

CHAPTER 15

INITIAL ENVIRONMENTAL EXAMINATION

CHAPTER 15. INITIAL ENVIRONMENTAL EXAMINATION

15.1 General

This chapter presents the results of our INITIAL ENVIRONMENTAL EXAMINATION (IEE) performed for the Tegucigalpa Urban Transport Study. Table 15.1 summarizes our conclusion.

The purpose of the present IEE is (1) to understand the existing environmental conditions at project sites, (2) to estimate environmental impacts which may arise from the projects, (3) to propose possible alternatives of mitigation measures and (4) to recommend further ENVIRONMENTAL IMPACT ASSESSMENT (EIA) if necessary in the stage of feasibility study in the future.

General environmental conditions in Tegucigalpa are presented in Chapter 3. In Section 15.2, target values of allowable limits for environmental protection are discussed. Section 15.3 describes the project and predicts impacts, for which mitigation measures are listed in Section 15.4. Section 15.5 finalizes our IEE.

15.2 Target Values of Allowable Limits

Due to the characteristics of the project, major negative impacts predicted are:

- (1) Displacement of residential houses, public facilities and cultural inheritances
- (2) Damage to fauna and flora
- (3) Air pollution by emission of gas and noise from vehicle

Table 15.2 summarizes target values of allowable limits. Our policy, when choosing 'target values of allowable limits for environmental protection' is at least not to worsen the present situation through the development project and, furthermore, to follow the standards and/or targets which are already established by the government or similar surrounding countries. Simple application of strict standard of other countries of different conditions is not practical and sometimes harmful to the development of the country. In this sense, we proposed the present standards specified by Honduran government as the environmental target values in this study. When the standard concerned is not available, such as a matter of resettlement, we followed the rule 'not to worsen the present situation.'

In the table, target values for air pollution were originally proposed by Pan-American Organization (PAO) and World Health Organization (WHO). They are modified and adopted by the Honduran government. Standards for gas emission are established by the government through the study of gas emission monitored from present vehicles in Honduras.

15.3 Prediction of Impacts in Each Project

The primary positive impact is the relief of traffic congestion and resultant activation of economy in Centro. This is the common impact of all the projects. However, predicted negative impact differs significantly for each project depending on location and project characteristics.

Table 15.3 compares the existing condition and design condition in each project. As shown in the table, major projects are to widen the existing road or to construct road in an area where

Table 15.1.1 Result of Initial Impacts Examination on Each Project

Term	Category	Project No.	Positive Impact	Negative Impact	Present Evaluation *of Project	Need of EIA
Urgent	Improvement of Intersection	1	Relief of traffic congestion	Air pollution and noise	Positive	-
		2		Air pollution and noise	Positive	-
		3		Loss of public facility, air pollution and noise	Positive	-
		4		Air pollution and noise	Positive	-
		5		Public facility	Positive	-
Short-term	Improvement and Construction of Road	7		Resettlement, loss of cultural property, air pollution and noise	Questionable (historically important architecture)	YES
		8		Resettlement, air pollution and noise	Positive	-
		9		Resettlement, air pollution and noise	Positive	-
	Construction of Bridge	(8)		Resettlement, air pollution and noise	Positive	-
		11-1		Resettlement	Positive	-
	Middle-term	Improvement of Road	6-2	Resettlement and loss of cultural property	Questionable (populated area and historical monument)	YES
11-2			Resettlement and loss of public facility	Questionable (populated area and historical monument)	YES	
12			Resettlement	Positive	-	
Construction of Bus Terminal		21	Resettlement and loss of economic activity base	22	Positive	-
		23				
		24				
		25				
		26				
Bus Transportation		18	Air pollution and noise	Positive	-	
		19	Loss of economic activity base	Positive (if no demolition be made)	-	
Community Road		20	-	Positive	-	
Long-term	Improvement and Construction of Road	6-1	Resettlement, loss of cultural property, air pollution and noise	Questionable (street of cultural inheritance)	YES	
		10	Resettlement, loss of cultural property and noise	Questionable (street of cultural inheritance)	YES	
		13	Resettlement	Positive	-	
		14	Resettlement	Questionable (New road through built-up area)	YES	
		15	Resettlement	Questionable (New road through built-up area)	YES	
		16	Resettlement	Positive	-	
		Parking Building	27	Loss of economic activity base (Saturday market)	Positive	-
	Truck Terminal	28	-	Positive	-	

*This evaluation is tentative and not final, subjected to mitigation measures taken

Table 15.2.1 Target Values of Allowable Limits for Environment Conservation

Item	Impact	Target Value	Condition	Source
Resettlement	Displacement of residential house and loss of commercial base	No worse than present condition	-	-
Public Facility	Displacement of public, educational and social facilities	No worse than present condition	-	-
Culture	Displacement of cultural inheritance	Restore as before	-	Honduran government
Fauna & Flora	Nature conservation park	Restore as before	-	Honduran government
Air Pollution	Suspended Particulate Matter, SPM	240 microgram/m ³	One hour's value from 24 hours' monitoring	PAO/WHO
	Nitrogen Dioxide NO ₂	50 parts per billion	One hour's value from One month monitoring	PAO/WHO
	Ozone O ₃	50 parts per billion	One hour's value from One week monitoring	PAO/WHO
	Carbon Monoxide CO	9 parts per million	One hour's value from 8 hours' monitoring	PAO/WHO
	Lead Pb	0	Leaded gasoline is prohibited	Honduran government
Emission Gas from Vehicle	Carbon Monoxide CO	4.5 %	For gasoline car Idling at 1,000 rpm	Honduran government
	Hydrocarbon HC	350 parts per million	For gasoline car Idling at 1,000 rpm	Honduran government
	Diesel Black Smoke	6 bacharak Unit or 70 Hertridge Unit	For diesel Car	Honduran government
Noise	L50	80 dw	During 24 hours	Based on Honduran government

