nothing Scenario".

Apart from the proposed project, there are several on-going urban transport system improvement projects around the study area. It is quite essential to carry out quantitative evaluation of cumulative amounts of entire vehicular emissions (e.g., CO_2) to be generated by each project for relevant environmental mitigation studies, such as the regional vehicular emission control and/or the anti-global warming program. More detailed discussions of CO_2 emission will be presented in the vehicular emission study section of this report.

(14) Involuntary Resettlement

1) RoW Invasion

Several portions of the current RoW space of Av. Venezuela are occupied by illegal invasions of private properties such as factories. A certain amount of this illegally-occupied RoW will be returned as soon as possible.

2) Illegal Squatters

Several barracks of illegal squatters and garages exist along Av. Venezuela. It is necessary to relocate some of those illegally-occupied properties.

(15) Local Economy

The amenity of the current road space of the project route and relevant public transport system will be improved, and then positive indirect impacts on the local economy are expected.

(16) Land use and Utilization of Local Resources

Due to the improvement of the transport condition of the project route, one of the main corridors in Lima, certain indirect and/or secondary positive impacts on regional land use and utilization of local resources are expected.

(17) Social Institutions

The proposed project is an infrastructure development project, so no major direct impact on the social institutions of local communities is expected.

(18) Existing Social Infrastructures and Services

The smooth re-organization of the regional transportation system at local feeder roads connecting to the project route/or those facilities will be carried out. So, no major negative impacts on existing social infrastructure and services are expected, although certain re-organization of "moto-taxi"-based regional transport conditions on local feeder roads may occur.

(19) The Poor, Indigenous or Ethnic Group

Most of the project routes and bus system facilities will be constructed within the current RoW space and no properties of poor/or indigenous people exist around the project route. So, no major impact with this issue, such as expropriation of sacred land for indigenous tribes, is expected.

(20) Misdistribution of Benefit and Damage

The main purpose of the proposed project is to improve the public transport system along the project route, and the current bus operation system will be re-organized in order to maximize total benefits of the regional transport system while avoiding unfair distribution of benefits and damage. So, no major direct impact on this issue is expected.

(21) Local Conflicts of Interest

As mentioned earlier, the main purpose of the proposed project is to improve the public transport system, and the entire amenity of the public transportation system will be improved without causing local conflicts of interest. So, no major impact on this issue is expected. The current bus operation system will be re-organized in order to maximize total benefits of the regional transport system while avoiding unfair distribution of benefits and damage.

(22) Gender

No serious gender-related issue is reported around the project site. So, no major gender-related impact is expected. On the contrary, access to major market places or relevant facilities along the project route will be improved. So, certain indirect and/or second positive impacts are expected.

(23) Children's Rights

No serious children's rights-related issue is reported around the project site. So, no major negative impact with this issue is expected. On the contrary, access to schools or relevant facilities will be improved. So, certain indirect and/or second positive impacts are expected.

(24) Cultural Heritage

Several pre-Inca ruins such as Maranga Complex exist along the entire project route. A preliminary archeological study is carried out within this study. More detailed discussions about the current cultural environment around the project route will be presented in the cultural environment study section of this main report.

(25) Infectious Disease

No occurrence of any epidemic diseases is reported around the project route. So, no major infectious diseases-related impact are expected.

8.4.4. ToR of EIA-related Field Survey

Based on the potential impacts that may be induced during both construction and operation phases of the proposed project, described above, further environmental studies/or surveys, regarding several environmental issues, are carried out within this EIA study. Table 8.4-1 and Table 8.4-2 summarize the ToR of field surveys, conducted within this EIA study.

Table 8.4-1 Field Environmental Survey (Bio-Physical)

1. Roadside Air Quality
Carry out 24-hour continuous survey at ten (10) points across the study area (i.e., five points each for Avenida Venezuela and Carretera Central, respectively) . Parameter: PM10, PM2.5, CO, HC, NO_X, and SO_X Wind direction and magnitude, temperature, Traffic volume by vehicle type Survey Campaign: Once in winter (June – Aug).
2. Roadside Noise
Carry out 24-hour continuous survey at ten (10) points across the study area (i.e., five points each for Avenida Venezuela and Carretera Central, respectively). Parameter: Leq, Traffic volume by vehicle type Survey Campaign: Once in winter (June – Aug).
3. Roadside Vibration
Carry out 24-hour continuous survey at ten (10) points across the study area (i.e., five points each for Avenida Venezuela and Carretera Central, respectively). Parameter: L_{10}, Traffic volume by vehicle type Survey Campaign: Once in winter (June - Aug).

4. Water Quality Survey
Carry out literature review/or database search that contains appropriate water quality info.
5. Soil Survey
Carry out literature review/or database search that contains appropriate soil quality/or soil contamination info.
6. Hydrological Study
Carry out literature review/or database search that contains appropriate regional hydrological info, based on the available hydrological and/or meteorological data in order to grasp the regional water balance and regional run-off (e.g., drainage system) characteristics around the study area.

Table 8.4-2 Field Environmental Survey (Socio-Cultural)

1. Preliminary Archaeological and Cultural Surveys
Carry out cultural (historical and archeological) environment study in order to describe the current existing cultural resources, which include architectural, historical, and archeological sites, as well as areas of unique importance because of their ecological, scientific, or geological information around the study area, and to qualitatively identify the potential impacts of the proposed project on those cultural resources. The cultural environment study consists of the following three steps; 1. Identification of known cultural resources 2. Identification of potential cultural resources 3. Determination of significance of cultural resources Based on the results of the identification processes mentioned above, the significance of those resources must be carefully investigated.
2. Visual Resources Survey
Carry out an inventory of visual resources to describe the existing visual resources. 1) Describe and define the general character of the existing area. Qualitative/or quantitative evaluation of existing visual quality of the area surrounding the project site will be conducted along the project routes. 2) Document visual resources and/or visually sensitive lands. Inventory of roadside visual resources will be summarized foreach side of the project route.
3. Roadside Health Survey
In order to grasp the current health conditions of people working at heavy traffic congestion areas of Lima and Callao Cities and to study the health damage caused by vehicular emission, the questionnaire-based health damage survey will be carried out. (1) Transit police officers in charge of traffic control and patrol (100 officers) (2) Street vendors (100 persons). (3) Office worker (50 persons)

8.5. ENVIRONMENTAL FIELD STUDY

8.5.1. ROADSIDE AIR QUALITY SURVEY

(1) Outline of the Field Survey

In order to analyze the current roadside air quality conditions of the project route, the roadside air quality field measurements were carried out by the Study Team. Within this study, the following six pollutants, PM-10, PM2.5, CO, HC, NO_2 and SO_2 are of concern.

Based on the current traffic condition of Av. Venezuela, Av. Arica, Av. Ayllón and Carretera Central, ten points along the project route, representing dominant characteristics of the public transport system, land use, and topographical conditions, were chosen for the roadside air quality measurements. Basically, 24-hour continuous roadside air quality surveys are conducted. Besides, local meteorological conditions such as wind flow patterns, temperature and other parameter are also measured. Of the 10 points, five points are located along Av. Venezuela, Av. Arica, while the remaining five are along Av. Ayllón, Carretera Central. Table 8.5-1 and Table 8.5-2 summarize the basic details of the air quality measurements.

Table 8.5-1 Instruments Used for Air Quality Measurements

Pollutant	Instrument Used for Measurement
Dust (PM-10, PM-2.5)	R & P (Rupprecht and Patashnick) Model Partisol TECM 1400H
CO	T- API Model 300 (Advanced Pollution Instrument Inc.)
NOx	T-API NOX Gas Analyzer Model 200 (Advanced Pollution Instrument Inc.)
SO_2	T-API SO2 Gas Analyzer Model 100 (Advanced Pollution Instrument Inc)
HC	SKC Low Volume Sampler
Meteorological Station	Met One 010C, Met One 020C, Met One 065, Met One 083C-0-35, Met One 455

Notes: Total number of sampling points = 10, Measuring period: July and August 2006

Table 8.5-2 Measurement Point Location (Air Quality)

Point. of Site	Location (approx)
Point-1	Av. Venezuela 1139
Point-2	Av. Venezuela 6055
Point-3	Av. Venezuela, Naval Hospital
Point-4	Av. Venezuela, Cdra. 26
Point-5	Av. Arica 1239
Point-6	Av. Nicolas Ayllón 1060
Point-7	Av. Nicolas Ayllón Cdra. 18
Point-8	Av. Nicolas Ayllón 3010
Point-9	Carretera Central Cdra. 22
Point-10	Carretera Central, Essalud Hospital

Note: Roadside noise and vibration measurements are carried out, using the same 10 survey points.

(2) Prevailing Wind Pattern.

Figure 8.5-1 to Figure 8.5-3 show the hourly wind-blowing pattern (i.e., magnitude and direction) measured at three points (i.e., Points 1, 8 and 10, respectively). It is noted that the wind direction is expressed in terms of the displaced angle from the due north direction, in the clockwise direction. As shown in these figures, the southern (i.e., 180 degrees) or southeastern winds (i.e., 135 degrees) are the prevailing wind directions, and the maximum wind speed reached around 2.0 – 4.5 m/sec throughout the survey period. This tendency is also mentioned earlier (see "Brief Summary of Baseline Environment" of this report).

Basically, there is no strong wind in the early morning and thus, it can be said that the regional atmospheric condition is stable. Then, after 7:00 or 8:00 a.m., the wind starts to blow gradually and ceases in the evening. Usually, this wind flow lasts for 12–14 hours every day. This is the typical wind flow pattern observed around the study area in Lima during this season although there are several exceptional cases of wind flow, mainly due to the regional topographic differences between each survey site. Also, several short-term wavelength fluctuation patterns (T = 3–4 hours) are recognized within each daily wind flow pattern, and these might be caused by a meso-scale climatological condition. It is recommended to collect more regional meteorological data set for more detailed meteorological study such as the correlation study between wind flow and regional climatological patterns.

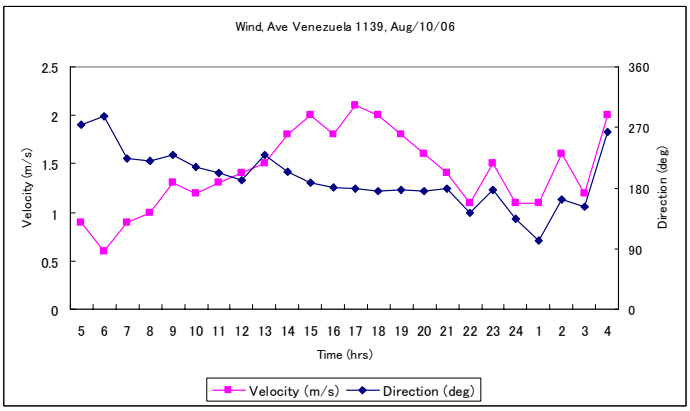
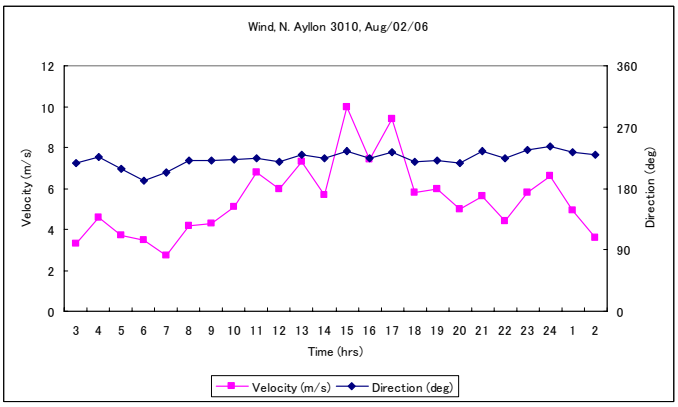
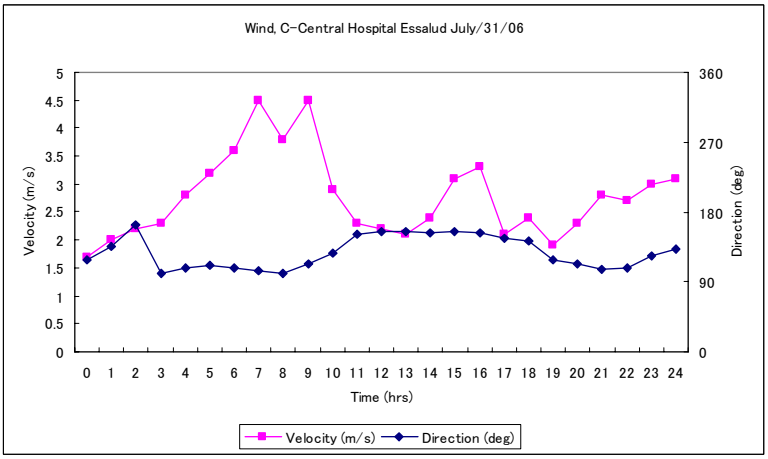


Figure 8.5-1 Wind Flow Pattern (Velocity and Direction, Aug/10/06), Av. Venezuela 1139



Note: 0 degree: north, 90: east, 180: south, 270:west.

Figure 8.5-2 Wind Flow Pattern (Velocity and Direction, Aug/02/06), Av. Nicolas Ayllón 3010



Note: 0 degree: north, 90: east, 180: south, 270:west.

Figure 8.5-3 Wind Flow Pattern (Velocity and Direction, Aug/11/06), Carretera Central Essalud Hospital

(3) Results and Discussions

1) PM-10 and PM-2.5

Figure 8.5-4 and Figure 8.5-5 show the time variation of hourly-averaged, measured PM-10 and PM-2.5 concentration values at two sampling points (i.e., Points 1 and 7, respectively). As shown in these figures, all measured values (maximum measured PM-10 and PM-2.5 value are of 86.7 μ g/m^3 and 41.7 μ g/m^3, respectively) are below the current Peruvian air quality standard (1-day averaged standards of both PM-10 and PM-2.5 are of 150 μ g/m^3 and 65 μ g/m^3, respectively). Throughout this survey, relatively large PM-10 and PM-2.5 values are detected along the heavy traffic roads such as Points 6, 7 and 8 of Av. Nicolas Ayllón and Points 9 and 10 of Carretera Central. So it can be said there is a strong correlation between the current traffic conditions and the spatial variation of both PM-10 and PM-2.5 concentrations, as found in the preliminary roadside air quality study, conducted within the Master Plan Study of the proposed project.

2) CO

Figure 8.5-6 and Figure 8.5-7 show the time variation of hourly-averaged, measured CO concentration values at two sampling points (i.e., Points 3 and 5, respectively). From these figures, it can be seen that all measured CO values are below the current Peruvian air quality standard (1 hour and 8 hour-averaged standards are of 30,000 ug/m3 and 10,000 ug/m3, respectively). Throughout this survey, relatively large CO values tend to be detected along the Av. Venezuela and Arica. Most of the measured CO values tend to decrease during the night and reach the lowest values around the early morning. Then, they start to increase at around 4:00-6:00 a.m. in the morning. After that, CO concentrations increase gradually during the morning, and reach those peak values around mid-day. After reaching a mid-day peak, CO concentration gradually decreases, occasionally increasing again, n reaching an evening peak at around 6:00–8:00 p.m.. Basically, several peaks are found within this survey results (maximum measured peak value = 10,886 ug/m3), and this fluctuation pattern may be due to the current transport mode around the sampling points (e.g., each concentration peak seems to correspond to the current transport peaks such as morning and evening, respectively).

Short-term wavelength fluctuation pattern (T = 3–4 hours), discussed previously in the wind flow data, is recognized within several results, and this implies that there is a correlation between both temporal fluctuation patterns of the roadside air quality variation and wind flow pattern.

3) NO_2

Figure 8.5-8 and Figure 8.5-11show the time variation of hourly-averaged, measured NO_2 and SO_2 values at four sampling points (i.e., Points 1, 3, 5 and 9, respectively). From these figures, it can be seen that all measured NO_2 values are below the current Peruvian air quality standard (1 hour-averaged standard = 200 μ g/m^3). Throughout this survey, relatively large NO_2 values are detected along the heavy traffic roads such as Points 1 (Av. Venezuela 1139), 2 (Av. Venezuela 6055), 3 (Av. Venezuela navy Hospital) and 10 (Carretera Central Essalud Hospital). Also, similar diurnal fluctuation pattern observed in measured PM-10, PM-2.5 and CO values discussed previously can be observed within this NO_2 measurement. NO_2 concentration starts to increase around 4:00–6:00 am and reaches those peak values around mid-morning (maximum measured peak value = 106.7 μ g/m^3). Also, there seem to be three peaks that correspond to the current traffic mode (morning, afternoon and evening peaks, respectively). Similarly, short-term wavelength fluctuation pattern (T = 3–4 hours), discussed previously, is also recognized within several results.

4) SO_2

As shown in Figure 8.5-8 to Figure 8.5-11, all measured values (maximum measured value = 119.4 μ g/m^3) are far below the current Peruvian air quality standard (1 day-averaged standard = 365 μ g/m^3). Throughout this survey, relatively large SO_2 values were detected along the heavy traffic roads such as Points 5 (Av. Arica 1239), 7 (Av. Nicolas Ayllón Cda 18), 9 (Carretera Central Cda 22) and 10 (Carretera Central Essalud Hospital). Also, similar diurnal fluctuation pattern, found in measured PM-10, PM-2.5, CO and NO_2 values, discussed previously, can be observed within this SO_2 measurement. SO_2 concentration starts to increase around 4:00–6:00 am and reaches those peak values around mid-morning (maximum measured peak value = 119.4 μ g/m^3). Also, there seem to be three peaks that correspond to the current traffic mode (morning, afternoon and evening peaks, respectively). Similarly, short-term wavelength fluctuation pattern (T = 3–4 hours), discussed previously, is also recognized within several results.

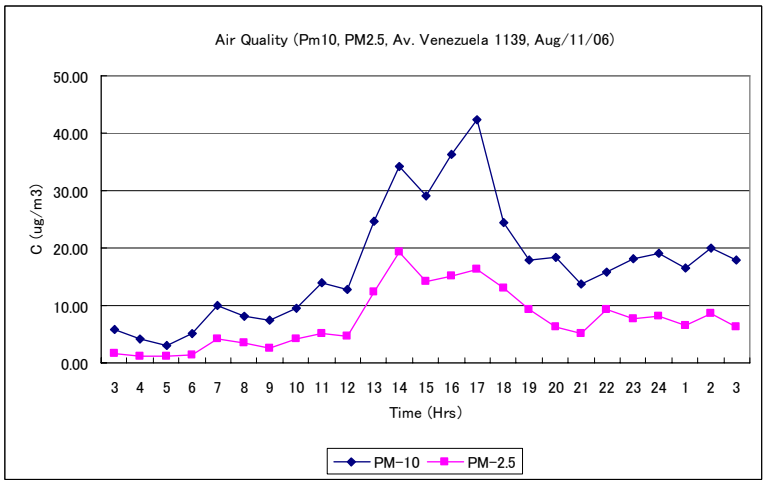


Figure 8.5-4 Roadside A/Q Survey (PM 10 and PM2.5, Av. Venezuela 1139, August/11/06)

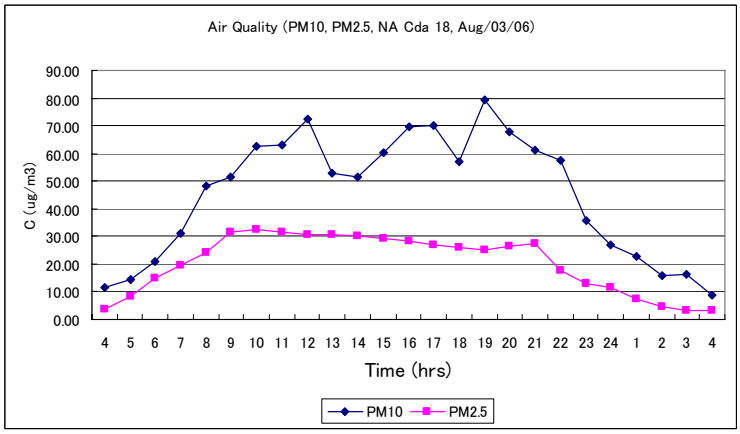


Figure 8.5-5 Roadside A/Q Survey (PM 10 and PM2.5, Av. Nicolas Ayllón Cdra. 18, August/03/06)

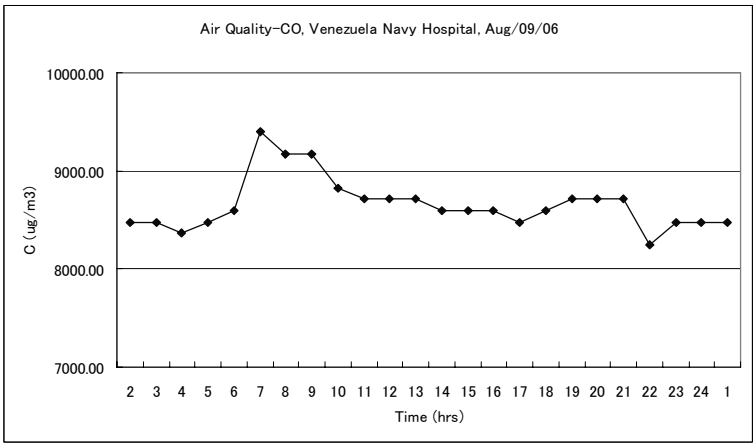


Figure 8.5-6 Roadside A/Q Survey Results (CO, Av. Venezuela Navy Hospital, Aug/09/06)

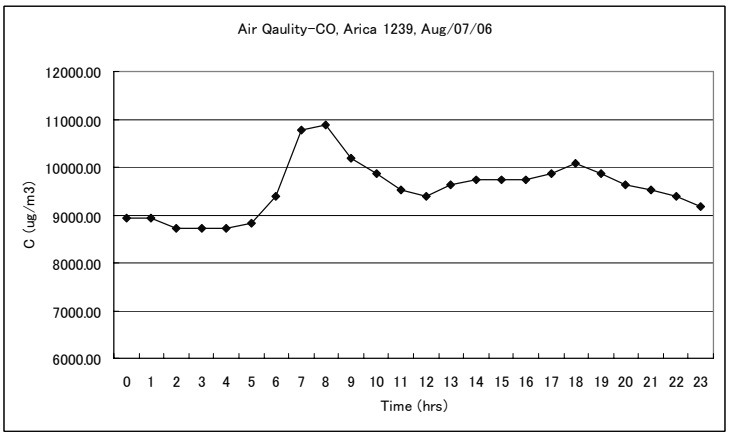


Figure 8.5-7 Roadside A/Q Survey Results (CO, Av. Arica 1239, Aug/07/06)

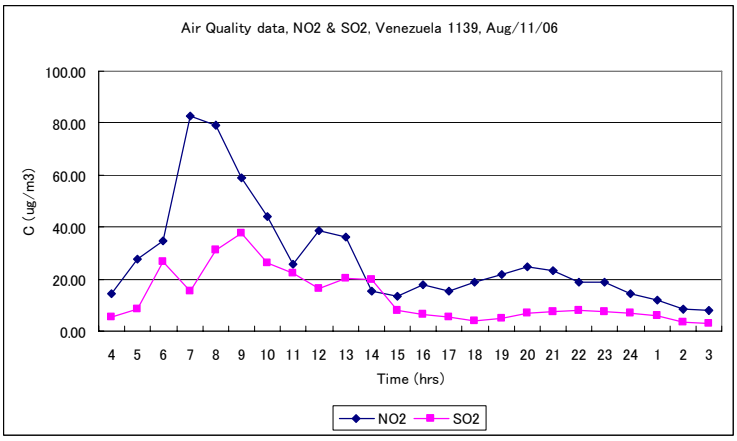


Figure 8.5-8 Roadside A/Q Survey Results (NO_2 and SO_2, Av. Venezuela 1139, Aug/11/06)

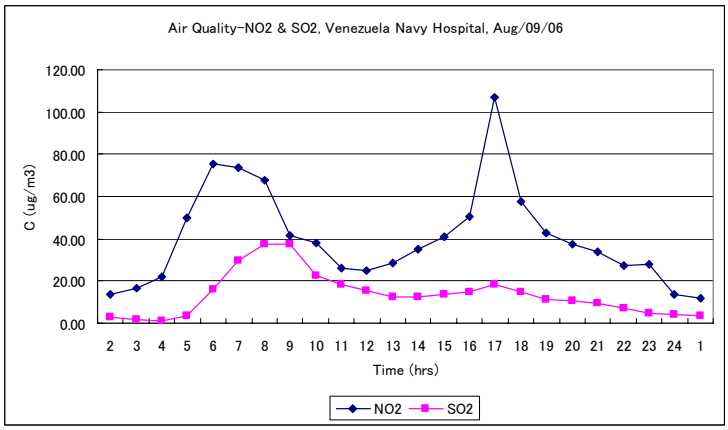


Figure 8.5-9 Roadside A/Q Survey Results (NO_2 and SO_2, Av. Venezuela Navy Hospital, Aug/09/06)

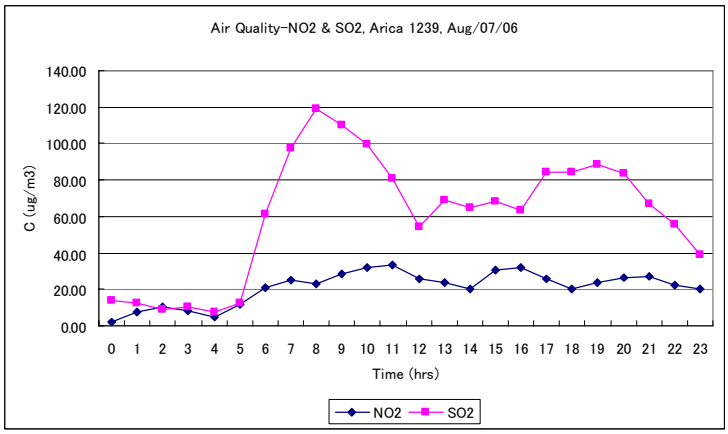


Figure 8.5-10 Roadside A/Q Survey Results (NO_2 and SO_2, Av. Arica 1239, Aug/07/06)

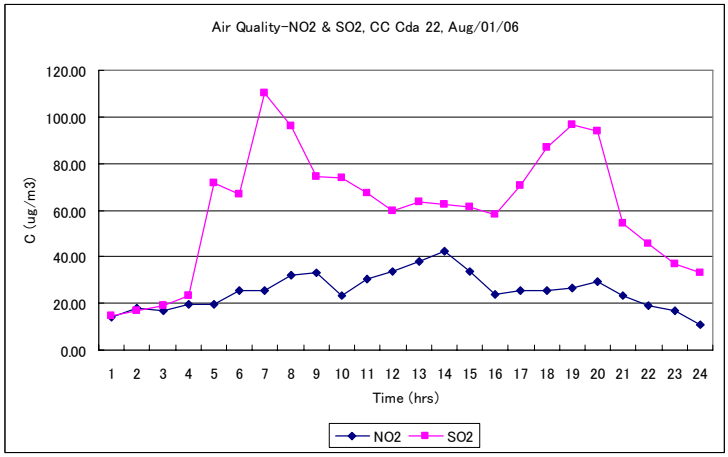


Figure 8.5-11 Roadside A/Q Survey Results (NO_2 and SO_2, Carretera Central, Cdra. 22, Aug/01/06)

8.5.2. ROADSIDE NOISE SURVEY

(1) Outline of Field Survey

In order to investigate the current roadside noise condition of the project route, the roadside noise survey was conducted by the Study Team. Within this measurement, noise parameter, Leq, is of concern. Based on the current traffic condition of both Av. Venezuela, Av. Arica and Av. Ayllón, Carretera Central, ten points were chosen for this measurement. Basically, 24-hour continuous noise surveys are conducted. Of the total of 10 points, five points were located along Av. Venezuela, Av. Arica while the remaining five were located along Av. Ayllón and Carretera Central. Table 8.5-3 and Figure 8.5-4 summarize the outline of this noise measurement.

Table 8.5-3 Noise Measurement

Total number of survey points = 10. Measuring period: July and August of 2006	
Parameter	Instrument
Leq	1. Type 1 Sound Level Meter (RION NL-31) 2. Microphone (RION UV-53A) 3. Preamplifier (RION NH-21) 4. Type 1 Acoustic Calibrator (RION NC-74)

Table 8.5-4 Measurement Point Location (Noise)

Site No.	Location (approx)
Point-1	Av. Venezuela 1139
Point-2	Av. Venezuela 6055
Point-3	Av. Venezuela, Naval Hospital
Point-4	Av. Venezuela, Cdra. 26
Point-5	Av. Arica 1239
Point-6	Av. Nicolas Ayllón 1060
Point-7	Av. Nicolas Ayllón Cdra. 18
Point-8	Av. Nicolas Ayllón 3010
Point-9	Carretera Central Cdra. 22
Point-10	Carretera Central, Essalud Hospital

Note: Roadside air quality and vibration measurements were carried out, using the same 10 survey points.

(2) Results and Discussions

Figure 8.5-12 to Figure 8.5-14 show the time variation of the hourly-averaged, measured Leq values at two points (i.e., Points 5 and 9, respectively). From these figures, it can be seen that Leq values measured at all roadside points vary between 60 and 80 dBA. A strong daily fluctuation pattern that would correspond to traffic flow pattern is recognized within the survey results of all roadside points. Mainly, most of the roadside Leq variation patterns seem to have three peaks that would correspond to traffic peaks (i.e., morning, noon and evening), and tend to be subdued around 65–70 dBA during the nighttime. A similar tendency is also recognized within the survey results of roadside vibration and air quality measurements.

In Peru, the daytime noise standards (7:00–22:00) for residential and commercial zones are of 60 and 70 dBA, respectively, and most of Leq measured at all roadside points exceed those standards. So, it can be said that the current daytime roadside environment is noisy and causes some disruptions in human health such as hearing changes, losses, interference with speech communication and/or annoyance. By the same token, the nocturnal noise standard (22:00–7:00) for residential and commercial zones is of 50 and 60 dBA, respectively. Similarly, most of the nocturnal Leq measured at all roadside points exceed those standards, so it can be said that current nocturnal roadside noise environment is not good, either.

Table 8.5-5 summarizes the Day-Night Average Sound Level, Ldn, computed at all points. From this table, it can be seen that most of Ldn values are higher than 70 dBA, and sometime exceed 80 dBA at several points along heavy traffic roads (e.g., Points 6 and 9). Using the noise zone classification criteria summarized in Table 8.5-6, current roadside noise conditions of the project routes can be classified as “severe exposure”-level. Note that Ldn values along Carretera Central are worse than those of Av. Venezuela within this survey. This classification result also supports the previous discussions. Thus, it can be said that the current roadside environment of the project route is noisy and harmful to the human health.

Table 8.5-5 Roadside Noise Survey Results

Site No.	Location (approx)	Date	Ld (dBA)	Ln (dBA)	Ldn (dBA)
Point-1	Av. Venezuela 1139	Aug/11	72.9	67.7	75.3
Point-2	Av. Venezuela 6055	Aug/10	73.5	68.0	75.8
Point-3	Av. Venezuela, Naval Hospital	Aug/09	74.6	68.4	76.4
Point-4	Av. Venezuela, Cdra. 26	Aug/08	74.8	69.8	77.4
Point-5	Av. Arica 1239	Aug/07	76.8	70.8	78.8
Point-6	Av. N Ayllón 1060	Aug/04	78.2	73.2	80.8
Point-7	Av. N Ayllón Cdra. 18	Aug/03	75.1	71.3	78.5
Point-8	Av. N Ayllón 3010	Aug/02	75.5	72.3	79.3
Point-9	Av. C Central Cdra. 22	Aug/01	78.1	73.9	81.2
Point-10	Av. C Central, Essalud Hospital	July/31	73.9	70.7	77.7

Table 8.5-6 Noise Zone Classifications

Items	Noise Exposure Class	DNL (dBA)	Leq (hour)	HUD Noise Standard
A	Minimal Exposure	< 55	< 55	Acceptable
B	Moderate Exposure	55 – 65	55 – 65	
C-1	Significant Exposure	65 – 70	65- 70	Normally Acceptable
C-2		70 – 75	70 – 75	
D-1	Severe Exposure	75 – 80	40 – 80	Unacceptable
D-2		80 – 85	80 – 85	
D-3		> 85	. 85	

(Source: Larry W. Canter, 1996)
DNL: Day-Night average sound level, Ldn, defined by following formula;
Ldn = 10 log (0.625 (10 (Ld/10)) + 0.375 (10 (Ln+10)/10)
where Ld is the Leq for the daytime (0700 - 2200) and Ln is the Leq for the nighttime (2200 - 0700).
HUD: Department of Housing and Urban Development, USA.

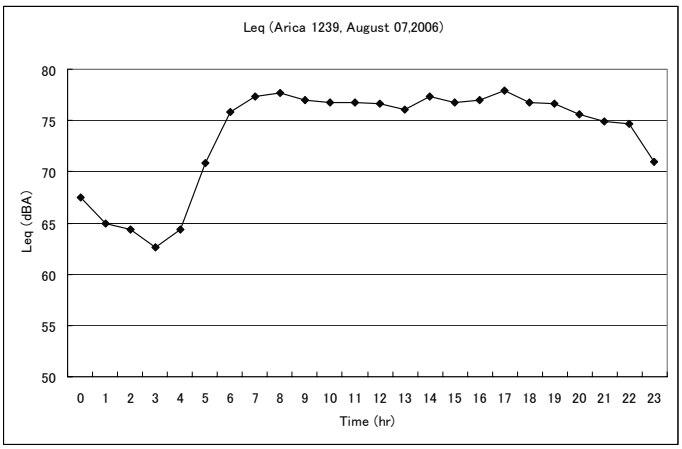


Figure 8.5-12 Noise Measurement Results (Av. Arica 1239, Aug/07/06)

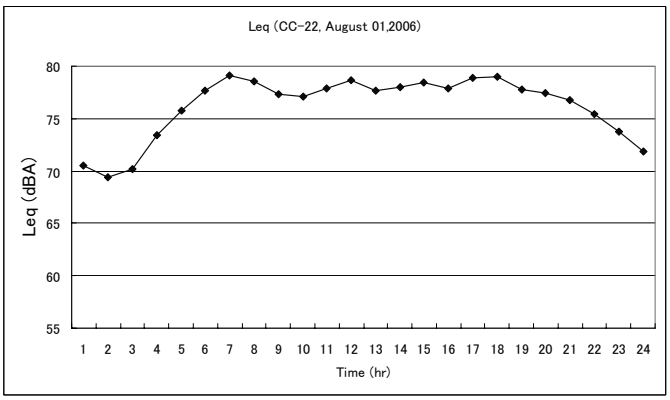


Figure 8.5-13 Noise Measurement Results (Carretera Central Cdra. 22, Aug/01/06)

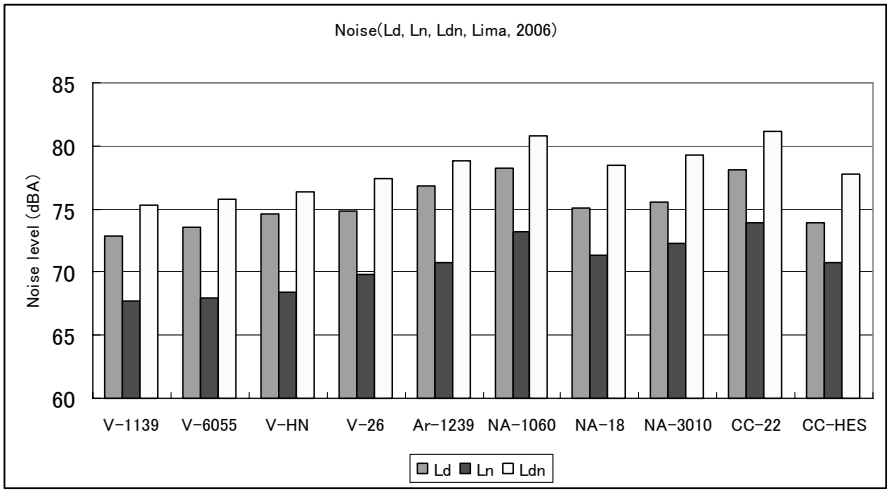


Figure 8.5-14 Roadside Noise Level (dBA)Ld, Ln and Ldn of Av. Venezuela and Carretera Central, 2006

8.5.3. ROADSIDE VIBRATION SURVEY

(1) Outline of Field Survey

In order to grasp the current roadside vibration condition of the project route, the roadside vibration survey was carried out by the JICA Study Team. Within this measurement, vibration parameter, VAL, is of concern. In general, the vibration parameter, L10, is directly measured and used for the quantitative evaluation of the vibration impact. However, due to the technical difficulties and limitations of the equipment used within this survey, another parameter, the vibration acceleration level (VAL), is computed instead. All VAL values are computed, using those measurement results mentioned earlier. It is empirically known that there is a strong correlation between L10 and VAL, and L10 is somewhat lower than VAL value (6–8 dB less, Watanabe, personal communication, 2002).

Based on the current transport situation of both Av. Venezuela and Carretera Central, ten points were chosen for this measurement. Basically, 24-hours continuous roadside vibration surveys were conducted. Of a total of 10 points, five points were located along Av. Venezuela while the remaining five were located along Carretera Central. Table 8.5-7 and Table 8.5-8 summarize the outline of this vibration measurement.

Table 8.5-7 Vibration Measurement

Total number of sampling points = 10. Measuring period: July and August of 2006	
Parameter	Instrument
VAL	Sound Analyzer CESVA-SC310 Vibration Pre-Amplifier CESVA-PA001 Accelerometer CTC AC102-1A

Table 8.5-8 Measurement Point Location (Vibration)

Site No.	Location (approx)
Point-1	Av. Venezuela 1139
Point-2	Av. Venezuela 6055
Point-3	Av. Venezuela, Naval Hospital
Point-4	Av. Venezuela, Cdra. 26
Point-5	Av. Arica 1239
Point-6	Av. Nicolas Ayllón 1060
Point-7	Av. Nicolas Ayllón Cdra. 18
Point-8	Av. Nicolas Ayllón 3010
Point-9	Carretera Central Cdra. 22
Point-10	Carretera Central, Essalud Hospital

Note: Roadside air quality and noise measurements were carried out, using the same 10 survey points.

(2) Results and Discussions

Figure 8.5-15 to Figure 8.5-17 show the time variation of the hourly-averaged, measured vibration acceleration level (VAL) values at three points (Points 1, 5 and 9, respectively). From these figures, it can be seen that VAL values computed at all roadside points vary between 55 and 70 dB. Also, gradual daily fluctuation pattern that would correspond to the traffic flow pattern is recognized. Mainly, most of the roadside VAL variation patterns seem to have three peaks that correspond to traffic peaks (i.e., morning, noon and evening), and tend to be subdued below 60 dB during the nighttime.

As described earlier, no vibration environmental standard has yet been introduced in Peru. Permissible daytime (6:00 – 20:00) vibration standard for residential and commercial/industrial areas, implemented in Japan, is of 65 and 70 dB, respectively (see Table 8.5-10). Note these Japanese vibration standards are based on L10 concept. Here in Lima, most of the daytime VAL values are less than 70 dB, so it can be assumed that L10 values at all points are less than 64 dB or 62 dB, provided that strong correlation between L10 and VAL, mentioned previously, exists. Thus, it can be said that the daytime roadside vibration environment is not a significant issue. By the same token, most of the nighttime VAL values vary below 60 dB, so it can be said that the nighttime roadside vibration environment is not so significant. Note that nighttime VAL of point 8 (i.e., Av. Nicolas Ayllón 3010) is higher than that of the daytime VAL. This is mainly due to the vibration, believed to be caused by the industrial activities of surrounding factories.

Table 8.5-9 summarizes the daily, daytime and nighttime-averaged VAL values, obtained from this survey. From this table, it can be seen that all of the daytime-averaged VAL values are less than 65 dB while all of nighttime-averaged VAL values are less than 60 dB. So, based on the vibration standards implemented in Japan, mentioned above, it can be said both daytime and nighttime vibration environments are not so deteriorated and those impacts on human activity are small. Figure 8.5-18 visualizes major survey results summarized.

Table 8.5-9 Roadside Vibration Survey Results

Site #	Location (approx)	Date	VAL (dB)	Daytime (dB)	Nighttime (dB)
1	Av. Venezuela 1139	Aug/11	59.0	59.5	57.6
2	Av. Venezuela 6055	Aug/10	58.6	59.4	56.2
3	Av. Venezuela, Naval Hospital	Aug/09	60.3	61.1	58.0
4	Av. Venezuela, Cdra. 26	Aug/08	58.1	58.8	56.3
5	Av. Arica 1239	Aug/07	67.4	68.4	64.4
6	Av. N. Ayllón 1060	Aug/04	59.5	60.2	57.4
7	Av. N. Ayllón Cdra. 18	Aug/03	67.5	69.1	55.8
8	Av. N. Ayllón 3010	Aug/02	60.4	59.9	61.4
9	Av. C. Central Cdra. 22	Aug/01	61.9	62.5	60.3
10	Av. C. Central, Essalud Hospital	July/31	55.7	55.8	55.3

Note: Permissible daytime (6:00–20:00) and nighttime (20:00–6:00) vibration standards for residential area, implemented in Japan, are of 65 and 60 dB, respectively, and those Japanese vibration standards are based on L10 concept.

Table 8.5-10 Vibration –related Environmental Standard, L10 (dB)

Zone	Day (6:00 – 20:00)	Night (20:00 - 6:00)
1	65	60
2	70	65

(Source: Japan Road Association, 1988)
Note: Zone 1: Zone that requires moderate, calm and quiet environment.
Most of the residential area uses these values.
Zone 2: Zone used for industrial and/or commercial purposes.

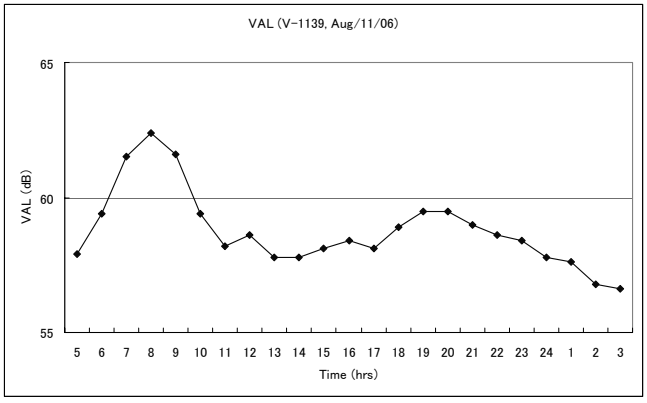


Figure 8.5-15 Vibration Measurement Results (Av. Venezuela 1139, August 11, 2006)

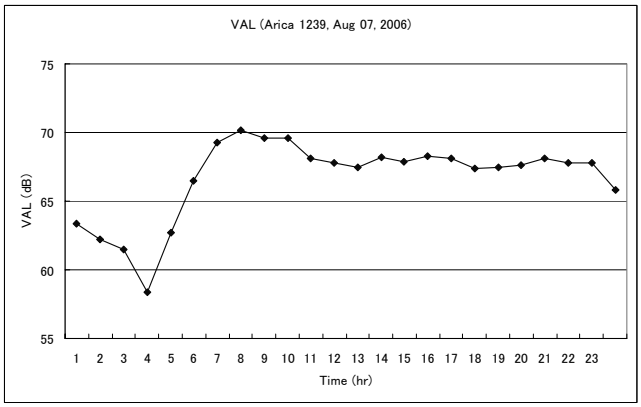


Figure 8.5-16 Vibration Measurement Results (Av. Arica 1239, August 07, 2006)

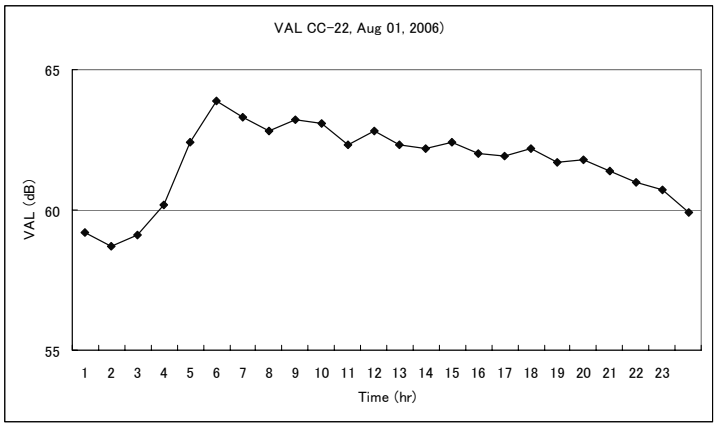


Figure 8.5-17 Vibration Measurement Results (Carretera Central Cdra. 22, August 01, 2006)

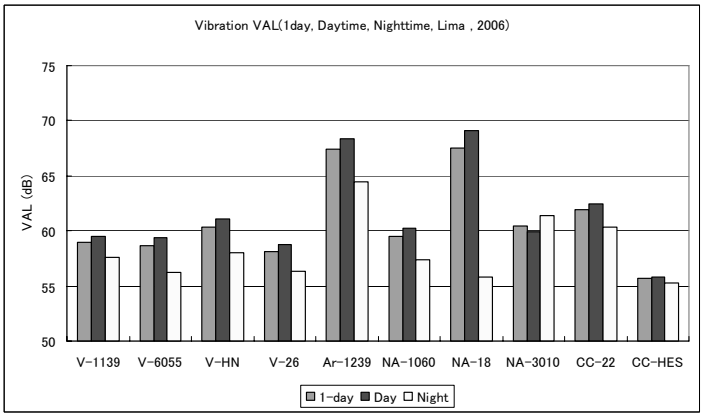


Figure 8.5-18 Daytime/Nighttime averaged VAL

8.5.4. CULTURAL ENVIRONMENT SURVEY

(1) Outline

A preliminary cultural (i.e., historical and archeological) environment study is carried out by the JICA Study Team in order to describe the current existing cultural resources, which include architectural, historical, and archeological sites, as well as areas of unique importance because of their ecological, scientific, or geological information around the study area, and to qualitatively identify the potential impacts of the proposed project on those cultural resources.

This cultural environment study consists of following three steps;

1) Identification of known cultural resources
   a) Archaeological resources
   b) Cultural resources related to areas of ecological, scientific, or geological importance (e.g., the conservation of mango trees).
   c) Local resources of importance to ethnic groups such as burial grounds and cemeteries or areas of unique religious importance
   d) Historic properties
   e) Others

2) Identification of potential cultural resources

A preliminary archaeological reconnaissance will be conducted in order to identify previously unknown archaeological resources in the study area. Depending on the

surrounding environment of the study area, one of the following archaeological surveys is implemented;

a) Controlled-exclusive survey
b) Uncontrolled-exclusive survey
c) Non-exclusive survey
d) Predictive survey

3) Determination of significance of cultural resources

Based on the results of the identification processes mentioned above, the significance of those resources is investigated.

(2) Results and Discussions

Table 8.5-11 and Table 8.5-12 summarize identified nearby major archeological sites located around Av. Venezuela and Av. Arica (Av. Venezuela side) and Av. Ayllón, Carretera Central, (Carretera Central side) respectively. From these tables, it can be seen that there are 11 archeological sites by the side of Av. Venezuela side as well as 1 site by the side of Carretera Central. It will be noted that there are several important pre-Inca ruins, such as Huaca San Marcos (i.e., Maranga Ruin Complex), along the Av. Venezuela.

Table 8.5-13 and Table 8.5-14 summarize identified major historical sites located by the side of the Av. Venezuela and Carretera Central respectively. From these tables, it can be seen that there is 1 important historical and cultural site by the side of Av. Venezuela as well as 10 sites by the side of the Carretera Central site. It will be noted that most of the major historical sites, identified within this cultural environment survey, are located close to the "Centro Historico", downtown, Lima.

Table 8.5-11 Summary of Nearby Archeological Sites (Close to Av. Venezuela)

	Site	Location	District	Importance
1	Huaca San Marcos	Cuadra 40 of Av. Venezuela	Cercado	High
2	Monticulo 21	Cuadra 38 of Av. Venezuela	San Miguel	High
3	Monticulo 22	Between Av. Los Alamos and cuadra 37 of Av. Venezuela	San Miguel	High
4	Monticulo 23	Between Av. Los Cedros and Pasaje Fresnos	San Miguel	Medium
5	Monticulo 25	Calle Los Poncianos	San Miguel	Medium
6	Monticulo 26	Crossing of Los Nogales and Av. Los Cedros	San Miguel	Medium
7	Monticulo 14 or Huaca Miguel Grau	Cuadra 1 of Calle Tte Fermin Diez Canseco, Urb. Pando 8va Etapa Ascoc. Riva Aguero	San Miguel	Medium
8	Huaca Potosi Alto	Cuadra 4 of Calle Teniente Diego Ferre	San Miguel	Medium
9	Huaca Palomino	Cuadra 27 of Av. Venezuela	San Miguel	High
10	Huaca Huerta Santa Rosa	Between the Streets Raul Porras Barreneechea and Antenor Orrego	San Miguel	Low
11	Huaca Corpus	Between the Streets Santa Justina and Santa Honorata	San Miguel	Medium

Table 8.5-12 Summary of Nearby Archeological Sites (Close to Carretera Central)

	Site	Location	District	Importance
1	Huaca Santa Raquel	Av. Huarochiri Cuadra 6	Ate	Medium

Table 8.5-13 Summary of Nearby Historical Sites (Close to Av. Venezuela)

	Site	Location	District	Importance
1	Plaza Bolognesi	Av. Arica and Av. Alfonso Ugarte	Lima	High

Table 8.5-14 Summary of Nearby Historical Sites (Close to Carretera Central)

No.	Site	Location	District	Importance
1	Av. 9 de Diciembre or Paseo Colon	Between Plaza Bolognesi and Plaza Grau	Cercado	High
2	Casa Cuneo Harrison	Av. 9 de Diciembre 323-321-319-313 # 83	Cercado	High
3	Property	Av. 9 de Diciembre 323-321-319-313 # 83	Cercado	High
4	Property	Av. 9 de Diciembre 300-302-310-318 esq Jr. Washintong 1492-1490-1488-1486-1484-1482-1480-1478-1476-1474-1472-1470-1468-1466 # 115	Cercado	High
5	Property	Av. 9 de Diciembre 340 # 114	Cercado	High
6	Property	Av. 9 de Diciembre 346 # 113	Cercado	High
7	Property	Av. 9 de Diciembre 350 # 112	Cercado	High
8	Property	Av. 9 de Diciembre 370-372-376-378 # 111	Cercado	High
9	Property	Av. 9 de Diciembre 388-390-392 # 110	Cercado	High
10	Property	Av. 9 de Diciembre 400-402-404 esq. Jr. Chota 1486-1490-1492-1494-1496 #109	Cercado	High

8.5.5. VISUAL RESOURCES ENVIRONMENT STUDY

(1) Outline

A preliminary visual resources environment study is carried out by the JICA Study Team in order to describe the existing visual resources around the project route. Throughout this study, the general character of the existing area around the project route is described and defined. Qualitative/or quantitative evaluation of existing visual quality of the area surrounding the project route is conducted for all road sections, defined in Table 8.5-15.

Table 8.5-15 Study Section of Visual Resources Study

Av. Venezuela Side
Section 1. Ovalo Saloon - Av. Insurgentes
Section 2. Av. Insurgentes - Av. Faucet
Section 3. Av. Faucet - Navy Hospital
Section 4. Navy Hospital - Av. Universitaria
Section 5. Av. Universitaria - Av. Tingo Maria
Section 6. Av. Tingo Maria - Plaza Bolognesi
Carretera Central Side
Section 1. Av. Grau - Av. Mexico
Section 2. Av. Mexico - Av. Las Torres
Section 3. Av. Las Torres - Evitamiento
Section 4. Evitamiento - Av. La Molina
Section 5. Av. La Molina - Av. 22 de Julio

Within this study, major visual resources and/or visually sensitive land such as municipal parks, publicly/or privately operated recreational areas, architectural structures and sites of traditional importance, historic sites, important urban landscape, important architectural elements and structures representing community style and neighborhood character, designated open space (e.g., college ground, garden and others), roadside vegetation and others are documented. Inventory of roadside visual resources is summarized on each side of the project route.

(2) Results and Discussions

Table 8.5-16 and Table 8.5-17 summarize the identified visual resources along Av. Venezuela, Av. Arica (By the side of Av. Venezuela) and Av.Ayllón and Carretera Central (By the side of Caretera Central), respectively. From these tables, it can be seen that there are 22 visual resources along Av. Venezuela side as well as 25 ones by the side of Carretera Central side It shall be noted that several "Grutas" that become religious icons for local communities exist along both project roadsides. Table 8.5-18 summarizes potential sensible visual resources around the study area. These are selected from the inventory of the current visual resources, summarized in Table 8.5-16 and Table 8.5-17. From this table, it can be seen that there are 5 potentially sensitive visual resources by the side of Av. Venezuela as well as 5 ones by the side of Caretera Central.

Table 8.5-16 Identified Visual Resources (Av. Venezuela)

No.	Site	Location	Character
Section 1: Ovalo Saloom – Av. De Los Insurgentes			
1	Monument to Santa Rosa	Ovalo Saloom, beginning of Av. La Perla	Religious
2	Bust of Eugenio Cogorno	Ovalo Saloom, Av. Santa Rosa	Cultural
3	Sedapal Water Cistern	Seen from the Ovalo Saloom	Landscape with Tree
4	Green Areas	Ovalo Saloom	Landscape
5	Mural	Calle J. Boterin and Av. Venezuela	Cultural
6	Park	Av. Venezuela	Landscape
7	Monument to Juan Bosco	Av. Insuegentes and Av. Venezuela	Religious
Section 2: Av De Los Insurgentes – Av. Faucett			
8	Trees on the shoulders	Av. Venezuela	Landscape
9	Green Area, Park	Av. Venezuela	Landscape
10	Plaza Bellavista	Crossroad of Av. Venezuela and Av Faucett	Landscape
11	Façade of Shopping Center	Same as above	Landscape
Section 3: Av. Faucett – Hospital Naval			
12	Hospital Naval	Av Venezuela Cdra. 39	Landscape
13	Huaca Aramburu	Av Venezuela Cdra. 38	Cultural
Section 4: Hospital Naval – Av. Universitaria			
14	Plantation of Eucalyptus	In front of UNMSM	Landscape
Section 5: Av. Universitaria – Av. Tingo Maria			
15	San Martin de Porres Grout	Av. Venezuela, between the Molitalia factory and the Rotary International	Religious
16	Green Area, Park	Av. Venezuela and Av. Alborada	Landscape
17	Huaca Palomino	Av. Venezuela Cdra. 30	Cultural
18	Santisima Cruz Grout	Crossroad of Av. Venezuela and Av. Alborada	Religious
Section 6: Av. Tingo Maria – Plaza Bolognesi			
19	Plaza Murillo	Crossroad of Av. Venezuela and Av. Aguarico	Landscape
20	Bust of Victor Raul Haya de la Torre	Beginning of Av. Arica, Av. Venezuela and Jr. Aguarico	Cultural
21	Bell Tower of Colegio la Salle	Av. Arica Cdra. 5	Religious
22	Plaza Bolognesi	Av. Venezuela and Av. Tingo Maria	Cultural

Table 8.5-17 Identified Visual Resources (Av. Carretera Central)

No.	Site	Location	Character
Section 1: Av Grau – Av. Mexico			
1	Paseo Colon	Av. Paseo Colon	Cultural
2	Old houses – Paseo Colon	Av. Paseo Colon	Cultural
3	Plaza Grau, Art Museum, Anglo Peruvian Building	Crossroad of Av. Grau and Via Expresa	Landscape
4	Via Expresa of Av. Grau	Av. Grau	Landscape
5	Guillermo Almenara Hospital	Crossroad of Av. Grau and Jr. Cangallo	Landscape
6	Faculty of Medicine of the Universidad Nacional Mayor de San Marcos UNMSM	Crossroad of Av. Grau and Jr. Huanta	Cultural
7	Parque de la Medicina	Cdra. 13 of Av. Grau	Landscape
8	Cerro San Cosme	La Victoria District	Landscape
Section 2: Av Mexico – Av. Las Torres			
9	Cerro El Pino	La Victoria District	Landscape
10	Religious Image Towers	Crossroad of Av Nicolas Ayllón and Av. Circunvalación San Luis	Religious
11	Cruz de Yerbateros Grout	Same as above	Same as above
12	Señor de los Milagros Grout	Same as above	Same as above
13	Green Welcome Area in the District of San Luis	Av. Nicolas Ayllón Cdra. 9	Landscape
14	Hogar Clinica San Juan de Dios	Av. Nicolas Ayllón Cdra. 18	Landscape
Section 3: Av. Las Torres – Evitamiemiento			
15	First Pedestrian Bridge	Crossroad of Av. Nicolas Ayllón and Av. Las Torres	Landscape with Trees
16	Second Pedestrian Bridge	Crossroad of Av. Nicolas Ayllón and Av. Santa Ana	Landscape with Trees
17	Third Pedestrian Bridge	Crossroad of Av. Nicolas Ayllón and Av. Santa Rosa	Landscape with Trees
18	Evitamiento Bridge	Crossroad of Evitamiento and Carretera Central	Landscape with Trees
Section 4: Evitamiemiento – Av. La Molina			
19	Municipal Nursery	Evitamiento Bridge	Landscape
20	View from the Evitamiento Bridge	Evitamiento Bridge	Landscape
21	Cerro El Agustino	Trebol of Santa Anita	Landscape
22	Congregation of buildings and urban elements	Crossroad of Carretera Central and Av. La Molina	Landscape
Section 5: Av. La Molina – Av. 22 de Julio			
23	Plaza Vea Supermarkets	Crossroad of Av. Ayllón and Av. La Mar	Landscape
24	Public signs in front of Plaza Vea	Av. Carretera Central Cdra. 24	Landscape with Trees
25	Reservoir Tower of Backus	Carretera Central Km. 3.0	Cultural

Table 8.5-18 Selected Potentially Sensitive Visual Resources

No.	Site	Location	Character
Avenida Venezuela			
1	Monument to Santa Rosa	Ovalo Saloom, beginning of Av. La Perla	Religious
2	Huaca Aramburu	Av Venezuela Cdra. 38	Cultural
3	Plantation of Eucalyptus	In front of UNMSM	Landscape
4	Huaca Palomino	Av. Venezuela Cdra. 30	Cultural
5	Plaza Bolognesi	Av. Venezuela and Av. Tingo Maria	Cultural
Avenida Carretera Central			
1	Paseo Colon	Av. Paseo Colon	Cultural
2	Old housess – Paseo Colon	Av. Paseo Colon	Cultural
3	Plaza Grau, Art Museum, Anglo Peruvian Building	Crossroad of Av. Grau and Via Expresa	Landscape
4	Faculty of Medicine of the Universidad Nacional Mayor de San Marcos - UNMSM	Crossroad of Av. Grau and Jr. Huanta	Cultural
5	Cruz de Yerbateros Grout	Crossroad of Av Nicolas Ayllón and Av. Circunvalación San Luis	Same as above

8.5.6. HEALTH DAMAGE SURVEY

(1) Objectives

In order to grasp the current health conditions of people working in heavy traffic congestion areas of the project route and to study the health damage to be caused by the vehicular emission, the questionnaire-based health damage survey is carried out by the JICA Study Team. Within this study, following three groups of people are of concern; (i) transit police officers in charge of traffic control and patrol, (ii) street vendors, and (iii) office workers. Here, it is assumed that most of the office workers are working inside of the building, so opportunities for direct exposure to vehicular emissions are fewer than those of transit police officers and street vendors. Throughout the comparison of those three targeted groups, the qualitative effects of vehicular emission and/or noise on human health can be analyzed qualitatively.

(2) Outline

Table 8.5-19 summarizes the outline of this health damage survey.

Table 8.5-19 Study Design of Health Damage Survey

Total number of interviewees	100	100	50
Items	Transit Police Officers	Street Vendors	Office Worker
Survey Periods	July 2006		

Pollutants generated by vehicular emissions have many adverse effects on human health. Inhalation is the main route of the exposure to air pollutants originating from vehicular emissions. Exposure by inhalation directly affects the respiratory, nervous and cardiovascular systems of the human body, resulting in impaired pulmonary functions, sickness, and even death.

The interviews (with a previously – prepared and tested questionnaire) were carried out by five to seven trained technical assistants under the direction of the JICA Study Team.

This survey addressed the following three major study topics;

a) General descriptions of working environment (e.g., working hours, daily income (street vendors)), and other fundamental information).
b) Current health conditions (respiratory, nervous, cardiovascular and otolaryngological

systems).
c) Medical history (current/or past medical treatment of respiratory, nervous, cardiovascular and otolaryngological system).

Based on background differences of the three targeted groups mentioned above, two different survey sheets (one is rewritten, using simpler expressions in order to avoid the usage of complicated terminology and/or phrase) were prepared by the JICA Study Team.

(3) Results and Discussions

1) Transit Police Officers

a) Backgrounds

Most of the transit police officers in charge of the traffic control and patrol along the project route are between 30 and 44 years old (64 %). It is noted that the rate of female to male officers is of almost 1 to 9. In general, the ratio of female officer is high among the transit police. However, due to the danger associated with the local environment and current transport conditions along the project route, less dangerous duties such as traffic control at tourist places are assigned to most female officers. 25 % of transit police officers work less than four years whereas 60 % of them work for between 5 and 20 years. 26 % of them work outside for 18–39 hours per week while 74 % work outside for more than 40 hours per week. So it can be said that they are highly vulnerable to direct vehicular emissions.

b) Current Health Condition

Table 8.5-20 summarizes the results of the health survey for police officers.

Table 8.5-20 Health Survey Results (Police Officers: multiple answers)

	Symptom	Sickness Duration (years)			
		< 4	5 – 10	> 10	Total
1	Chronic Bronchitis	5	3	1	9
2	Acute Bronchitis	4	4	1	9
3	Chronic Asthma	1	1	2	4
4	Acute Asthma	0	1	0	1
5	Days of restricted activity	11	6	2	19
6	Respiratory Hospital sickness	4	0	3	7
7	Coronary Sickness	0	0	0	0
8	Hypertension	5	1	0	6
9	Deafness	13	3	2	18
10	Others (severe cough, congestion, sore throat)	24	6	5	35
Total		67	25	16	108

Within this survey, 69 % of all interviewees claim various symptoms. Among of them, 28 % of interviewees claim several minor health problems with respiratory system such as bronchitis and/or asthma. Also, 18 % of interviewees claim hearing difficulties. Only 22 % of respondents who claim several health problems have received medical treatment (e.g., purchase of medicines and/or medical services). From this survey, it can be said that there are several health ailments, caused by direct exposure to vehicular emissions and/or noise.

2) Street Vendors

a) Backgrounds

Ages of street vendors interviewed vary widely between 15–50 years (80 %). The ratio of female to male street vendors is of almost 1 to 1. 62 % of them work outside for 38 to 76 hours per week. This means they are highly prone to direct exposure to vehicular emissions. Their incomes vary between S/ 5 and S/44 per day (74 %). 57 % of them have been

working in their current business for less than 4 years. 64 % have a family (1 to 5 people exist within each family) and some of the interviewees are family heads or main income earners within their family.

b) Current Health Condition

Table 8.5-21 summarizes the results of the health survey for the street vendors.

Table 8.5-21 Health Survey Results (Street Vendors: multiple answers)

	Symptom	Sickness Duration				
		< 6 months	< 1 year	< 4 years	> 5 years	Total
1	Severe cough	9	2	3	6	20
2	Sore throat	11	5	5	11	32
3	Nasal congestion	9	6	4	8	27
4	Hearing Difficulties	18	17	7	14	56
5	Itching eyes	17	13	14	8	52
6	Headache	11	14	14	8	47
7	Mental dullness	11	12	20	12	55
8	Los of working days	10	7	5	4	26
Total		96	76	72	71	315

Within this study, 84 % of interviewees claim several health problems. Especially, the percentage of sore throat (32 %), hearing difficulty (56 %), itching eyes (52 %) and mental dullness (55 %) are quite high compared with other symptoms caused by vehicular emissions and/or noise. 79 % of interviewees do not go to a clinic/hospital for treatment but 49 % of the same group bought medicine for treatment.

3) Office Workers

a) Background

Ages of office workers interviewed vary widely between 20–43 years (80 %). The ratio of female to male office workers is of almost 1 to 4. 72 % of them work at their office for 36 to 61 hours per week. 84 % of them have been working in their current jobs for 1-10 years.

b) Current Health Condition

Table 8.5-22 summarizes the results of the health survey for office workers.

Table 8.5-22 Health Survey Results (Office Workers: multiple answers)

	Symptom	Sickness Duration (years)			
		< 4	5 – 10	> 10	Total
1	Chronic Bronchitis	2	0	1	3
2	Acute Bronchitis	4	0	1	5
3	Chronic Asthma	2	1	0	3
4	Acute Asthma	0	0	0	0
5	Days of restricted activity	8	0	1	9
6	Respiratory Hospital sickness	1	0	1	2
7	Coronary Sickness	4	1	0	5
8	Hypertension	10	0	1	11
9	Deafness	11	0	0	11
10	Others (severe cough, congestion, sore throat)	13	0	0	13
Total		55	2	5	62

Within this study, 68 % of interviewees claim several health problems. Compared with the two previous target groups, it can be said that the total number of health claims seems to be

smaller within this group, in addition to which , the duration of most of the sickness is less than 4 months, shorter than those of the transit police officers and street vendors.

(4) Conclusions

Within this study, it is found that most of the interviewees working outside have several health problems such as sore throat, congestion, itching eyes and hearing difficulty. In particular, the health ailments of street vendors seem to be much more serious than those of transit police officers. Presumably, those symptoms are caused by the direct, long-term exposure to vehicular emissions/or noise.

More detailed investigation, such as an epidemiological study, is recommended in order to grasp the mechanism of human health deterioration caused by vehicular emissions and/or noise and evaluate the impact on the human body.

8.6. EXPROPRIATION ESTIMATION STUDY

8.6.1. INTRODUCTION

When resettlement or relocation issues arise within a large-scale infrastructure development project, a full compensation program must be prepared prior to any construction activities. As previously mentioned, the preliminary design was conducted based on the Final Design of Av. Venezuela and Av. Arica conducted in 1996 by the Lima and Callao municipalities. The right of way (ROW) of Av. Venezuela was decided at 52.0 m to 42.0 m in accordance with the specification of RoW defined by the Municipal by law No. 341 of 2001 and the Final Design of Av. Venezuela and Av. Arica. The ROW width of the East-West trunk busway is adopted in accordance with the above mentioned ROW width of Av. Venezuela.

As a result of the Road Inventory Survey conducted by JICA Study Team, the ROW width of some road segments on Av. Venezuela is measured at 25.0 m to 36.0 m. The outside areas of the existing ROW width on Av. Venezuela are occupied by private industrial companies and school playgrounds. Based on the above mentioned land use conditions on Av. Venezuela, additional land acquisition on the some road segments of Av. Venezuela are required.

8.6.2. AREA OF LAND ACQUISITION REQUIRED

(1) Road Segments Requiring Land Acquisition

Based on the reconnaissance survey, road inventory survey, environmental survey, and historical design, the cross section design was conducted along the project roads. As a result of the cross section design conditions, the following additional land acquisition conditions are required.

a) The cross section design on Av. Venezuela was conducted in accordance with the future ROW which was decided by the Final Design of Av. Venezuela and av. Arica. Therefore, additional land acquisition on the some road segments of Av. Venezuela is required.

b) The cross section design on Av. Arica was conducted within the area of the existing ROW of Av. Arica. Therefore, additional land acquisition is not required.

c) The cross section design on Av. Ayllón was conducted within the area of the existing ROW of Av. Ayllón. Therefore, additional land acquisition is not required.

d) The cross section design on Carretera Central was conducted within the area of the existing ROW of Carretera Central. Therefore, additional land acquisition is not required.

(2) Land Acquisition Required on Av. Venezuela

As a result of the cross section design on Av. Venezuela, a total of 13 areas of additional land acquisition are required. The location, required land area and characteristics of each area are shown in Table 8.6-1, and the location site and conditions are presented in Figure 8.6-1 to Figure 8.6-3. The total area for land acquisition is estimated at about 47,000 m2.

(3) Land Acquisition Required for Bus Terminals

Two (2) trunk bus terminals are planned near the Ovalo Saloom in Callao city and Santa Anita in Lima city. The area of these terminals is estimated at about 15,500 m2 in each case. The candidate locations for trunk bus terminals (Plan-A and Plan-B on Callao and Lima sides) are presented in the Appendix “Drawings”.

(4) Suggestion for Activities of Land Acquisition

In previous Chapter 7 in this report, 52 m wide road cross section was recommended for Av. Venezuela. When this cross section will be constructed, additional land acquisition shown in Table 8.6-1 is needed. In addition, land acquisitions are required at the two bus terminal areas planned. In general, land acquisition negotiations may require for long period. Therefore, Lima and Callao municipalities should be conducted the following activities as soon as possible.

a) To commence a negotiation process to the existing land owner according to the Table 8.6-1.
b) To decide the detailed land acquisition area after conducted a final design of East-West trunk busway facilities.

Table 8.6-1 Possible Expropriation Required.

No.	Affected Site/or property	Location	A (m^2)	Major facilities and/or structures
1	COGORNO S.A.	Av. Venezuela No. 890	7,857.20	Brick wall, mortar floor, water tank, several storage facilities & parking lots
2	TRANSCARGA S.A.	Av. Venezuela No. 990	4,832.27	Brick wall, mortar floor, storage facilities & parking lots.
3	ALMACENES MUNDO S.A.	Av. Venezuela No. 1700	3,347.38	N/A
4	IESA S.A.	Av. Venezuela, toward Av. Insurgentes No. 1075	1,643.59	N/A
5	BANCO INTERNATIONAL DEL PERU	Av. Venezuela S/N Ficha No. 47312 D	5,097.60	N/A
6	DAVID FU LAY	Av. Venezuela w/o, next to Sociedad Importadora (BIP)	1,274.40	Brick wall, mortar floor & vegetation.
7	INDUSTRIAS VENCEDOR S.A.	Av. Venezuela w/o, next to David Fu Lay company	3,313.44	Brick wall, buildings, security booth, mortar floor, parking lots & vegetation.
8	YPF PERÚ S.A.	Av. Venezuela w/o, fuel service center	1,380.60	Underground tank & mortar floor.
9	ALMACENES SAN JOSÉ S.A.	Av. Venezuela No. 4641, next to the Servicentro de Combustible and ends at Pasaje Aramburu	1,539.90	Several building, mortar floor, vegetation.
10	PRAXIAR PERÚ S.A.	Av. Venezuela No. 2597, starts from Calle Las Águilas	2,520.13	Fence, vegetation, mortar floor & illumination.
11	VIDRIOS INDUSTRIALESS	Av. Venezuela N0.2695	2,124.00	Brick wall, vegetation.
12	RADIO LA CRÓNICA	Av. Venezuela w/o, starts in Pasaje Aramburu	3,373.06	Brick wall
13	COLEGIO LICEO NAVAL	Av. Venezuela w/o, next to Industrias Vencedor S.A.	8,627.69	Brick wall, security booths & vegetation.
	Total		46,931.26	

Note: "w/o" means that the site does not have a specific address number. A: Approximate Area to be expropriated.
(Source: This Study, 2006).

Figure 8.6-1 Location Site of Land Acquisition Required on Av. Venezuela (1)

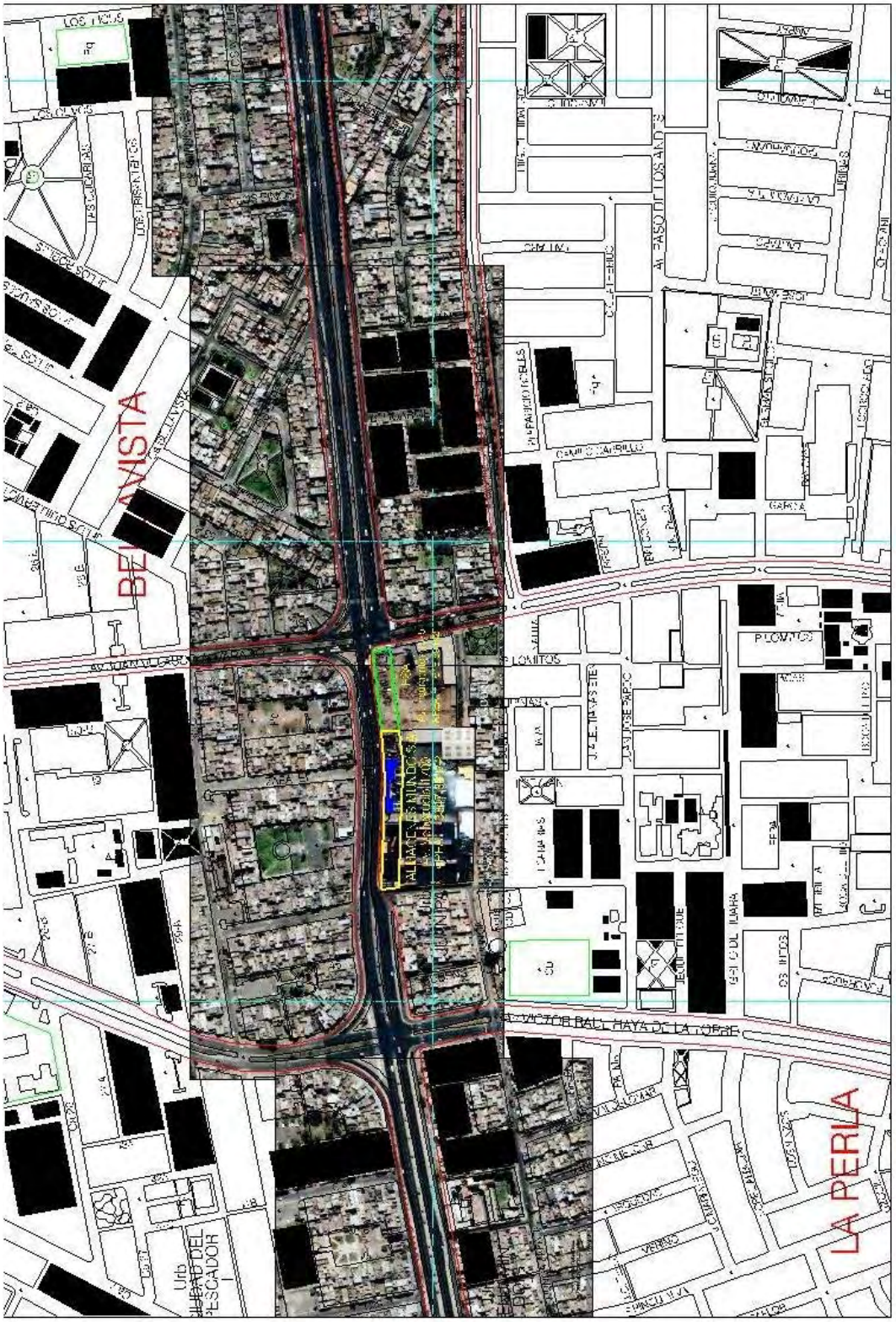


Figure 8.6-2 Location Site of Land Acquisition Required on Av. Venezuela (2)

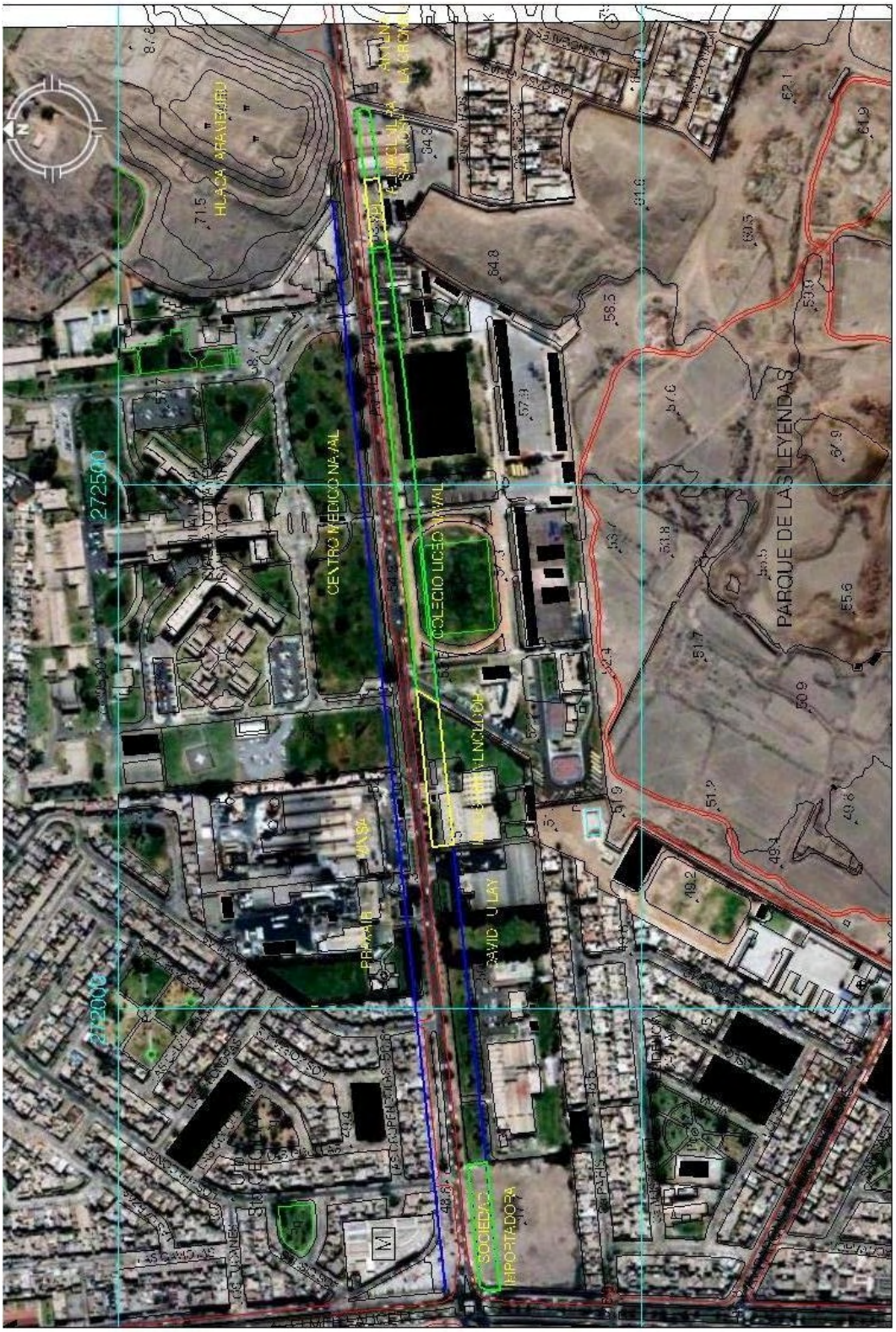


Figure 8.6-3 Location Site of Land Acquisition Required on Av. Venezuela (3)

8.7. IMPACTS MITIGATION

8.7.1. INTRODUCTION

The comprehensive, effective measures of the mitigation (i.e., avoidance, reduction, and elimination) of negative impacts for the pre-construction and construction phases of the project, identified in pervious section, are described in this section. The presented mitigation plan addresses the potential negative environmental impacts caused by the construction work and its operation. The impacts to be caused during the construction period are mostly of a temporary nature, lasting only for the construction period but not for the operating period. Detailed descriptions of each mitigation measure are summarized in Table 8.7-1 In this table, cost effective mitigation measures have been recommended. The principal purposes of these mitigation measures are as follows:

a. Maintenance of a comfortable roadside environment throughout the project.
b. Alleviation of impacts of roadside noise/vibration.
c. Harmonization of new transport facilities with surrounding communities and /or cultural environment.
d. Smooth preparation for the expropriation program.

Mitigation measures must be incorporated into tender documents prepared under the engineering component of this project in order to ensure that the contractor is obliged to comply with measures in the environmental management plan (EMP). Also, it is essential to incorporate probable working practices into the mitigation program. By doing this, those potential environmental issues can be anticipated and relevant knowledge of potential environmental impacts can be shared among various stakeholders while a comprehensive environmental management program can be established smoothly prior to the construction.

8.7.2. IMPLEMENTATION

Table 8.7-1 summarize the mitigation measure of negative biophysical and socio-cultural environmental impacts for entire new roads and bus system, respectively, identified in the previous section. The organizations responsible for implementing and monitoring are identified.

Table 8.7-1 Summary of Mitigation Measures

Element/ Negative Impact	Mitigation Measure	Residual Impact	Responsibility	Monitoring Requirements	I.P Schedule
Air Quality					
Dust during construction	Vehicles delivering materials will be covered to reduce spills. Mixing equipment will be well sealed, and vibrating equipment will be equipped with a dust-removing device. Wind erosion from open land can be controlled by use of the following three basic techniques (watering, use of chemical stabilizers, and wind breaks) in addition to vegetation cover. Operators will pay attention to their health.	Dust levels controlled.	Contractor	Engineer	On-going during construction
Local air quality degradation around new roads and bus system.	Introduce environmentally-friendly vehicles (e.g., hybrid type vehicles), more sophisticated I/M program, traffic regulation, clean fuel policy and others. It is recommended that air quality environmental standards be adhered to.	Air quality level controlled.	Government of Peru	Government of Peru.	After construction

Waste Disposal					
Preparation of Excavated soil dump site.	Inventory of possible construction wastes will be summarized. Selection of soil dumping sites will be well-discussed with relevant agency such as CONAM. Soil dumping sites will be well-spread over entire project site to avoid local traffic congestion.	Illegal dumping of construction material/or soil avoided.	Contractor	Contractor	Before construction
Noise/Vibration					
Noise and vibration during construction period	It is recommended that Environmental Standards for construction sites be adhered to. Mobile equipment will be in compliance with Peruvian noise emission standards. Machinery and vehicles will be well-maintained in order to keep their noise at a minimum.	Noise/vibration nuisance reduced and controlled.	Contractor	Engineer	On-going during construction
Noise/vibration transmitted from new roads and bus system.	Vehicular noise can be reduced at source through vehicle construction process, selection of tires and exhaustion system as well as vehicle maintenance. Also, the application of smooth, well-maintained surfaces is effective in reducing frictional noise and vibration. Noise barrier is the most common mitigating measures used. Low noise pavement is also a useful mitigating measure. Note building façade insulation such as double window glazing is an option to dampen noise in building. More detailed discussion about noise impact prediction will be presented in a later section	Same as above	Design Engineer, Government of Peru	Government of Peru	After construction.
Flora/Fauna					
Destruction of roadside vegetation.	Planting should be done wherever possible with native species which are likely to require little maintenance and may prove beneficial in maintaining ecosystem integrity with coordination of competent environmental sections of local municipalities. Topsoil must be removed, segregated, stored, and redistributed with minimum loss or contamination. Topsoil and subsoil may be removed separately and replaced in sequence. In cases where non-native species are deemed essential, careful monitoring should be planned.	Impact on roadside vegetation minimized, not eliminated.	Design Engineer, Contractor	Contractor Local Municipalities	Before construction.
Accidents					
Worsened traffic accidents	During construction period, trucks delivering materials to site will be thoroughly checked to ensure that they are road worthy and that brakes are in full working order. Where feasible, trucks will avoid driving through residential areas. Trucks used for transportation of material will be routed, where feasible, to avoid residential area.	Risk of accidents reduced but not eliminated.	Contractor	Engineer	On-going during construction

Involuntary Resettlement (Land Take)					
Land take due to road alignment along new-road route.	Within the long-term framework, approximately 62,908 m^2 will be expropriated along the project route Alternative houses/or resettlement sites must be provided prior to the land take. Alternative houses and/or sites will be located as close as possible to the previous location. Appropriate expropriation programs should be prepared.	Housing rebuilt in alternate location. Appropriate compensation prepared.	Government of Peru.	Government of Peru	Before expropriation begins.
Conflict with on-going local development plans.	Direct interference among all projects must be avoided. Potential cumulative and/or secondary impacts will be well examined.	All projects coordinated.	Government of Peru	Government of Peru	Planning stage.
Historical and Cultural					
Archaeological discovery of potential sites.	If new or additional archaeological and/or historic properties are discovered, damage to those newly discovered ones should be minimized. Typical mitigation measures include limiting the magnitude of the undertaking, modification of undertaking through the re-design, re-orientation of construction, repairing, rehabilitation, or restoration of affected areas, preservation and maintenance operation for involved historic properties, relocation of historic properties and so on. INC must be consulted.	Disturbance to potential archaeological site minimized.	Design Engineer, Contractor	Government of Peru	Planning stage and On-going during construction.
Loss of visual continuity of townscape.	It is recommended that basic design and architectural elements (e.g., form, line, color, texture and architectural features) typically used in surrounding community should be used or repeated in order to ensure the compatibility in urban area. INC must be consulted.	Townscape visual continuity kept.	Design Engineer	Government of Peru	Planning stage.
Visual Conflict with surrounding community.	Provision of greenbelts around project sites is recommended. Also, provision of appropriate visual screens or barriers in viewscape to preclude unsightly intrusion from the project is efficient. Incorporation of underground utilities (electricity, water, sewer and gas) in project planning. Provision of appropriate visual screens or barriers in the viewscape to preclude unsightly intrusions from the project. Planning and implementation of an appropriate landscaping program. INC as well as environmental sections of local municipalities must be consulted.	Visual conflict reduced to minimum.	Design Engineer	Government of Peru	Planning stage.

8.8. ENVIRONMENTAL IMPACT PREDICTION STUDY

8.8.1. NOISE IMPACT PREDICTION

(1) Objectives

The purpose of this analysis is to calculate the roadside sound pressure level to be generated by the future traffic and transport conditions along the project route under With and Without project scenarios, and carry out the quantitative evaluation of impacts on the roadside noise environment.

(2) Numerical Parameters

Basically, the noise impact prediction study is carried out for a peak-time transport condition. Four different standard road cross sections such as Type A (W=52 m), Type B (W=42 m), Type C (W=36 m) and Alternative 1 of Type E (W=25 m) are used for this prediction study (see the engineering study section of this main report for more detailed descriptions). Table 8.8-1 summarizes the outline of this noise impact prediction.