Table 15.3.1 Existing Condition versus Design Condition

Term	Category	Project No.	Existing Condition at Site	Design Condition at Site	
Urgent	Improvement of Intersection	1	Two lanes	Three lanes and signals	
		2	Two lanes	Three lanes including left turn lane	
		3	Offset intersection	Cross intersection	
		4	No signal	Traffic signal	
		5	Athletic field for university.	Approach road with 14m width	
Short-term	Improvement and Construction of Road	7	An old town densely built-up with minimum road width 10m. A historical building of former embassy of Costa Rica is found.	20m width road with 4 lanes	
		8	Minimum road width is 10 m at Calle Nixon and Calle 12 of built-up area.	14m width road	
		9	Road with minimum width of 7m at Boulevard Jose Cecilio de Valle located inside nature conservation park	20m width road	
	Construction of Bridge	(8)	Workshop and food factory on river banks	Bridge	
		11-1	A number of houses on river banks	Bridge	
Mid term	Improvement of Road	6-2	Historical buildings of former presidential house and former ministry of electricity; traditionally fashioned street	14m width road and bridges with 10m width	
		11-2	Minimum road width is 5m only at southern end of Avenida 6. Minimum road width is 6m only at Barrio La Granja and Colonia Tiloarque. There is a built-up residential area at Residencial Lomas de Tiloarque with a minimum road width of 10m. An orphanage blocks proposed road at Colonia Las Delicias. Minimum road width is 6m only at Colonia La Flor Del Campo Sector No.3. A commercial building 50m wide and 100m long blocks proposed road at Colonia Sulacal.	14m width road	
		12	Minimum road width is 6m only. Maximum slope angle is 60%. Many vender stalls occupy both sides of street at Barrio El Centavo. A community blocks proposed road at Colonia Soto.	14m width road	
	Construction of Bus Terminal	21	Bus terminal, market and restaurants	Bus terminals	
		22			
		23			
		24			
		25			
	Bus Transportation	18	Mixed traffic	Bus exclusive lane	
		19	Many stalls occupy sidewalks of Avenida 6 at south of Bridge Soberinia Nacional	Bus exclusive way	
		20	Mixed Traffic	Pedestrian exclusive road	
	Long-term	Improvement and Construction of Road	6-1	Old town of Tegucigalpa, densely built-up with minimum road width of 3m only.	14m width road and a bridge
			10	Around Barrio Morazan is old town of Comayagüela with minimum road width of 10m.	20m width road
13			Residencial La Fuente is a built-up area with minimum road width of 8m. Cemetery is located along road.	20m width road.	
14			Minimum road width is 5m at Colonia Canada. Colonia La Pena is a built-up area with minimum road width of 5m.	14m width road	
15			Huge housing estate is under construction at Colonia Santa Isabel. Access road is also under construction.	14m width road	
16			Colonia La Pena is a built-up area with minimum road width 5m.	14m width road	
Parking Building		27	Parking lot on week days and open market on holiday	Car parking building	
Truck Terminal		28	Stock farm	Truck terminal	

residences houses are densely built-up or where old streets and/or historic monuments remain. Change of traffic volume before and after project are indicated in Table 15.4. The table indicates the drastic increase of traffic volume after the project in the most areas inferring the generation of air pollution or noise.

On the basis of changes in circumstances, we estimated impacts in Tables 15.5 through 15.9. As shown in the tables, negative impacts predicted are as follows:

(1) Displacement

Negative impacts are caused, if no mitigation measures are taken, by displacement of housings, public facilities and cultural inheritances. The intensity of the negative impacts depend on number of houses, necessity of the facility and values of the cultural properties.

Table 15.5 estimates the impact of resettlement and loss of commercial base. Areas with stronger negative impacts are:

- Barrio La Hoya (Project No. 6-2)
- Barrio Morazán (Project Nos. 7 and 10)
- Avenida 6 (Project No.11-2)
- Colonia Tiloarque (ditto)
- Residencial Lomas de Tiloarque (Project No. 11-2)
- Colonia La Flor La Campo Sector No.3 (Project No. 11-2)
- Colonia Sulacal (Project No. 11-2)
- Barrio La Leona (Project No. 6-1)
- Colonia Montes De Sina (Project No. 14)
- Colonia Santa Esabel (Project No. 15)

The impacts to public facilities, cultural inheritances, fauna and flora are shown in Table 15.6. Public facilities which suffer partial or total displacement are a hospital parking lot (Project No.3), a university athletic field (Project No. 5) and an orphanage (Project No.11-2).