Table 8.8-1 Numerical Conditions

	Descriptions
Prediction Method	B-method specified by Acoustics Society of Japan
Simulation Case	Carry out simulation for the peak time transport condition. Simulation is carried out for following two cases, 1. Without scenario in Year 2010. 2. With scenario in Year 2010.
Power Level*1)	Trunk Bus, Conventional & Feeder Bus : Lw = 90.0 + 10.0 log10 V Passenger Car : Lw = 82.0 + 10.0 log10 V where V is vehicle moving speed [km/hr]
Prediction Point	Hypothetical roadside boundary points between public and private properties, located at Avenida Venezuela and Carretera Central, respectively. Height of receptor: hp = 1.2 m.
Vehicle Traveling Speed	Trunk Bus: 35 km/hr Conventional & Feeder Buses: 20 km/hr Car, taxi, Truck: 20 km/hr

*1) ASJ Roadside Noise Study Group [ASJ, 1998]

(3) Results and Discussions

Table 8.8-2 and Table 8.8-3 summarize the predicted sound pressure level at typical roadside points of Av. Venezuela and Carretera Central, respectively. From these tables, it can be seen that all predicted noise levels at Av. Venezuela and Carretera Central exceed the current day-time noise standard of Peru. When the proposed project is implemented, predicted sound pressure levels at most of the receptor positions tend to be decreased by 0.4 (Type A) - 3 dBA (Types B and C) except Alternative 1 of Type E. This is mainly caused by the re-design of vehicle lanes, increasing the physical distance between the centerline of the outermost vehicle lane and receptor position slightly. So, it can be said that the roadside noise environment will be improved to some extent by implementing this proposed project. Figure 8.8-1 to Figure 8.8-4 visualize major prediction results summarized in Table 8.8-2 and Table 8.8-3.

Table 8.8-2 Simulation Results (Av. Venezuela)

	Without	With
Type A (W = 52 m)	74.85	74.43
Type B (W = 42 m)	80.83	76.95
Type C (W = 36 m)	80.33	76.96
Type E (W = 25 m)	79.58	80.30

(Unit: dBA)

Table 8.8-3 Simulation Results (Carretera Central)

	Without	With
Type A (W = 52 m)	77.05	75.22
Type B (W = 42 m)	80.55	77.74
Type C (W = 36 m)	80.49	77.87
Type E (W = 25 m)	80.56	80.97

(Unit: dBA)

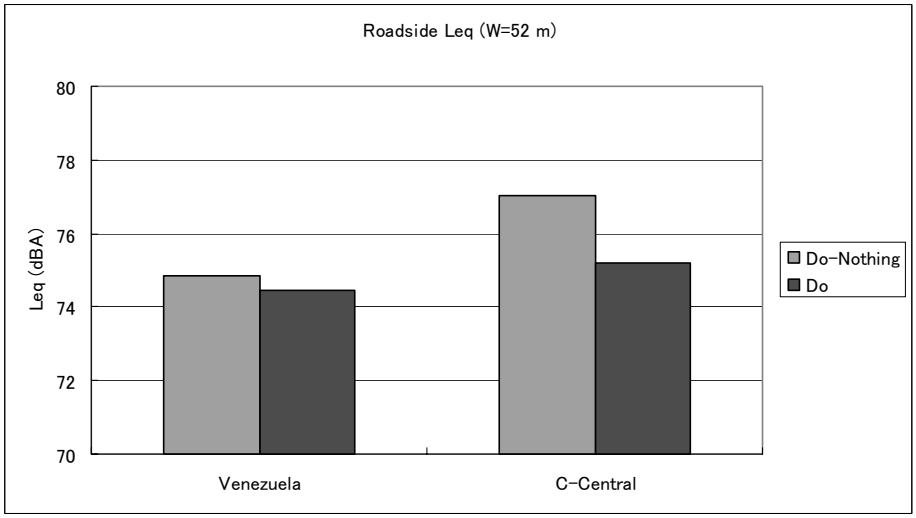


Figure 8.8-1 Predicted Roadside Leq Values (W=52 m)

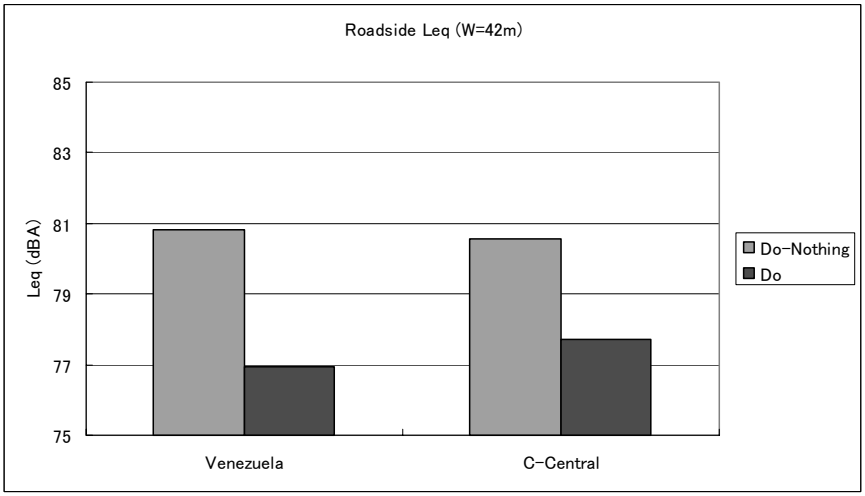


Figure 8.8-2 Predicted Roadside Leq Values (W=42 m)

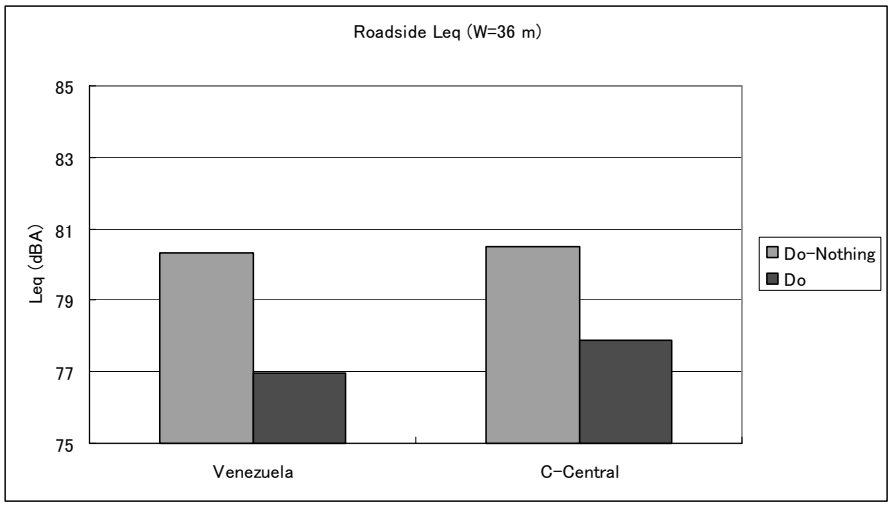


Figure 8.8-3 Predicted Roadside Leq Values (W=36 m)

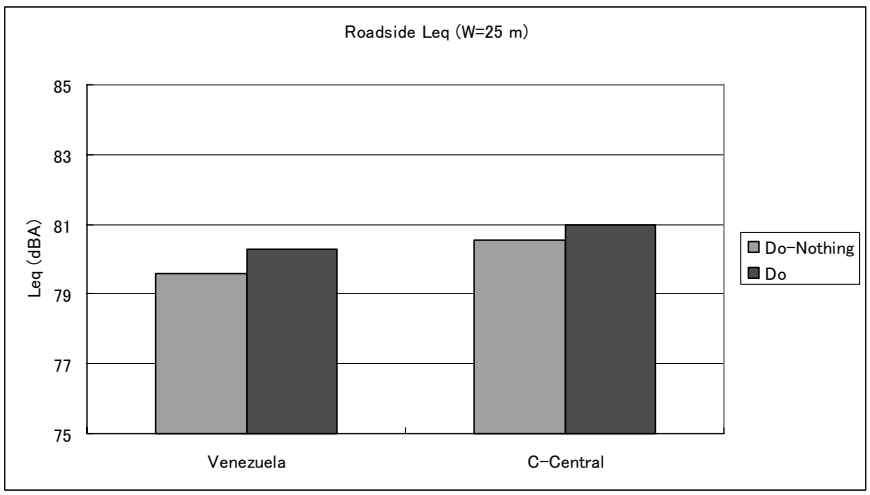


Figure 8.8-4 Predicted Roadside Leq Values (W=25 m)

8.8.2. VIBRATION IMPACT PREDICTION

(1) Objectives

The purpose of this analysis is to calculate the roadside vibration level to be generated by the future traffic and transport conditions along the project route under With and Without project scenarios, and carry out the quantitative evaluation of impacts on the roadside vibration environment.

(2) Numerical Parameters

Basically, the vibration impact prediction study is carried out for a peak-time transport condition. Four different standard road cross sections such as Type A (W=52 m), Type B (W=42 m), Type C (W=36 m) and Alternative 1 of Type E (W=25 m) are used for this prediction study (see the engineering study section of this main report for more detailed descriptions). Table 8.8-4 summarizes the outline of this vibration impact prediction. Within this study, the road surface flatness and the condition of the base course are expressed in term of the standard deviation of the road surface roughness, σ (unit: mm), and the dominant vibration frequency, f (unit: Hz), respectively. Also, both values of the

road surface flatness and the dominant vibration frequency of current road conditions are assumed to be of 8 mm and 20 Hz, respectively.

Table 8.8-4 Numerical Conditions

	Descriptions
Prediction Method	Standardized Prediction Method specified by the Ministry of Construction, the Government of Japan
Simulation Case	Carry out simulation for the peak time transport condition. Simulation is carried out for the following two cases, 1. Without scenario in Year 2010. 2. With scenario in Year 2010.
Prediction Point	Hypothetical roadside boundary points between public and private properties, located at Avenida Venezuela and Carretera Central, respectively.
Vehicle Traveling Speed	Trunk Bus: 35 km/hr Conventional & Feeder Buses: 20 km/hr Car, taxi, Truck: 20 km/hr

(3) Results and Discussions

Table 8.8-5 and Table 8.8-6 summarize the predicted L_{10} values at Av. Venezuela and Carretera Central, respectively. From these tables, it can be seen that all predicted roadside L_{10} values are less than 50 dB, below the current day-time vibration standard of Japan (65 dB). When the proposed project is implemented, predicted L_{10} values at both prediction points will tend to be reduced by 1-3dB. This is mainly caused by the following two factors, i.e., (1) the re-design of vehicle lanes, increasing the physical distance between the centerline of the outermost vehicle lane and the prediction point slightly, and (2) the improved pavement condition of the road surface. So, it can be said that the roadside vibration environment will be improved to some extents by implementing this proposed project. Figure 8.8-5 and Figure 8.8-6 visualize the major prediction results summarized in Table 8.8-5 and Table 8.8-6.

Table 8.8-5 Simulation Results (Av. Venezuela)

	Without	With
Type A (W = 52 m)	43.44	42.47
Type B (W = 42 m)	47.51	44.37
Type C (W = 36 m)	47.23	44.31
Type E (W = 25 m)	47.84	45.74

(Unit: dB)

Table 8.8-6 Simulation Results (Carretera Central)

	Without	With
Type A (W = 52 m)	47.18	43.90
Type B (W = 42 m)	49.53	45.91
Type C (W = 36 m)	49.22	45.91
Type E (W = 25 m)	49.54	47.33

(Unit: dB)

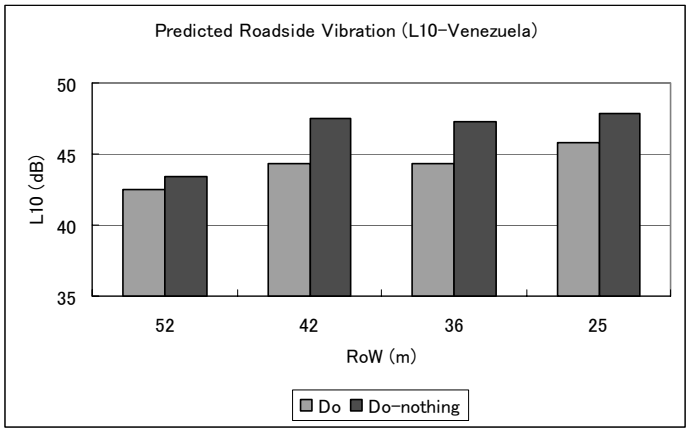


Figure 8.8-5 Predicted Roadside L10 Values (Av. Venezuela)

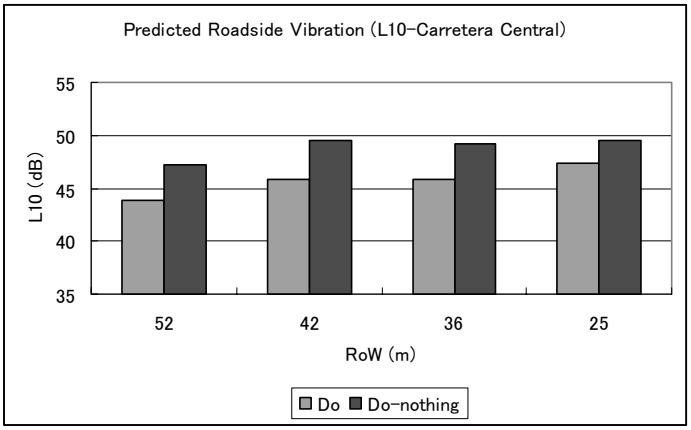


Figure 8.8-6 Predicted Roadside L10 Values (Carretera Central)

8.8.3. VEHICULAR EMISSION STUDY

(1) Introduction

The purpose of this study is to evaluate the amount of vehicular emission to be generated by the future regional traffic and transport condition around the study area, and carry out a comparative study under following two scenarios; i.e., **with** and **without** proposed busway project in Year 2010. Here, emission of the carbon dioxides (CO_2) is of concern.

(2) Computation of Vehicular Emissions

The daily amount of the total emission loading of pollutants, $\mathbf{W_s}$, is computed by,

$$\mathbf{W_s = \Sigma E_s \cdot CK} \qquad (1)$$

where $\mathbf{E_s}$ is the vehicle-type air pollution emission factor of targeted pollutants, and **CK** is the computational results (i.e., vehicle times kilometers) of the future traffic and transport demand forecast, that are carried out under various different development scenarios (see the future traffic and transport demand forecast study section of this main report for more detailed information). Four different vehicle types such as passenger car, taxi, truck and bus are considered and CO_2 emission factors, used in previous Master Plan Study of this proposed project are used for the clarification within this study.

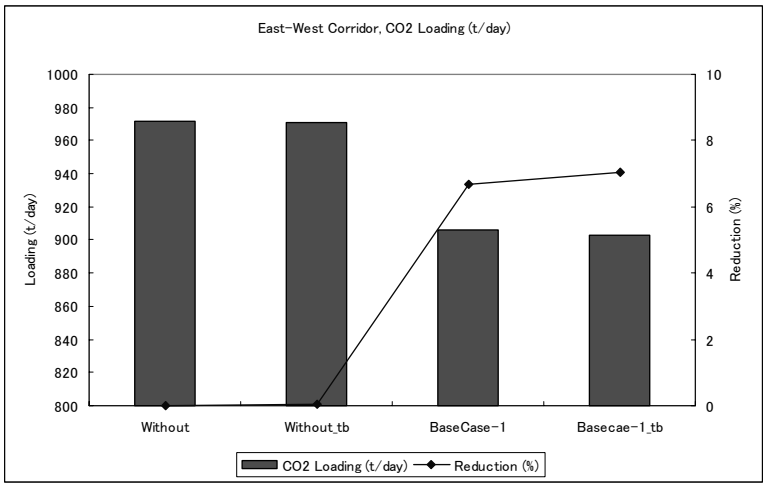
The estimation of the environmental benefit to be caused by the operation of the proposed transport project is carried out by evaluating the amount of the reduction of the emitted CO_2 loading, which is caused by the change of vehicle-kilometer of the entire transport situation.

Also, the implementation of CNG-fueled vehicles for public transport (e.g., trunk, conventional and feeder buses) is considered. It is well-known that vehicular CO_2 emission loading of CNG-fueled vehicles is less than that of gasoline-fueled vehicles, and can be reduced by approximately 20 – 30 percent. So, it is assumed that a 30 % reduction of vehicular CO_2 emission loading can be established by the implementation of CNG-fueled vehicle for purposes of simplification.

(3) Results and Discussions

Based on the evaluation procedures mentioned above, the calculation of the regional amount of CO_2 vehicular emission loading to be generated by the implementation of the proposed project in Year 2010 is carried out. Figure 8.8-7 shows the computational result of the total amount of CO_2 vehicular emission loading and relevant environmental benefits (i.e., the reduction of the emitted CO_2 loading) to be caused under different scenarios. From this figure, it can be seen that the total amount of the daily vehicular emission loading under Without-scenarios is of approximately 980 ton/day. By implementing the proposed project, this CO_2 emission loading can be reduced by 80 ton/day.

This reduction can be explained by the following two factors. First, the contribution of CNG-fueled vehicles to the reduction of CO_2 vehicular emission is significant. Second, after the operation of the proposed new bus system starts, the entire public transport will be improved around the study area, in comparison with the current disorganized traffic conditions, and eventually, the severity of current traffic conditions (e.g., traffic jams, road safety and so on) will be alleviated to some extents. As a result, the entire traffic condition and roadside environment around the study area will be improved (more detailed discussions of traffic transport benefits to be caused by proposed transport project can be found in the bus operation study section of this main report).



Note: Environmental Benefit is expressed in term of the reduction of CO2 vehicular emission loading, computed by Reduction (%) = 100 x (Emission without - Emission with)/(Emission without) (2)

Figure 8.8-7 CO_2 Vehicular Emission Loading and Environmental Benefit

8.9. ENVIRONMENTAL MANAGEMENT

8.9.1. INTRODUCTION

Effective environmental management during pre-construction and construction requires the establishment of effective institutional arrangements for the implementation of the Environmental Management Plan (EMP). In general, any environmental management programme will be carried out as an integrated part of project planning and its execution, making a significant and continuous contribution to the overall development of the scheme. It must not be regarded merely as an activity limited to monitoring and regulating activities using a pre-determined checklist of required actions. Rather, it must interact dynamically as the project implementation proceeds, dealing flexibly with environmental impacts – both expected and unexpected as they arise. For this reason, the plan provides for periodic audits, which will evaluate compliance of on-site environmental management practices with the EMP requirements and also to refocus the plan itself in the light of experience and issues arising.

8.9.2. SCOPES AND OBJECTIVES

The EMP is concerned with the environmental impacts due to the construction of the bus lane and their controlling procedures. The main purpose of the EMP is to ensure that the various environmental protection measures selected through the project-planning phase are implemented during the construction phase, so that the environmental degradation and pollution resulting from construction activities will be minimized. Specific objectives of the plan are to:

a. Define organizational and administrative arrangements for the environmental monitoring, including the definition of responsibilities of staff, coordination, liaison and reporting procedures.
b. Discuss procedures for pro-active environmental management, so that potential problems can be identified and mitigation measures adopted prior to the commencement of construction.

8.9.3. METHODOLOGY

The basic approach to the preparation of the management plan comprises the following parts:

1. Reviews of the mitigation plan.
2. Discussions with engineering staff engaged on the design phase of the project.
3. Experience gained through past relevant environmental monitoring activity.

8.9.4. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Within the EMP, the Engineer's role is to monitor the activities of the contractors and to take action under the terms of the contract to prevent and minimize environmental damage. Basically, there are three factors to be considered in order to have an organized and efficient EMP; i.e., (1) the contractors' organization, (2) the resident engineer's organization, and (3) the liaison, coordination and reporting between each section of the project.

(1) Contractors' Organization.

The tender documents will require the contractor to state his/or her environmental policy clearly. The clear specification of the responsibility for environmental protection within

the contractor's organization is a critical factor for the achievement of good environmental control. So, it is necessary to ask contractors for submission of their proposals for the environmental management. Basically, this proposal must contain the following items:

a. Clear statement of their environmental policy.
b. Their own organizational framework, in particular, the assignment of an engineer to take overall responsibility, to manage environmental control facilities on a daily basis and to liaise with the Resident Engineer's monitoring team.
c. Principal pollution control facilities, including procedures of the construction waste disposal, and of contingency plans in the event of facility failures.
d. Proposed environmental monitoring procedures in order to ensure that facilities are operating satisfactorily and problems are being dealt with promptly.
e. Environmental awareness training programme for the workforce.

(2) Resident Engineer's Organization (REO)

The following arrangement may be necessary when the staffing structure for the project is finalized. Ultimate responsibility for environmental matters within the REO will rest with the Project Manager (PM), and with the Chief Resident Engineer (CRE), being responsible for daily direction and management. It will be necessary to have an Environmental Monitor (EM) who will be able to make occasional visits to sites, and a full-time local Assistant Environmental Monitor (Assistant EM) who will be responsible for daily monitoring of projects. The Environmental Monitor (EM) must have suitable experience in environmental management.

Brief descriptions of the responsibilities of each team members are provided as follows.

1) Environmental Monitor (EM)

The EM has to act on two different levels. Firstly, the EM has to give overall advice and define the general procedures which will include the preparation of environmental reports. Secondly, the EM will be involved in the establishment of the daily monitoring procedures. The following are the EM's major tasks,

First Level

a. To review and make him/or herself familiar with the EMP, including advice on:
- The environmental management framework.
- Reporting and liaison requirements.
- Key environmental issues.
- Monitoring strategy.
- Data management.
- Environmental control measure.

b. To carry out periodic environmental audits of the project in order to:
- Identify any environmental performance deficiencies and advise how to address these.
- Assess the degree of compliance with the EMP achieved on site.
- Review the continuing relevance of the EMP in the light of experience, and instigate changes where appropriate.
- Review the organization and administrative frameworks for the environmental management.
- Review environmental monitoring data and its management.
- Review environmental problems which have arisen and how they have been dealt with.
- Propose changes to the environmental management procedures and framework and identify the need for additional measures to control environmental degradation.

c. To provide ad-hoc advice on environmental issues to the PM, CRE and Assistant EM.

Second Level

a. To establish an effective environmental monitoring, sampling and analysis programme.
b. To establish routine management, liaison and reporting systems, including the establishment of the environmental database.
c. To evaluate the results of the monitoring programme and to advise REs of required action.
d. To prepare routine management reports.
e. To advise the CRE/PM on the contractors' proposals for site establishments in terms of landscape, drainage, erosion control, liquid and solid hazardous waste management, fuel and chemical storage and site restoration.
f. To review the contractors' proposals for pollution control facilities and to advise on their adequacy.
g. To study the mitigation measures proposed by the contractors and to recommend safeguards.
h. To co-ordinate the sampling and analysis programme with a nominated laboratory.
i. To liaise and report on a routine basis with CTLC, IMP, PROTRANSPORTE, DIGESA, CONAM, INC and/or environmental sections of local municipalities.
j. To train and support the Assistant EM.
k. To recommend the procurement of the equipment required for environmental monitoring.
l. To advise on the need for expert assistance.

2) Assistant Environmental Monitor

The following are the fundamental routine tasks of the Assistant EM:

a. To undertake environmental monitoring through site inspections on a daily basis and to notify the EM/or the REs of any problems.
b. To conduct routine sampling and analysis programs, and take ad-hoc samples, when necessary.
c. To look after the environmental monitoring equipment and to advise the EM or REs of defects, problems or replacement/or additional requirements.
d. To assist the EM in the analysis of results, preparation of reports and with other duties, as required.
e. To be responsible for the daily management of the database system to be established.
f. To liaise with the local communities and to act as a channel for their concerns.

Sometimes, the Assistant EM has to take over the tasks f, g, k and l of the EM,,summarized earlier.

(3) Liaison, Co-ordination and Reporting

1) Liaison with the Contractors

The Assistant EM will attend a weekly site meeting of the relevant contractors' staff and address environmental shortcomings which have arisen there. From the contractor's standpoint, it would be preferable for the senior manager and the engineer responsible for environmental protection to attend this meeting. From the consultant's side, the EM or Assistant EM and the RE/or CRE will attend. These meetings will be minuted.

2) Liaison with Governmental Organization.

As mentioned above, the Assistant EM will prepare a short monthly report for submission to the relevant agencies, such as the CTLC, IMP, PROTRANSPORTE, DIGESA, CONAM, INC and local municipalities, and will be available to attend progress meetings when required.

3) Liaison with the Local Community

Liaison with the local community will be important during the construction period in order to ensure that their views are being taken into account, and that problems and nuisances such as noise and dust are reduced to a minimum. All complaints must be recorded, and also, these records will show what action was taken, and when, and what monitoring is necessary.

4) Consultant's Internal Co-ordination and Reporting

The Environmental Monitoring Team will prepare a monthly report, which will not be lengthy, but will summarize issues carried over from the previous report, stating whether they have been resolved or are on-going, and new issues arising. This will be included in a general monthly progress report to be submitted to the CTLC, PROTRANSPORTE, IMP and other relevant, competent agencies. It is not envisaged that formal meetings will be required for the internal management of the environmental programme, and that ad-hoc meeting should be adequate.

(4) Environmental Management and Audit Programme

The first few months of the construction phase will be important for the establishment of the EMP. It is anticipated that the Programme will be audited annually, but that the first audit will be carried out after six months in order to review the establishment of the management systems and procedures. The processes of environmental management will be continuously evolving and improving as the project proceeds.

8.10. ENVIRONMENTAL MONITORING

8.10.1. INTRODUCTION

The main objectives of the environmental monitoring are to provide a continuous feedback on project implementation to identify actual or potential successes/or problems at an early stage, and to implement timely adjustments to whole project management work. Monitoring is a continuous assessment of project implementation and must be an integrated part of good management during the construction.

8.10.2. OBJECTIVES

The objective of the monitoring system is to assist the project management through:

a. Defining requirements and procedures for the environmental monitoring (type of equipment to be used, monitoring schedule and parameters to be monitored, and so on).
b. Identifying targets and objectives of the project implementation.
c. Keeping environmental records for the project evaluation.
d. Identifying problems arising from the project, and figuring out procedures for environmental remediation in the event of pollution or similar incidents.
e. Providing readily available results of related environmental analysis for decision making.

8.10.3. SCOPE OF THE MONITORING PLAN

The scope of the monitoring plan is:

a. To identify the monitoring tasks to be undertaken by EM during the construction phase.
b. To identify the nature and the schedule of the monitoring.
c. To identify samples to be taken for analysis and parameters to be measured.

8.10.4. METHODOLOGY

The basic approach to preparing this monitoring plan has comprised the following components:

a. Reviews of the mitigation plan discussed in the previous section, and in particular, of the monitoring requirements identified for the construction phase of the project.
b. Discussions with engineering staff engaged in the project design and planning.
c. Consideration of the environmental monitoring experience.

Agency coordination is addressed, and coordination with the on-going monitoring program, such as monthly roadside air quality surveys along the project route by DIGESA will be vital in the development of the post-EIA monitoring system. The monitoring objectives will be related to the anticipated impacts of the action. Comprehensive and/or targeted monitoring can be planned. Several iterations may be necessary to achieve a workable monitoring system.

8.10.5. ENVIRONMENTAL MONITORING

The aim of the monitoring plan is to develop a cost-effective approach to monitoring the contractors' environmental performance. Certain parameters (e.g., roadside air quality, noise and vibration around the project area) can be monitored through measurements, and others can only be monitored through observation (e.g., tree felling). Careful observations made through this monitoring work, established by forward planning, is a key

part of a successful environmental management to prevent problems (or at least to limit their effects).

Baseline data to be summarized in this project will help to define the requirements for the site restoration and provide a basis for the comparison of effects during the construction. Post project audit will be carried out to examine the success of the site restoration and evaluate the effectiveness of the mitigation measures adopted.

8.10.6. MONITORING REQUIREMENTS

The monitoring requirements of the Monitoring Programme were identified in the Mitigation Plan. The Engineer will be responsible for monitoring the activities of the contractor, and the EM and the Assistant EM will assist the Engineer in the monitoring which requires measurements, based on responsibilities listed in the previous section.

As mentioned earlier, the monitoring activities can be divided into the following two groups; (i) one which can be carried out through measurement, and (ii) one which will be carried out through observation. Table 8.10-1 provides more detailed descriptions of the activities to be undertaken for each of the monitoring requirements. It is strongly recommended that the corresponding clauses be developed for inclusion in the bid documents. It is noted that monitoring activities of the roadside air quality, noise and vibration will be supervised by EM.

Table 8.10-1 Monitoring Activities and Indicators

Monitoring Issue	Monitoring Method	Positive Indicator
Air Quality	Observations will be made on the level of dust generated during construction activities. Damping down will be carried out if levels are unacceptable.	Deposition of dust on surfaces will decrease with increased dampening.
Waste Disposal	Engineer to ensure waste dumping site for construction waste material, soil, and so on.	No illegal disposal of waste material.
Noise/ Vibration	Noise measurement will be carried out at the boundary and the interior of the work site and at the nearest sensitive receiver. Vibration measurement will be carried out within the residential area.	Noise levels at the nearest sensitive receiver shall not exceed the Peruvian environmental standards.
Flora/Fauna (Vegetation)	Engineer will ensure that excessive clearance of vegetation is avoided. Contractor must seek approval of Engineer prior to clearance. Re-planting or relocation of trees will be done with the coordination of environmental section of local municipalities.	Area of vegetation to be cleared minimized. Relocation/or replanting must be coordinated with local municipalities.
Accidents (road safety)	Engineer will monitor the condition of trucks arriving at the site and keep a record of night driving.	No road accidents related with project. Night driving kept to minimum.
Complaints	Engineer will inspect the record of complaints made by local residents, to be kept by Contractor, and will check that action is taken quickly and that the number of complaints does not rise significantly.	Number of complaints decreases.

8.10.7. IMPLEMENTATION AND OPERATION OF MONITORING PROGRAM

In general, implementing the monitoring system requires considerable efforts in obtaining specific inter-agency agreement and necessary funding. This step mainly involves data collection, analysis, and evaluation. Impact evaluation will involve the pre-determination of criteria to be used for interpretation. These criteria will be based on legal, institutional limits, professional judgements and/or public inputs. Development of appropriate response plans to impact trends can be time-consuming and technically difficult, and may require considerable coordinating efforts. It is important that such plans be developed prior to implementation of the monitoring system. It is also very

important that periodical summary reports be prepared in order to document the finding and resulting response to the post-EIA (or EIS) monitoring program.

8.10.8. MANPOWER AND BUDGETING

It is envisaged that the Engineer will carry out the environmental monitoring programme as a part of the contract throughout the entire construction work. The EM will be employed on a full-time basis. Also, the Assistant EM will be full-time, and will report to the Engineer, and the EM. The cost of implementing the monitoring plan will include the full-time salary of the EM and Assistant EM. It may be necessary to employ an international environmental expert for the initial training of EMs and subsequently to attend at audit time.

8.11. RECOMMENDATION

1) Throughout this EIA study of the proposed project, it was found that potential impacts on the roadside air quality and noise/vibration are not negligible.
2) Also, it was found that several important pre-Inca ruins and cultural sites exist around the study area, so the careful coordination of the road design becomes one of the important factors to establish integrity with the surrounding cultural environment while minimizing/or avoiding any negative environmental impacts to be caused by the proposed project.
3) It is quite essential to establish comprehensive and effective environmental mitigation/management programs during the project-planning phase of this project with close co-ordination with various stakeholders, ranging from governmental organizations to local communities.
4) Some additional land acquisitions on Av. Venezuela are required. Therefore, Lima and Callao municipalities should be commence negotiation with the private industrial companies and other related authorities as soon as possible, to ensure the smooth and rapid implementation of the East-West trunk busway.
5) During the construction stage, traffic safety for the transportation and traffic of the construction materials and machines should be ensured.

8.12. STAKEHOLDER MEETINGS CONDUCTED

8.12.1. INTRODUCTION

(1) Outline

Within this feasibility study, three (3) stakeholder meetings are held, based on JICA Guideline. The schedule of three times stakeholder meeting is shown in Table 8.12-1. Major objectives of this stakeholder meeting are to enhance the public participation from various stakeholders with different backgrounds, establish comprehensive information disclosure, share common knowledge and understanding about the proposed project among stakeholders, and to achieve the smooth establishment of consensus. A separate summary of each stakeholder meeting is provided in the following section.

Table 8.12-1Schedule of Stakeholder Meetings

	Date	Place	Main Topics
1	June 08, 2006 (Thu)	Centro Cívico, Downtown, Lima	Project outline Outline of Environmental and Social Consideration
2	August 17, 2006 (Thu)	Same as above	1. Summary of Q/A session of 1st stakeholder meeting. 2. Information Disclosure (MTC's Homepage) 3. Study Progress (1) Engineering Aspects a) Summary of current traffic condition. b) Busway design policy (e.g., how to design the busway within the current RoW) c) Standard Cross Sections (2) Environmental Aspects a) Explanation of environmental study to be carried out within this study (ToR Explanation) b) Progress of Environmental Study i) Roadside Air Quality ii) Roadside Noise/vibration iii) Roadside Health Survey iv) Archaeological Survey
3	November 23, 2006 (Thu),	Same as above	Summary of Q/A session of 2nd stakeholder meeting. Future bus operation system and Major finding of environmental study.

(2) Information Disclosure

The importance of information disclosure of the proposed development project is stressed within JICA Guideline. Within this study, the following information has been put on the MTC's homepage and can be downloaded by any parties and/or individuals who are interested in this proposed study from this website (see Table 8.12-2).

Table 8.12-2 Homepage for Stakeholder Meetings

	Descriptions
Homepage address	www.ctlc-st.gov.pe/index/home.html
List of information	1. Announcement of each Stakeholder Meeting 2. Program of each stakeholder meeting (English & Spanish) 3. Presentation materials used at each stakeholder meeting 4. Contents of Q/A sessions (English & Spanish) 5. Lists of Attendants 6. Photo Records

8.12.2. SUMMARY OF STAKEHOLDER MEETINGS

(1) 1st Stakeholder Meeting

1) Outline of 1st Stakeholder Meeting

The 1st stakeholder meeting was held on June 08, 2006 in the basement conference room of Centro Cívico, downtown Lima. Table 8.12-3 summarizes the outline of this 1st meeting. Prior to this 1st meeting, a brief announcement was made within the website of MTC. Registration started at 8:30 a.m. of June 08 and the whole process of this stakeholder meeting was video taped. Originally, 84 stakeholders were selected from various organizations/agencies/schools/NGOs/groups/communities and others, and then, invitation letters were sent to the selected stakeholders. 30 people attended the 1st stakeholder meeting on June 08, 2006.

Table 8.12-3 Outline of 1st Stakeholder Meeting

(1) Registration
(2) Opening Remarks
(3) Explanation of Project Outline
(4) Explanation of JICA Guidelines for Environmental and Social Considerations
(5) Coffee Break
(6) Q/A Session
(7) Closing Remarks

2) Summary of Minutes of Meeting

There were 17 questions about this proposed project and detailed descriptions of this Q/A session are presented in see Table 8.12-4.

Table 8.12-4 Categorization of Questions

Topics	No. of Question
General	3
Integrity with current transport system	2
Right of Way	3
Compensation	1
Ruins/historical sites	1
Waste	1
Air Quality/Fuel/NMV	3
Socioeconomic	2
Traffic Management	1
Total	17

A simple questionnaire survey was conducted for all participants after the meeting was adjourned, and 25 replies were received.

76 percent of all respondents (i.e., 19 persons) said contents of this first stakeholder meeting are sufficient and/or understandable (see Figure 8.12-1) and 68 percent (17 persons) said the proposed project would cause no negative impacts on them (see Figure 8.12-2) and 60 percent (15 persons) said their situation would be improved if the proposed project is implemented (see Figure 8.12-3). It shall be noted that 92 percent (23 persons) are in favor and/or support the proposed project (see Figure 8.12-4).

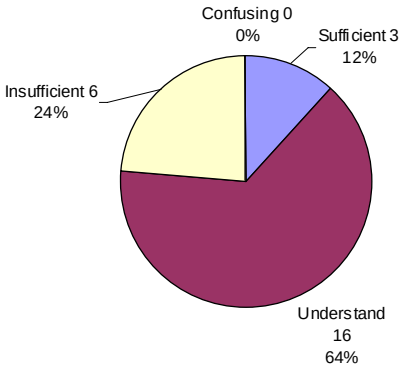


Figure 8.12-1 General Impression of 1st Stakeholder Meeting

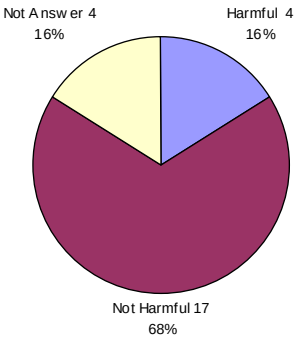


Figure 8.12-2 Does the proposed project cause any impacts?

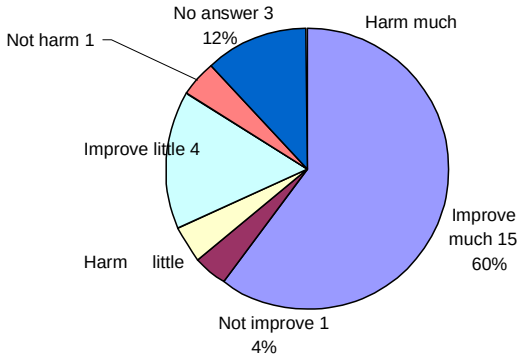


Figure 8.12-3 Positive/negative influence of the proposed project

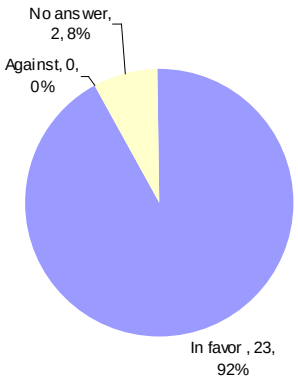


Figure 8.12-4 Do you support the proposed project?

(2) 2nd Stakeholder Meeting

1) Outline of 2nd Stakeholder Meeting

The 2nd stakeholder meeting was held on August 17, 2006 in the basement conference room of Centro Cívico, downtown Lima. Table 8.12-5 summarizes the outline of this 2nd meeting. Prior to this 2nd meeting, a brief announcement was made within the website of MTC. Registration started at 8:30 a.m. On August 17 and the whole process of this stakeholder meeting was video taped.

Based on 84 stakeholders, selected in previous meeting, several organization and individuals were added, and, consequently, 137 stakeholders were selected. After sending invitation letters to those selected stakeholders from MTC, the attendance of all stakeholders to the 2nd stakeholder meeting was multi-confirmed by phone until one day before the meeting. It turned out that 60 people attended the 2nd stakeholder meeting on August 17, 2006.

Table 8.12-5 Outline of 2nd Stakeholder Meeting

(1) Registration
(2) Opening Remarks
(3) Presentation
  1) Summary of Q/A session of 1st stakeholder meeting.
  2) Information Disclosure (MTC's Homepage)
  3) Study Progress
A Engineering Aspects
    a) Summary of current traffic conditions.
    b) Busway design policy
    c) Standard Cross Sections
B Environmental Aspects
    a) Explanation of environmental study to be carried out within this study (ToR Explanation)
    b) Progress of Environmental Study
      i) Roadside Air Quality
      ii) Roadside Noise/vibration
      iii) Roadside Health Survey
      iv) Archaeological Survey
(4) Coffee Break
(5) Q/A Session
(6) Closing Remarks.

2) Summary of Minutes of Meeting

Prior to the presentation of interim progress of the proposed study, a brief review of the question/answer session held at the 1st stakeholder meeting was carried out. Also, the outline of MTC's homepage, mentioned earlier, was explained and it was pointed out that all presentation material used within this stakeholder meeting can be downloaded from this website.

There were 12 questions about this proposed project and detailed descriptions of this Q/A session are shown in Table 8.12-6.

Table 8.12-6 Categorization of Questions

Topics	No. of Question
Cost-Benefit of Project	1
Impact on other transport modes	2
Right of Way	2
Health Survey	1

Ruins/historical sites	2
Institutional	1
Bus System Operation	1
Socioeconomic	3
Traffic Management	1
Others	1

A simple questionnaire survey was conducted for all participants after the meeting was adjourned, and 47 replies were received.

89 percent of all respondents (i.e., 42 persons) said the contents of this second stakeholder meeting are sufficient and/or understandable (see Figure 8.12-5) and 70 percent (33 persons) said the proposed project would cause no negative impacts on them (see Figure 8.12-6) and 75 percent (35 persons) said their situation would be improved if the proposed project is implemented (see Figure 8.12-7). It shall be noted that 89 percent (41 persons) are in favor and/or support this proposed project (see Figure 8.12-8). Figure 8.12-9 shows that most of the respondents of this survey pay great attention to roadside environment issues such as the air quality, noise and vibration (67 percents) within the proposed project.

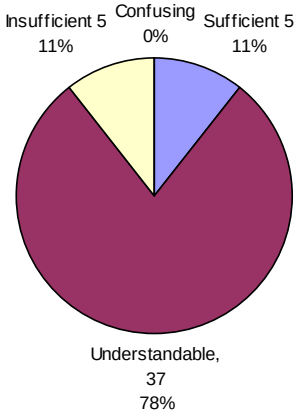


Figure 8.12-5 General impression of 2nd stakeholder meeting

Note: The same question was asked in the 1st stakeholder meeting and 76 % said the meeting was understandable

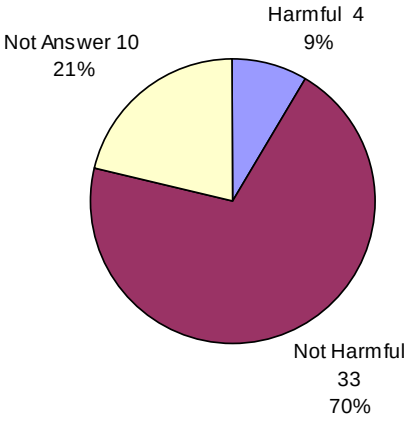


Figure 8.12-6 Does the proposed project cause any impacts?

Note: The same question was asked in the 1st stakeholder meeting and 68 % said no significant negative impacts will be caused by the proposed project.

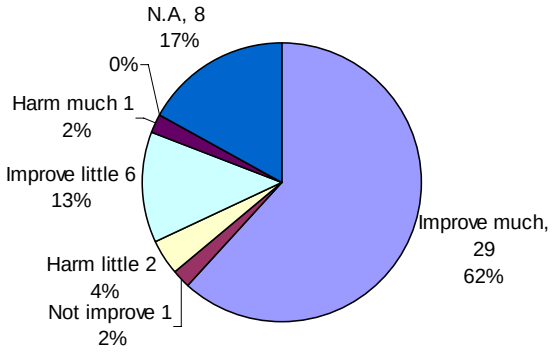


Figure 8.12-7 Positive/negative influence of the proposed project

Note: The same question was asked in the 1st stakeholder meeting and 60 % said surrounding conditions will be improved by the proposed project.

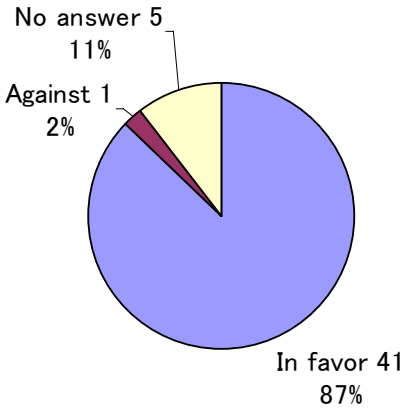


Figure 8.12-8 Do you support the proposed project?

Note: The same question was asked in the 1st stakeholder meeting and 92 % are favorable to the proposed project.

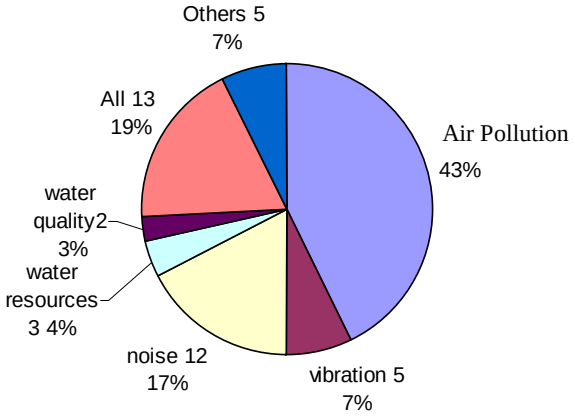


Figure 8.12-9 Which environmental aspect concerns you most? (multiple answers)

(3) 3rd Stakeholder Meeting

1) Outline of 3rd Stakeholder Meeting

3rd stakeholder meeting was held on November 23, 2006 at the basement conference room of Centro Civico, downtown Lima. Table 8.12-7 summarizes the outline of this 3rd meeting.

Based on 84 stakeholders, selected in previous 1st meeting, several organization and individuals are added, and, consequently, 120 stakeholders were selected. After sending invitation letters to those selected stakeholders from MTC, the attendance of all stakeholders to the 3rd stakeholder meeting was multi-confirmed by the phone until one day before the meeting. It turned out that 77 people attended at the 3rd stakeholder meeting on November 23, 2006.

Table 8.12-7 Outline of 3rd Stakeholder Meeting

(1) Registration
(2) Opening Remarks
(3) Presentation
  1) Summary of Q/A session of 2rt stakeholder meeting.
  2) Summary of Environmental Survey
  3) Summary of F/S of East-West trunk bus project
    a) Trunk bus system.
    b) Busway facilities design
    c) Benefits
    d) Social impacts.
    e) Project cost
    f) Economic and financial analysis
    g) Implementation schedule
(4) Coffee Break
(5) Q/A Session
(6) Closing Remarks.

2) Summary of Minutes of Meeting

Prior to the presentation of summary environmental survey and East-West trunk bus system, a brief review of question/answer session held at the 2nd stakeholder meeting was carried out.

There are 15 questions about this proposed project and detailed descriptions of this Q/A session are shown in Table 8.12-8.

Table 8.12-8 Categorization of Questions

Topics	No. of Question
Cost-Benefit of Project	1
Impact on other transport modes	2
Right of Way	2
Health Survey	1
Ruins/historical sites	2
Institutional	1
Bus System Operation	1
Socio-Economic	3
Traffic Management	1
Others	1

After question /answer section, the almost all participants understand the summary of environmental aspects regarding the project, and contents of the East-West trunk system and conditions of the trunk busway facilities.

Attendant lists of each stakeholder meeting and Minute of Meeting are shown in Appendix 8-2.

Appendix -8.1.

Roadside Air Quality Survey Results

CO Measurements

The detailed descriptions are presented in the Technical Report "Environmental Survey"

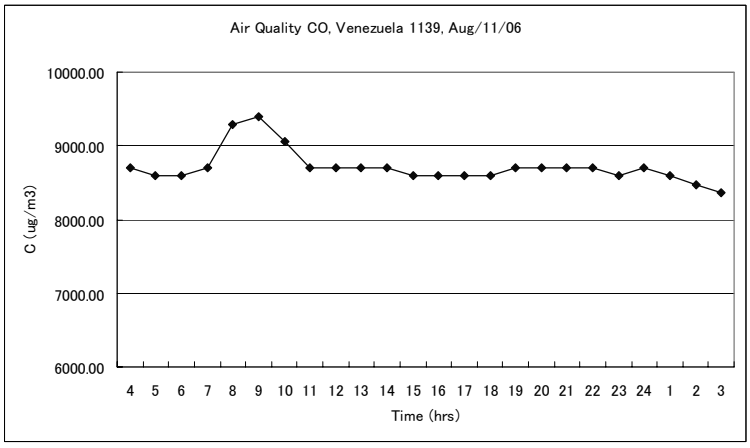


Figure A.8.1-1 Roadside A/Q Survey (CO, Avenida Venezuela 1139, August/11/06)

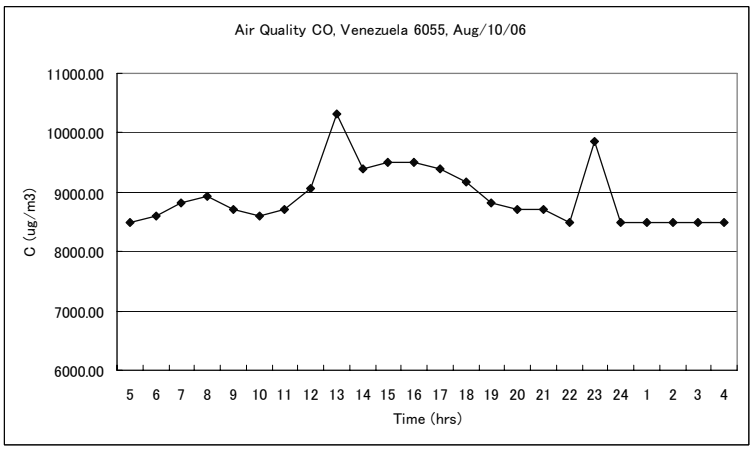


Figure A.8.1-2 Roadside A/Q Survey (CO, Av. Venezuela 6055, August/10/06)

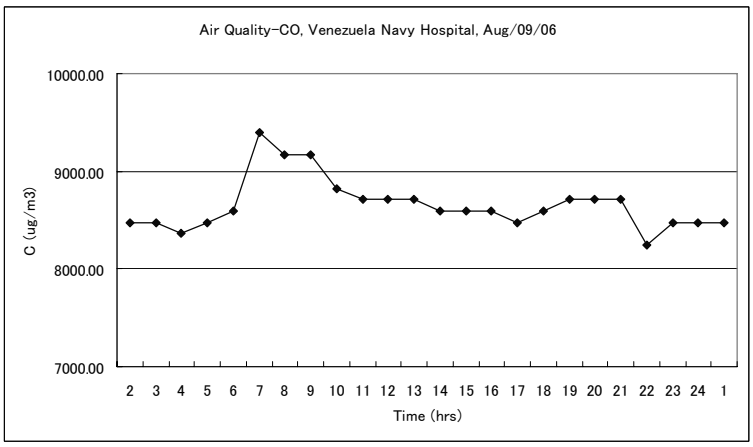


Figure A.8.1-3 Roadside A/Q Survey (CO, Av. Venezuela Navy hospital, August/09/06)

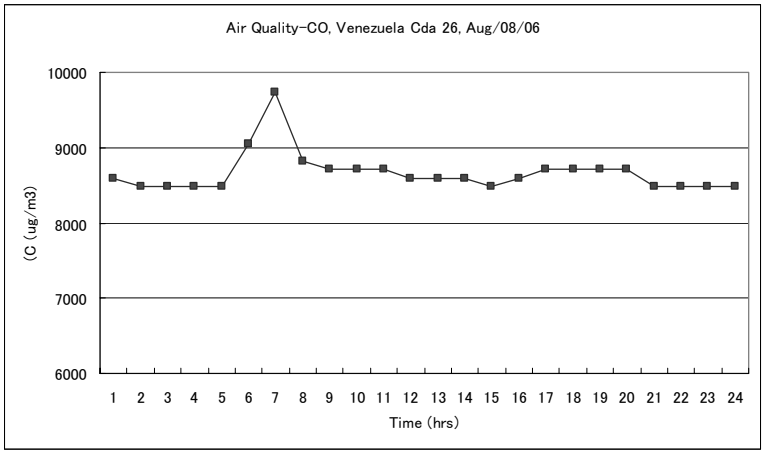


Figure A.8.1-4 Roadside A/Q Survey (CO, Av. Venezuela Cdra 26, August/08/06)

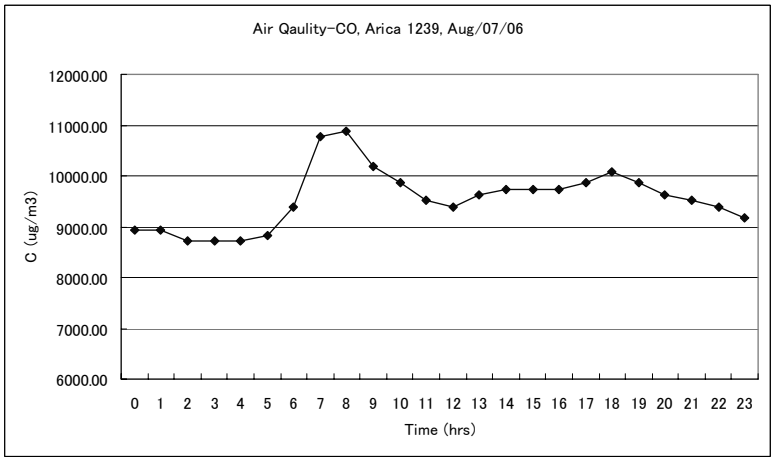


Figure A.8.1-5 Roadside A/Q Survey (CO, Av. Arica 1239, August/07/06)

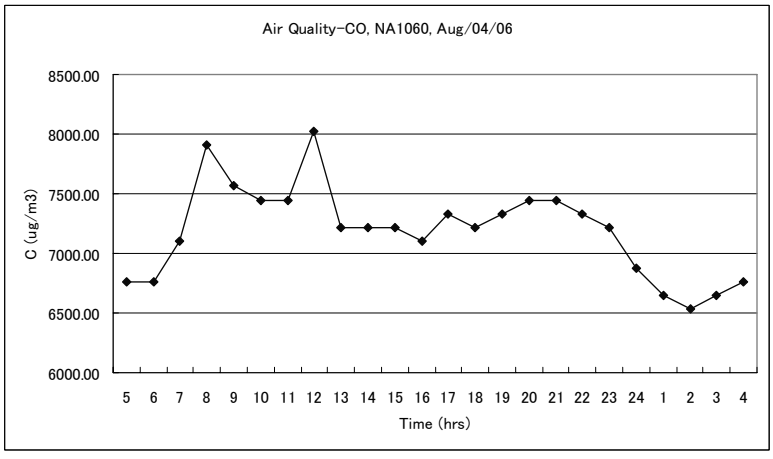


Figure A.8.1-6 Roadside A/Q Survey (CO, Avenida Nicolas Ayllon 1060, August/04/06)

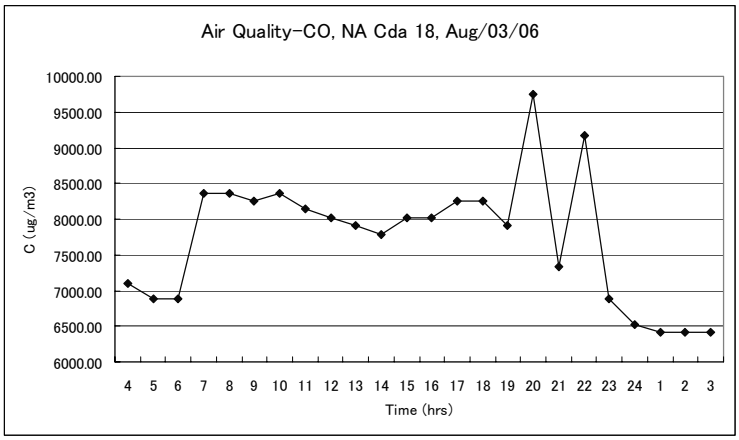


Figure A.8.1-7 Roadside A/Q Survey (CO, Av. Nicolas Ayllon Cda 18, August/03/06)

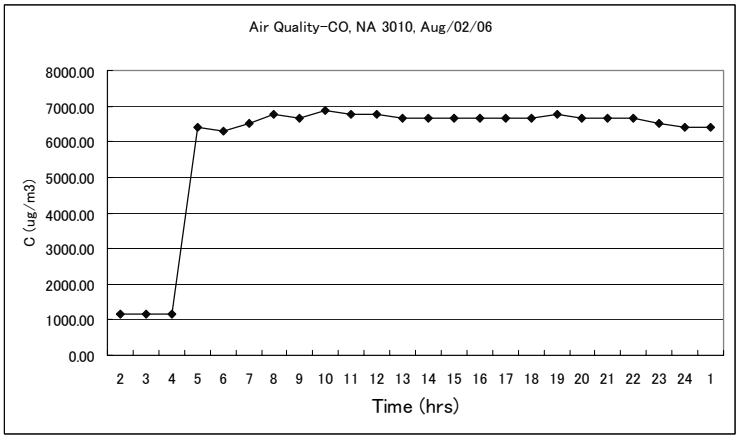


Figure A.8.1-8 Roadside A/Q Survey (CO, Av. Nicolas Ayllon 3010, August/02/06)

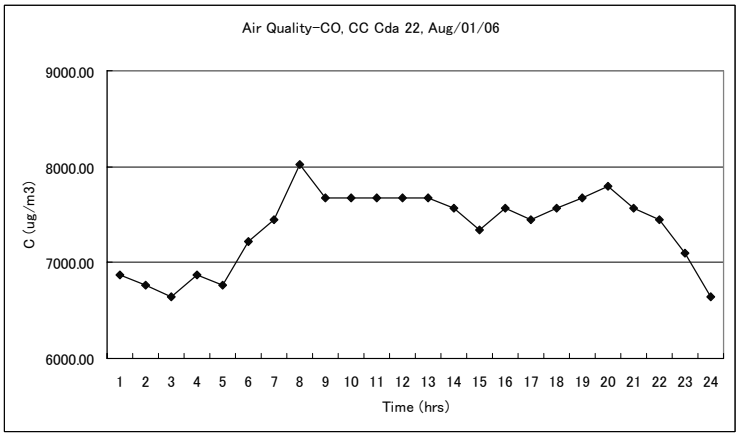


Figure A.8.1-9 Roadside A/Q Survey (CO, Carretera Central Cda 22, August/01/06)

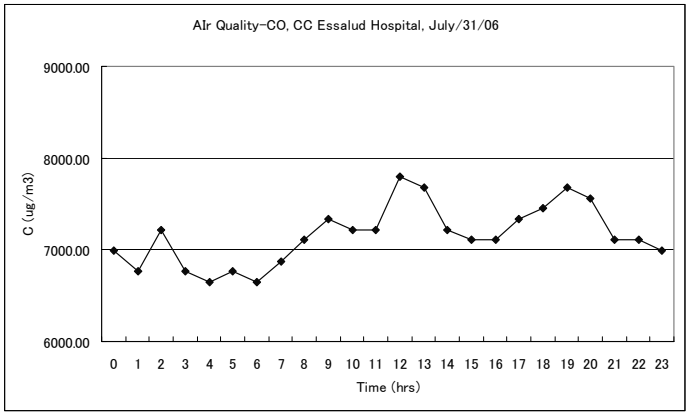


Figure A.8.1-10 Roadside A/Q Survey (CO, Carretera Central Essalud Hospital, July/31/06)

Appendix A.8.2

. Roadside Air Quality Survey Results

Measurements of NO_2 and SO_2

The detailed descriptions are presented in the Technical Report " Environmental Survey"

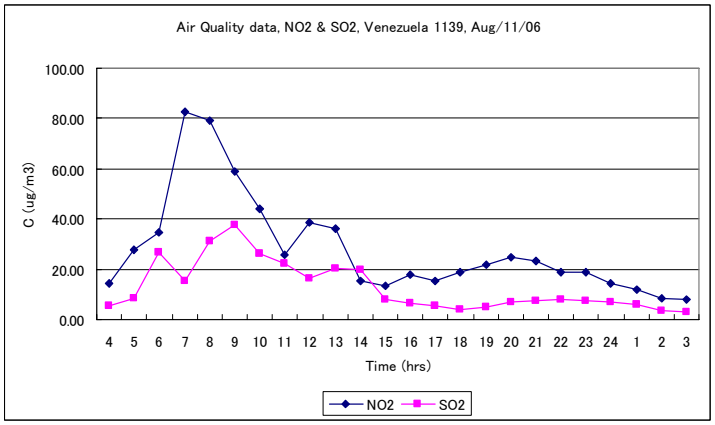


Figure A.8.2-1 Roadside A/Q Survey (NO_2 and SO_2, Av. Venezuela 1139, August/11/06)

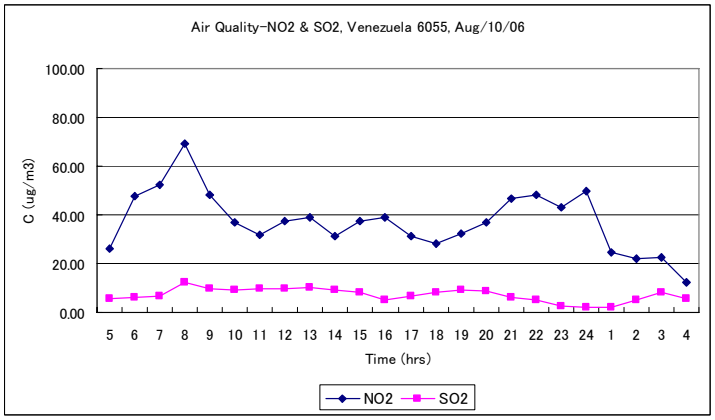


Figure A.8.2-2 Roadside A/Q Survey (NO_2 and SO_2, Avenida Venezuela 6055, August/10/06)

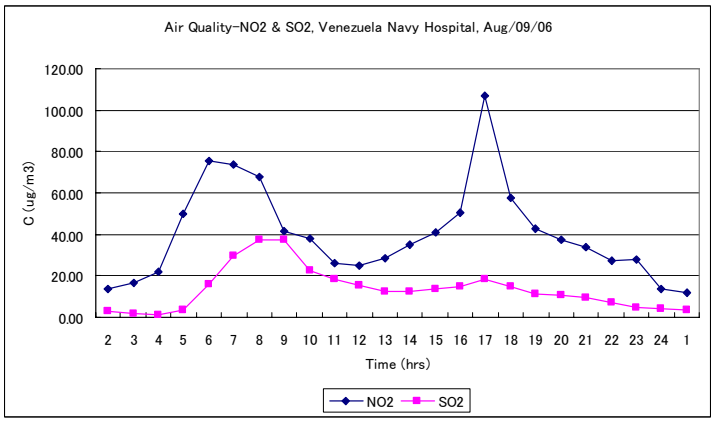


Figure A.8.2-3 Roadside A/Q Survey (NO_2 and SO_2, Av. Venezuela Navy hospital, August/09/06)

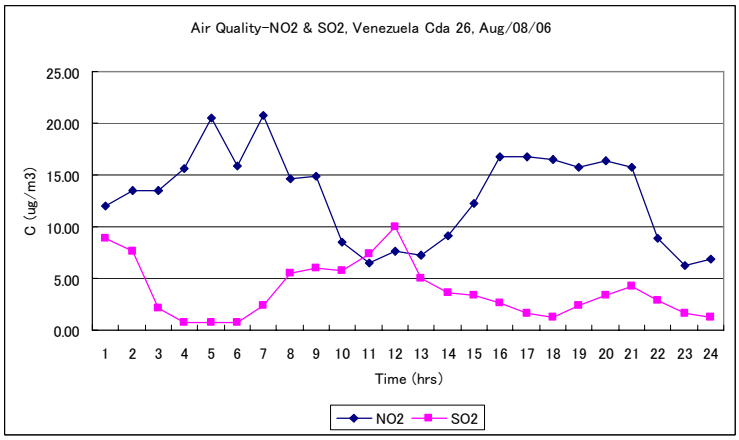


Figure A.8.2-4 Roadside A/Q Survey (NO_2 and SO_2, Av. Venezuela Cdra 26, August/08/06)

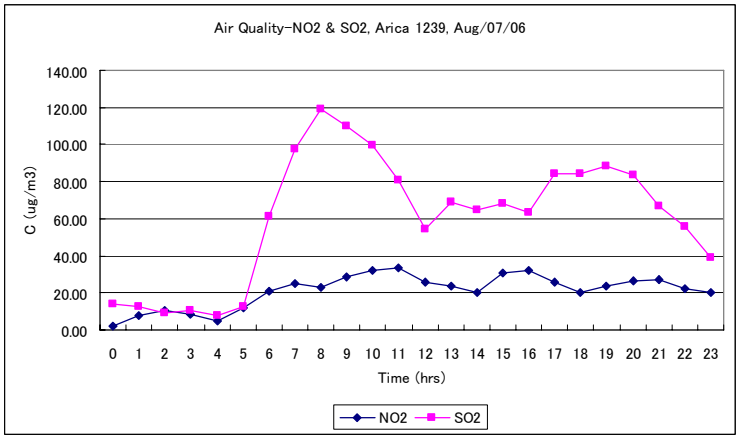


Figure A.8.2-5 Roadside A/Q Survey (NO_2 and SO_2, Av. Arica 1239, August/07/06)

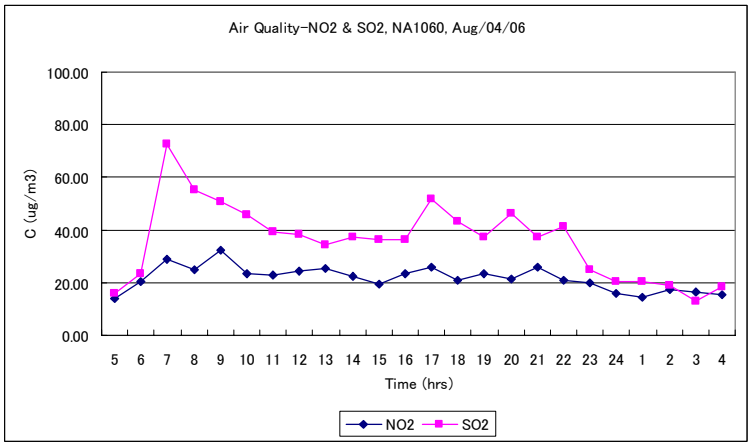


Figure A.8.2-6 Roadside A/Q Survey (NO_2 and SO_2, Avenida Nicolas Ayllon 1060, August/04/06)

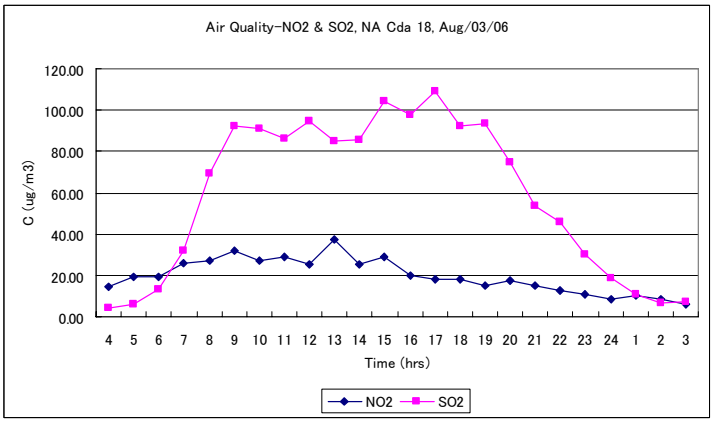


Figure A.8.2-7 Roadside A/Q Survey (NO_2 and SO_2, Av. Nicolas Ayllon Cda 18, August/03/06)

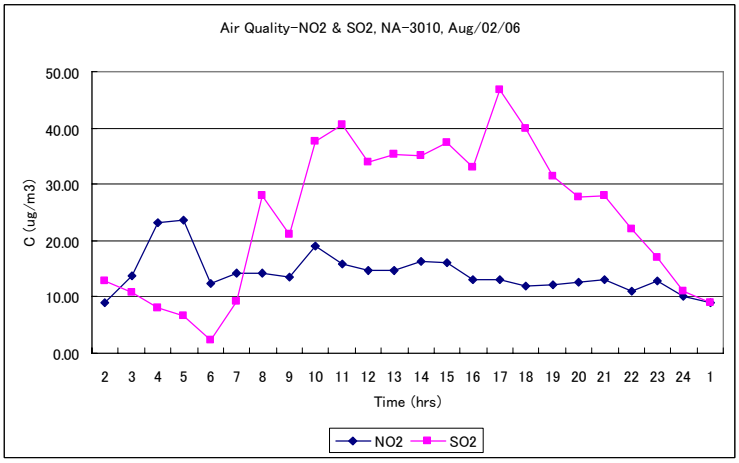


Figure A.8.2-8 Roadside A/Q Survey (NO_2 and SO_2, Avenida Nicolas Ayllon 3010, August/02/06)

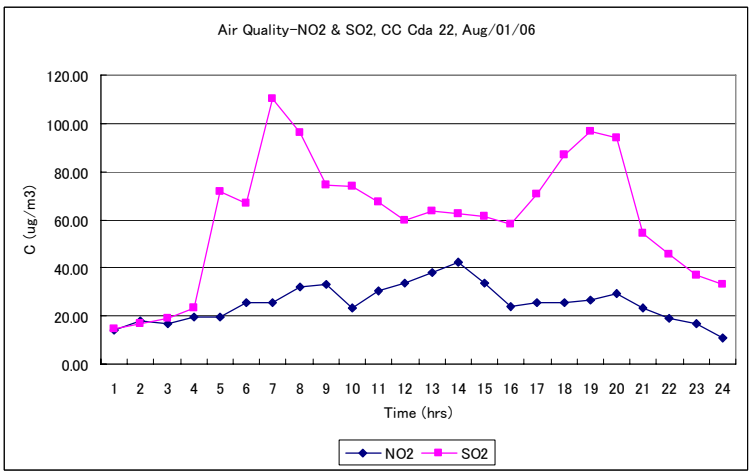


Figure A.8.2-9 Roadside A/Q Survey (NO_2 and SO_2, Carretera Central Cda 22, August/01/06)

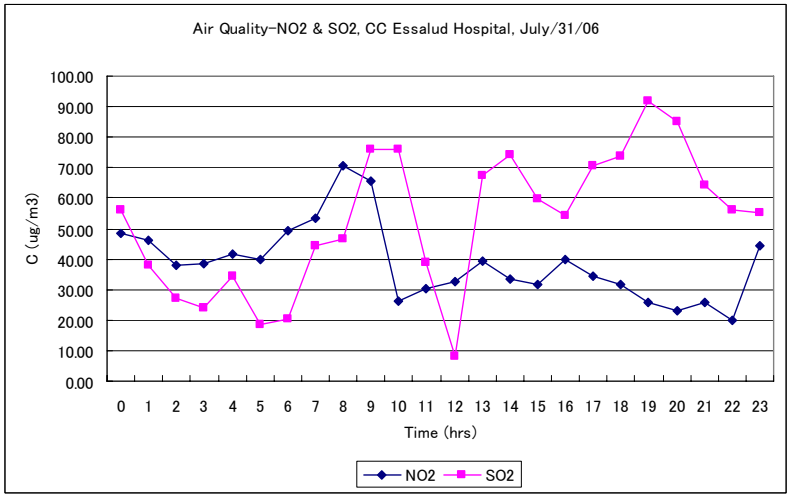


Figure A.8.2-10 Roadside A/Q Survey (NO_2 and SO_2, Carretera Central Essalud Hospital, July/31/06)

Appendix 8-2

Attendance list of 1st stakeholder meeting (June 8th, 2006)

1st Stakeholder Meeting Participant List - 08 June 2006

Nº	Organization/Institute/Company	Name	Tel/Cell
1	AGENCIA DE COOPERACIÓN INTERNACIONAL DEL JAPON - JICA	ELENA FERNÁNDEZ	221-2433
2	ASOCIACIÓN DE TRANSPORTE PÚBLICO DEL PERÚ - ASETRAP	VICTOR REYES VELASQUEZ EX-ENATRU	
3	ASOCIACIÓN DE PRESTACIÓN DE SERVICIOS ESPECIALES AUTOMOTRIZ	PEDRO CHAURA	
4	ASOCIACIÓN DE PRESTACIÓN DE SERVICIOS ESPECIALES AUTOMOTRIZ	AUREO CANCHARI	9657-1714
5	BIENESTAR DE LA MARINA	ING. ROCIO SOTO	452-0722 Anexo 4908 Cel. 9328-5897
6	BIENESTAR DE LA MARINA	JACK VENEGAS ROMERO	452-1485
7	COMITÉ DE GESTIÓN DE LA INICIATIVA DEL AIRE LIMPIO PARA LIMA Y CALLAO	GLADYS MACIZO	211-7930 Anexo 1837
8	COMITÉ ESPECIAL DE PROMOCIÓN DE LA INVERSIÓN PRIVADA	WILFREDO LANEGRA	427-9091
9	EMPRESA DE TRANSPORTE Y SERVICIOS UNIDOS "NUEVO SOL DE VITARTE"	ARGOMEDO SAICO	
10	EMPRESA DE TRANSPORTE Y SERVICIOS UNIDOS "NUEVO SOL DE VITARTE"	EMILIO MACAZANA V.	
11	FONDO NACIONAL DEL AMBIENTE FONAM	DOMINGO ARZUBIALDE ELORRIETA	449-6200 Anexo 30 Cel. 9590-5502
12	INSTITUTO DE AVANCE DEL TRANSPORTE PERUANO E.I.R.L	MANUEL J. MARTINEZ	226-4652
13	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA	ARNOLD MILLET LUNA	
14	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA	MIGUEL NAVARRO	
15	INSTITUTO PERUANO DE INVESTIGACIÓN Y DESARROLLO DE TRANSPORTES Y COMUNICACIONES - IPID - TC	MOISÉS TRAVI MEZA	
16	MUNICIPALIDAD DEL AGUSTINO	VICTOR MENDOZA	327-0636
17	MUNICIPALIDAD METROPOLITANA DE LIMA	ARQ. JOSE OVIEDO LIRA	315-1509 Cel. 9848-5904
18	MUNICIPALIDAD PROVINCIAL DEL CALLAO	LIDONIL DIAZ GONZALES	9905-7786
19	MUNICIPALIDAD PROVINCIAL DEL CALLAO	MANUEL COZ MIRAVAL	9811-7595
20	MUNICIPALIDAD PROVINCIAL DEL CALLAO	SUSANA M. MALDONADO	429-6477 Cel. 9728-4845
21	UNIVERSIDAD NACIONAL FEDERICO VILLAREAL	PERVIS PAREDES	9855-8465
22	REGION CALLAO	GLADYS ROMANI LOPEZ	9667-7303
23	ESTUDIANTE DE ING. DE TRANSPORTE	HERNÁNDEZ LEGUIN MIGUEL	9924-7563
24	ESTUDIANTE DE ING. DE TRANSPORTE	MANUEL DIAZ CHIROQUE	9313-1689
25	ARQUICUST S.R.L.	ELENA GUSHIKEN	461-5971
26	ARQUICUST S.R.L.	RAUL CHACON	578-6112
27	DIRECCION GENERAL DE SALUD AMBIENTAL - DIGESA	PAOLA CHINEN	442-8353
28	DIRECCION GENERAL DE SALUD AMBIENTAL - DIGESA	FRANCISCO GUEVARA ROBLES	442-8353
29	DIRECCION GENERAL DE SALUD AMBIENTAL - DIGESA	RONALD VALLE ALVITES	791-9259
30	EMPRESA SAN JUAN DE VILLA	SANTOS ALBURQUEQUE	9657-8305

Attendance list of 2nd stakeholder meeting (August 17th, 2006)

2nd Stakeholder Meeting Participant List, 17 August 2006

Nº	Nombre	Cargo	Nombre de la organización	Teléfonos
1	ELENA FERNÁNDEZ	Oficial de Programa	AGENCIA DE COOPERACIÓN INTERNACIONAL DEL JAPON - JICA	221-2433
2	RAÚL ROSALES		AGENCIA DE COOPERACIÓN INTERNACIONAL DEL JAPON - JICA	221-2433
3	JOSÉ LUIS DÍAZ LEÓN	Presidente	ASETUP - Asociación de Empresas de Transporte Urbano de Pasajeros	450-2051 276-7554
4	OSWALDO MONTEJO CARRIER		ASETUP - Asociación de Empresas de Transporte Urbano de Pasajeros	578-6261 9953-6325
5	ROSA MELLET	Vocal	ASOCIACIÓN VECINAL SAN JOSÉ, STA. CECILIA Y SAN JOAQUIN	451-0022
6	ALBERTO SÁNCHEZ AIZCORBE CARRANZA	Presidente Ejecutivo	Autoridad Autónoma del Proyecto Especial Sistema Eléctrico de Transporte Masivo de Lima y Callao	427-2020
7	JAVIER CORNEJO	Gerente de Desarrollo	Autoridad Autónoma del Proyecto Especial Sistema Eléctrico de Transporte Masivo de Lima y Callao	427-2020
8	ERICK REYES		Autoridad Autónoma del Proyecto Especial Sistema Eléctrico de Transporte Masivo de Lima y Callao	9992-7120
9	ROCÍO SOTO		BIENESTAR DE LA MARINA	9328-5897
10	MELISSA DOMINGUEZ GALLARDO	Asesora Legal	CAMARA DE COMERCIO DE LIMA	219-1591
11	RICARDO FALLAQUE		CENTRO MÉDICO NAVAL	9595-4099
12	LUIS PHILCO		CENTRO MÉDICO NAVAL	9859-4039
13	MARÍA ROSA DE VALERA	Presidenta	COMEDOR Y VASO DE LECHE DE CIUDAD DEL PESCADOR	451-7674
14	GLADYS MACIZO	Miembro	COMITÉ DE GESTIÓN DE LA INICIATIVA DEL AIRE LIMPIO PARA LIMA Y CALLAO	211-7930 (1837)
15	WILFREDO LANEGRA	Especialista	COMITÉ ESPECIAL DE PROMOCIÓN DE LA INVERSIÓN PRIVADA	427-9091
16	MARÍA VELÁSQUEZ CORREA	Practicante	COMITÉ ESPECIAL DE PROMOCIÓN DE LA INVERSIÓN PRIVADA	427-9091
17	DAVID GARCÍA		CONAM	225-5370 (275)
18	MIGUEL SAAVEDRA	Presidente	EMPRESA DE TRANSPORTE Y SERVICIOS "MI PERÚ"	348-9311
19	ARGOMEDO SAICO		EMPRESA DE TRANSPORTE Y SERVICIOS UNIDOS "NUEVO SOL DE VITARTE"	9703-6867
20	EDSON RAMOS PALACIN	Gerente General	EMPRESA DE TRANSPORTES IKARUS S.A.	9511-4249
21	JOSÉ ANTONIO BAYLÓN	Gerente General	EMPRESA DE TRANSPORTES URBANO LÍNEA 4	9666-8884
22	JOB HIGIDIO SACAY	Gerente General	EMPRESA DE TRANSPORTES VIRGEN DE FÁTIMA - EVIFASA	528-1423
23	JULIO SOLIS TAMARA	Gerente General	EMPRESA DE TRANSPORTES Y SERVICIOS LIMA - CHOSICA	361-8247
24	MOISES CONTRERAS		EMPRESA DE TRANSPORTES Y SERVICIOS LIMA - CHOSICA	360-1138
25	WERNER ARANA		EMPRESA DE TRANSPORTES Y SERVICIOS LIMA - CHOSICA	361-0531 9756-6603
26	JORGE ALVAREZ CALDERÓN	Gerente General	COMPAÑÍA UNIVERSAL TEXTIL S.A.	337-5260
27	ELENA OSEGA		FÁBRICA DE FIDEOS COGORNO eosega@cogorno.com.pe	420-7676
28	ELIAS PORTOCARRERO BENAVENTE	Asesor	FEDERACIÓN DEL EMPORIO COMERCIAL GRAU Y ZONAS ALEDAÑAS - FEDECGZA	9848-8903
29	HUMBERTO CHANGANO	Especialista	GERENCIA DE TRANSPORTE URBANO - MML	428-0561
30	LUZ RAMOS LORENZO	Directora Regional de Transportes y Comunicaciones	GOBIERNO REGIONAL DE LIMA	239-5427
31	ARNOLD MILLET LUNA	Profesional de la Gerencia General de Planificación y Transporte	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA	428-3333
32	EDWIN LUYO BARRIENTOS	Especialista	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA	428-3333
33	CARMEN OLIDEN		INSTITUTO NACIONAL DE CULTURA - INC	476-3706
34	MOISÉS TRAVI MEZA	Presidente	INSTITUTO PERUANO DE INVESTIGACIÓN Y DESARROLLO DE TRANSPORTES Y COMUNICACIONES - IPID - TC	566-2981
35	TERESA RENTERÍA DE GARAVITO	Presidenta	JUNTA VECINAL CDRA. 1 Y 2 AV. DE LAS AGUILAS	451-4328
36	SUSANA MALDONADO VILLANUEVA	Especialista de la Gerencia General de Desarrollo Urbano	MUNICIPALIDAD PROVINCIAL DEL CALLAO	429-6477 (259)
37	ALFREDO GARCÍA VILLACORTA	Jefe del Equipo de Control y Reducción de Fugas	SEDAPAL	317-3570
38	SIMÓN RODRÍGUEZ SULCA		SEGURIDAD CIUDADANA DE LA URB. PALOMINO	425-8168
39	ENRIQUE GUILLÉN CABREJOS	Gerente de Ingeniería y Construcción	TELEFÓNICA	210-2268
40	ROBERTO SIU		TELEFÓNICA	210-2477

41	DANIEL LORENA		TELEFÓNICA	210-2471
42	LUIS MARAVÍ ARIAS	Gerente General	TRANSLIMA S.A.	254-2097
43	ALFREDO AGUILAR	Gerente de Operaciones	TRANSLIMA S.A.	254-2097 9755-0029
44	PERVIS PAREDES	Coordinador de la Escuela de Ingeniería de Transporte	UNIVERSIDAD NACIONAL FEDERICO VILLAREAL	9855-8465 433-4403
45	JHONY PERDAVÉ	Docente	UNIVERSIDAD NACIONAL FEDERICO VILLAREAL	9679-0607
46	MARIANO AVILA QUEZADA		GERENCIA DE TRANSPORTE URBANO - MML	428-1311
47	TERESA VILCAPOMA HUAPAYA	Sub-director de Registro	INSTITUTO NACIONAL DE CULTURA - INC	226-3940
48	RAFAEL QUINTANA FLORES	Gerencia de Planeamiento	MUNICIPALIDAD PROVINCIAL DEL CALLAO	453-6090
49	LILIANA MIRAVAL CORDANO	Gerencia de Planeamiento y Catastro	MUNICIPALIDAD PROVINCIAL DEL CALLAO	482-3510
50	TERESA TRUJILLO		ARQUICUST	9963-2245
51	VICTOR ORTIZ		UNIDOS SOL DE VITARTE	
52	ELIZABETH MARÍA MEDINA TELLO		UNIVERSIDAD NACIONAL FEDERICO VILLAREAL	9737-0240
53	HAURY CARRANZA T.		COGORNO	420-7676 (45)
54	JULIA ZEA LOAIZA	Arquitecta	MUNICIPALIDAD PROVINCIAL DEL CALLAO	429-6477
55	MATILDE HINOSTROZA MORALES	Arquitecta Planeamiento	MUNICIPALIDAD DE LIMA	315-1508
56	GERARDO JACAX CASASOLA		EMPRESA DE TRANSPORTES VIRGEN DE FÁTIMA - EVIFASA	9657-2631
57	PEDRO BASTIDAS CHUQUILLANQUI	Sub-gerente	UNIDOS SOL DE VITARTE	
58	HILO ALVINO ATAHUAMAN	Gerente	E.T. CARRETERA CENTRAL	348-9311
59	JORGE DE CÁRDENAS LEGUÍA	Asesor Legal	AATE	427-2020
60	EMILIO MENDEZ GONZA	Gerente	E.T. NUEVA IMAGEN S.A.	9540-3636

Attendance list of 3rd stakeholder meeting（November 23rd, 2006）

3rd stakeholder meeting participant list 23.NOV.06

Nº	Name	Position	Organization, Institute, Company
1	RAÚL ROSALES	Gerente de Proyectos	AGENCIA DE COOPERACIÓN INTERNACIONAL DEL JAPON - JICA
2	ELENA GUSHIKEN UESU	Gerente General	ARQUITECTURA Y CONSULTORÍA ACÚSTICA - ARQUICUST
3	JOSÉ LUIS DÍAZ LEÓN	Presidente	ASETUP - Asociación de Empresas de Transporte Urbano de Pasajeros
4	LUIS GAONA		ASETUP - Asociación de Empresas de Transporte Urbano de Pasajeros
5	VICTOR REYES VELÁSQUEZ	Presidente	ASOCIACIÓN DE TRANSPORTE PÚBLICO DEL PERÚ - ASETRAP
6	ERICK REYES JAUREGUI		Autoridad Autónoma del Proyecto Especial Sistema Eléctrico de Transporte Masivo de Lima y Callao
7	JULIO CÉSAR LAVADO YARASCA		Autoridad Autónoma del Proyecto Especial Sistema Eléctrico de Transporte Masivo de Lima y Callao
8	ROCÍO SOTO		BIENESTAR DE LA MARINA
9	MARÍA ROSA DE VALERA	Presidenta	COMEDOR Y VASO DE LECHE DE CIUDAD DEL PESCADOR
10	WILFREDO LANEGRA	Especialista	COMITÉ ESPECIAL DE PROMOCIÓN DE LA INVERSIÓN PRIVADA
11	MARÍA VELÁSQUEZ		COMITÉ ESPECIAL DE PROMOCIÓN DE LA INVERSIÓN PRIVADA
12	GREGORIO TORRES GONZALES		CONFEDERACIÓN GENERAL DE TRANSPORTES - DGT
13	ANGELICA SILVA LÓPEZ		DIRECCIÓN GENERAL DE SALUD AMBIENTAL - DIGESA
14	CARLOS TABOADA	Gerente General	EMAPE
15	HUGO CONTRERAS		EMAPE
16	IVÁN UGARTE VALDIVIA	Gerente General	EMPRESA DE TRANSPORTES UNIDOS DE PASAJEROS - ETUPSA
17	GOMEZ SANCHEZ LOARTE	Asesor Legal	EMPRESA DE TRANSPORTES UNIDOS DE PASAJEROS - ETUPSA
18	WENKENMEZ SALINAS		EMPRESA DE TRANSPORTES URBANO LÍNEA 4
19	GERARDO JACAY	Gerente General	EMPRESA DE TRANSPORTES VIRGEN DE FÁTIMA - EVIFASA
20	MARIELA ATALA ALVAREZ		GTU
21	ARNOLD MILLET LUNA	Profesional de la Gerencia General de Planificación y Transporte	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA
22	EDWIN LUYO BARRIENTOS	Especialista	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA
23	WALTER PAREDES	Gerente de Planificación	INSTITUTO METROPOLITANO PROTRANSPORTE DE LIMA
24	TERESA VILCAPOMA HUAPAYA	Directora de Arqueología	INSTITUTO NACIONAL DE CULTURA - INC
25	MOISÉS TRAVI MEZA	Presidente	INSTITUTO PERUANO DE INVESTIGACIÓN Y DESARROLLO DE TRANSPORTES Y COMUNICACIONES - IPID - TC
26	ERICK COBEÑA	Directora General de Asuntos Socio Ambientales	MINISTERIO DE TRANSPORTES Y COMUNICACIONES
27	SUSANA MALDONADO VILLANUEVA	Especialista de la Gerencia General de Desarrollo Urbano	MUNICIPALIDAD PROVINCIAL DEL CALLAO
28	GUADALUPE OBREGÓN	Especialista de la Gerencia General de Desarrollo Urbano	MUNICIPALIDAD PROVINCIAL DEL CALLAO
29	EULOGIO ESPINOZA	Especialista de la Gerencia General de Desarrollo Urbano	MUNICIPALIDAD PROVINCIAL DEL CALLAO
30	FRANKLIN BARRETO VERÁSTEGUI	Jefe de la Unidad de Investigación de Accidentes de Tránsito	POLICÍA DE TRANSITO DEL PERU
31	ALFREDO GARCÍA VILLACORTA	Jefe del Equipo de Control y Reducción de Fugas	SEDAPAL
32	SIMÓN RODRÍGUEZ ASMAT	Coordinador	SEGURIDAD CIUDADANA DE LA URB. PALOMINO
33	LUIS MARAVÍ ARIAS	Gerente General	TRANSLIMA S.A.
34	JUAN CARLOS ARROYO		TRANSLIMA S.A.
35	ALFREDO AGUILAR		TRANSLIMA S.A.
36	CESAR RIVADENEYRA RIVAS		UNFV
37	MARIELENA CAMPOS		UNFV
38	ELIZABETH MEDINA TELLO		UNIVERSIDAD NACIONAL FEDERICO VILLAREAL
39	MIGUEL ROJAS CASTRO	Gerente	E.T. SAN CRISTOBAL
40	VICTOR RAÚL ZEGARRA BELLIDO		E.T. RAPIDO MUSA S.A.