Affected cultural inheritances are:

- Former Presidential building (Project No.6-2)
- Former Electric Ministry Building (ditto)
- Former Embassy of Costa Rica (Project No.7)
- Old Streets (Project Nos.6-2,7,19,6-1,10)

(2) Fauna and Flora

The slope of a hill of nature conservation park will be cut about 15m wide on the average and 300m long along Boulevard Jose Cecilio de Valle (Project No. 9). Negative impacts are (a partial loss of) nation's park and a possibility of slope failure if the slope is not properly protected.

(3) Air Pollution and Noise

Items of air pollution being monitored by CESCO, Pollution Survey Institute which belongs to ministry of health, are as shown below:

- Suspended Particulate Matter (SPM)

Table 15.3.2 Daily Traffic Volume at Present and Future

Term	Category	Project No.	Present Daily Traffic Volume	Future Daily Traffic Volume	Increment of Daily Traffic
Urgent	Improvement of Intersection	1	10,000 ~20,000	25,000 ~40,000	10,000 ~30,000
		2	30,000 ~35,000	30,000 ~35,000	-
		3	20,000 ~40,000	10,000 ~40,000	Minus 10,000 ~0
		4	20,000 ~30,000	40,000 ~50,000	10,000 ~30,000
		5	0	5,000<	5,000<
Short-term	Improvement and Construction of Road	7	10,000 ~15,000	40,000 ~50,000	30,000
		8	10,000 ~35,000	10,000 ~30,000	Minus 15,000 ~15,000
		9	10,000 ~15,000	40,000 ~50,000	35,000
	Construction of Bridge	(8)	10,000 ~35,000	10,000 ~30,000	Minus 15,000 ~15,000
		11-1	10,000<	10,000 ~20,000	5,000 ~15,000
Mid-term	Improvement of Road	6-2	10,000 ~15,000	10,000 ~15,000	5,000<
		11-2	10,000<	10,000 ~20,000	5,000 ~15,000
		12	-	10,000	10,000
	Construction of Bus Terminal	21	?	300<	300<
		22			
		23			
		24			
		25			
	Bus Transportation	18	5,000 ~30,000	10,000 ~35,000	5,000
		19	5,000 ~15,000	5,000 ~15,000	5,000
20		?	0	0<	
Long-term	Improvement and Construction of Road	6-1	5,000<	10,000 ~15,000	5,000 ~10,000
		10	10,000 ~20,000	30,000 ~40,000	35,000
		13	-	10,000	10,000
		14	-	5,000	5,000
		15	-	10,000	10,000
		16	-	5,000	5,000
	Parking Building	27	-	3,000	3,000
	Truck Terminal	28	-	5,000	5,000

Table 15.3.3 Estimation of Impact of Resettlement

Term	Category	Project No.	Affected Items	Impact	
Urgent	Improvement of Intersection	1	-	-	
		2	-	-	
		3	-	-	
		4	-	-	
		5	-	-	
Short-term	Improvement and Construction of Road	7	Houses along road	Negative impact on bases of commercial activity and residences	
		8	-	-	
		9	20 houses on river bank	Negative impact on residential base for vulnerable people	
	Construction of Bridge	(8)	Workshop and food factory on river banks	Negative impact on bases for residence and industrial activity	
		11-1	A number of houses on river banks	Negative impacts on residential base	
Mid-term	Improvement of Road	6-2	Many houses along road	Strong negative impacts on residential base	
		11-2	A sign board factory at Colonia Primavera, 10 houses at Barrio La Granija, 30 houses at Colonia Tiloarque, nearly 100 houses at Residencial Lamos De Tiloarque, an orphanage, 40 houses at Colonia La Flor Del Campo Sector No.3 and a commercial building at Colonia Sulacal	Strong negative impacts on residential base of Residencial Lomas de Tiloarque and commercial building at Colonia Sulacal	
		12	A whole community of Colonia Soto, 60 houses at Barrio Concepcion, small stalls on street at Barrio Centavo, and 50 houses at Colonia El Porvenir	Negative impacts on residential base for vulnerable people at Colonia Soto and commercial activity base at Barrio Centavo	
	Construction of Bus Terminal	21	Markets and restaurants	-	Negative impact on economic activity bases
		22			
		23			
		24			
		25			
	Bus Transportation	18	-	-	-
		19	Many small stalls on the street along Avenida 6 at south of Bridge Sobernia Nacional	Negative impact on commercial base	
	Community Road	20	-	-	
Long-term	Improvement and Construction of Road	6-1	Houses especially at Barrio Leone and Barrio Nixon	Strong negative impact on residential base	
		10	Houses along road at Barrio Morazan	Strong negative impact on residential base	
		13	Nearly 200 houses at Residencial La Fuente	Negative impact on residential base	
		14	20 houses at Colonia La Canada and many houses at Colonia La Pena	Strong negative impacts on residential and commercial bases at Colonia La Pena	
		15	Uncountable number of houses newly constructed or under construction at Colonia Santa Isabel	Strong negative impacts on residential base especially at Colonia Santa Isabel	
		16	About 70 houses	Negative impact on residential base	
	Parking Building	27	-	-	
	Truck Terminal	28	-	-	