41	LUIS OSCANOA PALOMINO		ETUPSA 73
42	MIGUEL SIDIA		INSTITUTO DE TRANSITO Y TRANSP.
43	DARIO ORIHUELA LÓPEZ		E. TRANSPORTE 102 S.A.
44	JULIA ZEA LOAIZA		MUNICIPALIDAD DEL CALLAO
45	MIRKA VILLEGAS		CONSULTOR
46	LUIS MIGUEL RAMÍREZ SOLLER		ESTUDIANTE UNFV
47	HUGO LEÓN PULIDO		ESTUDIANTE UNFV
48	CAROLINA SALAZAR RIVAS		UNFV
49	MATILDE HINOSTROZA MORALES		MUNICIPALIDAD METROPOLITANA DE LIMA
50	EDWIN PASTOR CENTENO		APOYO TÉCNICO ST.CTLC
51	ISABEL MOLINA	Jefe de Departamento de Proyectos	MARINA DE GUERRA
52	MARINA ALMEIDA	Asesor Legal	MARINA DE GUERRA
53	CIRILO CARHUAZ NOLASCO	Gerente General	EMPRESA DE TRANSPORTE FEDERICA VILLAREAL
54	JOSÉ ROMERO PONCE	Gerente General	EMPRESA DE TRANSPORTE 102 S.A.
55	MARCO ALCAZAR RODRÍGUEZ	Impacto Ambiental	DIGESA
56	ORLANDO OLCESE	Asesor	MTC
57	RICARDO FALLAQUE	Oficial de Seguridad	HOSPITAL NAVAL - MARINA DE GUERRA
58	RAFAEL QUINTANA FLORES	Supervisor Catastro	MUNICIPALIDAD PROVINCIAL DEL CALLO
59	RONALD MUÑOZ MARTEL	Gerente General	TRANSPORTES VENEZUELA S.A.
60	ERICKA SALCEDO	Gerente General	SSTRAPERS QMACKERS

Minute of Meeting
of the first stakeholder meeting for
Feasibility Study of Urban Transportation for the
Metropolitan Area of Lima and Callao

Date: Lima, June 8th, 2006
Local: "Centro Civico" Conference Room
Time: 9:00 A.M. to 12:30 P.M.

Questions and Answers

1) Question: When will the execution of work begin? And how long will it take?

Moto-taxi association: Asociación de Prestación de Servicios Especiales Automotriz
Representative: Mr. Aureo Canchari

Answer: Engineer Rómulo Chinchay

The feasibility study has just begun as a result of the studies conducted in the Master Plan of 2004 and it will be finished by December this year. Later, there will be a second stage to carry out the Detail Design Study in which recommendations of Environmental Impact Studies will be taken into account. It is important to make it clear that there are two aspects to this study. 1) The study of demand to define transportation technologies, and then the type of corridor with the correspondent necessary infrastructure and at the same time, the study of Environmental Impacts of the corridor. Regarding your question on how this corridor is going to affect your daily work, this is a very important issue for this study to figure out how to act in order to mitigate the impact. For instance, you could be benefited if you participated in a feeder route service. Precisely, the objective of this meeting is to listen to your points of view and concerns in order to take them into consideration during this study. I suppose that the D/D will be executed in 2007 and the construction stage in year 2010. Now we are developing the Feasibility Study.

2) Question: Taking into account that this kind of projects takes approximately 5 years from the study phase until its execution, I am concerned about urban development. In this regard, all Road System in Lima is regulated by the Municipal Ordinance N° 341 – 2001 –SVM (Sistema Vial Metropolitano – Metropolitan Road System). So, according to the Municipalities Organic Law, the only instruments that could limit or condition private properties are the approved projects of urban trains and road systems.
In this sense, I am a little concerned because in the order of processes to be developed within the project, the coordination with local regulations will be conducted in the last stages, when the most appropriate thing would be to request to the City a reservation of urban area as soon as there is a preliminary study, in order to avoid constructions in specific areas up to the consolidation of the study.

Entity: Gerencia de Desarrollo Urbano de la Municipalidad Metropolitana de Lima
Representative: Mr. José Alonso Oviedo

Answer: Engineer Rómulo Chinchay

Definitely, the Ordinance N° 341 about the Right of way will be taken into account in the present project since it is such an important issue. It is important to care for the right of way, which is part of the Urban Development. Urban Development should have a plan, a staff of attorneys to design a plan to recover the right of way and not to keep on waiting for the execution of road developments to start the procedures of recovery. In Lima, most Road Network has illegally been invaded by companies or persons; for that reason the Municipality should implement a staff of attorneys to design an urgent plan to recover the right of way, so that roads would be free of interferences at the moment road projects are executed.

3) Question: Does the project conduct any essential analysis of users-pedestrian demand? Because projects executed in Lima, usually do not take into consideration facilities for pedestrians, giving priority for motorization.

Company: Fondo Nacional del Ambiente - FONAM
Representative: Mr. Domingo Arzubialde

Answer: Engineer Rómulo Chinchay

According to the results of the Person Trip Survey conducted in the Master Plan Study, 25% of the total daily trips were by walking and 73% of motorized trips were by public transport (bus, microbus and combi) without including moto-taxi or taxi-colectivos. In this regard, the first priority of the city should be to concentrate investments in public transportation (70% of trips) and the second priority is the pedestrian. Therefore, it is necessary to develop an infrastructure based on pedestrians not on cars. It is not possible to forbid purchasing cars, everybody is free to do it, but what we should do as technicians and authorities is to promote the rational use of cars, as other cities do. So, that is why your participation is relevant because it emphasizes the importance of pedestrians. In the central area of Lima, for instance, it is possible to reduce the number of lanes for cars only to one lane and the remaining space for pedestrians. As you can see, in downtown Lima, there are streets with one meter wide sidewalks and people have to use the paved road to walk. In that case, one lane for cars could be transformed into a pedestrian way. The project is going to consider the integration of all systems, such as for pedestrians for bicycles as well as other systems such as taxis and the conventional system.

4) Question: Our premises are located at Venezuela avenue, block 34, in front of Hospital Naval. We heard that our zone, specifically Liceo Naval with Almirante Montero, would be affected with a reduction of 14 lineal meters in our land, according to some versions. There are about 3000 students at this school in both turns. Will the noise impact of this project affect us in some way? Will special bus stops be considered for the exit of these students? Likewise, Liceo Naval has 100 buses in peak hours, that is to say 7:30 a.m., 1 p.m. and 6:p.m. and they leave constantly. Will any type of access be considered for these buses, since the whole Transportation Department of the Peruvian War Navy is located in said area.
Entity : Bienestar de la Marina
Representative: Engineer Rocio Soto

Answer: Engineer Rómulo Chinchay

As you could see in the explanation, there are 25 items or factors to be considered in the environmental impact study and they contain precisely all you have already mentioned, the accessibility, safety facilities and noise. The environmental study will detect and evaluate the way to avoid or mitigate the impact that the project might cause on activities located in the influence area of the corridor. We will be always in contact with you, there are 3 meetings more to come. This is an opening meeting, in the second meeting we will inform on the progress of the study and in the third meeting we will provide the conclusions of the study. Such conclusions will be the result of interaction between the project developers and you, in order to get a consensus in the project planning.

5) Question: Regarding studies to be performed in order to establish the base line of critical zones of the corridor, air quality survey should identify the critical variables around the urban zones where such places will be located. In the F/S, it is important to consider the Plan for Solid Waste Handling, since there are regulation both at a general and at Municipality level.

Company: Dirección General de Salud Ambiental - DIGESA
Representative: Mr. Francisco Guevara

Answer: Engineer Rómulo Chinchay

Certainly, one of the subjects to be analyzed in the Environmental Study is to identify the appropriate number of industrial sites for waste treatment produced during construction, in order not to proceed as usual, when waste is disposed at rivers and the sea. Therefore, this project will identify such places in order to avoid pollution and to preserve the urban landscape.

6) Question: Is the project considering population security in the context of social aspect? Because when construction starts, in many cases streets are closed and some areas become dangerous due to thefts and robberies.

Company: Región Callao
Representative: Mrs. Gladys Romaní

Answer: Engineer Rómulo Chinchay

Population security is a very complex matter and so, during the construction period, all security measures have to be considered in order to assure the traffic flow without affecting in a negative manner the neighborhood. Definitely, it is important to consider this factor.

7) Question: According to the explanation, the project goes through Carretera Central, Grau Avenue and finally Venezuela Avenue. In this case, which have been the criteria to define this route? Were there other alternatives?

Company: Dirección General de Salud Ambiental - DIGESA
Representative: Engineer Paola Chinen

Answer: Engineer John Romero

The present issue is a development of the M/P, who evaluated alternatives both at socioeconomic and financial levels. One of the proposed projects was the East-West Corridor through Carretera Central, Av. Ayllón, Grau and Venezuela. During the development of the Master Plan, Grau Express way, one of the roads that is already secured with priority to public transportation, was also under execution. The execution of this work has been considered as of maximum priority in the context of the Short Term Plan for 2010, due to the high mobility existing in the East and West zone towards downtown.

8) Question: It is recommended to strengthen the issue of bicycle roads by making a comparison with European countries, saying that in said countries, taxes are deducted for bicycle users Which treatment is going to be given to the use of Natural Gas as fuel for vehicles, that has already been incorporated in our system? What kind of proposals do you have regarding Environment? And, is there any possibility to be part of the Evaluation Steering Committee?

Company: Instituto Peruano de Investigación y Desarrollo de Transportes y Comunicaciones
Representative: Mr. Moisés Travi

Answer: Engineer Rómulo Chinchay /Dra. Blanca Guerrero

As everybody is informed, Central Government has a policy to change the energy system in all the country. Specifically for the project, this variable has to be analyzed from the environmental, financial as well as from transportation technologies viewpoint. This subject surely shall be considered.

It would be a pleasure to invite you to our offices, probably not as member of the Steering Committee but we would be glad to hear you and inform about the project progress. Our offices are located at Centro Cívico, 14th Floor, Technical Secretariat of Lima and Callao Transportation Council where JICA Study Team is working on the study.

9) Question: One part of our terrain will be expropriated. Do you know when will it happen? When will start the conversations to establish the area the Navy has to give back for the development of this project?

Company: Bienestar de la Marina
Representative: Engineer Rocio Soto

Answer: Engineer Rómulo Chinchay

AS the Study progresses, the project design will be defined and then it will be a motive to concentrate on having more dialogue with you.

10) Question: As a suggestion, I think it would have been convenient if a schedule of all activities to be performed were fixed. This is a first meeting in which we are being

informed on activities related to the socio-environmental area and the possible impacts that could be generated. It would be important to know the future activities and what alternatives there are for the next meetings, so some questions could be prepared beforehand, since the information is too general and we do not know yet the global measures to be adopted for these impacts, which is the issue we all are interested at.

Company: Dirección General de Salud Ambiental - DIGESA
Representative: Engineer Paola Chinen

Answer: Engineer Rómulo Chinchay

The study lasts 8 months and will be finished on December. The objective of this first meeting is to inform you about what we are going to do, guidelines of the study and specific factors to be analyzed. There are three meetings with you; the second meeting will be based on the studies of environmental impact that we are developing. A consultant company specialized on such field has been hired for the purpose. And in the third meeting we will inform on the conclusions of the study in which will be included the viewpoints of you all. Actually, the schedule will take 8 months and it is not possible to specify the date of the second meeting. Also, as stated in the explanation, you will be duly notified for the second and third meeting.

11) Question: Will the study include technical strategies in relation to the quality of life and will that be marked by this social, cultural and economic differences?

Company: University Student
Representative: Ivan Matos

Answer: Engineer Rómulo Chinchay

In the guidelines of the study, there is an item referred to the social and economic aspects of the same. So, in relation to this issue, levels of education and income of the population will be analyzed, and then, according to the results, strategies will be studied to apply them in the Project.

12) Question: When we go from Chosica, Huaycán to the trunk area, how will it affect in regard to the economic aspect? Which would be the boarding area? And how would it affect small vehicles?

Company: Empresa de Transporte y Servicios Unidos “Nuevo Sol de Vitarte”
Representative: Argumedo Saico

Answer: Engineer Rómulo Chinchay

The Trunk Bus System has a strategy of implementation; it is a trunk-feeder system, accordingly to the urban characteristics of the city. There are areas of low demand where an articulated bus is not necessary, only one with low capacity such as a microbus or a conventional bus. In this regard, to get from Huaycán to downtown Loma, people will use a small vehicle, for example a microbus, to arrive to a bus terminal that could be located around Santa Anita Market and then transfer to a higher capacity bus and finally to Lima Downtown; in such a way that the rationalization of the system will

make people and not vehicles to travel. But as you know, there are vehicles that go from Comas to Villa el Salvador or from Ancón to Chosica with many O/D pairs and when a system is rationalized, routes do not need to be so large, but profitable. Sometimes short routes could be profitable, with small fleet and higher number of laps. Therefore, regarding how the activity of moto-taxi mode would be affected, you might be integrated to the system, feeding the system, the passengers. You might become feeders of the system that we are planning.

13) Question: We have a small business between Universitaria and Venezuela Avenues crossing. If the project goes thorugh Venezuela, will a by-pass be constructed or everything will go on as it is now in Av. Venezuela? In case a by-pass is constructed, it would affect our business too much, and so, all people working currently in said market would have to leave the place.

Company: Asociación de Prestación de Servicios Especiales Automotriz
Representative: Pedro Chaura

Answer: Engineer Rómulo Chinchay

We cannot make decisions on road infrastructure yet, it is part of the D/D and we do not have such conclusions yet. However, I could say my point of view regarding this kind of solutions. In urban zones and main roads, traffic is always intense and sometimes the construction of a by-pass is simply a specific solution not a real one that could solve the transportation problem. If a by-pass is constructed, the problem is solved at this place but the problem is transferred to 100 meters ahead and the problem goes on. So, there are many more interesting ways to solve the transportation problem, not only from the infrastructure point of view but also from traffic management. That is to say, to intervene in the thoughts of people, to invest in training of driving practices, to observe the good use of roads and sidewalks. In conclusion, we have not defined the engineering solution for Venezuela-Universitaria by-pass, but in fact we will get on it at the end of the study, we will define the type of infrastructure. The philosophy of the study is to think about people not about vehicles.

14) Question: Will the train system and trunk bus system exist both at the same time? or is it an alternative system either train or bus?

Company: Asociación de Transporte Público del Perú - Asetrap
Representative: Mr.Victor Reyes

Answer: Engineer Jhon Romero

It is known that the bus system will not be sufficient to support the demand of the system in the future. Train transportation system will have to coexist with bus transportation system. In Tokyo, for example, the subway system is very well organized and mass transportation system is based on railways, but there is also a system of bus routes for public urban transportation. We are going to work in the same way in the city and it is planned to be so. Obviously, in 2010 we will not have the entire train network, this is a plan designed for 2025 and projects will be gradually introduced according to the evaluated scenarios. The project considers the implementation of Line 1 of the train that gets until Aviación avenue with extension towards San Juan de Lurigancho district.

15) Question: Which archeological zones or historic centers will be affected in this first stage of the project?. Once this preliminary list of zones is known, there could be a wider material for discussion.

Company: Comité de Gestión de la Iniciativa del Aire Limpio para Lima y Callao
Representative: Gladys Macizo

Answer: Engineer Rómulo Chinchay

The objective of this initial meeting is to inform about the guidelines and factors to be taken into consideration. Intuitively, in the Carretera Central axis for example, we can observe an important archeological site belonging to Universidad de San Marcos. Just as this point, there are several points to be identified during the development of the preliminary environmental study. In the second meeting, information concerning the factors to be evaluated will be further detailed.

16) Question: What will the Transportation Council do with the transit management?. Since not only the project but also the transit management, as a complement is important.

Company: Agencia de Cooperación Internacional del Japón - JICA
Representative: Mrs.Elena Fernández

Answer: Engineer Jhon Romero

Regarding traffic management, it is a second component of the study and corresponds to a second stage. There are many taxis, colectivos, and moto-taxis operating inappropriately, besides parking, cargo system and road safety. There are many elements in the urban context that need to be improved and many of these improvements do not require infrastructure or a high investment, only just a better management than the existing one. As a second component for this second stage of the plan, we have the issue of traffic management that will consider what I just mentioned. In this case, we will analyze the subject regarding taxis, moto-taxis and auto-colectivo that has been increasing day by day and currently is not regulated yet. So, it is necessary to define policies regarding use of auto colectivo. The same occurs with cargo transportation. There is not an optimum cargo transportation system. For example: The intention of transforming the Port of Callao into one of the most important ports in the Pacific. Therefore, guidelines for cargo transportation should be established also. In relation to Road Safety, it is important to define the role of Lima and Callao Municipalities as well as the National Police regarding traffic accidents levels. Road safety issue, parking in the public way, traffic signals and traffic lights synchronization. Traffic management is very important and it will be also studied. In the middle of July, the Japanese expert, Engineer Kaneko will arrive to our country and will be in charge of this part of the study. As Peruvian counterpart, the Technical Secretariat and Lima and Callao Municipalities are collecting the information that will be provided to the specialist in order to develop the plans to be executed.

17) Question: The subject of this corridor is similar to Cosac 1, so as just did Cosac 1 Will technology of the vehicles be identified? Will you use conventional fleet or a new one? What kind of fuel are you suggesting?

Company: Instituto Metropolitano Protransporte de Lima
Representative: Arnold Millet

Answer: Engineer Rómulo Chinchay

In relation with axis of the study, they are complementary axes. We cannot define yet; intuitively, we can say that it is important to use vehicles of high capacity where demand is intensified and vehicle of low capacity where demand is low. Such would be in principle, but the study will technically define the technology, the fleet size and type of fuel.

Minute of Meeting
Of the second stakeholder meeting for
Feasibility Study on Urban Transport
for the Metropolitan Area of Lima and Callao

Date: Lima, August 17th 2006

Categories

- Project Cost Benefit
  Questions n. 1, 3
- Right of way
  Questions No. 2, 4
- Relation with other transport modes
  Questions no. 3, 7
- Traffic Management
  Question No. 3
- Archeological and historical sites
  Questions No. 5, 8
- Words of thanks
  Question No. 6
- Health survey
  Question No. 7
- Bus system operation
  Question No. 7
- Social Impacts
  Question No. 9, 10, 12
- Institutional Aspects
  Question No. 11

Question and Answer Session

Project cost benefit

1) Question: We welcome the initiative of the project, but we believe that there is not enough information, since it is an investment project. According to the information brochure of the Master Plan, the project will cost more than 5,000´000 dollars. In this aspect it would be important to know what works will be carried out in this corridor, if there is going to be a bypass. What type of transport will there be? Will it be gas? Will there be tolls? What will the cost-benefit be? Will the public transport fare decrease or increase? Will the cost of living decrease or increase? Since half of the population in old Lima and in the cones are poor people. Will the huacas be improved? Since it is necessary to have passive recreation spaces and tree planting. What will be the cost of all these works?

Company: Federation of the Commercial Emporium of Grau and Surrounding Areas (Federación del Emporio Comercial Grau y Zonas Aledañas –FEDECGZA)
Representative: Elias Portocarrero Benavente

Answer: Mr Kaneko

Thank you very much for your question. I would like to point out that in the first stage we elaborated the Master Plan, in which we proposed different projects and amongst these projects priority projects were chosen to carry out the feasibility study. Therefore, we are currently in the Feasibility stage of 2 projects that were selected as priority projects. The first one is the Feasibility Study of the East-West Bus Corridor and the other one is the Transit Administration Plan.
Now with regards to the tariff, the Construction Plans, how the Project will be, we are still in the study stage. The objective of the meeting today was to show the result of the progress of some field work that has been carried out until now in order to carry out the tariff study, propose a more detailed construction plan of which we expect to provide further details in a following meeting.

Right of way
2) Question: The company Cogorno is located in Section E-1 and with regards to what was mentioned concerning the right of way, how will it affect the companies located in this section? And, what measures will be taken so that the operations that are executed in a daily manner in that company are not affected?

Company: COGORNO
Representative: Haury Carranza

Answer:

- Eng. Rómulo Chinchay

What we have been doing is gathering information from the field regarding the rights of way. The axis of Av. Venezuela is regulated, it has a right of way of 52 meters, therefore, as you know, in the West-East direction there are two transport lanes and 2 additional lanes need to be recovered. Currently, it has not been a problem, the process will continue later on and your participation is important to begin a dialogue and solve the future problem. We need to think of the 8 million habitants of the city of Lima that will be benefited with the project.

Mr. Nishikatsu:

We are carrying out our design according to the Metropolitan Roadway Plan of Lima, but that roadway width will be for a long term plan, since we are not foreseeing an intervention in the short term plan and when that happens we will find the best way to solve the problems through these meetings with the interested parties.

Project cost benefit
Relation with other transportation modes
Traffic management
3) Question: It is healthy when there is a foreign or local investment that benefits the population, but it is also necessary to foresee the economic effects that it can leave behind to the population, the districts, the surrounding towns and institutions. This is why it is important to handle this type of work carefully since it deals with mass transport. Likewise, I recommend that advisers and the company, who will be equally benefited in case of achieving the objective, consider the favors for the population and

for the institutions. In the case of the Carretera Central and Av. Ayllón, which are very congested roadways, it is still not clear if the highway is going to be expanded or if the lanes are going to be expanded. We believe, still, that we are in a discussion and suggestion stage. What is going to be done with the minor vehicles? If this project is executed, pedestrian bridges will have to be built in each trunk road, since it will be a fast traffic.

Company: "Mi Perú" Transport and Service Company (Empresa de Transporte y Servicios "Mi Perú")
Representative: Miguel Saavedra

Answer: Mr. Kaneko

According to what I have understood, you have actually asked two questions, one of them refers to the economic results or the benefits of this roadway for the population. And the second one refers to pedestrian bridges, roadway facility and roadway security. We are precisely carrying out the field measurements of the environmental aspects in order to see the impacts or benefits that it could provide to the population. We have also carried out surveys to find the impact of the project in the moto-taxi drivers and in other means of transport. Our objective is precisely to propose a project that finds a balance between the economic results of the project and the least amount of negative impacts caused to the population. Therefore, we will propose a project in which not only one of the parts will be benefited. We will also propose a project in which all of the negative impacts regarding environmental contamination, noise and vibration can be reduced. And regarding the second part of your question, this is precisely engineer Kaneko's specialty, which is transit administration, and along with the bus project a transit administration project will be executed in order to reduce congestion and increase the roadway safety of the zone. Therefore, regarding your concern for the pedestrians, we will not be giving total priority to the buses so that they can fly by and never let anyone cross, but the intersections will be planned in such a manner that the pedestrians will be able to cross in a safe manner. On the other hand, an Education and Highway Safety Plan will also be provided, which is why it is also important for the citizenship to be aware of the importance of behaving in an adequate manner and in accordance to the laws, drivers as well as pedestrians. Currently, there is a great lack of satisfaction on behalf of the population with regards to the bad behavior of the bus drivers. Therefore, the Education and Highway Safety Plan will contemplate this aspect so that the drivers can serve the general population in a better manner and travel in a safer manner.

Information on right of way

4) Question: Before anything else I am going to take us back to the years 1996-1998 and as a contribution I am going to mention that during those years there was a Sub-Project regarding the Legal Physical Improvements of Av. Venezuela and as a result of this, agreements were made with many of the properties that occupied the rights of way and they were compensated for the properties that were legally expropriated, conversations with Cogorno and DESA were still pending, up to now. In any case, Cogorno granted one part, there was a change of administration and the situation changed a little, but until then they manifested the decision to cooperate. All of that documentation must be in what is currently the Regional Government of Callao, I could even provide you with some of the documents that I have. In the same manner, the IMP also carried out a

feasibility study and that information could also be helpful, which, I repeat, must be in the Regional Government of Callao. Finally, I would like to manifest my satisfaction as a professional that works in the transport area because things like this are being carried out.

Company: Regional Government of Lima
Representative: Luz Ramos Lorenzo

Answer: Mr.Kaneko

Thank you very much for your contribution. This information will surely be useful for the project.

Treatment of archeological sites

5) Question: With regards to the archeological remains found in Av. Venezuela, what measures or strategies are planned with regards to the archeological sites registered inside the direct influence area of the project? On the other hand, the institution has received a request regarding aspects to be treated in this project but they have not included maps or work schedules. It is recommended that you present this additional documentation so that the institution can issue a reply.

Company: National Culture Institute (Instituto Nacional de Cultura – INC)
Representative: Carmen Oliden

Answer:

Arch. Helena Gushiken

With regards to the question regarding the archeological remains found in the Venezuela – Carretera Central Axis mentioned previously, this is field work that is currently being carried out, study work, precisely to consider the non destruction of these remains and on the contrary attempt to revitalize all of the archeological remains that we have seen, as well as the historical resources. As we stated in the beginning, we are carrying out the field work. Afterwards and together with what is being designed, the part of the roadway expansion, a complete schedule will be elaborated, and we will probably have a concrete answer regarding this aspect.

Mr.Hayashida

I would like to briefly explain how we are going to handle the archeological remains. As we explained previously, this project has 2 stages, a short term stage and a long term stage. In the short term it is intended to take advantage of the existing roadway in its real existing dimensions in order to develop the design of the roadway, therefore, in the short term the land, archeological remains and everything else located on Av. Venezuela will not be affected and it will remain as it is currently. And with regards to the consults that were sent to the INC, as you can see this is a project, and since we are still in the Feasibility Stage we do not have an execution schedule yet, that is why it has not been annexed.

Words of thanks

6) Question: Of all of the studies that we have had in the past years, this is one of the best ones if not the best one and we would like to thank you because we are benefiting from this transfer of technology from Japan. Likewise, we acknowledge the last work that you have carried out which is the Master Plan and thank you profoundly for this and, once again, the Institute remains at your service.

Company: Peruvian Institute of Transport Investigation and Development (Instituto Peruano de Investigación y Desarrollo de Transportes)
Representative: Moisés Travi Meza

Answer: Mr. Kaneko

Thank you very much for your words, we also expect to continue cooperating with you and we will continue these meeting with the interested parties.

Relation with other transport modes
Health survey along the road
Bus system operation and administration

7) Question: We have a curiosity regarding the project and I congratulate you for the extraordinary work that you are carrying out. First of all we would like to know if this project is a continuation of the COSAC project. How is the systemic focus of this project conceived with regards to the Electric Train Project and the Cosac Corridor Project? I am also curious regarding the health aspect, why haven't you monitored the service operator that remains in the study line for 12 or 16 hours and that is not in a determined point? Inclusively, most of the passengers that board these units alight from the units and remain in constructions or houses near the line that you are studying, therefore it would be interesting to consider this. Another interesting point would be the man aspect in the administration aspect and in the operation aspect, which projects don't generally consider, and we would like to have, by the end of the project, a table that indicates the hour-man savings, the reduction of contamination, the reduction of accidents which is important, the reduction of noise contamination and of the vibrations of tremors that we cannot avoid with the passing of large units.

Company: TRANSLIMA S.A.
Representative: Juan Carlos Arroyo

Answer:

Mr. Kaneko

With regards to the Cosac, we intend to harmonize both projects, which is why we are carrying out discussions with the Cosac planners in order to select the optimum option that harmonizes both projects. With regards to the other mass transport modes, as we had proposed in the Master Plan, we have considered all of those other systems and in accordance to what is proposed regarding the short term economic aspects, we have decided to begin with the buses but in due time other forms of mass transport will be introduced. Now we are beginning to analyze the demand and the scale of the project so that we can propose the optimum forms of administration and operation. Based on

the information shown in the passenger boarding and alighting slide, we will propose the operative bus system. Besides that we must consider the connection with the other bus systems and the projection of the future demand. All of this is in the evaluation stage and when we have more concrete results we will let you know.

Mr. Hayashida

Regarding the second and fourth questions I would like to answer briefly. Your observation is very valuable with regards to the health survey on the roadways. On this occasion we have a certain time restriction and we also have a defined route, which is why we have selected that public to be surveyed since they were the ones directly affected. Since we wanted to survey the people who were exposed to contamination on that roadway, we decided to survey the transit police and the street vendors. And we also surveyed the office workers to have a comparison point between the people that are constantly exposed to these environmental aggressions and the people that are in offices protected from these aggressions. With regards to the fourth question regarding the noise measurements, vibration, reduction of transit accidents, we are precisely in the stage of processing this data. This data will probably be processed at the end of the month and we will have the results in the beginning of September.

Archeological and historical sites

8) Question: I would like to manifest the concern of the INC, because the stage that is currently being carried out is a stage of diagnosis and the data that you are showing is not complete. A week ago we received a consult on behalf of the Metropolitan Planning Institute regarding this project, I suppose that they must have transferred the consult and maybe you had not collected the information that we had provided. Regarding the monuments that you have mentioned, they are incomplete, because it is not only some of the properties that appear in the tables, but all of the Paseo Colón and Av. Venezuela. In this aspect, the concern of the INC is that the JICA team will have to request the approval of the sections that include the cultural patrimony and these will have to be revised by special commissions such as the Architecture and Archeology commissions. These sections must be presented in the projects so that they can be revised and we can see how this archeological and historical cultural patrimony will be affected.

Company: National Culture Institute (Instituto Nacional de Cultura – INC)
Representative: Teresa Vilcapoma

Answer: Arch. Elena Gushiken

Thank you for your observation. As we indicated and we repeat, we are still carrying out field work. One of these tasks has been precisely that of the archeologists, in this case our representative the Archeologist Emily Baca, who has walked through the entire section to investigate the archeological and historical remains, also in a bibliographical form in parallel. Consults were also made to the INC as you have indicated and yesterday we received the information regarding the part of Paseo Colón and 9 de Diciembre and in this manner we will continue our investigations. Precisely, the concern of the JICA team is the part of the archeological and historical remains. We are all aware that this is something very valuable for all of us and we are not going to destroy them just to expand a roadway. We would appreciate it if the INC could provide us with all of the updated data so that we can obtain goods results in the feasibility study.

Social impacts

9) Question: I see the conception of the project that is being discussed as an integral scope, which is important because it stands out from previous projects regarding the trunk bus corridors. This focus that you propose, also involves the transport actors such as the authority, operators and users. This makes the projects that are currently being developed to solve the transport problems in the capital, such as the High Capacity Segregated Corridor or the complementary corridors elaborated by a Spanish firm and many other participations, projects that tend to rationalize the urban transport problem in the city of Lima. The university sees this project as an interesting project because of its integral scope and I believe that this is the scope for the solution of the transport problems in our capital city. We have experiences of neighboring countries that have solved the transport problem under this scope and we approve this project.
In this case, I would like to ask if this project will consider a Social Mitigation act. We know that the projects of the Municipality of Lima and the project being developed by JICA along with the Transport Council of Lima consider the social problem that will be produced at the termination of this project, which I understand has many stages and in each stage you have to be careful with the gathering and analysis of information. We must consider this social problem so that the university can participate in this interesting project for the city by means of its students and teachers

Company: Federico Villareal University (Universidad Federico Villareal)
Representative: Pervis Paredes

Answer: Mr. Kaneko

Thank your very much for your question. It has been a nice surprise for us to hear that the University is interested in this project. Thus, as I mentioned previously this feasibility study will include an environmental and social impact study according to the results of the different studies, we will elaborate a plan to evaluate and study the negative and positive impacts in order to create a mitigation plan. As Eng. Hayashida explained previously, with regards to social impact, we will consider the impacts on the population, not only with regards to environmental or noise contamination but also the economic impacts. The person that will be carrying out the analysis of the economic impacts of the project has not incorporated the team yet.
In order to deliver a final product, we are carrying out these meeting in order to receive your opinions, as is the case of the University, and be able to incorporate them in our studies.

Social impacts

10) Question: It is necessary to make some precisions. Our company is providing services from the zone of Santa Eulalia through all of the Carretera Central, from the zone of Ricardo Palma, through Avenida Graú, Arica and Avenida Venezuela. In other words, the study is being carried out in the place were we work. As a result, we have a special interest in this project. In this aspect we would like to know, what treatment will be given to the persons that will be displaced (drivers, fee collectors and their families)? Will there be an alternative project for them? We are aware that when properties are displaced from the avenues, they are paid a compensation fee. In this aspect, those of us in the transport sector would like to know what is going to be done with the transporters that are going to be displaced. The second question is: why haven't you considered the

transporters and the companies? Since we still have not been asked anything. In this manner, we could join efforts and not feel displaced. The Law of Administrative Procedures that is established in the Peruvian Legislation, which talks about the Principle of Participation, must be considered. If companies are going to be affected they necessarily have to be consulted, since they will be affected in the future. This is also happening when concession contracts are signed and not consulted, in that case there is an offense. We are aware that this project will be handled by the Municipal authority and its consequences will be administrative, therefore we need to be consulted. The following question is regarding financing, is there an idea of how to carry out the renewal of units or a different proposal for these companies that currently include around 800 vehicles units?

Company: Lima-Chosica Transport and Service Company (Empresa de Transportes y Servicios Lima-Chosica)
Representative: Moisés Contreras

Answer:

Mr. Kaneko

With regards to the first question, as we explained previously, precisely now we have finished the diagnostic of the current situation and with that we will make the projection of the future demand. According to these results, we will design a bus plan, but the specialist in this area has not incorporated the team yet. This person will be arriving when we have the results of the demand and he will be able to provide more detailed information in September or October. Without the results of this data, it is not possible to carry out an adequate analysis of the integrated public transport network. Therefore, we cannot propose solutions without having a solid base.

Eng. Rómulo Chinchay

To complement the answer of Mr. Kaneko, I would tell you and all of the transporters that you have to be prepared to face the challenge of a new transport system. Do not worry about the financing, because when there is a rationalized system the project finances itself.

Institutional aspect

11) Question: Generally, when there is a proposal of change, proactive and negative reactions are generated. The transport aspect surpasses the interest that we may have as operators of the service. It is a subject that includes the citizens and therefore affects 8 million habitants. And we believe that it is natural that in the course of this project, since it is a process, there will be a moment in which you will have to determine the type of vehicle that will operate in this corridor, if the technology will be diesel gas, if it will be a hybrid, etc. These are aspects that will be discussed in due time because a project like this one has stages. When you mention the issue of vehicle renewal or financing, I disagree with Engineer Chinchay when he mentions that when there is a sustainable project it will finance itself. This is not necessarily true. Because we have transport organizations that cannot accredit that they actually have solid organizations and that they have clear entrepreneurial management concepts, no bank will lend them

money, although the business is profitable, because the bank will assume that there is a risk in the entrepreneurial management.
I would like to mention that during the years 1998-1999, a proposal was generated in Lima, which was the implementation of the famous Corredor Vitrina, which was going to take the Axis of Paseo la República - Vía Expresa as its main part. However, the great expectation that was generated in 1999 got cold during the next years, afterwards in 2002 once again there was the proposal of developing a BRT system for the city of Lima, based on the experience of Transmilenio of Bogotá, the System of Curitiba in Brazil and others that were being implemented. However, the expectation generated and that motivate the entrepreneur to continue his participation in these processes, become a disillusion when the implementation of these projects is not carried out. That is why we believe that the processes must be carried out as it is being done, for example with this corridor, in a clear and transparent manner, transmitting information to all of the citizens in general. And there is a question that the authorities must make to the citizens, what kind of city do we want Lima to be in the future? And in this manner generate our own project of the city that we want to live in. As operators, we believe that this is a disjunctive that has not been defined yet, which allows you to talk of 4 different projects that could cause confusion, that these are not integrated and that they do not conform the same plan (The Cosac, in charge of Protrasporte, The Complementary Corridors in charge of the GTU, The Electric Train and these studies that are being carried out). Therefore, it is necessary for all of these projects to have a single institutional level, since this is the problem of the weakness that we have in our country. For example, in the aspect with Callao in which the management regimes still haven't been resolved. When these projects are generated it seems that they do not consider some collateral measures that need to be carried out, as is the case of Cosac which still has not clearly and precisely explained what is going to happen with the services that imply a modal competition for this new trunk system, where will the routes that transit through the Sanjón go?
As operators we understand that we must be willing to assume this new challenge that is presented, that we must head towards modernization. But we must tell our Peruvian authorities that it is not possible that they abandon the transport operators so that they figure out how to participate in these new projects in the future, and the chaos that currently exists in the city is the result of unclear policies, which were promoted by the Peruvian state. Therefore, if we do not consider all of these aspects, despite of the project being good, it will not be sustainable in time and that is what we need to find. And in the same manner that there are transporters that are opposed to any change, there will also be serious and responsible transporters that have been working for many years to change the transport situation in Lima.

Company: Association of Passenger Urban Transport Companies (Asociación de Empresas de Transporte Urbano de Pasajeros – ASETUP)
Representative: José Luis Díaz León

Answer:

Mr. Kaneko

Thank you very much for your intervention. Our objective is to gather the greatest number of opinions and suggestions from the population. This is our second meeting with the interested parties. During the first meeting we presented the scope of the

project, and in this occasion we are presenting the results that we have achieved until now and we have also programmed a third meeting with the interested parties and we have thought of carrying out a workshop or seminar to present the project. Therefore, as you have mentioned, we are developing this project stage by stage and in each stage we are gathering the opinions of people so that they can be reflected in our work. Therefore, your intervention today will be considered and we will surely incorporate it in our third meeting.

Dr. Blanca Guerrero

We coincide with your frustrations regarding the projects that we have been developing since the years 1997-1998 in which we have always been accompanied by you in the different meetings. I can only commit to presenting your concerns to the Transport Council of Lima and Callao, where the maximum representative of the Metropolitan Municipality of Lima is located.

12) Question: As street vendors, we are affected by these projects, as is the case of the businesses on Av. Grau, we will also have that same problem. Has the company in charge of this project thought of ways to help the informal workers that are in that zone? And in that zone (Pando), how many meters wide is the roadway going to be?

Company: Association of Automobile Service Provision of Av. Venezuela (Asociación de Prestación de Servicios Automotriz de al Av. Venezuela)
Representative:

Answer: Mr. Kaneko

We still cannot provide a concrete answer to your question because, as we have mentioned previously, we are still finishing the evaluation of the existing situation, and according to this evaluation we will begin to establish a dialogue with the affected people in order to develop our work. And now, with regards to the width of the roadway in the zone that you have mentioned it is 25 meters.

Minutes of meeting
Of the third stakeholder meeting for
Feasibility Study of Urban Transportation in the Lima and Callao Metropolitan Area in the Republic of Peru

Stakeholder Meeting of November 3rd. 2006, Lima Civic Center Auditorium

Answers and Questions

1) Question: ¿Does this Study coincide with the present progress of Av. Grau?

Institution: Instituto Peruano de Investigación y Desarrollo del MTC (Peruvian Institute of Research and Development of MTC)
Representative: Mr. Enrique Becerra

Answer: Mr. Rómulo Chinchay:
Effectively, Grau corridor will be going to be compatible with the East-West corridor.
Answer: Mr. Tsuzuki:

Actually, the East-West line goes through Av. Grau and in the future both will have to be compatible. Actually, there will be a need to change the location of bus stops.

2) Question: Concerning the previous answer, about the proposal of articulated buses in the central lane, evidently they will go through the Grau corridor. Is this corridor prepared to support the traffic of articulated buses? Will the Grau corridor support the bus stops located there as part of the project? It has been said that there will be a reduction of 20% in the number of bus routes; considering the existing level of oversupply (of routes), it seems to me that the proposed percentage is too low, so is this situation something purely technical or is the social nature of the problem being considered also? What kind of repercussions would bring the reduction in the 20% of bus routes for the dropped out bus operators? On the other hand, by considering both the technical and social point of view, a greater number of operators would not generate inefficiencies for the corridor operation? Also, what is the length of said corridor?
Institution: ASETUP
Representative: José Luís Díaz

Answer: Mr. Tsuzuki:

- First, to answer your question concerning Grau corridor, the system has been designed to operate in the Grau corridor.
- In relation to the 20% reduction, it depends on the bus length, that is a matter of capacity, however it has been said that on 2007 there will be 77 routes. So, the reduction of 20% would be applied to said 77 routes.
- According to the studies we carried out, presently there are 500 vehicles /hour circulating in said axis, so by said method, there number of articulated buses would be only 100.

3) Question: So, the axis has the capacity to support articulated buses. By said projection and based on this limited number of operators. What is the average of passengers/day estimated for the project?
Which is the daily demand for the trunk road and the feeder roads?
What is the projection for the bus tariff for users?
The operator would be paid in the same system as the COSAC by a cost per km or by the number of transported passengers? If this Project is like a COSAC II, it could be understood that it would have a collecting system; would it be independent from COSAC or it would be the same operator? Since it concerns an issue of operation costs, finally which would be the total cost of this corridor; independently from the financial analysis; how much would cost this Project?

Institution: ASETUP
Representative: José Luís Díaz

Answer: Mr. Tsuzuki:

- The projected number of daily passengers would be 500,000
- Concerning the tariff we are carrying out the studies based on the projections of the trunk bus to the feeder bus, so there would be an integrated system that allowing feeder bus passengers to board the trunk bus in the bus terminal with the same ticket.
- The collecting system, concerning the ticket payment would be: users buy the ticket in the bus stop and enter the platform, so once in the platform no payment is made. It makes transfer between buses much easier.
- Concerning the total cost of the corridor, it is estimated in approximately 60 million dollars, only in infrastructure.
- In relation to your doubt concerning the operative and administrative system of the corridor, discussions concerning said issue will have start now.

4) Question: I would like to refer to the typical cross section presented I think in chart number 7, considering 7 m for the right of way, and correct me if I am wrong, for both buses downstream and upstream. I have had an experience in ENATRUPERU with buses in Av. Arequipa, the majority of lost loops were due to the break of mirrors because the road was narrow, also there were other inconveniences for example when trees were not trimmed in due time, and the design of buses for mirrors were in the front not at the sides. However, the narrowness worries me and with the concerns of José Luis about the Grau corridor: What would we do in Grau corridor with the right of way where we would have to take a lane from the private vehicles besides the center lane that we would need for the plarform? I think it rather difficult. So, how could we link it with the Grau corridor?

Institution: TRASLIMA
Representative: Mr. Juan Arroyo

Answer: Mr. Tsuzuki:

- Bus frequency in the corridor will be 1 minute, and we suppose a person will take one minute to board or alight the bus, so in 30 seconds, 30 persons could aboard and alight. So, physically two lanes will not be needed, it depends on the bus operation system, it could be an express bus, a bus stopping in each bus stop

or one that goes straight ahead. Such type of operation sometimes needs 2 lanes. For example, for a better understanding, COSAC 1 has an extension of 30 km from Comas to Chorrillos but there are many bus operation types in the same axis, express type or the ones stopping at each bus stop. For this type of corridor, two lanes are recommended for this system operation. But the East-West corridor has only 9 km and there will not be express buses, all will stop in all bus stops.

- The question concerning the 7 m width, that you said it would not be feasible. The bus is 2.5 ms wide, and then we have considered 50 cm for each side so that is sufficient.

5) Question: According to your explanation, some limitations will arise such as in COGORNO factory in the Venezuela Callao route and in second place San Marcos University. How are the conversations with them? Do they accept an enlargement in said sections of the road? Second; being Carretera Central a national road, why the end of the line was established in Santa Anita? And will the feeder buses service zones such as Chosica and Huaycán that are highly populated?.
Institution: Expreso Latinoamericano
Representative: Mr. Gregorio Torres

Answer: Mr. Rómulo Chinchay

- Actually one of the objectives of the present meeting is to analyze jointly the issue of right of way. As I say again, there is a municipal law establishing the right of way in 52 m. That is why we are here to talk, we have conducted the feasibility study, the second step is the contact between the several entities to talk and reach an agreement benefiting all citizens, and common welfare has to be considered so all benefit from the present project.
- Concerning Carretera Central, the system is a trunk feeder bus system, meaning that it does not end in Santa Anita, the system projects itself with feeder routes towards Huaycán and Santa Clara and in the case of Callao it serves all areas of Ventanilla, La Punta and other districts, so the routes presently operating from Callao to Lima, would operate in the system only in function of the demand for it would be meaningless to go through other roads without a demand.
- Concerning the 20% of routes to be affected, it has been determined from a technical point of view, equivalent to an integral strategy. For example if a route is equivalent to 80% of the corridor axis, it in meaningless to go on operating in the parallel routes because such demand will be attended. And the other routes maintaining the operating in roads parallel to the axis are routes with a short course or are routes coming from other places and that enter or leave Carretera Central by sections. In order to assure the financial sustainability, the system has to assure the demand.

6) Question: According to the results and said 52mts width of the corridor, Are you considering the needs of companies or institutions close to the road? For example, I am in Av. Venezuela close to the Navy Medical Center and in front there is a School for special children and a Catholic School. Both use said road twice or three times a day and the construction of a pedestrian bridge has already been requested to the Municipality. However, in your exposition pedestrian bridges have not been considered, only at level crossings. Said situation will affect

us in one way or another. I would like to know which considerations have been taken into account for the distinct institutions close to the road.

Institution: Marina de Guerra del Perú
Representative: Lieut. Isabel Molina

Answer: Mr. Tsuzuki:
If I am not wrong, the road width in the School you mentioned is 25m. I am not sure but in our studies we considered for said area a 43m width for the right of way. With such it would be possible to maintain a sidewalk 4 m wide in front of the Hospital and the School So, as we mentioned, all intersections in the corridor will have traffic lights considering the pedestrians needs, also we could construct pedestrian bridges but it seems they are not much used.

Representative: Isabel Molina: I am talking about the volume of students not about pedestrians, special children going from one school to another.

Answer: Mr. Tsuzuki:
In this case some changes would be made in the traffic light cycles considering the crossing of said persons.

7) Question: I forgot about School Montero in front of the Navy Hospital where 150 to 200 buses go in and out towards Lima and Callao. How are you going to solve the entrance for said place?

Representative: Isabel Molina:
Institution: Marina de Guerra del Perú

Answer: Mr. Rómulo Chinchay

- There is a picture of Vía Evitamiento where some persons are crossing the road and a dog is crossing the pedestrian bridge. So the philosophy defined in our Project is that an active pedestrian signaling system will be habilitated for persons, mostly if they are for special persons, so the at level solution given is the best and of course, as mentioned by Mr. Tsuzuki, the traffic light cycles will be calculated, there are even audible signs otherwise, the most appropriated ones will be used.
- Concerning the entrance and exit of the fleet, I imagine that the entrance and exit at the present is a very serious problem but with the Project I assure you that the accesses will be better and not pernicious because that is why projects are developed. Even so, in the final design all efforts will be made so that the most proper measures are taken.

8) Question: In Av. Venezuela both at right and left we have the Navy Medical Center with the Special School and in front there is the Navy Welfare Direction and the Montero School, now we have 4 entrances. What are you going to do? Install traffic lights each 10 0r 20 ms between the doors? Have you taken into account the opinion of the Navy when preparing the Project?

Institution: Marina de Guerra del Perú
Representative: Dra. Almeida

Answer: Mr. Tsuzuki
From a start, with the implementation of the present Project, there would be a reduction in the emission of pernicious gas and particles as also in noise pollution. That is why this project would bring high benefits to schools and hospitals. It means an improvement in the environment of your installations. So it is also right that to obtain said benefits there will be some inconveniences but that is an issue of private and public interests. So the most interesting thing in cases such as this one is the dialogue, comments and suggestions between the parts, so that the affected parts look for solutions to improve the system, for example in the case of buses entering and leaving the installations an improvement in the parking system could be considered, always it is better when planners and the benefited population think together about solutions.

CHAPTER 9
Economic and Financial Studies

9. ECONOMIC AND FINANCIAL STUDIES

9.1. GENERAL METHODOLOGY

This chapter aims to evaluate the proposed project, East-West Trunk Bus System, from viewpoints of economic and financial aspects based on the various foreseeable assumptions.

Ordinal two evaluation methods are applied for each purpose. The one is the economic cash flow analysis based on 'benefit-cost' analysis, that is analyzed comparatively both of so called 'social benefits' derived by the project in the regional economy and 'social costs' necessary for the project's implementation. Another is the financial analysis based on the financial balance of 'profit-cost' cash flow for the project operator.

9.1.1. ECONOMIC AND FINANCIAL EVALUATIONS

As there are many differences between the economic and financial evaluations, the most significant ones are their standpoints. The economic evaluation is made from the regional economic viewpoint comparing both the case of 'with project' and 'without project', and financial evaluation is from the trunk bus-way operator's standpoint about a financial status of project operation. Consequently, the cost and benefit in the economic analysis are calculated in terms of the economic price, while the cost and revenue in the financial analysis are measured by the market price. Moreover, the project lives are different in each analysis; 20 to 25 years for economic evaluation and 10 to 15 years for financial evaluation, in general. They are summarized in Table 9.1-1.

Table 9.1-1 Economic vs. Financial Evaluations

Items	Economic Evaluation	Financial Evaluation
Project	Trunk Bus-way System	Trunk Bus-way System
Standpoint	Regional Economy	Trunk Bus Operator
Evaluation Method	Benefit/Cost Analysis With/Without Comparison Economic Price	Cost/Revenue Analysis Financial Statement Market Price
Inflation and Tax	Not accounted for	Accounted for
Direct Beneficiaries	Road Users Bus Passengers	Stakeholders Financiers Employees

9.1.2. GENERAL CONDITIONS FOR ANALYSIS

(1) Base Year, Target Year

In this analysis, the present condition is as of 2006 and the preparation for the project will start from 2007 and all the necessary investments/works for the infrastructure, bus fleet and operational entity are completely prepared until the end of 2010. East-West Trunk Bus-way System will be in full-scale operation from 2011.

(2) Necessary Fundamental Data/Information

As some of the basic necessary data, such as socioeconomic data (population, GRDP, etc.) and total trip demands in the future, are derived from the Master Plan Study (The Master Plan for Lima and Callao Metropolitan Area Urban Transportation in the Republic of Peru, 2005), various adequate amendments are carried out in accordance with the updated information.

(3) SNIP

There is a guideline so called SNIP (Ordinance No. 004-2002-EF/68.01), National System for Public Investment, for major transportation infrastructure projects in Peru.

The guideline defines the contents of the feasibility study as follows:

1) Executive Summary
General Aspects
Formulation and Evaluation
   a) Demand Analysis
   b) Technical Descriptions of Selected Alternatives
   c) Cost Estimate
   d) Benefits
   e) Social Evaluation
   f) Sensitivity Analysis
   g) Risk Analysis
   h) Sustainability Analysis
   i) Environmental Impact
   j) Organization and Management
   k) Implementation Plan
   l) Project's Logic Frame

Since there are many useful descriptions in the related documents of SNIP for this analysis, necessary information is reviewed and some parameters/indicators are applied from these materials as much as possible. Major references are:

   a) Contained Minimal of the Feasibility Study of Public Investment Project (ANNEX SNIP – 07)
   b) Methodology of MEF (Evaluation Manual of Urban Road Project)
   c) Evaluation Parameters (ANNEX SNIP – 09)
   d) Actualization of Social Discount Rate (2006)

9.2. ECONOMIC ANALYSIS

9.2.1. GENERAL

(1) Impacts

In general, various impacts, whether quantifiable or not, can be expected when an improved public transport system with a 'Trunk Bus-way' is introduced. For instance, reduction of road traffic congestion and increase in travel speed, improvement of services for public transport users, decrease in noise/air pollutions and traffic accidents, business reform for traditional public transport operators/employees and related/dependent business societies, etc., along the East-West corridor.

As some of the abovementioned impacts are also analyzed in other parts of the report, Chapter 8 'Environment Study' and Chapter 6.4, most representative and stable impacts derived from the project are reduction of total travel volume in terms of vehicle-km, passenger-km, vehicle-hour and passenger-hour by implementation of the project. And they are quantified comparing 'with project' case and 'without project' case, and converted into money terms to evaluate economic benefit. Since other beneficial impacts are not considered, the results can be said in the safer side. The result of this chapter provides one of the criteria for comprehensive evaluation to judge the feasibility of the proposed projects.

(2) General Workflow of Economic Evaluation

In general, economic evaluation study is carried out following the workflow illustrated as in Figure 9.2-1.

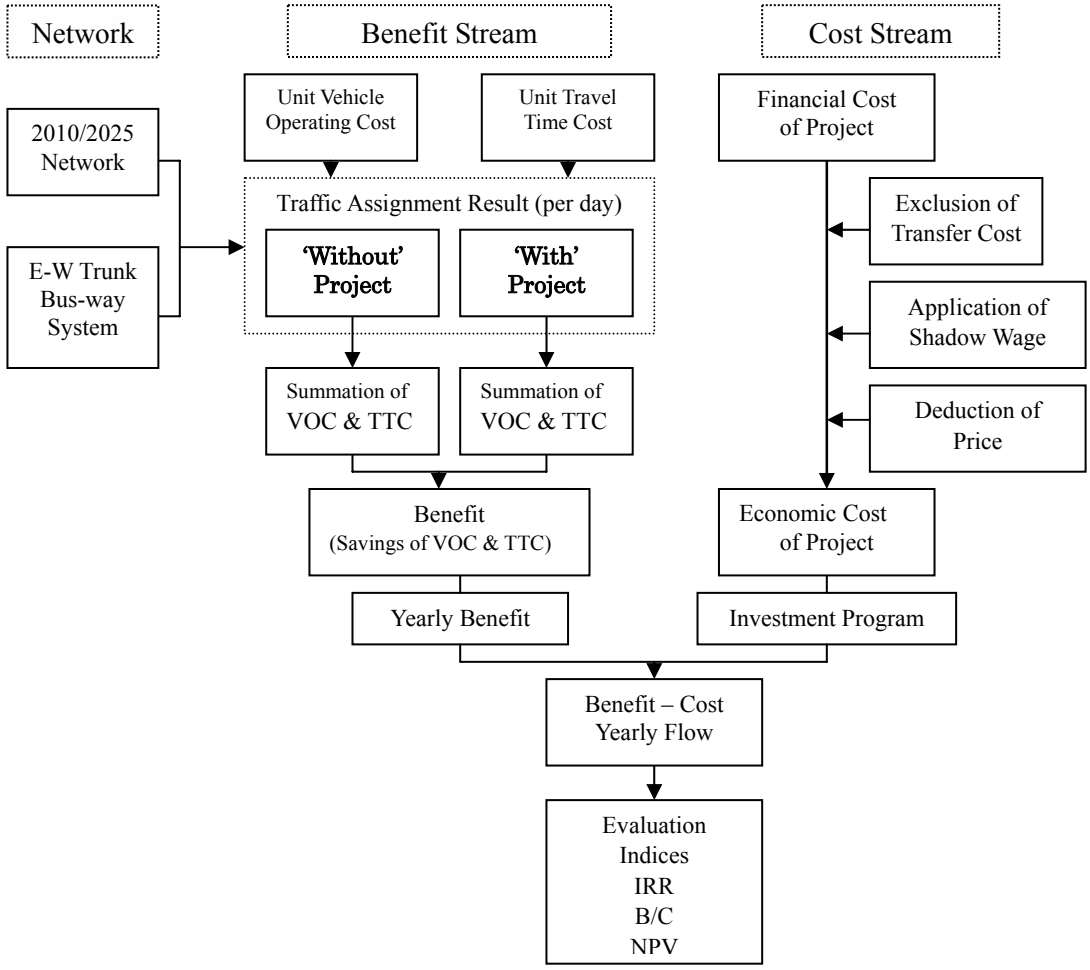


Figure 9.2-1 Workflow of Economic Evaluation

(3) Indicators of Economic Evaluation

Economic costs and benefits throughout the project life periods are compared by a discount cash flow analysis. The discount rate (DR) of 11% is applied, which is widely used in Peru as a social discount rate. For economic evaluation, three indicators are calculated: Internal Rate of Return (IRR), Benefit/Cost ratio (B/C) and Net Present Value (NPV). They are defined as below:

a) Internal Rate of Return (IRR): r satisfying: $\sum \frac{B_n}{(1+r)^n} = \sum \frac{C_n}{(1+r)^n}$

b) Net Present Value (NPV) = $\sum \frac{B_n - C_n}{(1+DR)^n}$

c) B/C Ratio (B/C) = $\sum \frac{B_n}{(1+DR)^n} \div \sum \frac{C_n}{(1+DR)^n}$

9.2.2. ECONOMIC FEASIBILITY STUDY OF COSAC PROJECT

There is a very similar on-going project in Lima, so called COSAC and many useful data for this analysis can be obtained from the economic feasibility study conducted in 2003. Though COSAC project was not exactly applied the present standards of SNIP at that stage of the project approval, almost the same procedure/level of feasibility analysis was conducted, and the examination by MEF passed smoothly and also the international official loan was approved. Therefore, the COSAC feasibility study should be carefully examined in order to find possible areas to apply in this analysis. The items of the COSAC feasibility study is listed as follows and significant characteristics are summarized below:

(1) Introduction and Objectives

(2) Demand and Supply (Operation Design) Analysis

(3) Project Description (Technical)

(4) Evaluation Methodology

(5) Project Cost Analysis

Major project costs consist of the necessary facilities' construction costs for trunk bus system, such as trunk bus-way, bus-stops/stations, terminals/depot and control center, and purchase costs of bus fleet both of trunk & feeder service. In addition, the residual value equivalent to the existing amount of buses that becomes useless after the new system introduction is accounted for as minus cost.

(6) Benefit Analysis

Savings in VOC are calculated from the difference between existing buses and proposed new system and savings in TTC are obtained from the calibrated models for morning- & evening-peak hours and for off-peak hours.

An impediment cost influence during the construction period of the bus-way is calculated from the model application as a minus benefit, besides the usual VOC and TTC.

(7) Future Trend

Demand and TTC value growths are estimated based on the forecasted population and GRDP.

(8) Social Evaluation of Project

14% of social discount rate is applied for the evaluation period of 20 years.

(9) Sensitivity Analysis

Many cases are examined: Social discount rate (variation from 10% to 18%) and NPV, and other 16 factors (variation from –30% to +30%) and IRR.

(10) Risk Analysis

(11) Results and Conclusion
   a) NPV = US$ 61.2 million, IRR = 20.8%
   b) The project presents high feasibility from social economic viewpoint.
   c) Sensitivity analysis also shows high grade of feasibility. Most influential parameter is construction cost among 16 factors.
   d) Risk analysis results in: NPV expected = US$ 53.3 million, Confidence interval of 95% = US$ 18.2 – 81.5 million, and Probability of positive NPV = 99.8%.

9.2.3. BASIC CALCULATION OF FACTORS FOR ECONOMIC EVALUATION

(1) Basic Assumptions

In order to conduct the economic evaluation of the East-West Trunk Bus-way project, the following basic assumptions are applied, considering various related information.

(1) Project Life: 20 years
(2) Constant Prices in 2006
(3) Social Discount Rate: 11%
(4) Exchange Rate in 2006: US$ 1.00 = S/. 3.25

(2) Unit VOC

In general, vehicle-operating cost (VOC) per unit distance is estimated by type of vehicle being composed of the following components:

a) Fuel cost
b) Oil cost
c) Tire cost
d) Repair cost
e) Depreciation cost
f) Capital opportunity cost
g) Crew and overhead cost

Meanwhile, there are the detailed data of VOC (in 2001) for public transport modes in the COSAC economic feasibility study report. Therefore, these data are revised and updated in accordance with the recent price indices by type of related goods, exchange rate of local currency of Soles. They are summarized in Table 9.2-1.

Table 9.2-1 Unit Vehicle Operating Cost (Public), 2006

	Market price				Economic price			
Soles/km in 2001	Camioneta	Microbus	Omnibus	Trunk Bus	Camioneta	Microbus	Omnibus	Trunk Bus
Fuel	0.3715	0.4466	0.6561	1.0287	0.2452	0.2948	0.4331	0.6790
Lubricants	0.0230	0.0303	0.0419	0.0677	0.0175	0.0231	0.0319	0.0516
Tire	0.0343	0.0891	0.1357	0.1865	0.0260	0.0676	0.1030	0.1415
Maintenance	0.1138	0.1407	0.1338	0.3134	0.0919	0.1136	0.1080	0.2530
Wage	0.3842	0.4544	0.4790	0.4309	0.3461	0.4094	0.4315	0.3882
Others	0.0578	0.0830	0.0500	0.0607	0.0467	0.0670	0.0404	0.0490
Total	0.9846	1.2441	1.4965	2.0879	0.7734	0.9755	1.1479	1.5623
Soles/km in 2006	Camioneta	Microbus	Omnibus	Trunk Bus	Camioneta	Microbus	Omnibus	Trunk Bus
Fuel	0.5620	0.6756	0.9925	1.5562	0.3709	0.4459	0.6551	1.0271
Lubricants	0.0348	0.0458	0.0634	0.1024	0.0265	0.0349	0.0483	0.0780
Tire	0.0358	0.0929	0.1415	0.1945	0.0272	0.0705	0.1074	0.1477
Maintenance	0.1336	0.1652	0.1571	0.3680	0.1079	0.1334	0.1268	0.2971
Wage	0.4512	0.5336	0.5625	0.5060	0.4065	0.4807	0.5067	0.4559
Others	0.0631	0.0907	0.0546	0.0663	0.0510	0.0732	0.0441	0.0535
Total	1.2805	1.6039	1.9717	2.7935	0.9899	1.2387	1.4885	2.0593
US$/1,000km(2006)	Camioneta	Microbus	Omnibus	Trunk Bus	Camioneta	Microbus	Omnibus	Trunk Bus
Fuel	170.3	204.7	300.8	471.6	112.4	135.1	198.5	311.2
Lubricants	10.5	13.9	19.2	31.0	8.0	10.6	14.6	23.6
Tire	10.8	28.2	42.9	59.0	8.2	21.4	32.6	44.7
Maintenance	40.5	50.1	47.6	111.5	32.7	40.4	38.4	90.0
Wage	136.7	161.7	170.5	153.3	123.2	145.7	153.6	138.1
Others	19.1	27.5	16.6	20.1	15.4	22.2	13.4	16.2
Total	388.0	486.0	597.5	846.5	300.0	375.4	451.1	624.0
Composition (%)								
Fuel	*43.9*	*42.1*	*50.3*	*55.7*	*37.5*	*36.0*	*44.0*	*49.9*
Lubricants	*2.7*	*2.9*	*3.2*	*3.7*	*2.7*	*2.8*	*3.2*	*3.8*
Tire	*2.8*	*5.8*	*7.2*	*7.0*	*2.7*	*5.7*	*7.2*	*7.2*
Maintenance	*10.4*	*10.3*	*8.0*	*13.2*	*10.9*	*10.8*	*8.5*	*14.4*
Wage	*35.2*	*33.3*	*28.5*	*18.1*	*41.1*	*38.8*	*34.0*	*22.1*
Others	*4.9*	*5.7*	*2.8*	*2.4*	*5.1*	*5.9*	*3.0*	*2.6*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Regarding the VOC for private vehicles, only rough estimation by type of vehicle (car, taxi and truck) is conducted based on the related study results, because very more impact is forecast for private modes both in terms of vehicle-km and vehicle-hour without any significant improvements by the bus-way introduction (refer to (5) estimated traffic volume, hereinafter). Final estimated results of VOC are tabulated in Table 9.2-2.

Table 9.2-2 Unit Vehicle Operating Cost

(Unit: US$/km)

Items	Car	Taxi	Truck	Camioneta	Microbus	Omnibus	Trunk Bus
Market price	-	-	-	0.3880	0.4860	0.5975	0.8465
Economic price	0.1083	0.1241	0.3934	0.3000	0.3754	0.4511	0.6240

(3) Unit TTC

On the other hand, there is a description regarding travel time cost (TTC) in SNIP ANNEX 09 (09, Sep. 2006), as shown in Table 9.2-3. Applying these parameters, TTC is estimated with a consideration of future estimated economic growth and conversion factor to US$, as shown in Table 9.2-4.

Table 9.2-3 Social Time Value of Transport Users by Mode (SNIP Annex 09)

	Time value	
Mode	(S/./hr)	($/hr)
National Airway	4.25	1.288
Interurban Car	3.21	0.973
Interurban Public Transport	1.67	0.506
Urban Car	2.80	0.848
Urban Public Transport	1.08	0.327

Table 9.2-4 Travel Time Cost

(Unit: US$/hr)

Year	Private Car Users	Public Transport Users
2006	0.848	0.327
2011	1.007	0.388
2025	1.266	0.488

(4) Investment Cost

1) Infrastructure

Project cost for Trunk Bus-way infrastructure construction is estimated in market prices in Chapter 7.5 as summarized in Table 7.5-11. They are converted into economic cost and the residual cost after the project life is calculated for economic evaluation, taking the following process.

a) Infrastructure construction cost is broken down into three items: material cost (60%), equipment cost (30%) and labor cost (10%).
b) Out of material and equipment cost, import duty and value added tax are deducted.
c) For the portion of unskilled labor cost (70%), Shadow Wage Rate (SWR) is applied. According to the INEI data the unemployment rate in Lima is in the range between 7.8% in 2000 and 11.4% in 2005, as shown in Figure 9.2-2. The 10.1% of the recent average unemployment rate is applied to Haveman's formula and 74% of SWR is obtained to adjust the labor cost.

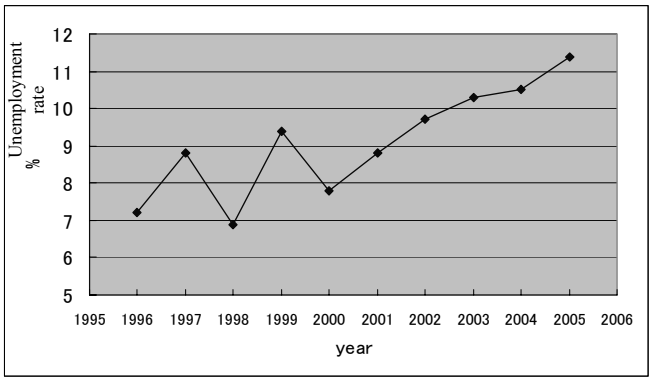


Figure 9.2-2 Unemployment Rate in Lima

SWR = (Wage rate in market) X (1.25 – Unemployment rate/0.2) = 74.3%

d) Residual value of infrastructure is 25% of initial investment cost after the life year of 20 years.

Accordingly, the economic cost of the East-West Trunk Bus-way infrastructure is estimated in US$ 41.2 million, 67% of its market price, as shown in Table 9.2-5.

Table 9.2-5 Economic Cost and Financial Cost of Project

Items	Economic Cost (US$ million)	Financial Cost (US$ million)	Economic/ Financial
Initial Investment	41.2	61.4	0.671
Residual Value (25%)	10.3	15.4	0.668

Total amount of investment cost is allocated in accordance with the proposed implementation schedule (from 2007 to 2010) described in Chapter 10. Task for preparation such as land acquisition and engineering design are carried out during the beginning two years and main construction works are implemented in 2009 and 2010.

Table 9.2-6 Investment Schedule of Infrastructure

Year	Economic Cost (US$ million)	Financial Cost (US$ million)
2007	0.9	1.9
2008	3.9	6.4
2009	18.3	26.2
2010	18.0	26.9
Total	41.2	61.4

It is necessary to invest the maintenance/operation cost even after completion of the trunk bus-way infrastructures in 2010. A half amount of ordinary infrastructure O/M cost, 2.5% of initial investment, is allocated yearly, as shown in Table 9.2-6, because the initial infrastructure investment includes not only the bus-way itself but also the total right-of-way construction cost along the corridor.

2) Bus Fleet and Bus Operation Cost

The required costs for trunk bus operation are examined in Chapter 6.10 in market price.

These data are converted into economic price and estimated in the form of yearly cost flow in this section. Major assumptions are:

a) Conversion parameter of bus fleet from market price to economic price: 0.7692
b) Life: 10 years, Residual Value: 10%
c) Operation costs are estimated taking into consideration the unit operating cost described in and the results in Chapter 6.10.

The summary results are as follows:

a) Initial investment of 100 articulated buses for trunk route and 300 microbuses for feeder services accounts for US$ 52.0 million in 2010. And the same amount of investment is also required for replacement after 10 years.
b) Residual value after 10 years counts as a minus investment.
c) Additional investment to cope with the increasing demands also requires: 2 articulated buses and 6 microbuses every year, and it cost of US$ 0.8 million.
d) Annual operating cost is US$ 11.9 million in 2011 with about a 3% increase per year in accordance with demand increase.

(5) Estimated Traffic Volume

The summary results of assigned traffic volume for economic evaluation, 'without and with project' networks both in 2011 and 2025, are summarized in Table 9.2-7.

Table 9.2-7 Total Estimated Traffic Volume

(000)	Private			Private	Conventional Bus		E-W Trunk Bus		Public	Total
Vehicle-km	Car	Taxi	Truck	Total	80	37	Trunk Bus	Feeder Bus	Total	Assigned Volume
2010without	7,579	13,292	3,173	24,043	2,686	154	0	0	2,840	26,884
2010with	7,555	13,258	3,176	23,988	2,494	154	53	54	2,754	26,743
2025without	18,539	26,035	6,217	50,791	3,449	319	0	0	3,768	54,559
2025with	18,318	25,651	6,187	50,156	2,828	230	181	117	3,357	53,513
Vehicle-hr										
2010without	456	854	233	1,543	195	12	0	0	207	1,751
2010with	445	842	238	1,526	183	13	2	4	201	1,727
2025without	2,561	3,833	931	7,325	437	43	0	0	480	7,805
2025with	2,431	3,640	916	6,987	339	30	5	20	395	7,382
Passenger-km										
2010without	14,475	27,513	6,029	48,018	118,047	2,981	0	0	121,028	169,045
2010with	14,429	27,443	6,035	47,907	107,676	3,007	5,818	1,127	117,627	165,535
2025without	35,410	53,893	11,813	101,115	129,773	4,703	0	0	134,476	235,592
2025with	34,987	53,097	11,756	99,839	100,937	3,386	19,234	1,632	125,189	225,029
Passenger-hr										
2010without	871	1,768	444	3,082	8,321	259	0	0	8,580	11,662
2010with	850	1,743	453	3,047	7,445	265	166	87	7,963	11,010
2025without	4,892	7,933	1,768	14,594	15,757	703	0	0	16,460	31,054
2025with	4,644	7,535	1,740	13,919	10,968	467	550	284	12,269	26,187

As can be seen in the above results, the differences between 'without' and 'with' cases not so significant in the ratio of 'without'/'with' in 2011, because the impacts of the introduction of trunk bus-way are relatively small in comparison with the total amount volumes of whole traffic assignment volume, especially in private mode. This fact changes in 2025, a certain reduction in public demand can be observed both in vehicle-hr and passenger-hr. Detailed comparisons are summarized in Table 9.2-8.

Table 9.2-8 Comparison of Estimated Traffic Volume

Items	2011						2025					
	Without-With (000)			with/without			Without-With (000)			with/without		
	Private	Public	Total	Private	Public	Total	Private	Public	Total	Private	Public	Total
Vehicle-km	55	86	141	1.00	0.97	0.99	636	411	1,047	0.99	0.89	0.98
Vehicle-hr	17	6	24	0.99	0.97	0.99	337	85	423	0.95	0.82	0.95
Pass.-km	80	3,400	3,480	1.00	0.97	0.96	1,276	9,287	10,563	0.99	0.93	0.96
Pass.-hr	29	617	645	0.99	0.93	0.94	675	4,192	4,867	0.95	0.75	0.84

(6) Economic Benefits

Economic benefits are calculated multiplied the estimated traffic volumes and unit VOC/TTC respectively for each case, and the amount of 'without' case minus 'with' case is considered as the benefit provided by the project.

The procedure of estimate of economic benefits is shown as followings.

- Vehicle-km and Vehicle-hour for private vehicle and passenger-km and passenger-hour for public transportation by "With" and "Without" projects are calculated by the traffic and transit assignment methods.
- The difference of those traffic indices between "With" and "Without" projects shows the measure of traffic and transportation improvement related to the vehicle operation cost and the time travel cost.

- The unit values of VOC and TTC estimated by vehicle and person, respectively, are converted into the unit of traffic indices by vehicle occupancy.
- The economic benefit of VOC and TTC are calculated multiplied the estimated traffic indices and unit VOC/TTC respectively.

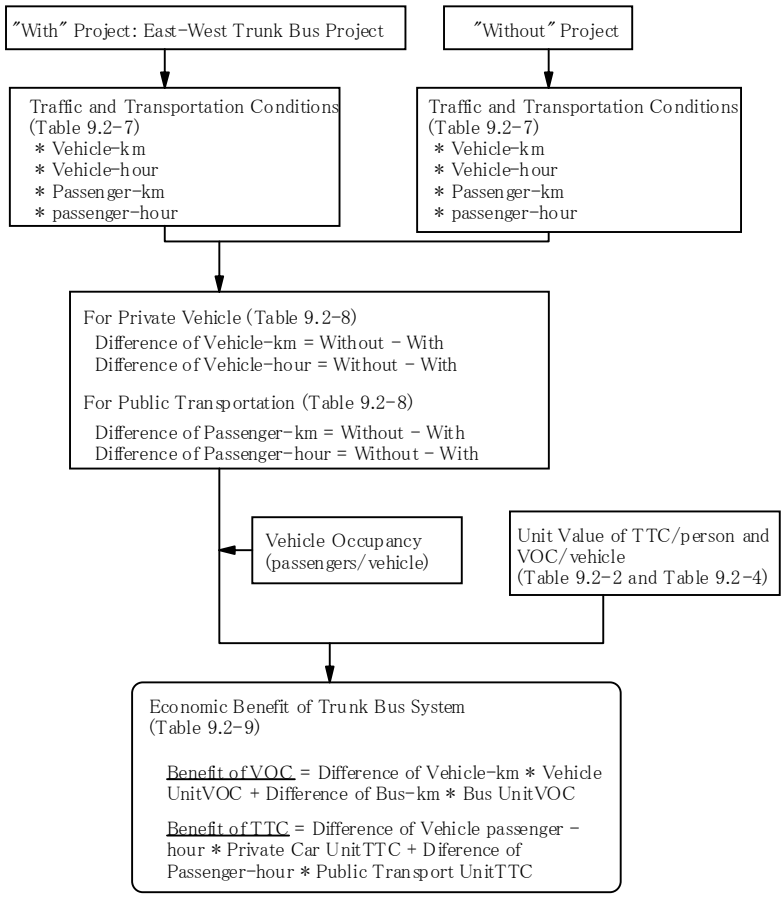


Figure 9.2-3 Procedure of Estimation of Economic Benefit

The estimated total amounts of economic benefits are summarized in Table 9.2-9

Table 9.2-9 Economic Benefit of Trunk Bus-way System

Items		2011		2025		2025/2011
		($ 1000)	%	($ 1000)	%	
VOC	Public	10,352	85.9	48,053	65.1	4.6
	Private	1,706	14.1	25,735	34.9	15.1
	Total	12,058	100.0	73,788	100.0	6.1
TTC	Public	74	82.5	630	78.1	8.5
	Private	16	17.5	177	21.9	11.4
	Total	89	100.0	807	100.0	9.0
Total	Public	10,426	85.8	48,683	65.3	4.7
	Private	1,721	14.2	25,912	34.7	15.1
	Total	12,147	100.0	74,595	100.0	6.1

Most of the benefits are provided by public transport in 2010 (over 80% both in VOC and TTC), the same as in the estimated traffic volume. In 2025, the contribution of private mode will increase from 20% to 35% shares in 2025, because of great increases, both in passenger-km and passenger-hour.

9.2.4. ECONOMIC EVALUATION

(1) Calculation of Evaluation Indices

Yearly benefit-cost flow is tabulated based on the results obtained up to this stage, and necessary indices such as Internal Rate of Return (IRR), Net Present Value (NPV) and Benefit-Cost Ratio (B/C) are calculated under the social discount rate of 11% and for reference, 14% is also calculated.

The economic evaluation of the Base Case (Infrastructure + Bus Fleet + Operation) is analyzed based on the following calculation conditions.

1) The project cost consists of necessary land acquisition cost, construction cost of the exclusive trunk bus-way (2-lane) and arterial road (4-lane to 6-lane), the maintenance cost of the exclusive trunk bus-way, the investment cost for bus fleet and trunk bus system operating cost.
2) The trunk bus system will be operated both trunk bus and feeder bus together.
3) The exclusive trunk bus-way will be constructed up to the end of 2010, and the operation will be started from 2011.
4) The benefits will be made from in year 2011.
5) The social discount rates are adopted at 11% and 14%.
6) Evaluation term is adopted at 20 years after operation of the trunk bus-way.

The economic evaluation result of the base case is tabulated in Table 9.2-10.

As the results of economic analysis on the Base Case, the economic indicators such as IRR=15.4%, NPV=US$ 35,302 thousand, and B/C=1.26 are estimated. Therefore, the proposed East-West trunk bus project can be said economically feasible.

Table 9.2-10 Economic Cash Flow of Trunk Bus-way System

Base Case (A: Infra. + Bus + Bus Operation)

(US$000)

Year	Infrastructure				Bus Fleet			Bus Operation	Total Cost	Benefit	Benefit - Cost	Discounted (11%)		Discounted (14%)	
	Land Acquisition	Const-ruction	Bus-way Maintenance (C*5%*30%)	Sub-total	Bus Fleet (new)	Bus Fleet (disposal)	Sub-total					Cost	Benefit	Cost	Benefit
2007	930			930			0		930		-930	930	0	930	0
2008	930	3,005		3,935			0		3,935		-3,935	3,545	0	3,452	0
2009	9,301	9,014		18,315			0		18,315		-18,315	14,865	0	14,093	0
2010		18,029		18,029	39,998	-10,153	29,845		47,873		-47,873	35,005	0	32,313	0
2011			451	451	800		800	11,900	13,151	12,147	-1,003	8,663	8,002	7,786	7,192
2012			451	451	800		800	12,257	13,508	13,726	218	8,016	8,146	7,015	7,129
2013			451	451	800		800	12,625	13,875	15,524	1,649	7,418	8,300	6,321	7,073
2014			451	451	800		800	13,003	14,254	17,575	3,321	6,866	8,465	5,696	7,024
2015			451	451	800		800	13,394	14,644	19,918	5,273	6,355	8,643	5,134	6,982
2016			451	451	800		800	13,795	15,046	22,596	7,550	5,882	8,833	4,627	6,949
2017			451	451	800		800	14,209	15,460	25,665	10,205	5,445	9,039	4,170	6,923
2018			451	451	800		800	14,635	15,886	29,184	13,298	5,040	9,260	3,759	6,906
2019			451	451	800		800	15,075	16,325	33,228	16,903	4,666	9,498	3,388	6,897
2020			451	451	39,998	-11,999	27,999	15,527	43,976	37,882	-6,094	11,324	9,755	8,007	6,897
2021			451	451	800	-240	560	15,993	17,003	43,247	26,243	3,945	10,033	2,716	6,907
2022			451	451	800	-240	560	16,472	17,483	49,440	31,957	3,654	10,333	2,449	6,926
2023			451	451	800	-240	560	16,967	17,977	56,604	38,627	3,385	10,658	2,209	6,956
2024			451	451	800	-240	560	17,476	18,486	64,904	46,418	3,136	11,010	1,993	6,997
2025			451	451	800	-240	560	18,000	19,011	74,595	55,585	2,905	11,400	1,798	7,054
2026			451	451	800	-240	560	18,540	19,551	78,325	58,775	2,692	10,784	1,622	6,497
2027			451	451	800	-240	560	19,096	20,107	82,241	62,135	2,494	10,201	1,463	5,984
2028			451	451	800	-240	560	19,669	20,680	86,354	65,674	2,311	9,649	1,320	5,512
2029			451	451	800	-240	560	20,259	21,270	90,671	69,402	2,141	9,128	1,191	5,076
2030			451	451	39,998	-11,999	27,999	20,867	49,316	95,205	45,889	4,473	8,634	2,422	4,676
Residual	-9,301	-7,512		-16,813	-38,878	-240	-39,118		-55,931		55,931	-4,570	0	-2,410	0
										IRR	15.4%	150,586	189,771	123,465	132,556
										NPV	$35,302				
										B/C	1.26				

14% NPV $7,974
B/C 1.07

(2) Alternative Cases

It can be assumed that the components of Trunk Bus-way System project consist of 1) Bus-way infrastructures, 2) Bus fleet and 3) Bus transport operation. Therefore, the following three alternative compositions of the project are examined.

1) Base Case (A)

All costs, infrastructure, bus fleet, bus operation costs, are included as one package of the project. This Case is the most critical condition of the East-West trunk bus-way project.

2) Case (B)

Investment costs consist of infrastructure construction and maintenance only, same as road projects or expressway projects.

3) Case (C)

Infrastructure and Bus Fleet Provision: Public or semi-public sector burdens the huge amounts of initial investments for the public transport service and private or semi-private sector takes on its responsibility for its operation only.

4) Case (D)

Infrastructure and Bus Operation: If some organizations own bus fleet only for lease purpose without operation, it is probable case.

In all alternative cases, the results of evaluation indices indicate feasible conditions from social/economic viewpoints, and the priority order results in 'B - C - D – Base Case (A)', as shown in Table 9.2-11.

Table 9.2-11 Economic Evaluation Indices in Alternative Cases

				Discount Rate: **11%**			Discount Rate: 14%		
Case	Infra.	Bus	Bus Operation	IRR(%)	NPV($000)	B/C	IRR(%)	NPV($000)	B/C
Base Case	O	O	O	15.4	35,302	1.26	15.4	7,974	1.07
Case B	O	X	X	35.3	140,538	5.62	35.3	88,264	4.15
Case C	O	O	X	25.5	111,337	2.87	25.5	63,609	2.21
Case D	O	X	O	21.2	64,502	1.61	21.2	32,629	1.39

The Case B, bus-way infrastructure project, shows a very high feasibility (35.3% of IRR) and it is designated as a very feasible project in the metropolitan area to contribute the public from the regional economic viewpoint.

Even the most critical condition case that is Base Case (A), the calculated IRR (15.4%) exceeds the social discount rate of 11% and 14%, this means that the project is worth to be implemented from economic points of view, same as other alternatives. The cash flows of Case (B), (C) and Case (D) are tabulated in Table 9.2-12 to Table 9.2-14.

Table 9.2-12 Cash Flow of Case(B)

Case (B: Bus-way Infrastructure only)

(US$000)

Year	Infrastructure				Benefit	Benefit - Cost	Discounted (11%)		Discounted (14%)	
	Land Acquisition	Const-ruction	Bus-way Maintenance (C*5%*30%)	Total Cost			Cost	Benefit	Cost	Benefit
2007	930			930		-930	930	0	930	0
2008	930	3,005		3,935		-3,935	3,545	0	3,452	0
2009	9,301	9,014		18,315		-18,315	14,865	0	14,093	0
2010		18,029		18,029		-18,029	13,183	0	12,169	0
2011			451	451	12,147	11,697	297	8,002	267	7,192
2012			451	451	13,726	13,275	267	8,146	234	7,129
2013			451	451	15,524	15,074	241	8,300	205	7,073
2014			451	451	17,575	17,125	217	8,465	180	7,024
2015			451	451	19,918	19,467	196	8,643	158	6,982
2016			451	451	22,596	22,146	176	8,833	139	6,949
2017			451	451	25,665	25,214	159	9,039	122	6,923
2018			451	451	29,184	28,734	143	9,260	107	6,906
2019			451	451	33,228	32,778	129	9,498	94	6,897
2020			451	451	37,882	37,431	116	9,755	82	6,897
2021			451	451	43,247	42,796	105	10,033	72	6,907
2022			451	451	49,440	48,990	94	10,333	63	6,926
2023			451	451	56,604	56,153	85	10,658	55	6,956
2024			451	451	64,904	64,453	76	11,010	49	6,997
2025			451	451	74,595	74,145	69	11,400	43	7,054
2026			451	451	78,325	77,874	62	10,784	37	6,497
2027			451	451	82,241	81,791	56	10,201	33	5,984
2028			451	451	86,354	85,903	50	9,649	29	5,512
2029			451	451	90,671	90,220	45	9,128	25	5,076
2030			451	451	95,205	94,754	41	8,634	22	4,676
Residual	-9,301	-7,512		-16,813		16,813	-1,374	0	-724	0
						IRR	33,774	189,771	31,935	132,556
						NPV				
						B/C				

		14%
NPV	$88,264	$140,538
B/C	4.15	5.62

Table 9.2-13 Cash Flow of Case (C)

Case (C: Infra. + Bus Fleet)

(US$000)

	Infrastructure				Bus Fleet						Discounted (11%)		Discounted (14%)	
Year	Land Acquisition	Const-ruction	Bus-way Maintenance (C*5%*30%)	Sub-total	Bus Fleet (new)	Bus Fleet (disposal)	Sub-total	Total Cost	Benefit	Benefit - Cost	Cost	Benefit	Cost	Benefit
2007	930			930			0	930		-930	930	0	930	0
2008	930	3,005		3,935			0	3,935		-3,935	3,545	0	3,452	0
2009	9,301	9,014		18,315			0	18,315		-18,315	14,865	0	14,093	0
2010		18,029		18,029	39,998	-10,153	29,845	47,873		-47,873	35,005	0	32,313	0
2011			451	451	800		800	1,251	12,147	10,897	824	8,002	741	7,192
2012			451	451	800		800	1,251	13,726	12,475	742	8,146	650	7,129
2013			451	451	800		800	1,251	15,524	14,274	669	8,300	570	7,073
2014			451	451	800		800	1,251	17,575	16,325	602	8,465	500	7,024
2015			451	451	800		800	1,251	19,918	18,667	543	8,643	438	6,982
2016			451	451	800		800	1,251	22,596	21,346	489	8,833	385	6,949
2017			451	451	800		800	1,251	25,665	24,414	440	9,039	337	6,923
2018			451	451	800		800	1,251	29,184	27,934	397	9,260	296	6,906
2019			451	451	800		800	1,251	33,228	31,978	358	9,498	260	6,897
2020			451	451	39,998	-11,999	27,999	28,449	37,882	9,433	7,326	9,755	5,180	6,897
2021			451	451	800	-240	560	1,011	43,247	42,236	234	10,033	161	6,907
2022			451	451	800	-240	560	1,011	49,440	48,430	211	10,333	142	6,926
2023			451	451	800	-240	560	1,011	56,604	55,593	190	10,658	124	6,956
2024			451	451	800	-240	560	1,011	64,904	63,893	171	11,010	109	6,997
2025			451	451	800	-240	560	1,011	74,595	73,585	154	11,400	96	7,054
2026			451	451	800	-240	560	1,011	78,325	77,314	139	10,784	84	6,497
2027			451	451	800	-240	560	1,011	82,241	81,231	125	10,201	74	5,984
2028			451	451	800	-240	560	1,011	86,354	85,343	113	9,649	65	5,512
2029			451	451	800	-240	560	1,011	90,671	89,660	102	9,128	57	5,076
2030			451	451	39,998	-11,999	27,999	28,449	95,205	66,755	2,580	8,634	1,397	4,676
Residual	-9,301	-7,512		-16,813	-38,878	-240	-39,118	-55,931		55,931	-4,570	0	-2,410	0
									IRR	25.5%	66,186	189,771	60,041	132,556
									NPV	$111,337				
									B/C	2.87				

14%	NPV	$63,609
	B/C	2.21

Table 9.2-14 Cash Flow of Case (D)

Case (D: Infra. + Bus Operation)

(US$000)

Year	Infrastructure				Bus Operation	Total Cost	Benefit	Benefit - Cost	Discounted (11%)		Discounted (14%)	
	Land Acquisition	Const-ruction	Bus-way Maintenance (C*5%*30%)	Sub-total					Cost	Benefit	Cost	Benefit
2007	930			930		930		-930	930	0	930	0
2008	930	3,005		3,935		3,935		-3,935	3,545	0	3,452	0
2009	9,301	9,014		18,315		18,315		-18,315	14,865	0	14,093	0
2010		18,029		18,029		18,029		-18,029	13,183	0	12,169	0
2011			451	451	11,900	12,351	12,147	-203	8,136	8,002	7,313	7,192
2012			451	451	12,257	12,708	13,726	1,018	7,541	8,146	6,600	7,129
2013			451	451	12,625	13,075	15,524	2,449	6,991	8,300	5,957	7,073
2014			451	451	13,003	13,454	17,575	4,121	6,480	8,465	5,377	7,024
2015			451	451	13,394	13,844	19,918	6,073	6,007	8,643	4,853	6,982
2016			451	451	13,795	14,246	22,596	8,350	5,569	8,833	4,381	6,949
2017			451	451	14,209	14,660	25,665	11,005	5,163	9,039	3,954	6,923
2018			451	451	14,635	15,086	29,184	14,098	4,787	9,260	3,570	6,906
2019			451	451	15,075	15,525	33,228	17,703	4,438	9,498	3,222	6,897
2020			451	451	15,527	15,978	37,882	21,905	4,114	9,755	2,909	6,897
2021			451	451	15,993	16,443	43,247	26,803	3,815	10,033	2,626	6,907
2022			451	451	16,472	16,923	49,440	32,517	3,537	10,333	2,371	6,926
2023			451	451	16,967	17,417	56,604	39,187	3,280	10,658	2,140	6,956
2024			451	451	17,476	17,926	64,904	46,978	3,041	11,010	1,932	6,997
2025			451	451	18,000	18,451	74,595	56,145	2,820	11,400	1,745	7,054
2026			451	451	18,540	18,991	78,325	59,335	2,615	10,784	1,575	6,497
2027			451	451	19,096	19,547	82,241	62,695	2,424	10,201	1,422	5,984
2028			451	451	19,669	20,120	86,354	66,234	2,248	9,649	1,284	5,512
2029			451	451	20,259	20,710	90,671	69,962	2,085	9,128	1,159	5,076
2030			451	451	20,867	21,317	95,205	73,887	1,933	8,634	1,047	4,676
Residual	-9,301	-7,512		-16,813		-16,813		16,813	-1,374	0	-724	0
									118,173	189,771	95,358	132,556

IRR	21.2%
NPV	$64,502
B/C	1.61

14%	NPV	$32,629
	B/C	1.39

(3) Sensitivity Analysis

Some sensitivity analyses are conducted for the 'Base case (A)'. In the base case, Net Present Value (NPV) varies from US$ 85 million (at the discount rate of 8%) in accordance with the social discount rate increases as shown in Figure 9.2-3.