**Table 15.3.4 Estimation of Impact on Public Facilities,
Cultural Inheritances, Fauna and Flora**

Term	Category	Project No.	Afected Items	Impact
Urgent	Improvement of Intersection	1	-	-
		2	-	-
		3	A parking lot hospital	Negative impact on medical facility
		4	-	-
		5	An athletic field of university	Negative impact on educational facility
Short-term	Improvement and Construction of Road	7	Old houses along road	Strong negative impact on cultural inheritance
		8	-	-
		9	Hill of nature conservation park	Negative impact on fauna and flora
	Construction of Bridge	(8)	-	-
		11-1	-	-
Mid-term	Improvement of Road	6-2	Former presidential house, a former electric ministry building and old houses	Strong negative impacts on historical monument and cultural inheritance
		11-2	An orphanage near Colonia La Delicias	Negative impact on social facility
		12	-	-
	Construction of Bus Terminal	21	-	-
		22	-	-
		23	-	-
		24	-	-
		25	-	-
	Bus Transportation	18	-	-
		19	Antique houses at Comayagüela and Tegucigalpa	Strong negative impact on cultural inheritance
	Community Road	20	-	-
Long-term	Improvement and Construction of Road	6-1	Antique houses at Barrio Leone and Barrio Nixon	Strong negative impact on cultural inheritance
		10	Antique houses at Barrio Morazan	Strong negative impact on cultural inheritance
		13	-	-
		14	-	-
		15	-	-
		16	-	-
	Parking Building	27	-	-
	Truck Terminal	28	-	-

- Nitrogen Oxides (NOx)
- Ozone (O₃)
- Carbon monoxide (CO)
- Lead (Pb)

It is considered that these pollutants are emitted from motorized vehicles. SPM, predominantly emitted from diesel vehicles, is the most critical pollutant in Centro. Although Pb also has been a critical pollutant, the use of leaded gasoline is prohibited from this year and the concentration of Pb should not be problematic in the future. NOx and other pollutants have not been found in critical amounts.

In our study, we performed estimation of SPM and NOx at present and future on the basis of traffic volume and actual air pollution data. Tables 15.7 and 15.8 present the prediction of SPM and NOx respectively. As shown in the tables, many areas suffer from intense air pollution. The areas with high pollution of either SPM or NOx estimated in the future are:

- Intersection of Suiba and National Stadium (Project No. 1)
- Intersection of Avenida Nixon and Boulevard Santa Fe (Project No. 2)
- Intersection of Boulevard Comunidad de Europea at IHSS (Project No.3)
- Intersection of Boulevard Jose Cecilio and Calle Golan (Project No. 4)
- Road between National Stadium and Boulevard Morazan (Project No. 7)
- Calle Nixon-Calle 12-New Bridge-Boulevard Jose Cecilio de Valle (Project No. 8)
- Calle Isla-Boulevard Jose Cecilio de Valle (Project No. 9)
- Boulevard Santa Fe (Project No. 18)

Noise level by vehicle was surveyed by us on the street. Using this data, future level of noise is estimated as shown in Table 15.9. According to our estimation, noise also will be quite a problem in the future. The areas with greater level than target values in the future are same as air pollution areas, adding Boulevard Juan Manuel Galves (Project No. 10) as above.

Table 15.10 summarizes our estimation of impacts in each project. For the evaluation of air pollution, we took which impact was worse, by SPM or by NOx. It is noted, in the table, that impacts indicated are the ones before mitigation measures were taken and which (negative impacts) can be reduced or converted into positive impacts depending on the mitigation plan.

15.4 Mitigation Plan

We summarized possible mitigation measures in Table 15.11. Background is detailed as below:

(1) Displacement

Mitigation measures for displacement of residential houses and commercial bases are basically compensation. The compensation includes (1) providing houses with reasonable infrastructures and transportation system, (2) reestablishing their enterprises and business, and (3) developing their potential as productive members of society.

When resettlement is conducted properly, the impact of resettlement will turn out to be positive, although budgetary problems arise in its place. Economic analysis will be required for the detailed evaluation of displacement.

Table 15.3.5 Estimation of Suspended Particulate Matter (SPM) at Present and Future

Term	Category	Project No.	Present SPM Level micro-g/m3	Future SPM Level micro-g/m3	Impact
Urgent	Improvement of Intersection	1	150	290	Negative
		2	450	300	Negative
		3	540	230	Positive**
		4	130	600	Negative
		5	-	60	-
Short-term	Improvement and Construction of Road	7	50	600	Negative
		8	450	320	Negative
		9	50	600	Negative
	Construction of Bridge	(8)	450	320	Negative
		11-1	60	120	--
Mid term	Improvement of Road	6-2	60	80	-
		11-2	60	120	-
		12	?	60	-
	Construction of Bus Terminal	21	-	-	-
		22	-	-	-
		23	-	-	-
		24	-	-	-
		25	-	-	-
	Bus Transportation	18	450	330	Negative
		19	160	240	-
	Community Road	20	?	-	-
Long-term	Improvement and Construction of Road	6-1	-	60	-
		10	50	120	-
		13	-	100	-
		14	-	50	-
		15	-	60	-
		16	-	-	-
	Parking Building	27	-	-	-
	Truck Terminal	28	-	600	Negative

*Estimation on the basis of calculated SPM from traffic volume and monitored SPM by CESCO, Pollution Survey Institute of Honduras

**Due to drastic reduction in number of large vehicles.

Table 15.3.6 Estimation of Nitrogen Oxides (NOx) at present and Future

Term	Category	Project No.	Present NOx Level ppb	Future NOx Level ppb	Impact
Urgent	Improvement of Intersection	1	20	80	Negative
		2	40	90	Negative
		3	60	80	Negative
		4	20	200	Negative
		5	-	25	-
Short-term	Improvement and Construction of Road	7	10	200	Negative
		8	55	100	Negative
		9	10	200	Negative
	Construction of Bridge	(8)	55	100	Negative
		11-1	10	45	-
Mid term	Improvement of Road	6-2	-	10	-
		11-2	10	45	-
		12	?	25	-
	Construction of Bus Terminal	21	-	-	-
		22	-	-	-
		23	-	-	-
		24	-	-	-
		25	-	-	-
	Bus Transportation	18	55	110	Negative
		19	20	80	Negative
Community Road	20	?	-	-	
Long-term	Improvement and Construction of Road	6-1	-	10	-
		10	10	45	-
		13	-	40	-
		14	-	15	-
		15	-	25	-
		16	-	-	-
	Parking Building	27	-	-	-
	Truck Terminal	28	-	200	Negative

* Estimation on the basis of calculated NOx from traffic volume and monitored NOx by CESCO, Pollution Survey Institute of Honduras

Table 15.3.7 Estimation of Noise* at Present and Future

Term	Category	Project No.	Noise ** at Existing Level	Noise** at Design Level	Impact
Urgent	Improvement of Intersection	1	75-80	80-85	Negative
		2	75-85	80-85	Negative
		3	85	85	Negative
		4	80	85	Negative
		5	-	60	-
Short-term	Improvement and Construction of Road	7	75	85	Negative
		8	75-85	80-85	Negative
		9	75	85	Negative
	Construction of Bridge	(8)	75-85	80-85	Negative
		11-1	70-75	75-80	-
Mid term	Improvement of Road	6-2	-	70	-
		11-2	70-75	75-80	-
		12	-	75	-
	Construction of Bus Terminal	21	-	60-70	-
		22	-	-	-
		23	-	-	-
		24	-	-	-
		25	-	-	-
		26	-	-	-
	Bus Transportation	18	70-85	75-85	Negative
		19	75	75	-
		20	?	60-70	-
	Long-term	Improvement and Construction of Road	6-1	55	75
10			75	85	Negative
13			-	75	-
14			-	65	-
15			-	75	-
16			-	60	-
Parking Building		27	-	-	-
Truck Terminal		28	-	80-85	Negative

* Estimation on the basis of calculated noise from traffic volume, modified by actual noise monitored by study team

** Noise level of L50

Table 15.3.8 Summary of Impacts Predicted

Term	Category	Project No.	Resettle-ment and economic activity	Public Facility	Cultural Inheritance	Fauna & Flora	Air Pollution	Noise
Urgent	Improve-ment of Inter-section	1	-	-	-	-	Negative	Negative
		2	-	-	-	-	Negative	Negative
		3	-	Negative	-	-	Negative	Negative
		4	-	-	-	-	Negative	Negative
		5	-	Negative	-	-	-	-
Short-term	Improve-ment and Construc-tion of Road	7	Negative	-	Highly negative	-	Negative	Negative
		8	Negative	-	-	-	Negative	Negative
		9	Negative	-	-	-	Negative	Negative
	Construc-tion of Bridge	(8)	Negative	-	-	-	Negative	Negative
		11-1	Negative	Negative	-	-	-	-
Mid-term	Improve-ment of Road	6-2	Negative	-	Highly negative	-	-	-
		11-2	Highly negative	Negative	-	Negative	-	-
		12	Negative	-	-	-	-	-
	Construc-tion of Bus Terminal	21	Negative	-	-	-	-	-
		22						
		23						
		24						
		25						
	26							
	Bus Trans-portation	18	-	-	-	-	Negative	Negative
19		Negative	-	-	-	-	-	
Community Road	20	-	-	-	-	-	-	
Long-term	Improve-ment and Construc-tion of Road	6-1	Highly negative	-	Highly negative	-	-	Negative
		10	Highly negative	-	-	-	-	-
		13	Highly negative	-	-	-	-	-
		14	Highly negative	-	-	-	-	-
		15	Highly negative	-	-	-	-	-
		16	Negative	-	-	-	-	-
	Parking Building	27	-	-	-	-	-	-
	Truck Terminal	28	-	-	-	-	Negative	Negative

Table 15.4.1 Mitigation Measures

Item	Mitigation Measure
Resettlement	Compensation of not less than what is lost
Public Facility	Provision of substitute of no less quality than before
Cultural Property	Relocation if technically possible
Fauna & Flora	Restoration as before
Air Pollution and Noise	By Vehicle -Strict and regular vehicle inspection especially for engine, muffler and catalyzer
	By Traffic -Systemization of signals -Introduction of exclusive lanes -Prohibition of overload -Restriction of large vehicles into city -Restriction of use of horn inside city -Promotion of mass public transportation -Restriction on maximum speeds -Installation of road hump
	By Road -Installation of green buffer zone between traffic lane and pedestrian lane -Construction of noise barrier along road -Repair of potholes

Displacement of public facilities may be not very difficult and mitigation measures are to construct one of the same or better quality. Even if the facility is not restored, other facilities may be able to be used (school or hospital) although it causes great inconvenience for the user of the facility.