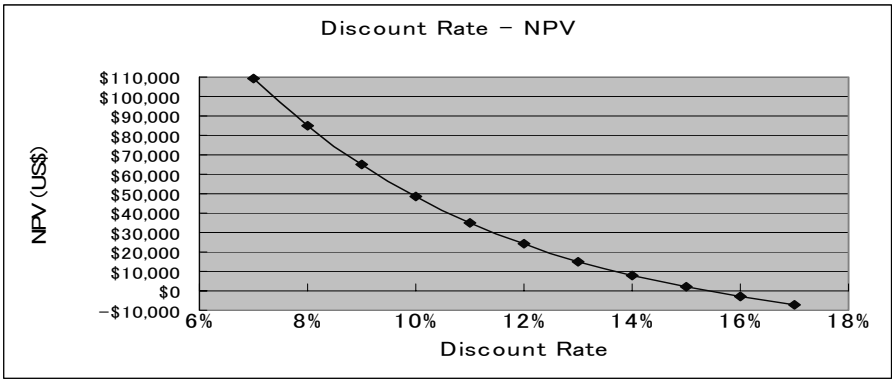


Figure 9.2-4 Social Discount Rates and Net Present Values, Base Case (A)

The rather stable economic feasibility of the project is also clarified in the following results of sensitivity analysis both of cost and benefit variation, and the project falls into unfeasible situation only in some cases as shown in the following Table 9.2-15.

Table 9.2-15 Variation of Cost and Benefit in Base Case

Benefit Variations	Cost Variations						
	-30%	-20%	-10%	Base	+10%	+20%	+30%
-30%	**15.4**	**12.8**	10.6	8.7	7.0	5.4	4.0
-20%	**18.0**	**15.4**	**13.1**	**11.2**	9.4	7.8	6.4
-10%	**20.5**	**17.7**	**15.4**	**13.3**	**11.6**	10.0	8.5
Base	**22.8**	**19.9**	**17.5**	**15.4**	**13.5**	**11.9**	10.4
+10%	**25.0**	**21.9**	**19.4**	**17.3**	**15.4**	**13.7**	**12.2**
+20%	**27.1**	**23.9**	**21.3**	**19.0**	**17.1**	**15.4**	**13.8**
+30%	**29.2**	**25.8**	**23.0**	**20.7**	**18.7**	**16.9**	**15.4**

(4) Conclusion

It can be concluded the proposed East-West Trunk Bus-way project, in any alternative case, is a quite feasible project from the viewpoint of the regional economy.

9.3. FINANCIAL EVALUATION

As the economic feasibility of the project is proved in the previous section, another financial aspect of the project feasibility is examined in this section. The main purpose of financial analysis is to clarify a profitability/soundness in cash flow of the project, in order to examine the probability of private funds investment in the project.

9.3.1. GENERAL

In general, financial analysis of the project is carried out in accordance with the following framework, as shown in Figure 9.3-1. Major work is to prepare the input data for the financial statements and necessary external variables are investment, revenue and operating cost.

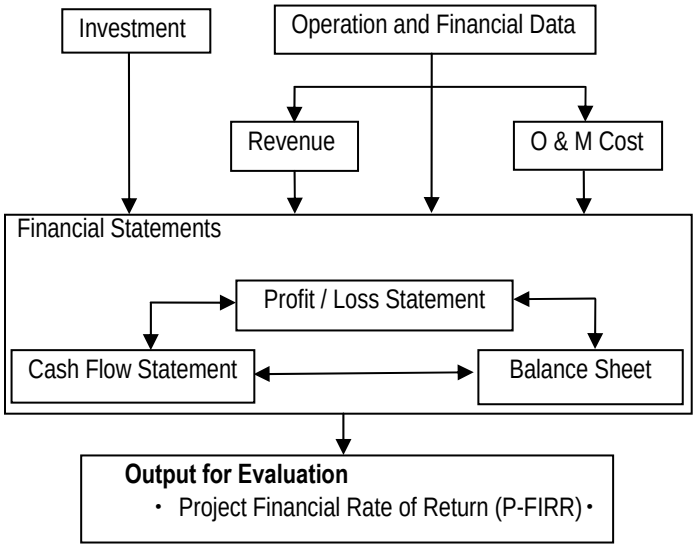


Figure 9.3-1 Framework of Financial Evaluation of Trunk Bus-way System

Usually financial statements are composed of three forms, 1) Profit-loss statement, 2) Cash flow statement and 3) Balance sheet, and each contents and purpose of each are as follows:

1) Profit-loss statement: Descriptions of annual profit/loss to indicate the project performance, including the items of operating revenue, operating expenses, operating profit, non-operating revenue, non-operating expenses, net profit before taxes, and net profit.
2) Cash flow: Statements of cash in-flow and out-flow to estimate the annual surplus or deficit including loan and application of funds besides operating expenses; sources of funds, application of funds, and cash flow.
3) Balance sheet: Description of assets condition at the end of the fiscal year to indicate financial stability and soundness of the company; assets, liabilities, and capital or net worth.

9.3.2. MAJOR ASSUMPTIONS

(1) Real/Nominal terms

As there are two ways in financial analysis, ‘in real terms’ and ‘nominal terms’, here the financial statements in real terms are mainly in order to examine the Financial Internal Rate of Return (FIRR).

(2) Evaluation Period

Though the evaluation period of financial analysis is 10 years in Peru, duration of 20 years is applied for this financial examination of the project, because a long-term loan is assumed.

(3) Alternatives

The operation and management of proposed East-West trunk bus-way system is assumed to be managed by one bus corporation as mentioned in Chapter 6.10. Moreover the necessary information for the financial evaluation is examined; such as 1) organization and operating cost of the corporation, 2) facilities and equipments cost, 3) bus operation cost, and 4) bus fleet procurement plan. These data are directly applied for financial evaluation.

(4) Commission/Contribution

As it is assumed that a private/semi-private body operates the trunk bus system independently in this evaluation, it may be necessary to pay some commission or license fee to the government for the overall supervision purpose. The amount of 5% of the total revenue is presumed as commission/contribution of trunk bus system operation.

(5) Necessary Funds

It is necessary to prepare a certain amount of fund for the initial investment cost both for the bus-way infrastructure and bus fleet. Three kinds of loan systems are supposed: the one is Japan's official government (JBIC) loan with an interest rate of 1.5% and under repayment for 25 years (7year of grace period), the second is a financing from Financial Corporation for Development (COFIDE), with an interest of official bank rate + 2.5% (less 5 years), the third is a short-term bank loan with an interest rate of 15%. Some combinations are applied depending on the alternative case.

9.3.3. REVENUE AND OPERATING COST

(1) Demand and Proceeds

The demand for East-West Trunk Bus-way System is forecasted in Chapter 5.3, that is the number of total passenger demand (both of trunk bus and its feeder bus) in the morning peak hour both in 2011 and 2025. There are 40.4 thousand passengers in 2011 and 51.5 thousand in 2025. On the other hand, the demand in the similar project of COSAC is forecasted at 100-110 thousand.

The total revenue (proceeds) by the trunk bus patronage is estimated based on this volume, considering following processes:

1) Expansion from peak-hour to day volume: Operation period of trunk bus service is supposed as 5:30 to 23:00 (17.5 hrs) and 10% of peak ratio (peak-hr/24 hrs) is applied from the result of traffic count survey (bus passenger) data at total screen line in the Master Plan study. As this conversion factor of 9.5 seems to be rather high compared with the 7.4 in the urban train project (AATE) case, it is reasonable in comparison with 11.9 derived by the 8% of peak ratio in vehicle volume.
2) Expansion from day to year volume: Considering the less traffic volume in weekends and national holiday comparing weekdays, the yearly volume is calculated as average daily volume multiplied by 308.
3) Estimation of paid passenger ratio: There is a regulation of fare exemption/discount for public transport users of military men, police, firemen, pupils and students. A factor of 0.75 is applied based on the estimated shares of free-ride passengers and 50% discounted student passengers. (0.875 in case of urban train project).

4) Unit fare: As four alternatives, S/. 1.0, S/. 1.2, S/. 1.5, and S/. 2.0, are examined as a unit fare rate in the previous section, a recommended fare rate of S/. 1.5 is applied in this study.

Finally the total yearly proceeds from trunk bus-way service are estimated as US$ 40.5 million in 2011 and US$ 51.7 million in 2025, respectively.

(2) Operating Cost

Annual operating cost and depreciation cost are directly quoted from Chapter 6.10 for the beginning year of the trunk bus operation, and yearly estimation for the future is carried out in accordance with additional bus fleet amount and/or increasing demands.

9.3.4. CASH FLOW AND ACCUMULATED BALANCE

(1) Alternative Case of Financial Analysis

As mentioned in previous, the results of the financial analysis in changed in accordance with East-West trunk bus operation organization. Considering the existing bus operation organization and COSAC bus operation organization, the following Seven (7) alternative cases are analyzed for the financial evaluation of the East-West trunk busway project.

1) Base Case (Case-A)

A public corporation or authority has all responsibilities without payment of commission under the following conditions.

a) Construction of the East-West trunk bus way facilities and related facilities.
b) Maintenance of the East-West trunk bus way facilities and related facilities.
c) Purchase the new trunk buses and new feeder buses required.
d) Operation of both trunk bus and feeder bus.

2) Case-B

A public corporation or authority has all responsibilities with payment of commission under the following conditions.

a) Construction of the East-West trunk bus way facilities and related facilities.
b) Maintenance of the East-West trunk bus way facilities and related facilities.
c) Purchase the new trunk buses and new feeder buses required.
d) Operation of both trunk bus and feeder bus.
e) Payment of a commission (5% of total bus proceeds) to the authority or municipality for East-West trunk bus supervision.

3) Case-C

A public corporation or authority has responsibilities (except infrastructure construction) under the following conditions.

a) Maintenance of the East-West trunk bus way facilities and related facilities.
b) Purchase the new trunk buses and new feeder buses required.
c) Operation and maintenance of trunk bus and feeder bus.

4) Case-D

A public corporation or authority has responsibilities (except infrastructure construction) under the following conditions.

a) Maintenance of the East-West trunk bus way facilities and related facilities.
b) Purchase the new trunk buses and new feeder bases required.
c) Operation and maintenance of trunk bus and feeder bus.
d) Payment of a commission (5% of total bus proceeds) to the authority or municipality for East-West trunk bus supervision.

5) Case-E

A corporation or authority has responsible without commission payment under the following

conditions.

a) No infrastructure construction
b) Maintenance of the East-West trunk bus way facilities and related facilities.
c) Purchase the new trunk buses and new feeder bases required.
d) Operation and maintenance of trunk bus and feeder bus.
e) All finance relying on COFIDE

6) Case-F

A corporation or authority has responsible with commission payment under the following conditions.

a) No infrastructure construction
b) Maintenance of the East-West trunk bus way facilities and related facilities.
c) Purchase the new trunk buses and new feeder bases required.
d) Operation and maintenance of trunk bus and feeder bus.
e) Payment of a commission (5% of total bus proceeds) to the authority or municipality for East-West trunk bus supervision.
f) All finance relying on COFIDE

7) Case-G

A private corporation or authority operates the system with commission payment under the following conditions.

a) Maintenance of the East-West trunk bus way facilities and related facilities.
b) Lease the new trunk buses and new feeder bases required.
c) Operation and maintenance of trunk bus and feeder bus.
d) Payment of a commission (5% of total bus proceed) to the authority or municipality of East-West trunk bus supervision.
e) All finance relying on COFIDE

(2) Assumption of Calculation for Financial Evaluation

The indicators of financial evaluation are calculated based on the following assumptions.

a) The project cost is adopted in Chapter 7 of this report.
b) The maintenance cost is only for the trunk bus-way portion.
c) Bus purchase cost is adopted in chapter 6.
d) Operation cost is adopted in Chapter 6
e) In case of operation by public sector, 75% of the project cost is adopted by soft (ODA) loan with 1.5% interest.
f) Remaining 25% of the project cost is adopted at the other loan with 7.5% interest.
g) Income tax is 30% of the profits

(3) Analysis

1) Full Scale Operation Case (Base Case (A), Case-B)

At first, an alternative case of full-scale operation such as Base Case (A) and Case-B is examined. It is case trunk bus corporation constructs the entire bus-way infrastructures on the public road space (including the terminal, depot and administrative offices) by its own risk and operates the bus service.

In this case bus corporation needs a big amount of initial investments both for infrastructure and bus fleet purchase at the beginning stage of the project. Since a rather difficult financial situation is easily foreseen and the project is exactly public service oriented, a desirable funding condition is supposed. It is assumed 75% of the total initial investment is treated by JBIC loan, and the rest is covered by COFIDE finance. The cash flow of the Base Case (Case-A) is shown in Table 9.3-1 and the Case-B is shown in Table 9.3-2

2) Without Construction of Infrastructure Case (Case-C, Case-D and Case-E)

Second alternative is 'without infrastructure' case such as Case-C, Case-D and Case-E. Infrastructure for trunk bus-ways are prepared by government and offered without any charge, but with the said commission to the trunk bus corporation, so trunk bus corporation can avoid a heavy burden of initial investment to some extent (about 45% of the previous case). In this case three types of financing are assumed: the short-term bank loan (interest rate: 15%) for preparative operation cost before actual bus operation, and both of JBIC loan (75%; with a interest rate of 1.5%) and COFIDE financing (25%; interest rate: 7.5%). The cash flow of the Case-C, Case-D and Case-E are shown in Table 9.3-3to Table 9.3-5 respectively.

Table 9.3-1 Financial Cash Flow of Base Case (Case-A)

All Include (Infra. + Bus + Bus operation)
Base Case (without Commission)

(US$000)

Year	Passenger Proceeds	Investment: Infra-structure (Incl. O/M)	Investment: Bus fleet: Purchase	Investment: Bus fleet: Disposal	Operation Cost	Operating Profit	ODA Loan (JBIC): Repayment (7/18:25years)	ODA Loan (JBIC): Interest 1.5%	Official Devel. Loan: Repayment (5 years)	Official Devel. Loan: Interest 7.5%	Net Profit: before Tax: per year	Net Profit: before Tax: Cumula-tive	Net Profit: Income Tax	Net Profit: after Tax: per year	Net Profit: after Tax: Cumula-tive
2007		1,937				-1,937	(75% of		(Rest, 25%)		-1,937	-1,937	0	-1,937	-1,937
2008		6,421				-6,421	Initial Invest.)				-6,421	-8,358	0	-6,421	-8,358
2009		26,180				-26,180					-26,180	-34,538	0	-26,180	-34,538
2010		26,904	52,000		8,499	-87,402	(85,082)		(29,769)		-87,402	-121,941	0	-87,402	-121,941
2011	40,546	747	1,040		16,997	21,761	0	1,276	5,954	2,233	**12,299**	-109,642	0	12,299	-109,642
2012	41,255	747	1,040		17,337	22,131	0	1,276	5,954	1,786	**13,115**	-96,527	0	13,115	-96,527
2013	41,977	747	1,040		17,684	22,506	0	1,276	5,954	1,340	**13,937**	-82,591	0	13,937	-82,591
2014	42,712	747	1,040		18,037	22,887	0	1,276	5,954	893	**14,764**	-67,827	0	14,764	-67,827
2015	43,459	747	1,040		18,398	23,274	0	1,276	5,954	447	**15,597**	-52,229	0	15,597	-52,229
2016	44,220	747	1,040		18,766	23,666	0	1,276	0	0	**22,390**	-29,839	0	22,390	-29,839
2017	44,994	747	1,040		19,141	24,065	4,727	1,276	0	0	**18,062**	-11,777	0	18,062	-11,777
2018	45,781	747	1,040		19,524	24,469	4,727	1,205	0	0	**18,537**	**6,760**	5,561	12,976	**1,199**
2019	46,582	747	1,040		19,915	24,880	4,727	1,134	0	0	**19,019**	**25,779**	5,706	13,313	**14,512**
2020	47,397	747	52,000	-15,600	20,313	-10,063	4,727	1,064	0	0	-15,853	**9,926**	0	-15,853	-1,341
2021	48,227	747	1,040	-312	20,719	26,032	4,727	993	0	0	**20,313**	**30,239**	6,094	14,219	**12,878**
2022	49,071	747	1,040	-312	21,134	26,462	4,727	922	0	0	**20,813**	**51,052**	6,244	14,569	**27,447**
2023	49,930	747	1,040	-312	21,556	26,898	4,727	851	0	0	**21,320**	**72,372**	6,396	14,924	**42,371**
2024	50,803	747	1,040	-312	21,987	27,341	4,727	780	0	0	**21,834**	**94,206**	6,550	15,284	**57,655**
2025	51,692	747	1,040	-312	22,427	27,790	4,727	709	0	0	**22,354**	**116,560**	6,706	15,648	**73,303**
2026	52,597	747	1,040	-312	22,876	28,246	4,727	638	0	0	**22,881**	**139,441**	6,864	16,017	**89,320**
2027	53,517	747	1,040	-312	23,333	28,709	4,727	567	0	0	**23,415**	**162,856**	7,024	16,390	**105,710**
2028	54,454	747	1,040	-312	23,800	29,179	4,727	496	0	0	**23,956**	**186,812**	7,187	16,769	**122,479**
2029	55,407	747	1,040	-312	24,276	29,656	4,727	425	0	0	**24,504**	**211,315**	7,351	17,152	**139,631**
2030	56,377	747	52,000	-15,600	24,761	-5,532	4,727	355	0	0	-10,613	**200,702**	0	-10,613	**129,018**
Residual		-15,361	-50,544			65,905					65,905			65,905	
					FIRR(20)	16.7%				FIRR(20)	11.3%		FIRR(20)	9.5%	

Table 9.3-2 Financial Cash Flow of Case-B

All Include (Infra. + Bus + Bus operation)
Case B (with Commission)

(US$000)

Year	Passenger Proceeds	Commission (5%)	Substantial Revenue	Investment: Infrastructure (Incl. O/M)	Investment: Bus fleet: Purchase	Investment: Bus fleet: Disposal	Operation Cost	Operating Profit	ODA Loan (JBIC): Repayment (7/18:25years)	ODA Loan (JBIC): Interest 1.5%	Official Devel. Loan: Repayment (5 years)	Official Devel. Loan: Interest 7.5%	Net Profit: before Tax: per year	Net Profit: before Tax: Cumulative	Net Profit: Income Tax	Net Profit: after Tax: per year	Net Profit: after Tax: Cumulative
2007				1,937				-1,937	(75% of		(Rest, 25%)		-1,937	-1,937	0	-1,937	-1,937
2008				6,421				-6,421	Initial Invest.)				-6,421	-8,358	0	-6,421	-8,358
2009				26,180				-26,180					-26,180	-34,538	0	-26,180	-34,538
2010				26,904	52,000		8,499	-87,402	(85,082)		(29,769)		-87,402	-121,941	0	-87,402	-121,941
2011	40,546	2,027	38,518	747	1,040		16,997	19,734	0	1,276	5,954	2,233	**10,271**	-111,669	0	**10,271**	-111,669
2012	41,255	2,063	39,192	747	1,040		17,337	20,068	0	1,276	5,954	1,786	**11,052**	-100,617	0	**11,052**	-100,617
2013	41,977	2,099	39,878	747	1,040		17,684	20,407	0	1,276	5,954	1,340	**11,838**	-88,780	0	**11,838**	-88,780
2014	42,712	2,136	40,576	747	1,040		18,037	20,752	0	1,276	5,954	893	**12,628**	-76,151	0	**12,628**	-76,151
2015	43,459	2,173	41,286	747	1,040		18,398	21,101	0	1,276	5,954	447	**13,424**	-62,727	0	**13,424**	-62,727
2016	44,220	2,211	42,009	747	1,040		18,766	21,455	0	1,276	0	0	**20,179**	-42,548	0	**20,179**	-42,548
2017	44,994	2,250	42,744	747	1,040		19,141	21,815	4,727	1,276	0	0	**15,812**	-26,735	0	**15,812**	-26,735
2018	45,781	2,289	43,492	747	1,040		19,524	22,180	4,727	1,205	0	0	**16,248**	-10,487	0	**16,248**	-10,487
2019	46,582	2,329	44,253	747	1,040		19,915	22,551	4,727	1,134	0	0	**16,690**	**6,203**	5,007	**11,683**	**1,196**
2020	47,397	2,370	45,027	747	52,000	-15,600	20,313	-12,433	4,727	1,064	0	0	-18,223	-12,020	0	-18,223	-17,027
2021	48,227	2,411	45,815	747	1,040	-312	20,719	23,621	4,727	993	0	0	**17,902**	**5,881**	5,370	**12,531**	-4,496
2022	49,071	2,454	46,617	747	1,040	-312	21,134	24,008	4,727	922	0	0	**18,360**	**24,241**	5,508	**12,852**	**8,356**
2023	49,930	2,496	47,433	747	1,040	-312	21,556	24,401	4,727	851	0	0	**18,824**	**43,065**	5,647	**13,177**	**21,532**
2024	50,803	2,540	48,263	747	1,040	-312	21,987	24,800	4,727	780	0	0	**19,294**	**62,358**	5,788	**13,506**	**35,038**
2025	51,692	2,585	49,108	747	1,040	-312	22,427	25,205	4,727	709	0	0	**19,769**	**82,128**	5,931	**13,839**	**48,876**
2026	52,597	2,630	49,967	747	1,040	-312	22,876	25,616	4,727	638	0	0	**20,251**	**102,379**	6,075	**14,176**	**63,052**
2027	53,517	2,676	50,842	747	1,040	-312	23,333	26,033	4,727	567	0	0	**20,739**	**123,118**	6,222	**14,517**	**77,570**
2028	54,454	2,723	51,731	747	1,040	-312	23,800	26,456	4,727	496	0	0	**21,233**	**144,351**	6,370	**14,863**	**92,433**
2029	55,407	2,770	52,637	747	1,040	-312	24,276	26,885	4,727	425	0	0	**21,733**	**166,084**	6,520	**15,213**	**107,646**
2030	56,377	2,819	53,558	747	52,000	-15,600	24,761	-8,351	4,727	355	0	0	-13,432	**152,652**	0	-13,432	**94,214**
Residual				-15,361	-50,544			65,905					65,905			65,905	
							FIRR(20)	14.9%				FIRR(20)	9.5%		FIRR(20)	7.9%	

Table 9.3-3 Financial Cash Flow of Case-C

Excluding Infrastructure (Bus-way maintenance + Bus + Bus operation)
Case C (without Commission)

(US$000)

Year	Passenger Proceeds	Investment: Busway Maintenance	Investment: Bus fleet: Purchase	Investment: Bus fleet: Disposal	Operation Cost	Operating Profit	Short-term Loan: Repayment	Short-term Loan: Interest (15%)	JBIC Loan: 75% of Bus Fleet: Repayment (10 years)	JBIC Loan: 75% of Bus Fleet: Interest (1.5%)	Official Devel. Loan: Rest of Bus Fleet: Repayment (5 years)	Official Devel. Loan: Rest of Bus Fleet: Interest (7.5%)	Net Profit: before Tax: per year	Net Profit: before Tax: Cumulative	Net Profit: Income Tax (30%)	Net Profit: after Tax: per year	Net Profit: after Tax: Cumulative
2010			52,000		8,499	-60,499	(8,499)		(39,000)		(13,000)		-60,499	-60,499	0	-60,499	-60,499
2011	40,546	747	1,040		16,997	21,761	4,249	1,275	3,900	585	3,120	975	**7,657**	-52,841	0	**7,657**	-52,841
2012	41,255	747	1,040		17,337	22,131	4,249	637	3,900	527	3,120	741	**8,957**	-43,884	0	**8,957**	-43,884
2013	41,977	747	1,040		17,684	22,506			3,900	468	3,120	507	**14,511**	-29,373	0	**14,511**	-29,373
2014	42,712	747	1,040		18,037	22,887			3,900	410	3,120	273	**15,185**	-14,188	0	**15,185**	-14,188
2015	43,459	747	1,040		18,398	23,274			3,900	351	3,120	39	**15,864**	**1,676**	4,759	**11,105**	-3,083
2016	44,220	747	1,040		18,766	23,666			3,900	293	0	0	**19,474**	**21,150**	5,842	**13,632**	**10,548**
2017	44,994	747	1,040		19,141	24,065			3,900	234	0	0	**19,931**	**41,081**	5,979	**13,952**	**24,500**
2018	45,781	747	1,040		19,524	24,469			3,900	176	0	0	**20,394**	**61,475**	6,118	**14,276**	**38,776**
2019	46,582	747	1,040		19,915	24,880			3,900	117	0	0	**20,863**	**82,338**	6,259	**14,604**	**53,380**
2020	47,397	747	52,000	-15,600	20,313	-10,063			3,900	59	0	0	-14,021	**68,316**	0	-14,021	**39,359**
2021	48,227	747	1,040	-312	20,719	26,032			3,900	585	3,120	975	**17,452**	**85,768**	5,236	**12,217**	**51,575**
2022	49,071	747	1,040	-312	21,134	26,462			3,900	527	3,120	741	**18,174**	**103,943**	5,452	**12,722**	**64,297**
2023	49,930	747	1,040	-312	21,556	26,898			3,900	468	3,120	507	**18,903**	**122,846**	5,671	**13,232**	**77,529**
2024	50,803	747	1,040	-312	21,987	27,341			3,900	410	3,120	273	**19,638**	**142,484**	5,891	**13,747**	**91,276**
2025	51,692	747	1,040	-312	22,427	27,790			3,900	351	3,120	39	**20,380**	**162,864**	6,114	**14,266**	**105,542**
2026	52,597	747	1,040	-312	22,876	28,246			3,900	293	0	0	**24,053**	**186,917**	7,216	**16,837**	**122,379**
2027	53,517	747	1,040	-312	23,333	28,709			3,900	234	0	0	**24,575**	**211,492**	7,372	**17,202**	**139,581**
2028	54,454	747	1,040	-312	23,800	29,179			3,900	176	0	0	**25,103**	**236,595**	7,531	**17,572**	**157,154**
2029	55,407	747	1,040	-312	24,276	29,656			3,900	117	0	0	**25,639**	**262,234**	7,692	**17,947**	**175,101**
2030	56,377	747	52,000	-15,600	24,761	-5,532			3,900	59	0	0	-9,491	**252,743**	0	-9,491	**165,610**
Residual			-50,544			50,544							50,544			50,544	
					FIRR(20)	36.7%						FIRR(20)	22.0%		FIRR(20)	18.2%	
												FIRR(10)	16.7%		FIRR(10)	11.8%	

Table 9.3-4 Financial Cash Flow of Case-D

Excluding Infrastructure (Bus-way maintenance + Bus + Bus operation)
Case D (with Commission)

(US$000)

				Investment					Short-term Loan		JBIC Loan		Official Devel. Loan		Net Profit				
					Bus fleet						75% of Bus Fleet		Rest of Bus Fleet		before Tax		Income	after Tax	
Year	Passenger Proceeds	Commi-ssion (5%)	Substan-tial Revenue	Busway Mainte-nance	Purchase	Disposal	Operation Cost	Operating Profit	Repay-ment	Interest (15%)	Repayment (10 years)	Interest (1.5%)	Repayment (5 years)	Interest (7.5%)	per year	Cumula-tive	Tax (30%)	per year	Cumula-tive
2010					52,000		8,499	-60,499	(8,499)		(39,000)		(13,000)		-60,499	-60,499	0	-60,499	-60,499
2011	40,546	2,027	38,518	747	1,040		16,997	19,734	4,249	1,275	3,900	585	3,120	975	**5,630**	-54,868	0	**5,630**	-54,868
2012	41,255	2,063	39,192	747	1,040		17,337	20,068	4,249	637	3,900	527	3,120	741	**6,895**	-47,974	0	**6,895**	-47,974
2013	41,977	2,099	39,878	747	1,040		17,684	20,407			3,900	468	3,120	507	**12,412**	-35,561	0	**12,412**	-35,561
2014	42,712	2,136	40,576	747	1,040		18,037	20,752			3,900	410	3,120	273	**13,049**	-22,512	0	**13,049**	-22,512
2015	43,459	2,173	41,286	747	1,040		18,398	21,101			3,900	351	3,120	39	**13,691**	-8,822	0	**13,691**	-8,822
2016	44,220	2,211	42,009	747	1,040		18,766	21,455			3,900	293	0	0	**17,263**	**8,441**	5,179	**12,084**	**3,262**
2017	44,994	2,250	42,744	747	1,040		19,141	21,815			3,900	234	0	0	**17,681**	**26,122**	5,304	**12,377**	**15,639**
2018	45,781	2,289	43,492	747	1,040		19,524	22,180			3,900	176	0	0	**18,105**	**44,227**	5,431	**12,673**	**28,313**
2019	46,582	2,329	44,253	747	1,040		19,915	22,551			3,900	117	0	0	**18,534**	**62,761**	5,560	**12,974**	**41,287**
2020	47,397	2,370	45,027	747	52,000	-15,600	20,313	-12,433			3,900	59	0	0	-16,391	**46,370**	0	-16,391	**24,895**
2021	48,227	2,411	45,815	747	1,040	-312	20,719	23,621			3,900	585	3,120	975	**15,041**	**61,411**	4,512	**10,529**	**35,424**
2022	49,071	2,454	46,617	747	1,040	-312	21,134	24,008			3,900	527	3,120	741	**15,721**	**77,132**	4,716	**11,005**	**46,428**
2023	49,930	2,496	47,433	747	1,040	-312	21,556	24,401			3,900	468	3,120	507	**16,406**	**93,538**	4,922	**11,484**	**57,913**
2024	50,803	2,540	48,263	747	1,040	-312	21,987	24,800			3,900	410	3,120	273	**17,098**	**110,636**	5,129	**11,969**	**69,881**
2025	51,692	2,585	49,108	747	1,040	-312	22,427	25,205			3,900	351	3,120	39	**17,795**	**128,431**	5,339	**12,457**	**82,338**
2026	52,597	2,630	49,967	747	1,040	-312	22,876	25,616			3,900	293	0	0	**21,424**	**149,855**	6,427	**14,996**	**97,334**
2027	53,517	2,676	50,842	747	1,040	-312	23,333	26,033			3,900	234	0	0	**21,899**	**171,754**	6,570	**15,329**	**112,664**
2028	54,454	2,723	51,731	747	1,040	-312	23,800	26,456			3,900	176	0	0	**22,381**	**194,134**	6,714	**15,666**	**128,330**
2029	55,407	2,770	52,637	747	1,040	-312	24,276	26,885			3,900	117	0	0	**22,868**	**217,003**	6,860	**16,008**	**144,338**
2030	56,377	2,819	53,558	747	52,000	-15,600	24,761	-8,351			3,900	59	0	0	-12,310	**204,693**	0	-12,310	**132,028**
Residual					-50,544			50,544							50,544			50,544	
							FIRR(20)	33.1%						FIRR(20)	18.8%		FIRR(20)	15.7%	
														FIRR(10)	12.1%		FIRR(10)	8.0%	

Table 9.3-5 Financial Cash Flow of Case-E

Excluding Infrastructure (Bus-way maintenance + Bus + Bus operation)
Case E (without Commission)

(US$000)

Year	Passenger Proceeds	Investment			Operation Cost	Operating Profit	Short-term Loan		Official Devel. Loan		Net Profit				
		Busway Mainte-nance	Bus fleet				Repay-ment	Interest (15%)	Rest of Bus Fleet		before Tax		Income Tax (30%)	after Tax	
			Purchase	Disposal					Repayment (10 years)	Interest (7.5%)	per year	Cumula-tive		per year	Cumula-tive
2010			52,000		8,499	-60,499	(8,499)		(52,000)		-60,499	-60,499	0	-60,499	-60,499
2011	40,546	747	1,040		16,997	21,761	4,249	1,275	5,200	3,900	**7,137**	-53,361	0	**7,137**	-53,361
2012	41,255	747	1,040		17,337	22,131	4,249	637	5,200	3,510	**8,535**	-44,826	0	**8,535**	-44,826
2013	41,977	747	1,040		17,684	22,506			5,200	3,120	**14,186**	-30,640	0	**14,186**	-30,640
2014	42,712	747	1,040		18,037	22,887			5,200	2,730	**14,957**	-15,683	0	**14,957**	-15,683
2015	43,459	747	1,040		18,398	23,274			5,200	2,340	**15,734**	**51**	4,720	**11,014**	-4,669
2016	44,220	747	1,040		18,766	23,666			5,200	1,950	**16,516**	**16,567**	4,955	**11,561**	**6,892**
2017	44,994	747	1,040		19,141	24,065			5,200	1,560	**17,305**	**33,872**	5,191	**12,113**	**19,006**
2018	45,781	747	1,040		19,524	24,469			5,200	1,170	**18,099**	**51,972**	5,430	**12,670**	**31,675**
2019	46,582	747	1,040		19,915	24,880			5,200	780	**18,900**	**70,872**	5,670	**13,230**	**44,905**
2020	47,397	747	52,000	-15,600	20,313	-10,063			5,200	390	-15,653	**55,219**	0	-15,653	**29,252**
2021	48,227	747	1,040	-312	20,719	26,032			5,200	3,900	**16,932**	**72,151**	5,080	**11,853**	**41,105**
2022	49,071	747	1,040	-312	21,134	26,462			5,200	3,510	**17,752**	**89,903**	5,326	**12,426**	**53,531**
2023	49,930	747	1,040	-312	21,556	26,898			5,200	3,120	**18,578**	**108,481**	5,573	**13,005**	**66,536**
2024	50,803	747	1,040	-312	21,987	27,341			5,200	2,730	**19,411**	**127,891**	5,823	**13,587**	**80,123**
2025	51,692	747	1,040	-312	22,427	27,790			5,200	2,340	**20,250**	**148,141**	6,075	**14,175**	**94,298**
2026	52,597	747	1,040	-312	22,876	28,246			5,200	1,950	**21,096**	**169,237**	6,329	**14,767**	**109,065**
2027	53,517	747	1,040	-312	23,333	28,709			5,200	1,560	**21,949**	**191,186**	6,585	**15,364**	**124,429**
2028	54,454	747	1,040	-312	23,800	29,179			5,200	1,170	**22,809**	**213,995**	6,843	**15,966**	**140,395**
2029	55,407	747	1,040	-312	24,276	29,656			5,200	780	**23,676**	**237,670**	7,103	**16,573**	**156,968**
2030	56,377	747	52,000	-15,600	24,761	-5,532			5,200	390	-11,122	**226,548**	0	-11,122	**145,846**
Residual			-50,544			50,544					50,544			50,544	
					FIRR(20)	36.7%				FIRR(20)	20.7%		FIRR(20)	16.9%	
										FIRR(10)	14.5%		FIRR(10)	9.6%	

Table 9.3-6Financial Cash Flow of Case-F

Excluding Infrastructure (Bus-way maintenance + Bus + Bus operation)
Case F (with Commission)

(US$000)

Year	Passenger Proceeds	Commi-ssion (5%)	Substan-tial Revenue	Investment			Operatio n Cost	Operating Profit	Short-term Loan		Official Devel. Loan		Net Profit				
				Busway Mainte-nance	Bus fleet						100% of Bus Fleet		before Tax		Income Tax (30%)	after Tax	
					Purchase	Disposal			Repay-ment	Interest (15%)	Repayment (10 years)	Interest (7.5%)	per year	Cumula-tive		per year	Cumula-tive
2010					52,000		8,499	-60,499	(8,499)		(52,000)		-60,499	-60,499	0	-60,499	-60,499
2011	40,546	2,027	38,518	747	1,040		16,997	19,734	4,249	1,275	5,200	3,900	**5,110**	-55,388	0	**5,110**	-55,388
2012	41,255	2,063	39,192	747	1,040		17,337	20,068	4,249	637	5,200	3,510	**6,472**	-48,916	0	**6,472**	-48,916
2013	41,977	2,099	39,878	747	1,040		17,684	20,407			5,200	3,120	**12,087**	-36,829	0	**12,087**	-36,829
2014	42,712	2,136	40,576	747	1,040		18,037	20,752			5,200	2,730	**12,822**	-24,007	0	**12,822**	-24,007
2015	43,459	2,173	41,286	747	1,040		18,398	21,101			5,200	2,340	**13,561**	-10,447	0	**13,561**	-10,447
2016	44,220	2,211	42,009	747	1,040		18,766	21,455			5,200	1,950	**14,305**	**3,859**	4,292	**10,014**	-433
2017	44,994	2,250	42,744	747	1,040		19,141	21,815			5,200	1,560	**15,055**	**18,914**	4,517	**10,539**	**10,106**
2018	45,781	2,289	43,492	747	1,040		19,524	22,180			5,200	1,170	**15,810**	**34,724**	4,743	**11,067**	**21,173**
2019	46,582	2,329	44,253	747	1,040		19,915	22,551			5,200	780	**16,571**	**51,295**	4,971	**11,600**	**32,773**
2020	47,397	2,370	45,027	747	52,000	-15,600	20,313	-12,433			5,200	390	-18,023	**33,273**	0	-18,023	**14,750**
2021	48,227	2,411	45,815	747	1,040	-312	20,719	23,621			5,200	3,900	**14,521**	**47,793**	4,356	**10,165**	**24,915**
2022	49,071	2,454	46,617	747	1,040	-312	21,134	24,008			5,200	3,510	**15,298**	**63,092**	4,589	**10,709**	**35,623**
2023	49,930	2,496	47,433	747	1,040	-312	21,556	24,401			5,200	3,120	**16,081**	**79,173**	4,824	**11,257**	**46,880**
2024	50,803	2,540	48,263	747	1,040	-312	21,987	24,800			5,200	2,730	**16,870**	**96,044**	5,061	**11,809**	**58,690**
2025	51,692	2,585	49,108	747	1,040	-312	22,427	25,205			5,200	2,340	**17,665**	**113,709**	5,300	**12,366**	**71,055**
2026	52,597	2,630	49,967	747	1,040	-312	22,876	25,616			5,200	1,950	**18,466**	**132,175**	5,540	**12,926**	**83,982**
2027	53,517	2,676	50,842	747	1,040	-312	23,333	26,033			5,200	1,560	**19,273**	**151,448**	5,782	**13,491**	**97,473**
2028	54,454	2,723	51,731	747	1,040	-312	23,800	26,456			5,200	1,170	**20,086**	**171,534**	6,026	**14,060**	**111,533**
2029	55,407	2,770	52,637	747	1,040	-312	24,276	26,885			5,200	780	**20,905**	**192,439**	6,272	**14,634**	**126,167**
2030	56,377	2,819	53,558	747	52,000	-15,600	24,761	-8,351			5,200	390	-13,941	**178,498**	0	-13,941	**112,226**
Residual					-50,544			50,544					50,544			50,544	
							FIRR(20)	33.1%				FIRR(20)	17.4%		FIRR(20)	14.3%	
												FIRR(10)	9.6%		FIRR(10)	5.3%	

Table 9.3-7 Financial Cash Flow of Case-G

Excluding Infra. & Bus (Bus-way maintenance + Bus lease + Bus operation)
Case G (with Commission)

(US$000)

Year	Passenger Proceeds	Commi-ssion (5%)	Substan-tial Revenue	Cost			Operating Profit	Short-term Loan		Net Profit				
				Busway Mainte-nance	Bus fleet Lease	Operation Cost		Repay-ment	Interest (15%)	before Tax		Income Tax (30%)	after Tax	
										per year	Cumula-tive		per year	Cumula-tive
2010					(31,200)	8,499	-8,499	(39,699)		-8,499	-8,499	0	-8,499	-8,499
2011	40,546	2,027	38,518	747	10,400	16,997	10,374	7,940	5,955	-3,521	-12,019	0	-3,521	-12,019
2012	41,255	2,063	39,192	747	10,608	17,337	10,500	7,940	4,764	-2,204	-14,223	0	-2,204	-14,223
2013	41,977	2,099	39,878	747	10,816	17,684	10,631	7,940	3,573	-882	-15,105	0	-882	-15,105
2014	42,712	2,136	40,576	747	11,024	18,037	10,768	7,940	2,382	446	-14,659	0	**446**	-14,659
2015	43,459	2,173	41,286	747	11,232	18,398	10,909	7,940	1,191	1,778	-12,881	0	**1,778**	-12,881
2016	44,220	2,211	42,009	747	11,440	18,766	11,055			11,055	-1,825	0	**11,055**	-1,825
2017	44,994	2,250	42,744	747	11,648	19,141	11,207			11,207	**9,382**	3,362	**7,845**	**6,020**
2018	45,781	2,289	43,492	747	11,856	19,524	11,364			11,364	**20,746**	3,409	**7,955**	**13,975**
2019	46,582	2,329	44,253	747	12,064	19,915	11,527			11,527	**32,273**	3,458	**8,069**	**22,044**
2020	47,397	2,370	45,027	747	12,272	20,313	11,695			11,695	**43,968**	3,509	**8,187**	**30,230**
2021	48,227	2,411	45,815	747	12,480	20,719	11,869			11,869	**55,837**	3,561	**8,308**	**38,538**
2022	49,071	2,454	46,617	747	12,688	21,134	12,048			12,048	**67,886**	3,614	**8,434**	**46,972**
2023	49,930	2,496	47,433	747	12,896	21,556	12,233			12,233	**80,119**	3,670	**8,563**	**55,536**
2024	50,803	2,540	48,263	747	13,104	21,987	12,424			12,424	**92,543**	3,727	**8,697**	**64,233**
2025	51,692	2,585	49,108	747	13,312	22,427	12,621			12,621	**105,165**	3,786	**8,835**	**73,068**
2026	52,597	2,630	49,967	747	13,520	22,876	12,824			12,824	**117,989**	3,847	**8,977**	**82,044**
2027	53,517	2,676	50,842	747	13,728	23,333	13,033			13,033	**131,022**	3,910	**9,123**	**91,167**
2028	54,454	2,723	51,731	747	13,936	23,800	13,248			13,248	**144,270**	3,974	**9,274**	**100,441**
2029	55,407	2,770	52,637	747	14,144	24,276	13,469			13,469	**157,739**	4,041	**9,429**	**109,870**
2030	56,377	2,819	53,558	747	14,352	24,761	13,697			13,697	**171,436**	4,109	**9,588**	**119,457**
Residual					31,200		31,200			31,200			31,200	
						FIRR	123.3%			27.5%			23.9%	

(4) Summary and Conclusion

Results of financial analysis on alternative cases are summarized in Table 9.3-8.