In the case of cultural inheritance, the situation is quite different. It is usually very difficult, for example, to dismantle brick-made structure and re-construct exactly the same as before. There is no decisive mitigation method for displacement of old streets and monumental buildings in Centro.

(2) Fauna and Flora

The mitigation measure is to completely cover the slope with same type of plants as before after the hill was cut. The vegetation on the surface of the slope, not only presenting visual comfort, prevents erosion of slope caused by rainwater and surface-running water.

(3) Air pollution and Noise

The principal cause of air pollution is gas emission from vehicles. Among the vehicle, large trucks and buses are the primary sources of black diesel smoke with SPM and NO_x which are believed to cause respiratory disease and/or lung cancer. Therefore, strong countermeasures should be taken regardless of the project.

Although noise from vehicles is not recognized as a critical problem in Centro presently, we propose to take measures beforehand since the issue of noise along main roads will surely arise soon due to sharp increase of traffic volume.

Mitigation measures to reduce gas emission and/or noise can be classified into three types of measures such as; (1) to improve the vehicle itself, (2) to control traffic, and (3) to supply roadside facilities (barriers, etc.). Possible alternatives are tentatively presented in Table 15.11.

15.5 Conclusion and Recommendation

We summarize our conclusion in Table 15.1. This table includes description of project location, type of impacts predicted, tentative evaluation of project and need of EIA on each project proposed in the Master Plan. It is noted that the evaluation is made on the assumption that mitigation plans such as in Table 15.11 are properly implemented. Depending on the actual mitigation plan to be taken, the evaluation will fluctuate significantly.

In the stage of IEE, primary positive impact is a relief of traffic congestion, while most critical negative impacts are issues of resettlement in densely populated area and relocation of historical monuments. Full scale EIA is recommended for these projects. Problems of air pollution and noise will arise in most areas but we believe they can be mitigated by improvement of vehicles which are the primary sources of air pollution. Resettlement in spacious areas is not a very serious problem and may be easily covered by compensation.

CHAPTER 16

MANAGEMENT AND OPERATION PLAN F OR MAINTENANCE

CHAPTER 16 MANAGEMENT AND OPERATION PLAN FOR MAINTENANCE

16.1 General

The study of the management and operation plan for road maintenance is broadly divided into four main categories:

1) Present Situation of Road Maintenance and Management

- Present organization;
- Road management and maintenance;

2) Road Maintenance and Operation

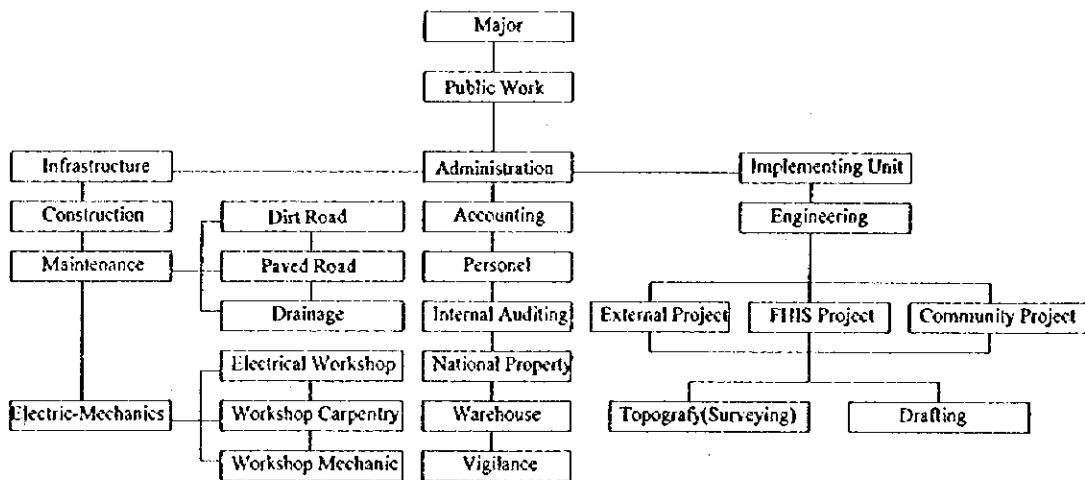
- Maintenance Inspections
- Maintenance Items
- Organization of Maintenance

3) Training of Inspection and Engineers

16.2 Present Situation of Road Management and Operation for Maintenance

16.2.1 Present Organization

Road Facilities in the study area are generally carried out maintenance and operation by ALCALDIA. In ALCALDIA, road maintenance is charge of Infrastructure Department.



Note; FHHS: Honduran Found for Social Investment

Fig. 16.2.1 Organization Chart of ALCALDIA

This department consists of three sections; construction, maintenance and electric.

The number of staff in the Infrastructure Department is shown in Table 16.2.1.

Table 16.2.1 Number of Staff in Infrastructure Department

Function	Organization Units	Number of Staffs
Infrastructure Department	1. General Division	16
	2. Construction Division	148
	3. Maintenance Division	53
	4. Electric Mechanics Division	61

16.2.2 Road Maintenance Management

Present road maintenance carried out is mainly simple repair such as road surface, potholes and road facilities according to maintenance budget in ALCALDIA. Therefore existing roads in some section are not maintained.

ALCALDIA keeps the vehicles and equipment for construction and maintenance as shown in Table 16.2.2.

Table 16.2.2 Vehicles and Equipment Possessed by Infrastructure Department

Type of Equipment	Number
Dump Truck	14
Truck	2
Water Sprinkler	2
Pick-Up Truck	7
Tractor	4
Motor Grader	2
Asphalt Finisher	1
Road Roller	7

16.3 Road Maintenance and Operation

16.3.1 Purpose

The purpose of maintenance activity is to keep the satisfactory roadway, bridges and other facilities in as safe a condition as situation permits. Certain basic principles and ideas can help to achieve this purpose.

16.3.2 Maintenance Inspection

The purpose of maintenance inspections is to detect early evidences of defects before actual failure occurs. Frequent inspections and effective follow-up procedures prevent minor defects from becoming serious and causing major repair. Special vigilance must be exercised during rainy seasons, and after every storm or flooding.

The maintenance inspection is divided into routine inspection, periodic inspection and special inspection as follows;

1) Routine inspection

Routine inspection is carried out on a daily, a weekly or a monthly basis of road structure and facilities, within the limits of visually observable damage.

2) Periodic inspection

Periodic inspection is based on detailed inspection to be performed at certain time interval such as the end of rainy season or the special seasons. This inspection is carried out checking and testing the condition of various road structure and facilities on problem points such as bridge collapsing or landslide.

3) Special inspection

Special inspection is basically the work to be carried out to restore the road and facilities to their normal operation condition after they are damaged by road accident or natural causes.

16.3.3 Inspection Items

Major inspection items and frequency are as shown in Table 16.3.1.

Table 16.3.1 Inspection Items and Frequency

Item	Inspection point	Inspection Item	Frequency
Cut and Fill Slope	Slope,	Erosion, Landslide, Vegetation	Weekly
	Ditch	Debris	Weekly
Pavement	Surface, Base	Pothole, Hollow, Crack, Resettlement	Weekly
Drainage	Culvert, Ditch, Inlet,	Debris	Weekly
Bridge	Abutment, Pier	Damage	Monthly
	Curb	Damage	Monthly
	Drainage	Debris	Monthly
	Slab	Crack, Damage	Monthly
Bus Terminal	Facilities	Damage	Monthly

16.3.4 Required Vehicles and Equipment

Equipment for maintenance should be on standby at the workshop of the ALCALDIA to perform smooth maintenance as shown in Table 16.3.2.

Table 16.3.2 Required Vehicles and Equipment

Road Maintenance	Vehicles and Equipment Required
1. Inspection	Inspection car
2. Road Cleaning	Truck, Sprinkler truck
3. Vegetation Control	Truck, Mower
4. Asphalt Pavement and Shoulders	Grader, Vibration roller, Loader, Compressor, Steel, Wheel roller, Truck, Asphalt distributor, Compactor
5. Bridge	Truck with small crane
6. Bus Terminal	Truck with small crane
7. Cut and Fill Slopes	Bulldozer, Loader, Truck

16.3.5 Organization for Maintenance

To perform the effective maintenance the Infrastructure Department should be considered as follows:

- All engineers in this department should understand maintenance technique
- ALCALDIA should have relationship with other agencies or contractors to keep smooth maintenance.
- Data base such as cross section, pavement structure and road length, etc. should be kept in this department.

16.4 Training of Inspections and Engineers

1) Training of inspectors and engineers for the maintenance is important to keep optimum road maintenance levels. The inspectors and engineers should be trained to be responsible for inspectors, recording observations, preparing inspection reports planning maintenance works and managing operations in an efficient manner.

2) To upgrade management capability of ALCALDIA, efforts are required to develop expertise in budget planning and management, as well as in project planning and realization. To alleviate the present conditions, hiring of professionals and staff training will be necessary.

CHAPTER 17
RECOMMENDATIONS

CHAPTER 17 RECOMMENDATIONS

It becomes clear that the traffic congestion within the study area is getting worse year by year because of the disorderly sprawl of the housing area by the rapid increment of population. Therefore, the following points are concluded and recommended;

(1) Realization of master plan

① Implementation of urgent projects

Since the realization of master plan takes five to fifteen years, at places where the traffic congestion is especially severe, the urgent projects are desired to be implemented as soon as possible.

② To construct two new bridges during the short term

In the master plan, many projects are proposed. Among them it is identified that the east-west transportation axis and the north-south transportation axis should be strengthened in the short term. In order to strengthen these two axis, it is of utmost importance to construct two new bridges.

③ To continually implement the projects recommended in the Master Plan

It will take time to realize all the projects listed in the Master Plan. Therefore, it is very important to continue efforts for the realization of the master plan. In Honduras, the long term plan is apt to be neglected when political power changes hands. In order to avoid this situation, it is advised that the Master Plan be realized, despite political changes.

④ To reform the organization

At present several national governmental organizations are involved in the civil work projects in the study area because of lack of funds as well as planning and engineering staff in the Municipality. It is desired that as many necessary civil work projects be performed by the Municipality for itself as possible. For this purpose, it is concluded that the organization of the Municipality related to the transportation and city planning should be reformed as shown in Fig. 17.1., that is, under the mayor the Urban Development Division is strengthened and all the basic policy of the city planning and transportation is determined together with representatives from SECOPT, SANAA, AMDC, EUEE, etc. As for the concrete implementation of the policy, the following departments are in charge under this division.