Table 9.3-8Results of Financial Analysis on Each Case

Alternative Cases	Operation Body	Construction Infrastructure	ODA Loan	Purchase of Bus Fleets	Bus Operation	Payment of Commission	FIRR (%) Before Tax	FIRR (%) After Tax
Base Case (A)	Public	○	○	○	○	×	11.3	9.5
Case-B	Public	○	○	○	○	○	9.5	7.9
Case-C	Public	×	○	○	○	×	22.0	18.2
Case-D	Public	×	○	○	○	○	18.8	15.7
Case-E	Semi-public	×	×	○	○	×	20.7	16.9
Case-F	Semi-public	×	×	○	○	○	17.4	14.3
Case-G	Private	×	×	Lease	○	○	27.5	23.9

From Table 9.3-8 and cash flow of each case, the following conditions or characteristics can be pointed out.

1) At first, all the system be constructed and operated by public sector/authority relying the official government loan with very low interest, as both case A and B.

2) FIRRs of the after tax in the base case (A) and case-B are calculated at 9.5% and 7.9%, this means very critical situation of financial feasibility borderline and some improvements in various conditions are necessary. An unfeasible situation with continuous debts over 20 years in cumulative balance even under the desirable loan condition.

3) FIRR of the after tax on the case-C and case-D is calculated at 18.2% and 15.7 %. FIRR of case-C and case-D are indicated at the comparatively high value in comparison with the interest of commercial banks (interest is about 15%). Therefore, Case-C and Case-D are financially feasible.

4) In cases of without ODA loan, case-E and case-F, financial results show a slightly low, 16.9% and 14.3%. This means the project is exactly at the borderline of financial feasibility same as case-A and case-B.

5) Due to require the high initial procurement cost for bus fleets (US$ 52.0 million) , the FIRRs of case A to case D are indicated at the comparatively low value. In order to decrease the initial burdens of the operator, the bus fleets may be considered to adopt the leasing system, if available.

6) When the bus fleet can be procured by lease system, the FIRR of Case-G is calculated at 23.9% after tax, and therefore case-E is quite financially feasible, even though the leasing system is necessary to be further studied.

7) Therefore, it is clear the provision of funds for initial bus fleet investment is the critical problem, and various probabilities of the financing for the new bus purchase should be examined in the further implementation stage.

8) The more detailed and more various conditions of the financial analysis should be conducted in the final design stage based on the trunk bus operation organizations required.

9.3.5. FINANCIAL PROCUREMENT

Based on the results of financial evaluations and the execution organization structures for the East-West trunk bus system, the following organizations and responsibilities are recommended.

1) The Lima and Callao municipalities are recommended as supervision and control organization for the East-West trunk bus system and the conventional bus system.
2) Protransporte is recommended as execution organization of the East-West trunk bus system under controlled by Lima and Callao municipalities.
3) Newly private cooperative bus company is recommended as operation and maintenance of the East-West trunk bus system under controlled by Protransporte.
4) Lima and Callao municipalities have responsible for construction of East-West trunk busway facility and its related facilities.
5) .Lima and Callao municipalities have responsible for procurement of construction cost of East-West trunk busway facility and its related facilities.
6) Newly private cooperative company has responsible for procurement of bus fleets and also procurement of bus fleets cost.
7) Newly private cooperative company has responsible for operation and maintenance of the East-West trunk bus system, and also procurement of the operation and maintenance costs (OM cost).

The following project cost of each execution item was estimated in Chapter 6 and 7 of this report.

1) The project cost for construction of busway facility and its related facilities were estimated at about US$ 61 million.
2) The project cost for procurement of bus fleets was estimated at US$ 52 million.
3) The annual operation and maintenance cost was estimated at about US$ 17 million.

Considering the above mentioned conditions and the results of financial evaluation, the following financial procurement procedures are suggested.

1) The Lima and Callao municipalities and Protransporte should search for ODA soft loan such as JBIC loan credit, WB loan credit, and other International ODA loan credit for procurement of the project cost of busway facilities construction (US$ 61 million).
2) Considering the percentage of offer shares for subscription of a newly private bus cooperative company (research for possibility of the third sector), a newly private cooperative company should search for ODA soft loan and other International ODA soft loan for procurement of bus fleets cost (US$ 52 million).

CHAPTER 10
Implementation Plan of the East-West Trunk Bus System

10. IMPLEMENTATION PLAN OF THE EAST-WEST TRUNK BUS SYSTEM

10.1. NECESSITY OF THE PROJECT

The realization of the East-West Trunk Bus Project will contribute to the environmental preservation, mitigation of traffic congestion and promotion of the development of social and economic activities in the Lima and Callao Metropolitan Area based on the results of the Master Plan Study for Lima and Callao Metropolitan Area, and this Feasibility Study.

The necessity of realization of the East-West trunk bus system is summarized as the results of the comparison analysis between "With project case" and "Without project case".

(1) Preservation of the Environment

The discharge of Carbon Dioxide (CO_2) is the most important contributing factor of global climate change. As the results of comparison analysis between With Project Case and Without Project Case show, the discharge of Carbon Dioxide (CO_2) of the With Project Case can be decreased by approximately 8 % in comparison with the Without Project Case in 2010.

Considering environmental conditions in the Lima and Callao metropolitan area and global climate change conditions in the world, the East –West trunk system should be constructed as soon as possible.

(2) Mitigation of Traffic Congestion

As a result of the comparative analysis between With Project and Without Project Cases, the With Project Case can obviously improve the following traffic conditions compared to the Without Project Case. Considering the mitigation of traffic congestion in the Lima and Callao metropolitan area, the East-West trunk system should be constructed as soon as possible.

1) The average operation speed of the conventional bus is observed at about 13.5 km/h. When the average operation speed of the trunk bus will be expected at about 35.0 km/h.
2) The average traffic congestion rate on the existing roads can be improved and to ensure smooth traffic flows on the existing related roads by 2010.

(3) Improvement of Poverty Life

As a result of comparative analysis, the With Project Case can improve the following poor living conditions. The With Project Case can obviously contribute to the improvement or betterment of poor living conditions. Therefore, the East-West trunk system should be constructed as soon as possible.

1) Working hours of the lower-income segments will be increased due to the reduction in travel time.
2) Economic activities of the lower-income segments will be increased due to the extension of a smooth and efficient bus transport system to the areas where they live, and their income will be increased.
3) The socio economic activities of the lower-income segments will be improved, and transport costs will be reduced.

(4) Improvement of Bus Passenger Situation

The daily number of bus passengers in the Lima and Callao metropolitan area was estimated at about 7.0 million persons, and about 0.4 million persons (about 5.7 % of the

total passengers) are using the Av. Venezuela, Av. Ayllon and Carretera Central. When the East-West trunk bus system is completed, the following improvements can be expected for bus passengers. Therefore, the East-West trunk bus system should be executed as soon as possible.

1) Average travel time will be reduced by about 10 to 15 minutes, due to the increased trunk bus operating speed.
2) Security conditions inside the bus fleet will be improved due to the introduction of a new bus fleet.
3) Traffic safety conditions of operation of the trunk bus will be improved as a result of traffic safety education being provided.

(5) Economic and Financial Aspects

As a result of economic analysis, economic internal ratio of return (EIRR) of 15.4 %, cost /benefit ratio (B/C) of 1.07, and net present value of US$ 35,302 million are estimated. Therefore, the East-West trunk bus system will contribute to the improvement of socio economic activities in the Lima and Callao metropolitan area.

10.2. DESCRIPTION OF PROPOSED PROJECT

10.2.1. OBJECTIVES OF THE PROJECT

The major objectives of the East-West trunk bus system are to create the efficient bus transportation network, to improve traffic congestion, and to preserve environmental aspects on the existing Av. Ayllon/Carretera Central and Av. Venezuela which are the most heavily traffic congested roads in the Lima and Callao metropolitan area.

10.2.2. PROJECT ENVIRONMENT

(1) Project Location Site

The East-West trunk bus-way is constructed on the existing Av. Venezuela-Av. Arica and Av. Ayllon-Carretera Central. The total length of the East-West trunk bus-way is 17.41km.

1) Av. Venezuela-Av. Arica = 9.05 km
2) Av. Ayllon-Carretera Central = 8.36 km
3) Total length = 17.41 km

(2) Functions and Characteristics of the East-West Trunk Bus System

The East-West trunk bus system has the following functions and characteristics.

1) Buses of the trunk bus system operate on the trunk busway.
2) Trunk busway is constructed on the central space of the existing roads.
3) Trunk busway is integrated by separators from the other traffic vehicles lanes.
4) Trunk busway is an exclusive trunk bus road. The conventional buses are operated on the other traffic vehicles lanes or frontage roads.
5) Trunk bus system is formed by the trunk bus and feeder bus.
6) Bus fare between trunk bus and feeder bus is integrated.
7) Trunk bus system has exclusive facilities such as bus terminals and bus stops.
8) Trunk bus should ensure the high operating speed.
9) Trunk bus should be maintained good security and traffic safety.

(3) Typical Cross Section of Trunk Busway

The trunk busway is classified as the following three (3) types of cross section according to right of way width of the existing roads.

1) Exclusive trunk busway
2) Exclusive trunk bus lane
3) Priority trunk bus lane.

The exclusive trunk busway is adopted at a right of way width of 52m from the existing road, the right of way width for the exclusive trunk bus lane is adopted at 32m, and the right of way width for the priority trunk bus lane is adopted at 20 m.

Figure 10.2-1 shows the typical cross section of the exclusive trunk busway. The exclusive trunk busway is constructed to use the central reservation width of the existing road. The exclusive trunk busway is adopted at 2-lane with 3.5 m lane width of exclusive busway, and the busway is separated from the private traffic lane by a cement concrete barrier.

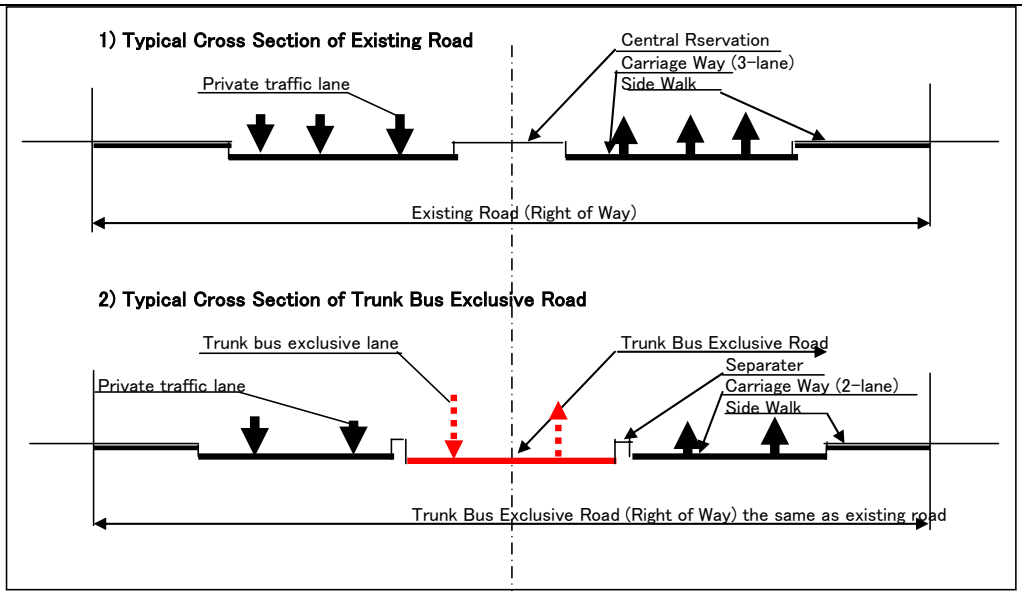


Figure 10.2-1 Typical Cross Section of Exclusive Trunk Busway

10.2.3. OUTLINE OF THE PROJECT

The outline of the East-West trunk bus system is summarized in Table 10.2-1.

Table 10.2-1 Outline of Recommendation of the Project

Items	Outline of Recommendation
Location of the Project	1) Av. Venezuela 2) Av. Arica 3) Av. Ayllon 4) Carretera Central
Typical Cross Section of the Project	1) Exclusive trunk bus-way (W = 52m) 2) Exclusive trunk bus lane (W = 32 - 42m) 3) Priority trunk bus lane (W = 25m)
Operation System of Trunk Bus	1) Operation Line-1 = Santa Anita-Lima Centro 2) Operation Line-2 = Callao-Lima Centro 3) Operation Line-3 = Callao-Santa Anita 4) Operation frequency = 45 seconds head in peak hours
Operation System of Feeder Bus	1) Operation Line in Callao (Callao—Bus Terminal) = 4 lines 2) Operation Line in Lima (Santa Anita—Bus Terminal) = 6 lines
Trunk Bus Fleet	1) New articulated bus fleet should be introduced. 2) CNG should be introduced. 3) Maximum transport capacity of bus fleet is about 150 to 170 passengers. 4) Door of bus is installed on the left hand side. 5) Bus fleet operating life is about 10 years.
Feeder Bus Fleet	1) New single bus should be introduced. 2) CNG should be introduced. 3) Maximum transport capacity of bus fleet is about 35 to 40 passengers. 4) Bus fleet operating life is about 10 years.
Bus Fare System	1) Conventional bus applies present fare system. 2) Feeder bus + trunk bus = 1.5 Soles/time 3) Trunk Bus only ＝ 1.5 Soles/time 4) Trunk bus + Feeder bus ＝ 1.5 Soles/time 5) Trunk bus + Other Trunk bus = 1.5 Soles (in the future plan) 6) Conventional + Trunk bus ＝ Conventional bus fare + 1.5 Soles
Bus stop Facility of trunk	1) Bus stop is constructed at left hand side of busway.

bus system	2) Bus stops are located at major intersections.
Bus Terminal Facility	1) Bus terminals are located in the Callao and Santa Anita area. 2) Trunk bus and feeder bus are operated in this bus terminal. 3) Trunk bus and feeder bus is integrated in the bus terminal.
Organization and management of bus system	1) Municipality is responsible for entity management of bus transport. 2) Municipality is responsible for approving and issuing bus operating permits. 3) Municipality is responsible for approving and issuing permits of the trunk bus system. 4) Protransporte is responsible for the planning, design, construction and operation of the trunk bus system. 5) Private cooperative bus company is responsible for the operation of trunk and feeder buses.

10.3. PROJECT COSTS

10.3.1. PROJECT COSTS

(1) Project Costs

The project costs are estimated based on the preliminary design conducted in accordance with the right of way width which was decided by the Av. Venezuela and Av. Arica final design in 1996 with additional land acquisition and compensation.

Table 10.3-1 shows the results of project cost. The project cost includes construction cost, compensation, engineering cost, administrative cost and contingencies.

Table 10.3-1 Summary of Project Cost

(unit: US$1,000)

Items	Av. Venezuela Av. Arica	Av. Ayllón Carretera. Central	Improvement Bus Stop on Av. Grau	Total
(1) Construction Cost (A)	15,086	13,330	529	28,945
(2) Land Acquisition Cost (B) and Compensation	7,545	1,756	0	9,301
(3) Sub-total (A)	22,631	15,086	529	38,246
(4) Engineering Cost （A*10％）	2,263	1,509	53	3,825
(5) Administration Cost （A*10%）	2,263	1,509	53	3,825
(6) Contingency (A*15％)	3,395	2,263	79	5,737
(7) Sub-total (B)	30,552	20,366	714	51,632
(8) IGV (B*19%)	5,805	3,870	136	9,810
(9) Total	36,357	24,236	850	61,442

(2) Annual Operation and Maintenance (OM) Cost for Trunk Bus System

As shown in Table 10.3-2, the annual OM cost of operation of the trunk bus system includes personnel cost for administration and bus drivers, fuel and oil cost, maintenance of bus fleets, etc.

Table 10.3-2 OM Cost for Trunk Bus Operation

Items	Classification	Annual OM Cost (US$)
1. Personnel Cost	Manager, Driver, Inspector, etc.	9,173,800
2. Facility & Equipment Cost	Office, Depot, etc.	1,687,220
3. Operation Cost	Fuel, Oil, etc.	6,135,639
Total		16,996,659

(3) Bus Fleets Purchase Cost

The East-West trunk bus system is operated at the trunk bus and feeder bus. The trunk bus is operated by the articulated bus and the feeder bus is operated by the single bus respectively. The number of buses required is estimated in accordance with the future bus passenger demand. The annual bus fleet purchase costs of the articulated (100 fleets) and single buses (300 fleets) required are shown in Table 10.3-3.

Table 10.3-3 Annual Bus Fleet Purchase Cost

(unit: US$1,000)

Year	Bus Fleets Purchase Cost		Total
	Articulated Bus	Single Bus	
2010	22,000	30,000	52,000
2011	440	600	1,040
2012	440	600	1,040
2013	440	600	1,040
2014	440	600	1,040
2015	440	600	1,040
2016	440	600	1,040
2017	440	600	1,040
2018	440	600	1,040
2019	440	600	1,040
2020	22,000	30,000	52,000
2021	440	600	1,040
2022	440	600	1,040
2023	440	600	1,040
2024	440	600	1,040
2025	440	600	1,040
2026	440	600	1,040
2027	440	600	1,040
2028	440	600	1,040
2029	440	600	1,040
2030	22,000	30,000	52,000

10.4. PROJECT BENEFITS

10.4.1. TECHNICAL EVALUATION AND EFFECTIVENESS

(1) Effectiveness for Existing Traffic Conditions

When the East-West trunk bus system is realized, the following traffic effectiveness is expected in 2010 as shown below in Table 10.4-1.

Table 10.4-1 Changing Traffic Conditions in 2010

Items	Traffic Conditions		Effectiveness
	Without Case (A)	With Case (B)	(A) -(B)
1. Carr. Central (General Section)			
Traffic Volume (pcu/h/direction) (A)	2,500	3,500	1,000
Conventional Bus Volume	1,400	100	1,300
Running Speed (km/h) (B)	13.5	13.8	0.3
Degree of Congestion > 1.5(%) (All Study Area)	55	49	6
Av. Travel Time (min.)	42	28	14
2. Av. Venezuela (General Section)			
Traffic Volume (pcu/h/direction) (A)	2,800	500	2,800
Conventional Bus Volume	900	100	800
Running Speed (km/h)(B)	13.5	13.8	0.3
Degree of Congestion >1.5(%) (All Study Area)	55	49	6
Av. Travel Time (min.)	42	28	14

(2) Effectiveness for Bus Passengers

When the East-West trunk bus system is completed, the following effectiveness for bus passengers is expected in 2010 as shown in Table 10.4-2.

Table 10.4-2 Effectiveness for Bus Passengers

Items	Conditions		Effectiveness
	Without Case (A)	With Case (B)	(A) -(B)
Av. Running Speed (km/h)	13.5	35	11.5
Av. Waiting Time at Bus Stop (minutes)	2-3	1-2	1
Av. Travel Time (minutes)	42	28	14

10.4.2. ENVIRONMENTAL EVALUATION AND SOCIAL IMPACTS

(1) Effectiveness of CO_2 Reduction

When the East-West trunk bus system is completed, about 80mg/m^3/day of the CO_2 reduction is expected as shown in Table 10.4-3.

Table 10.4-3 Effectiveness of CO_2 Reduction

Year	CO_2 Annual Discharge (μg/m^3)		Effectiveness
	Without Case (A)	With Case (B)	(A) — (B)
2010	980	900	80 (about 8%)

(2) Establishment of New Jobs

When the East-West trunk bus system begins to operate, some conventional bus routes will be concentrated. As a result of the concentration of conventional bus routes, some

employees will be expected to lose their existing jobs as drivers, conductors, inspectors, etc.

However, the East-West trunk bus system is expected to create the following new jobs from the new trunk bus operation organization structure (Cooperative bus operating company). About 1803 employees will work in the Cooperative bus operating company.

1) Manager and Deputy Manager (6)
2) Administrative Staff and bus operation staff (62)
3) Driver and Conductor (1,540)
4) Bus fare ticket seller at each bus stop and bus terminal (101)
5) Worker at Bus Depot (60)
6) Worker at Bus Terminal (34)

10.4.3. ECONOMIC AND FINANCIAL EVALUATION

Table 10.4-4 shows the results of economic and financial analysis. IRR, B/C, and NPV of the economic evaluation are presented at very high values. Therefore, the East-West trunk bus system can contribute to increase the socio-economic activities in the Lima and Callao metropolitan area.

The results of the financial analysis, FIRR also indicates comparatively high values; therefore the operation of the East-West trunk bus system can be promoted to private companies.

Table 10.4-4 Results of Economic and Financial Analysis

Items	Economic Analysis	Financial Analysis	Remarks
Internal Ratio of Return (IRR) (%)	15.4 to 35.3	7.9 to 23.9	
Cost Benefit Ratio (B/C)	1.26 to 5.62	------	
Net Present Value (NPV)	7,974 to 63,609	------	

10.5. IMPLEMENTATION OF ORGANIZATION STRUCTURE

(1) Organization Structure

In 2011, the bus transportation system in Lima and Callao metropolitan area will be operated by the trunk bus and feeder bus, and the conventional bus. The East-West trunk bus with the feeder bus will be operated in the cities of Lima and Callao. Considering the existing bus operation system and trunk bus system, the following organization structures are required. The recommended organization structure is shown in Figure 10.5-1.

1) Lima Municipality is responsible for the management of the conventional bus system operated in the city of Lima and the East-West trunk bus system including the feeder bus system.
2) Callao municipality is responsible for the management of the conventional bus operated in Callao city and the East-West trunk bus system including the feeder bus system.
3) Protransporte is responsible for the management of the East- West trunk bus system including the feeder bus system.
4) The conventional bus is operated by the private bus operating company.
5) The East-West trunk bus system will be operated by the private cooperative bus company. However, the detailed organization and function of the private cooperative bus company should be more fully discussed in future with the related bus operation and management authorities and the existing bus operation and management companies and other related companies.

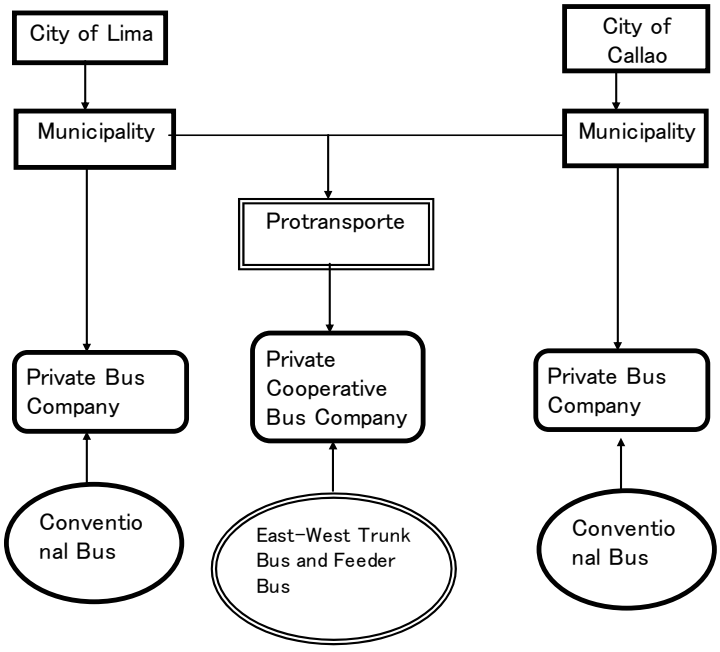


Figure 10.5-1 Organization of Trunk Bus Operation

(2) Functions and Responsibility of Each Organization

The detailed functions and responsibilities of organization structures shown in Figure 10.5-1 were examined in Chapter 6. In this section, these functions and responsibilities are summarized in Table 10.5-1.

Table 10.5-1 Summary of Function and Responsibility of Organization

Organization	Major Function and Responsibility	Remarks
Lima & Callao Municipalities	To prepare future bus transport development policy and plans in Metropolitan area	
	To control conventional bus system in Metropolitan area	
	To control trunk bus system in Metropolitan area	
	To support trunk bus operation organizations	
Protransporte	To control and manage a trunk bus system in Metropolitan area	
	To prepare future trunk bus transport development policy and plans in Metropolitan area	
	To construct trunk bus way and related facilities	
Newly Cooperative Bus Company	To operate trunk bus system controled by Protransporte	
	To create a newly consortium for trunk bus operation	
	To procure bus flees cost	
	To procure bus operation and maintenance cost	
	To prepare office and depot	

(3) Activities Required for Each Organization

The major activities flows of each organization for execution of the East-West trunk bus system are presented in Figure 10.5-2.

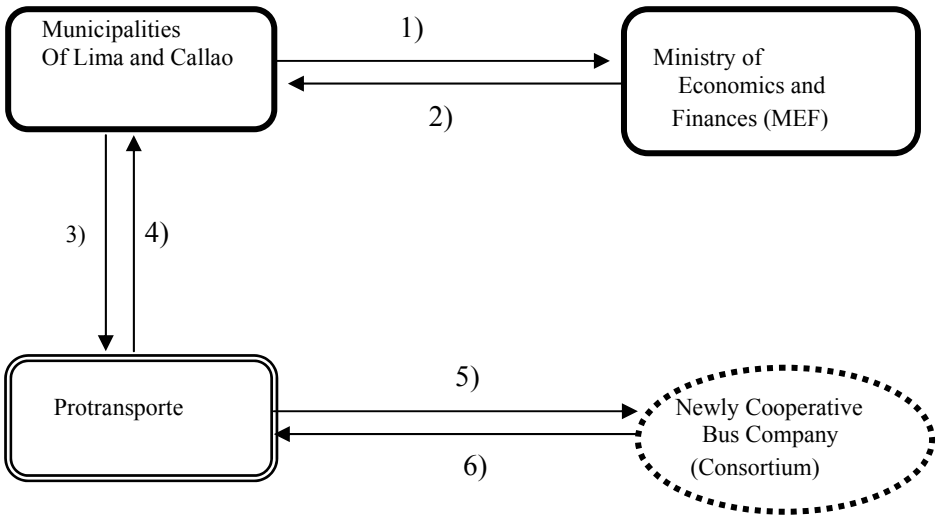


Figure 10.5-2 General Activities Flow Chart of Organization

The major activities among each organization shown in Figure 10.5-2 are as follows,

1) Activity Flow (From Municipalities to MEF)

The major activities from Lima and Callao municipalities to MEF are i) to request the approval of the execution of East-West trunk bus system, and ii) to request the approval of the contents of the Feasibility Study based on the SNIP. In addition the above, municipalities request to MEF iii) to request the approval about a procurement of project cost.

2) Activity Flow (From MEF to Municipalities)

MEF has responsible for approval of implementation of all public projects. The major activities from MEF to Municipalities are i) to make the approval of execution of East-West trunk bus system based on SNIP, and ii) to make a decision of procurement of the project cost.

3) Activity Flow (From Municipalities to Protransporte)

Municipalities are recommended as the management organization of the East-West trunk bus system. The major activities from Municipalities to Protransporte are i) to make a decision of the execution of the East-West trunk bus System, and ii) to reinforce the organization of Protransporte.

4) Activity Flow (From Protransporte to Municipalities)

Protransporte is recommended as the execution organization of the East-West trunk bus system. The major activities from Protransporte to Municipalities are i) to take a decision of the execution of East-West Trunk bus system including procurement of project cost, and also ii) to request the approval of the contents of Feasibility Study.

5) Activity Flow (From Protransporte to Newly Cooperative Bus Company)

The major activities from Protransporte to Newly Private Company are i) to make a decision of the various conditions of concession, and ii) to control and manage of trunk bus system operated by Newly Cooperative Bus Company.

6) Activity Flow (From Newly Cooperative Bus Company to Protransporte)

The Newly Cooperative Bus Company is recommended as the operation and maintenance of the East-West trunk bus system. The major activities from Protransporte to Newly Cooperative Bus Company are i) to take the approval of organization structure and conditions of Newly Cooperative Bus Company (Consortium), ii) to take the approval of bus operation plans, and iii) to take the approval of facilities and staffs of the East-West trunk bus system under controlled by Protransporte.

In addition to the above mentioned, based on the Figure10.5-2, and the operation organization in Chapter 6, the detailed activities of the executive organization and related organization for smooth and early implementation of the East-West trunk bus project are summarized in Table 10.5-2.The each organization should be commenced the activities in accordance with Table 10.5-2 as soon as possible.

Table 10.5-2 Relation between Organization and Activities

Organization	Major Activities Required	Related Organization
Lima and Callao Municipalities	To make decision of implementation of the East-West trunk bus project	MCT, MEF
	To make decision of conditions of implementation organization of East-West trunk bus system	MML, MTC, MEF
	To reinforce the organization of GTU and GGTU	GTU, GGTU
	To reinforce the organization of Protransporte	Protransporte
	To commence the project cost procurement	MEF
	To conduct land acquisition	
Protransporte	To construct the COSAC project	MML
	To get approval of contents of F/S of SNIP	MEF
	To reinforce the organization of Protransporte	
	To make a decision of condition of concession	
	To make a decision of conditions of private bus operation company (organization)	MML
	To conduct promotion of trunk bus system	
	To conduct a final design of East-West trunk bus way	
	To assist and support a private bus operation company created	
	To provide a tender documents	
	To construct East-West trunk bus way	EMAPE
Newly Cooperative Bus Company	To create newly consortium	Protransporte
	To make a decision of organization of consortium	
	To make a decision of conditions of concession	Protransporte
	To procure the budget for operation and maintenance cost	
	To procure the budget for trunk bus fleets	
	To conduct a traffic safety education to employees	

(4) Risks of Each Organization

The risks of each organization shown in Figure 10.5-1 were examined in Chapter 6 in this report. In this section, the risks of each organization is summarized bellow,

1) *Risks of Lima and Callao Municipalities*

The following risks are pointed for Lima and Callao Municipalities

a) At present, the heavy traffic congestions have occurred in Lima and Callao metropolitan area. In accordance with the increasing traffic volume, the areas of the heavy traffic congestion have been expanded. Therefore, East-West trunk bus project should be executed by both municipalities for mitigation of the heavy traffic congestion in metropolitan area as soon as possible.
b) The project cost of the East-West trunk bus project for construction of infrastructures was estimated at about US$ 61 million. As the results of economic analysis, the minimum economic internal rate of return (EIRR) among some evaluation cases was estimated at about 15.4%. The project cost of infrastructure should be decreased by a final design of East-West trunk busway for increasing the economic evaluation index and activities.
c) Both municipalities should be procured the project cost with the lowest interest of organization, in addition a benefit principle system should be introduced for return of loan of project cost.

2) *Risks of Protransporte*

The following risks are pointed for Protransporte

a) The COSAC project should be constructed as soon as possible.
b) The Protransporte should be reinforced engineers and planners for smooth implementation of the East-West trunk bus project.
c) The Protransporte should be conducted final design of the East-West trunk busway to decrease the construction cost of busway.
d) For solution of the social impact, about 1,000 persons who lost the job in accordance with elimination of the conventional bus routes should be employed in newly cooperative bus company.

3) *Risks of Private Bus Company*

The following risks are pointed for private bus company

a) As results of the financial analysis, the minimum financial internal rate of return among some cases was estimated at about 14%. Therefore, the private bus company (Consortium) should be fined the lowest interest of loan, and also to decrease the bus operation and maintenance (OM) cost.
b) For solution of the social impact, about 1,000 persons who lost the job in accordance with the elimination of the conventional bus routes should be employed in newly private bus company.
c) Newly cooperative bus company should be examined to increase a bus passenger demand continually to avoid decrease the bus passenger demand.

(5) Recommendation of Implementation Organization Structure

Considering the above mentioned functions and responsibilities, the existing bus operation organization, and the results of financial analysis, the following implementation organization structure for execution of the East-West trunk bus project is recommended as shown in Figure 10.5-1.

a) The conventional bus system and East-West trunk bus system in metropolitan area is controlled and managed by Lima and Callao municipality with reinforcement of engineers in GTU and GGTU.
b) The East-West trunk bus project is executed by Protransporte with reinforcement of engineers in Protransporte.
c) The infrastructure of trunk busway and related facilities are constructed by Protransporte.
d) The operation and management of the East-West trunk bus system is operated by the newly cooperative bus company with consortium.

10.6. IMPLEMENTATION SCHEDULE

10.6.1. WORK ITEMS TO BE EXECUTED FOR REALIZATION OF EAST-WEST TRUNK BUS SYSTEM

The following 13 actual and more detailed activities should be executed for the smooth and early realization of the East-West trunk bus system recommended by the Feasibility Study.

(1) Make the Decision for the Realization of the East-West Trunk Bus System

Lima and Callao municipalities, together with the related authorities involved, should make the final decision to execute the East-West trunk bus system (the Project) in accordance with the results of the Feasibility Study, as well as to get a consensus for the implementation of the Project from the population of the cities of Lima and Callao. When the Lima and Callao municipalities obtain a consensus, the following principal activities should be executed.

1) Talk with Central Government and Local Government
2) Talk with private organizations
3) Talk with stakeholders including related authorities and organizations
4) Held a public hearing

(2) Get Approval from the Municipal Assembly

Lima and Callao municipalities should obtain the approval for the realization of the Project from each of their municipal assemblies.

(3) Reinforcement of Protransporte

In this Feasibility Study, Protransporte is recommended as the executing organization. In addition, Protransporte has responsible for execution of the COSAC trunk bus project. At present, however, the engineers of Protransporte have not sufficient. Therefore, the organization of Protransporte should be reinforced. The detailed function and responsible and recommendations for Protransporte are examined in previous section 10.5 of this report.

(4) Get Approval from National System of Public Investment (SNIP)

In the Feasibility Study, the preliminary design was formulated. The Executing Organization created should obtain the approval of SNIP after discussions with Ministry of Economy and Finance and related authorities or organizations, based on the results of the Feasibility Study.

(5) Create Newly Cooperative Bus Company (Private Bus Campany)

In this Feasibility Study, the newly cooperative bus company is recommended as the organization for operation and maintenance (OM) of the East-West trunk bus system Newly Cooperative Bus Company should be created in accordance with the conditions of consortium prepared by Protransporte. The functions and responsibilities of the Newly Cooperative Bus Company are examined in previous section 10.5 of this report.

(6) Procurement of Project Investment

In the Feasibility Study, the procurement of the project cost was suggested. However, the Executing Organization should prepare more detailed discussion materials and letters for procurement of the investment required for the Project, and should also discuss procurement of the project cost with the Central Governments, Local Governments, and related authorities based on the results of the Feasibility Study. The following activities will be necessary to achieve procurement of the investment of the Project.

1) Talk with Central Government and Local Government
2) Examine and to evaluate potential creditors

3) Prepare a request letter and investment procurement documents for creditors
4) Negotiate and talk with creditors
5) Obtain approval from creditors
6) Sign an agreement

(7) Conduct a Final Design of the East-West Trunk Bus System

The Executing Organization conducts the final design for the East-West trunk bus system based on the results of the Feasibility Study, and the conditions of SNIP. The following design or study items are included in the final design.

1) Trunk bus and feeder bus operation system design
2) Bus fare system design
3) Articulated and single bus fleet design
4) Trunk and feeder bus operation organization design
5) Executing organization design
6) Condition of bus operation concession design
7) Condition of revitalization design
8) Various field surveys
9) Trunk bus-way and feeder bus facility design
10) Trunk bus and feeder bus related facilities design such as bus terminal and bus stop.
11) Traffic information and signal system design
12) Full scale environmental study
13) Project cost estimate
14) Economic and financial study
15) Preparation of tender documents
16) Presentation of bid documents

(8) Identify Tendering Conditions for Trunk Bus Operation

The Executing Organization and related authorities should decide the tendering conditions for the execution of the trunk bus operation system. The major tendering conditions to be identified are as follows.

1) Conditions of concession of trunk bus system
2) Conditions of bus operation company or organization (cooperative company)
3) Conditions of bus fleet operation
4) Conditions of bus fare system

(9) Execute Tender for Construction of Trunk Bus Facilities

The Executing Organization conducts the tendering for the construction of the trunk bus facilities such as trunk bus exclusive road, bus terminal and bus stops. The major activities are as follows.

1) Invite Pre-Qualification (PQ) documents and prepare of short list
2) Announce the tender.
3) Explain the tender documents and conditions of tender
4) Execute the tender
5) Examine and evaluate tenderer
6) Negotiate
7) Execute agreement

(10) Execute Tender for Trunk Bus Operation

The Executing Organization conducts the tendering for the trunk bus operation based on the following activities.

1) Invite Pre-Qualification (PQ) documents and preparation of short list
2) Announce tender

3) Explain tender documents and conditions of tender
4) Execute tender
5) Examine and evaluate selected company or organization
6) Negotiate
7) Execute agreement

(11) Execution of Land Acquisition and Resettlement

Based on the results of final design to be conducted in the future, the Executing Organization and related Authorities execute the additional land acquisition and compensation and re-settlements required in accordance with local Laws and Regulations.

(12) Construct East-West Trunk Bus Road and Related Facilities

The selected construction company constructs the exclusive bus road and trunk bus related facilities in accordance with the final design under the control of the Executing Organization.

(13) Support Trunk Bus Operation Company Selected

The Executing Organization and municipalities should support the following activities of the selected private bus operation company.

1) Procurement of new articulated and single bus fleets for operation on the trunk and feeder bus system.
2) Trunk bus operation system and maintenance.
3) Organization structure of operation of the trunk bus system.

10.6.2. IMPLEMENTATION SCHEDULE

As mentioned above, many activities to be carried out for the realization of the East-West trunk bus system (the Project) are still pending. The Project should be constructed by the year 2010 in order to mitigate traffic congestion and increase socio-economic activities in the Lima and Callao metropolitan area.

Considering the functions and characteristics of the above mentioned activities, the implementation schedule of each activity for the realization of the Project is shown in Figure 10.6-1.

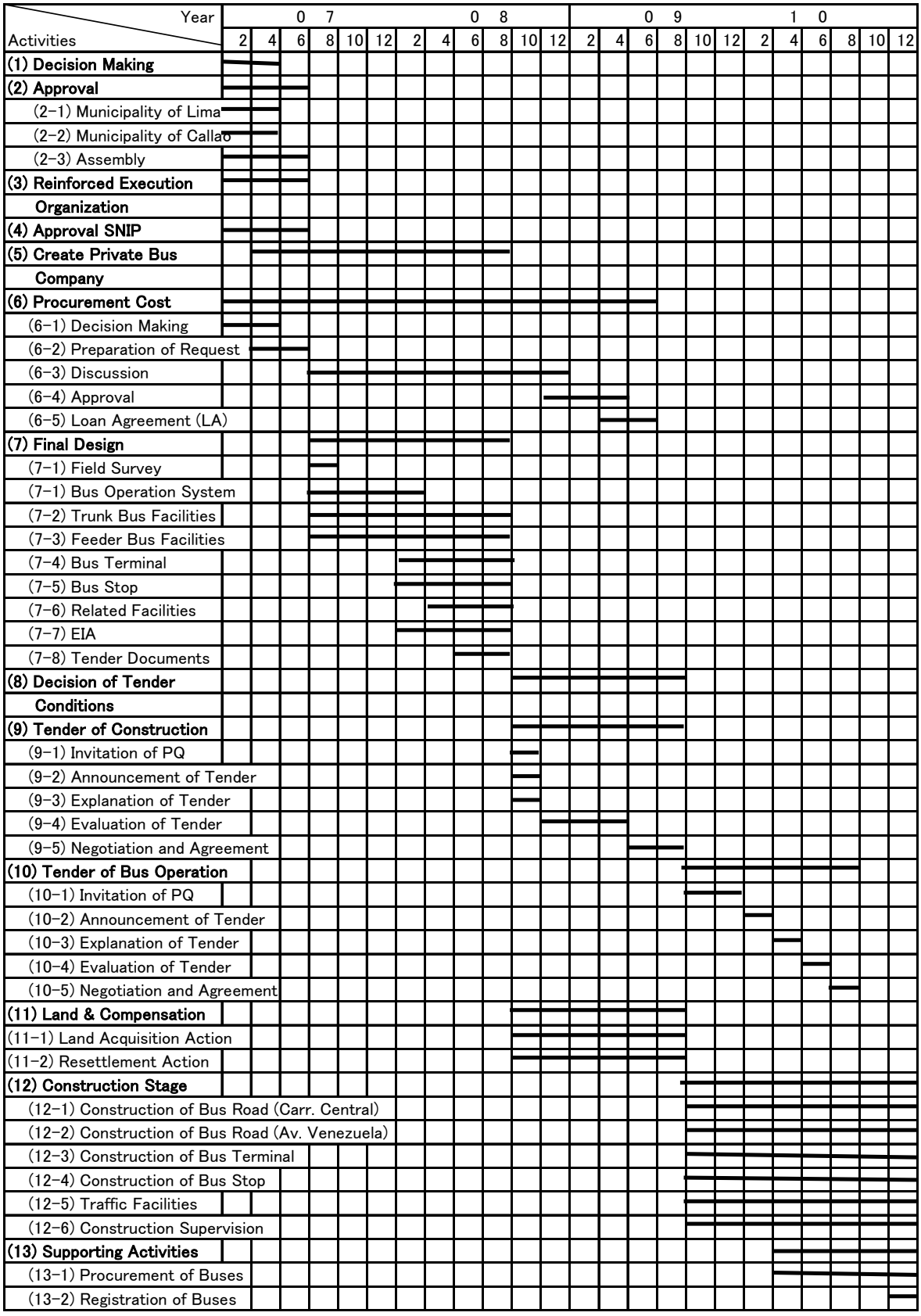


Figure 10.6-1 Implementation Schedule