- MANAGEMENT OF METROPLAN takes a role of the city planning.
- MANAGEMENT OF TRANSPORT AND VIAL MATTERS is in charge of the road planning.
- MANAGEMENT OF MARKETS is change of market planning.

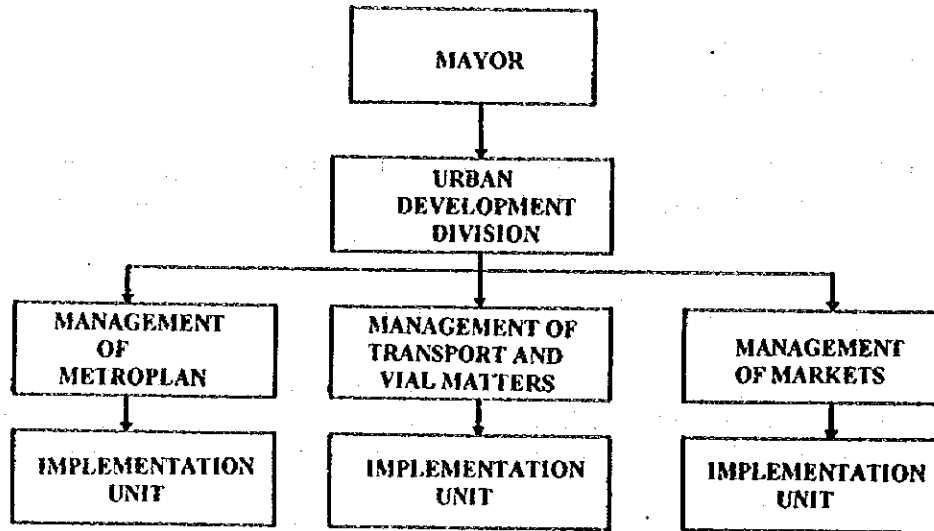
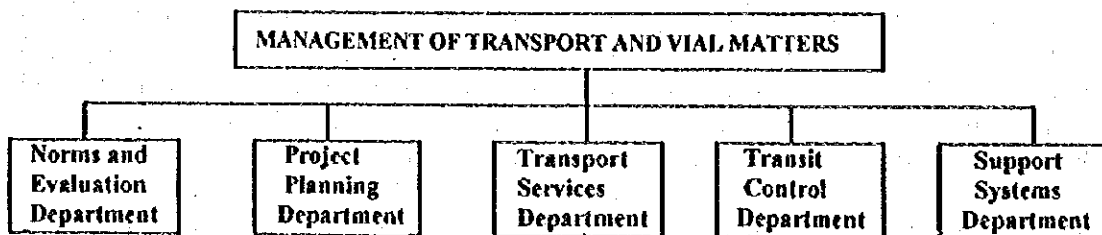


Fig. 17.1 Proposed Organization Related to Transportation

Structure of the Management of Transportation and Vial Matters:

To achieve its attributions and objectives, the Management of Transportation and Vial Matters is organized in five general departments:

For the adequate performance of the these department it is necessary a good organization of the management.



- ⑤ To make haste to complete the outer ring road (so called Anillo Periférico)

The Master Plan was formulated on the assumption of the completion of the outer ring road called Anillo Periférico, however, the work of this project is behind schedule. It is recommended to complete this outer ring road as soon as possible. Especially it is recommended to complete the section 2 of Anillo Periférico (from Colonia Altos de Loarque to Colonia Kennedy), because it greatly contributes in saving travel time between the southern part of the study area and the western part (Suyapa, Miraflores, Kennedy, The National Autonomous University of Honduras, etc.). In addition, it reduces congestion on Boulevard Comunidad Europea significantly.

⑥ **To restructure the bus route network system**

It is recommended that the future bus route network be changed into the system with fewer number of bus routes and more navigation frequencies on bus routes compared with the existing system. In addition, it is also recommended to examine a suitable tariff system including the allocation of subsidies.

⑦ **To secure the financial sources for the projects**

In order to realize the Master Plan, a large amount of funds is necessary. For some projects the cost may be provided by loan or donation from the international lending agencies, bilateral and/or multi-lateral agreement. However, since it cannot depend on the loan or donation for all of the project cost, the Municipality itself should seek the project fund source. Therefore, it is recommended to examine the possibility of application of the following measures as the financial sources for implementing the Master Plan projects;

- City Planning Tax
- Development Tax
- Automobile Fuel Surcharge Tax
- Automobile Tonnage Tax

(2) To continue road maintenance work

It is recommended to continue effective road maintenance such as drawing lane marking and stop lines, filling potholes and gaps on the roads, etc. Bad poor road maintenance decreases the road capacity through the speed-down and congestion around holes and gaps on the roads.

(3) To make use of various data obtained during the study

Several traffic surveys were conducted during the study and many important data were obtained. These data will be useful in analyzing the feasibility of new projects not to be examined in this Master Plan and for training the staff to follow the Master Plan.

(4) To conduct further study

Some projects require the further studies on detail design, detailed cost estimation, financial feasibility, etc. Before implementing the project, it is recommended to conduct further study on these as much as possible where necessary.

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